The Reverent Eye:

Scientific Visual Culture and

The Origins of Modern British Zoology, 1815-1840

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Abstract

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Between 1815 and 1840, decades of unprecedented social and political upheaval, the life sciences in Britain were transformed. What for centuries had been a single subject, natural history, fragmented into a set of related but distinct scientific disciplines, defined by their objects of investigation. This study focuses on one of them, zoology, and the ways in which its emerging, transitional practices and methodologies, prompted by the vast increase in empirical information, the emergence of new institutions, development of new audiences, and increasing colonial expansion, were codified and disseminated in some of the most stunning images ever created of life on earth.

At the heart of this process was quinarianism, a now almost forgotten system of ordering the natural world which originated in the long-running and acrimonious 'Species Debate', the single most important issue in early-nineteenth century biology. Far from being a historical and scientific irrelevance, quinarianism was crucial to the institutional and methodological development of zoology in Britain. As developed by a small, politically-diverse group of zoologists centred upon the Linnean and Zoological Societies of London, it fused natural theology and continental Idealism in a powerful synthesis which, for twenty years, defined zoology as a British, imperial science, providing the institutional framework which made possible the great advances of the 1860s and 1870s.

At a time when widespread unrest, calls for political reform, and imported European materialism seemed to threaten the stability of British society, the quinarian vision of a stable, divinely-ordained world was mobilised to both establish zoology as a discipline and promote a ‘safe’, hierarchical social order.

Ornithology was one of the first biological disciplines to emerge from the broader natural history, and it was here that quinarianism made the greatest impact. It was also the most visual and ornithological works, from relatively cheap editions to the vast expensive folios of John Gould were copiously illustrated by well-known artists and engravers. These illustrated works have long been neglected as a historical resource, their images regarded as secondary to text as a source of scientific knowledge and often regarded purely on aesthetic grounds. To fully understand the genesis and appeal of quinarianism, it is crucial to consider these images not simply as art objects, but as sources of scientific authority within their wider context. Deploying an interdisciplinary methodology, and building upon recent studies by Lorraine Daston, Peter Galison, and Jonathan Smith, it is demonstrated here that, created through the manipulation of the visual conventions of natural history, images such as Gould’s were central to the epistemological and extra-scientific agendas of early nineteenth-century zoologists, and crucial to our understanding of a formative, transitional period in British science that has long been shrouded in obscurity.

For my parents, Ann and Douglas

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Contents

List of Abbreviations

BHH	Hodgson Zoological Collections, Zoological Society of London. London.
BP	Brown Papers, Linnean Society of London. London.
CP	Castlereagh Papers, Public Records Office Northern Ireland. Belfast.
GP	Gould Papers, Natural History Museum. London.
HP	Hansard, Parliamentary Papers
JH	John Hancock Correspondence, GNM: Hancock, NEWHM. Newcastle-upon-Tyne.
JP	Sir William Jardine Papers, Harvie-Brown Collection, Royal Scottish Museum, Edinburgh.
KU	John Gould Ornithological Collection, University of Kansas, Lawrence, Kansas.
LS	Linnean Society of London.
LPS	Letter Books, Literary and Philosophical Society of Newcastle. Newcastle-upon-Tyne.
MBP	Marquess of Bute Papers, National Library of Wales. Cardiff.
MP	Macleay Papers, Linnean Society of London. London.
MW	William MacGillivray, original watercolours for *History of British Birds*, NHM, London.
PJS	Prideaux John Selby, original engravings for *Illustrations of British Ornithology*, GNM: Hancock, NEWHM, Newcastle-upon-Tyne.
RSM	Royal Scottish Museum, Edinburgh.

SC	Swainson Correspondence, Linnean Society of London, London.
SDUK	Society for the Diffusion of Useful Knowledge.
WP	Wellington Papers, Southampton University Special Collections, Southampton.
ZSL	Zoological Society of London.

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Introduction

Zoology in Britain, 1815-1840

This is a study of zoological culture as it emerged in Britain between 1815 and 1840, which focuses on the origins, development, and dissemination of quinarianism, a long-forgotten theory of ordering the natural world which, during its brief life, dominated the investigation of the animal world. These were crucial transitional years, in which the form of the modern zoology emerged from the inchoate framework of eighteenth-century natural history, but that have been overshadowed by the spectacular, and highly-public, transformation wrought during the 1860s. Scientific activity during this earlier period was characterised by three features. First, the growing self-consciousness of 'gentlemen of science' as to the aims and nature of their work, with a resultant process of specialisation during which natural history fragmented into distinct disciplines.[1] Second, naturalists' search for social and intellectual legitimation, leading inexorably to a spirit of professionalisation and attendant proliferation of specialist scientific societies, such as the Zoological Society of London and the British Society for the Advancement of Science.[2] Finally, naturalists' sophisticated mobilisation of visual culture in support of this process: as a means to codify knowledge; to disseminate knowledge; and to

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[1] An outstanding exploration of the role of specialisation in the development of scientific thought is M. J. S. Rudwick, *The Great Devonian Controversy: The Shaping of Scientific Knowledge among Gentlemanly Specialists* (Chicago, IL: University of Chicago Press, 1985).

[2] See, for example, D. E. Allen, *The Naturalist in Britain: A Social History* (London: Allen Lane, 1976); J. B. Morrell, 'Science and Scottish University reform: Edinburgh in 1826', *Journal of the History of Science*, 6 (1972), 39-56; 'The Patronage of Mid-Victorian Science in the University of Edinburgh', *Science Studies*, 3, 4 (Oct., 1973), 353-388;

establish intellectual and institutional authority. Of these three, closely-interconnected principal themes, only the first two have attracted the attention of historians.

Scholarly interest in this era pivots around the titanic figure of Charles Darwin (1809-1882). The resurgence of Darwin studies in the 1980s prompted a new interest in the scientific culture in which he devised and shaped his theory of evolution by natural selection, and the Darwin bicentennial in 2009 provided a further boost to the Darwin 'industry'.[3] Whilst an invaluable spur to further research, few of the resultant studies considered early-nineteenth century British scientific culture in depth and on its own merits, serving to further focus attention on precursors to evolution, reactions to evolution, and the scientific impact of natural selection.[4] In this body of work, the publication of Darwin's *Origin of Species* in 1859 has tended to be represented as a shift in scientific thinking so seismic to warrant triumphalist characterisation as the 'Darwinian Revolution', with the decades leading up to 1859 and its central figures dismissed as 'pre-Darwinian'.[5] Taking its cue from Thomas Kuhn's influential, positivist model of science as driven by sudden and decisive change, this characterisation is

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[3] See M. Ruse, 'The Darwin Industry: A Guide', *Victorian Studies*, 39, 2 (Winter, 1996), 217-235.

[4] There is a vast and ever-expanding literature on Darwin and his early intellectual environment. The most important in locating this study include J. Browne, 'Making Darwin: Biography and the Changing Representations of Charles Darwin', *Journal of Interdisciplinary History*, 40, 3 (Winter 2010), 347-373; A. Desmond, J. Moore, *Darwin* (London: Penguin Books Ltd., 1992); J. Browne, *Charles Darwin: Voyaging* (London: Pimlico, 1995). For the background to evolution, see D. Young, *The Discovery of Evolution* (Cambridge: Cambridge University Press, 1992); S. Sheets-Pyensen, 'Darwin's Data: His Reading of Natural History Journals, 1837-1842', *Journal of the History of Biology*, 14, 2 (Autumn, 1981), 231-248; P. Elliot, 'Erasmus Darwin, Herbert Spencer, and the Origins of the Evolutionary Worldview in British Provincial Scientific Culture, 1770 – 1850', *Isis*, 94, 1 (March 2003), 1-29; Finally, for the reaction to Darwin's theory, see I. Hesketh, *Of Apes and Ancestors: Evolution, Christianity, and the Oxford Debate* (London: University of Toronto Press, 2009); D. Kohn, 'Darwin's Ambiguity: the Secularisation of Biological Meaning', *British Journal for the History of Science*, 22 (1989), 215-239. A. Ellegård, 'Public Opinion and the Press: Reactions to Darwinism', *Journal of the History of Ideas*, 19, 3 (Aug., 1958), 379-38, an older study, remains a standard work on the 'popular' reception of Darwinism.

[5] For example, M. Ruse, *The Darwinian Paradigm* (London: Routledge, 1989), and *The Darwinian Revolution* (Chicago, IL: University of Chicago Press, 1999); S. Herbert, 'The Darwinian Revolution Revisited', *Journal of the History of Biology*, 38 (2005), 51-66; A. Desmond, 'Robert E. Grant: The Social Predicament of a Pre-Darwinian Transmutationist', *Journal of the History of Biology*, 17, 2 (Summer, 1984), 189-223; A. Ellegård, *Darwin and the General Reader: The Reception of Darwin's Theory of Evolution in the British Periodical Press 1859-1872* (Chicago, IL: University of Chicago Press, 1990); D. Ospovat, *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838-1859* (Cambridge: Cambridge University Press, 1981); R. Bellon, 'Inspiration in the Harness of Daily Labor: Darwin, Botany, and the Triumph of Evolution, 1859 – 1868', *Isis*, 102, 3 (Sep. 2011), 393-420.

misleading on several counts.[6] Implying that Darwin's idea burst onto a culture completely unprepared for evolution, a notion which remains widespread despite the work of James Secord and others on earlier transmutationist theories, it is based on the fundamental assumption that early-nineteenth century science was homogenous, unified by a universal interpretation and acceptance of natural theology.[7] This is far from the truth. As this study demonstrates, through the analysis of the vibrant print culture in which it was conducted, at no other time in the history of British science has scientific debate been as fierce as in the decades 'before Darwin'.

As a result of this approach, much about this transitional period, including its driving personalities and the practical and intellectual frameworks in which they worked, remains to be re-discovered. This is particularly true in the case of zoology, which reached disciplinary maturity in the 'pre-Darwinian' period.[8] Although poorly studied, its process of development, so crucial to the development of how we view the natural world, saw the emergence and dissemination of recognisably 'modern' methodologies, many of which have either been lost to history or consistently misinterpreted by historians. This can be traced to the primacy of textual, written sources in which theories were discussed, such as the *Origin of Species*, in positivist histories of science; the attendant diminution of the value of pictorial sources; and, from the 1860s onwards, the rigid differentiation of 'popular' science from scientific practice at its elite levels. A demarcation which, owing to the rapid proliferation of print culture and

[6] T. Kuhn, *The Structure of Scientific Revolutions, Third Edition* (Chicago, IL: University of Chicago Press, 1996).
[7] J. A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* (Chicago, IL: The University of Chicago Press, 2000); K. Thomson, *The Watch on the Heath: Science and Religion before Darwin* (London: Harper Collins Publishers, 2006). An important corrective to this view is provided by P. F. Rehbock, *The Philosophical Naturalists: Themes in Early Nineteenth-Century British Biology* (Madison, WI; University of Wisconsin Press, 1983).
[8] Adrian Desmond's work on the dawn of a highly-politicised zoological culture in the late-Georgian period made an invaluable contribution to this field of research, though his exclusive focus on institutional politics as the driving force of change is overdrawn. See A. Desmond, *Archetypes and Ancestors: Palaeontology in Victorian London, 1850-1875* (London: Blond & Briggs, 1982); 'The Making of Institutional Zoology in London, 1822-1836', *History of Science*, 23 (1985), 153-185, 223-250; and *The Politics of Evolution: Morphology, Medicine and Reform in Radical London* (Chicago, IL: University of Chicago Press, 1989).

creation of new audiences for scientific works, was far from being clear-cut in the years between 1815 and 1840.

One of the most important, and certainly one of the most misunderstood of these lost methodologies, quinarianism was an ambitious, ‘natural’ system of classifying species devised in Britain in the immediate aftermath of the Napoleonic Wars. Long dismissed as irrelevant by historians who have analysed a narrowly-textual source base, the principal argument of this study is that quinary theory, in its three principal variants, exerted a formative influence on the development of zoology in Britain and its expanding empire. This is demonstrated by a sustained analysis of the many ways in which the quinarians harnessed print culture in the 1820s and 1830s, particularly the rapid development of illustrative techniques, to bring their theory and its potential application to a wider audience than ever before. Illustration was just one plank in the quinarian rhetorical and scientific platform, but served a crucial function without which the theory would not have risen to such a degree of dominance. Accordingly, it is strongly argued that illustrated materials from the period, almost universally viewed as secondary to texts as historical sources, are a vital and untapped resource that, considered alongside the other manifestations of scientific and popular print culture of the period, have the potential to transform our understanding of modern science.[9]

[9] B. Lightman, ‘The Visual Theology of Victorian Popularisation of Science: From Reverent Eye to Chemical Retina’, *Isis*, 91, 4 (Dec., 2000), 651 – 680.

I.

The work which follows is broadly structured to follow quinarianism's rise to fashion, its brief but vital period of influence, and its rapid decline. Each phase was dominated by a different form of quinarianism. Initially devised by William Sharp Macleay (1792-1865) and first published in 1819, quinarianism quickly developed into three main variants, the other two developed by the ornithologists Nicholas Vigors (1785-1840) and William Swainson (1789-1855). Neither the theory itself, nor the careers of its three principal proponents, have received much historical attention.

At this point, it is worthwhile to briefly outline the three variants which, whilst they shared common features, differed sufficiently in detail for it to pose a critical obstacle to quinarianism as a durable taxonomic system. Macleay's system was shaped, primarily, by his studies of *annulosa*, arthropods (invertebrates with exoskeletons, such as insects and crustaceans) and worms, though he was later to make a foray into ornithology with a descriptive catalogue of the birds of Cuba after being encouraged by Vigors' own work in the early 1820s.[10] Macleay was particularly fascinated by the seemingly-endless variation in the anatomical structure of beetles, an interest that he shared with many nineteenth century naturalists, including Charles Darwin and Alfred Russel Wallace (1823-1913).[11] As advanced in the first volume of his first work, the *Horae Entomologicae*, published in 1819, Macleay's quinary theory may justly be seen as intended exclusively for the use of entomologists.[12] Indeed, it is an extended essay which outlines his painstaking work classifying the Linnaean

[10] W. S. Macleay, 'Remarks on the Comparative Anatomy of certain Birds of Cuba, with a view to their respective Places in the System of Nature or to their Relations with other Animals', *Transactions of the Linnean Society*, 16 (1829c), 1-46, 12.
[11] R. J. Barney, 'Leaf Beetle References in Charles Darwin's Correspondence', *The Coleopterists Bulletin*, 61, 4 (2007), 552-558.
[12] W. S. Macleay, *Horae Entomologicae*, 2 vols (London: S. Bagster, 1819-21).

genus *Scarabaeus* (scarab beetles). It is a mark of Macleay's ambition as a naturalist that in the next volume, published in 1821, Macleay went on to broadly apply the theory to the whole of the natural creation.[13] It was this extension of quinarian principles which heralded the theory as a major force in British zoology, and it was swiftly adopted by a small but prominent group of zoologists centred on London's scientific institutions, particularly Vigors and the zoologists of the Linnean Society of London.

What Macleay proposed was that, if only they would heed the evidence of their eyes, it was possible for naturalists to discern in nature "the plan by which the Deity regulated the creation" and that they would thereby obtain "a view of the universe as it was originally designed".[14] Though he was later to be accused of flirting with atheism, likely on account of his professed admiration of Lamarck's entomological work, from the first appearance of the *Horae* Macleay went to great pains to stress that his circular system reinforced, rather than undermined, the traditional, theistic 'Great Chain of Being' that had dominated how naturalists had viewed the natural world during the preceding centuries.[15]

The details of Macleay's original theory are complex. By the end of the nineteenth century, experienced zoologists could make neither head nor tail of it, and even in the 1820s certain aspects drew the condemnation of Macleay's contemporaries. Broadly speaking, the theory was based upon two parallel forms of resemblance that Macleay had observed in his study of *Coleoptera*, a class of beetles on which his father, the entomologist and colonial

[13] W. S. Macleay, *Horae Entomologicae: Or, Essays on the Annulose Animals, Vol. I. Part II.* (London: S. Bagster, 1821).
[14] W. S. Macleay, 'Remarks on the Identity of Certain General Laws which have Been Lately Observed to Regulate the Natural Distribution of Insects and Fungi', *Transactions of the Linnean Society of London*, 14, 1 (1825), 46–67.
[15] Macleay, *Horae, Part II*, 162-169. For a representative attack on Macleay, see J. Rennie (ed.), *Ornithological Dictionary of British Birds, by Colonel G. Montagu, F. L. S., with a Plan of Study, and many new articles and original observations* (London: Hurst, Chance and Co., 1831), especially xxxix-xlii.

administrator Alexander Macleay (1767-1848), was an acknowledged expert.[16] The first were based on similarities of structure, known as affinities, which link organisms within the *same* group or order, such as the similarities in morphology and anatomy between eagles and hawks. The second were similarities of appearance based on comparable structures between species in *different* orders, such as the wings of a bird and a bat. These were classed as analogies.[17]

Macleay, poring over his father's collections, had seen an underlying regularity to the bewildering array of forms represented in the ranks of pinned beetles. Some of the variations in appearance were minute, others startlingly apparent. Through what he was later at pains to present as a rigorously empirical study, Macleay began setting them into groups based on points of similarity and divergence. Eventually, he composed the species in the collection into families, each composed of five genera of five species each, with twenty-five species in each family. Despite not being well-versed in other branches of zoology, and similarly inexperienced in botany, he extended this privileging of the number five right across the animal and plant kingdoms, drawing points of analogy between the lowest forms of animal and the highest forms of plant. In the animal kingdom, he declared, there are five primary subkingdoms: Vertebrata, Annulosa (arthropods), Mollusca, Radiata (radially-symmetric animals, such as jellyfish), and Acrita (worms, polyps, protozoa). Each of these groups he divided into five classes, which were further subdivided into orders, and from then into genera and finally to species.[18]

At each level of classification, from kingdom downwards, the five groupings are arranged in touching ('osculant') circles, the forms within each circle arranged according to

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[16] H. King, 'Man in a trap: Alexander Macleay, colonial secretary of New South Wales', *Royal Australian Historical Society Journal and Proceedings*, 68 (1982), 37–48.
[17] M. Blaisdell, 'Natural Theology and Nature's Disguises', *Journal of the History of Biology*, 15, 2 (Summer, 1982), 170.
[18] B. Kohlmann, 'History of Scarabaeoid Classification', *Coleopterists Society Monographs. Patricia Vaurie Series*, No. 5 (Dec., 2006), 19-34, 22; Blaisdell, 170.

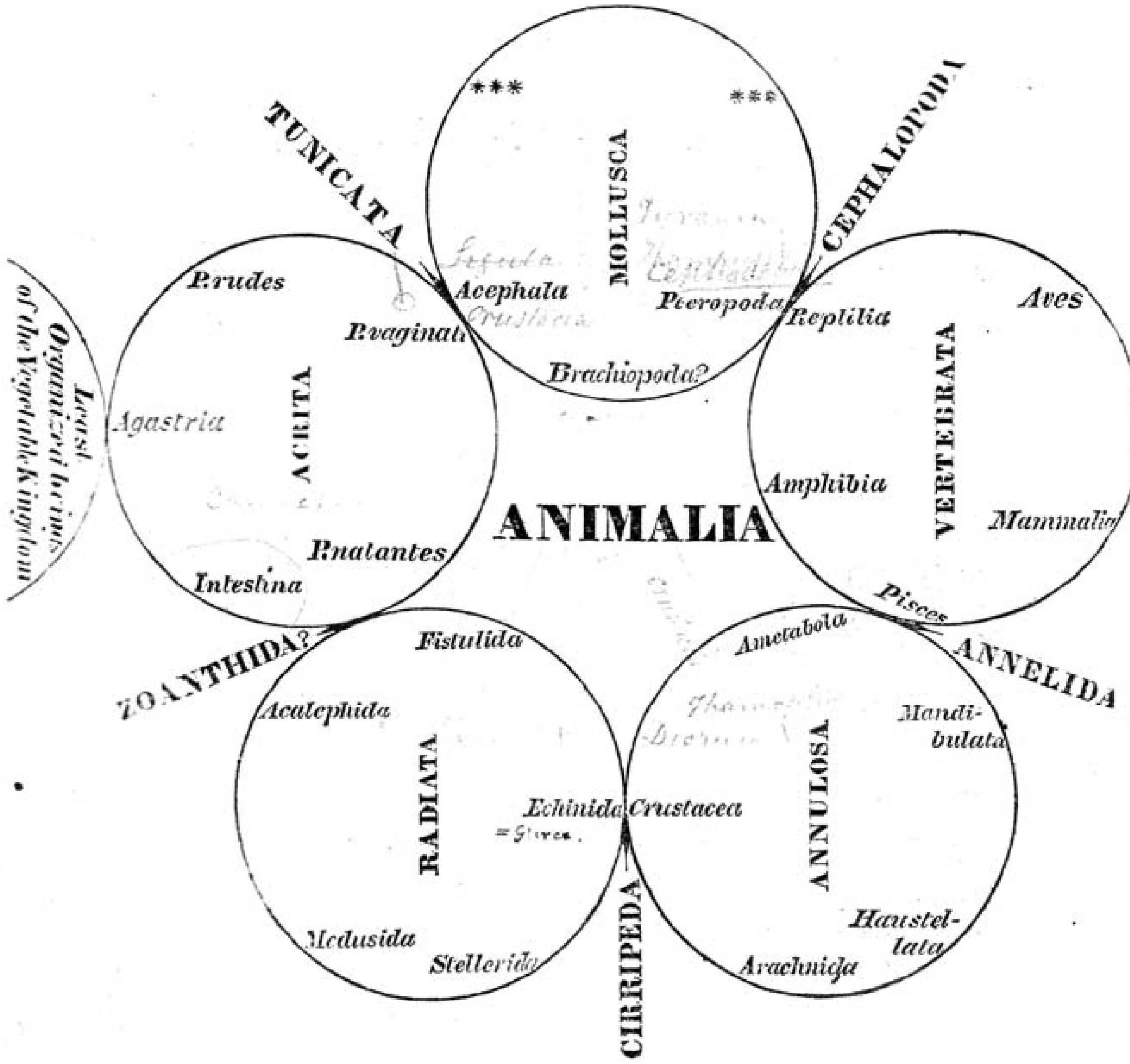

Figure 1. W. S. Macleay’s quinarian arrangement of the animal kingdom.

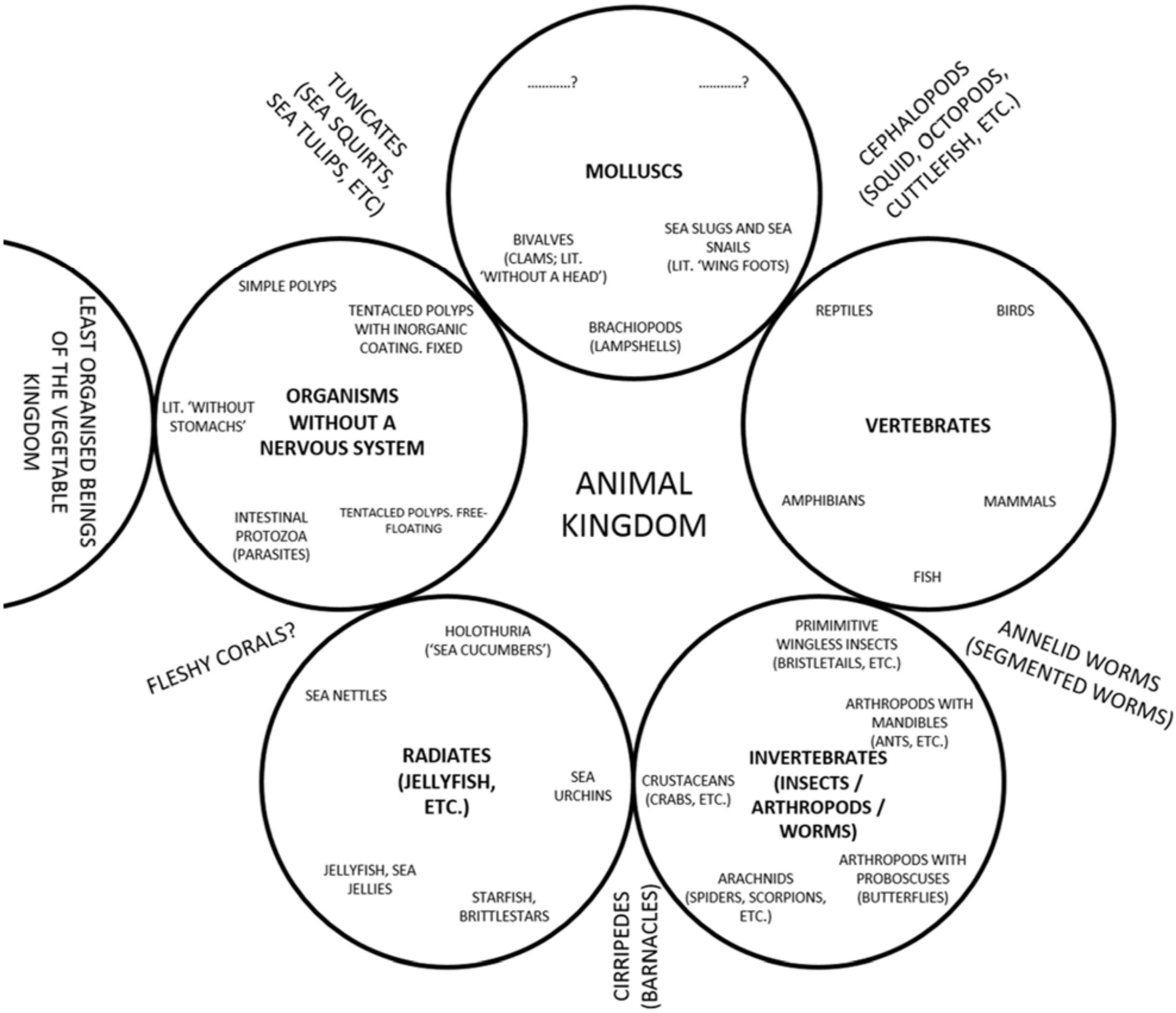

Figure 2. Macleay's arrangement of the animal kingdom (author's interpretation). It should be noted that many of the taxons used by Macleay in his original, latinate diagram have been superseded, incorporated into new taxons, or are now used to denote different animals. For example, Macleay's sub-kingdom 'Acrita', little known in the early-nineteenth century, is here understood to include polyps and protozoa. Acrita is now understood to be a sub-kingdom encompassing unicellular eukaryotic organisms (protozoa). To avoid confusion, the author has adhered to Macleay's understanding of the terms as much as possible.

gradations of similarity, or their affinities, to the next form (*figs.* 1 and 2). Like Linnaeus before him, and Darwin after, Macleay saw only graduated shifts in nature, not saltations, or sudden leaps. Each circle was formed by a series of affinities which ‘returned’ upon themselves, hence the circular diagrammatic arrangement. Whilst each particular circle was arranged according to affinities, the lowest forms at adjoining points on two different circles were related by analogies. This is Macleay’s concept of parallelism, and may be expressed thus:

Of the affinities within each circle: **A1** – A2 – A3 – A4 – A5 – **A1** etc.

Of the analogies between different circles: A1 --- A2 ---- etc.

↓ ↓

P1 --- P2 ---- etc.[19]

Every circle was therefore linked, by analogies, to every other circular series. This complex system of affinities and analogies, Macleay believed, most accurately reflected the web of inter-relations between species as they actually existed in nature. It was a ‘natural’, rather than ‘artificial’ system of classification.

This was important, for few issues exercised naturalists in the early-nineteenth century more rigorously than the division between ‘artificial’ and ‘natural’ classificatory systems greatly exercised, and the discovery of the true ‘natural’ system was their most highly prized goal. This may seem odd, for taxonomy, the process of naming and ordering, is ostensibly a rather dry business which largely fell out of favour with biologists in the second half of the

[19] This diagram draws heavily upon Ospovat’s own lucid analysis. Ospovat, *The Development of Darwin's Theory*, 103.

twentieth century, a possible reason why the decades before 1859 have been so neglected by modern scientists and historians alike. The rise of genetics, particularly following the evolutionary synthesis of the 1930s, left taxonomy and classification seeming anachronistic, even pointless. Fifty years ago, the biologist Frederick Warburton wearily noted the 'bored hostility' of students when confronted with lectures on classification, a response which he believed was the result both of any lecturer's inability to acquaint students with the sheer diversity of living organisms, and also of a general misunderstanding of *what* classification entailed.[20] The latter appears to have been a persistent problem. In 2002 Ernst Mayr and Walter Bock deemed it necessary in an important paper on ordering systems in zoology to state again the 'enormous importance' of the process of classification to all fields of science, including zoology, and noted that the twentieth-century disdain for classification had softened only to consider 'specific modern controversies' relating to Darwinian classification.[21]

That two biologists of the standing of Mayr and Bock made such comments should make us pause, for the eclipse of taxonomy in modern biology is an extraordinary phenomenon. Classification is a vital part of the biologist's work, reducing a chaos of diversity, whether it be at the cellular level or at the level of species and higher taxa, to the sort of manageable arrangements which make scientific explanation and hypotheses possible.[22] Further, despite the successive appearance of new approaches, such as phenetics (which classifies organisms on overall morphology) and cladistics (which groups organisms on the basis of common ancestry and which largely superseded phenetics), it is an activity which has been affected very little by the 'revolutions', Darwinian or otherwise, that have transformed biology over the past

[20] F. E. Warburton, 'The Purposes of Classification', *Systematic Zoology*, 16, 3 (1967), 241.
[21] E. Mayr, W. J. Bock, 'Classifications and other ordering systems', *Journal of Zoological Systematics and Evolutionary Research*, 40, 4 (2002), 169-170. One of the few relatively recent studies in the philosophy of biology which deals in detail with classification and its attendant philosophical issues is M. Mahner, M. Bunge, *Foundations of Biophilosophy* (Berlin: Springer, 1997), 213-270, especially 224-254.
[22] Mayr, Bock, 'Classifications', 170.

two hundred years. Indeed, Kevin de Queiroz argues that 'most' of the developments in biological classification from the 1850s to the late-twentieth century reflected technological advances in the means of gathering and analysing information rather than any concerted attempt to put classification on a 'modern', post-Darwinian basis.[23]

For nineteenth-century naturalists, including Macleay and his quinarian followers, classification was central to an issue which still haunts their contemporary successors and which still evades solution. According to Theodosius Dobzhansky, another of the great pioneers of the 'evolutionary synthesis', the 'Species Problem' is the oldest in biology, the source of countless controversies about the nature of species since at least the time of Aristotle. Prior to the evolutionary synthesis, which attempted to redefine the category as individual evolutionary units, the species was primarily a taxonomic concept in biology, the lowest level in the Linnaean system of classification.[24] It is in this more limited sense that Macleay and his contemporaries understood it.

This should not lead us to believe that the long nineteenth-century view of species was in any way clear-cut. The vagueness of the 'traditional' species concept can be seen in the many attempts to codify both botanical and zoological nomenclature from the 1840s onwards, which made no concerted effort to define what constituted a species, or even to define the species concept. The first of these attempts, the 'Strickland Code' of 1844, looms large in this study as its appearance effectively marked the end of quinarianism in Britain, if not across Britain's colonies. Hugh Strickland (1811-1853), the report's eponymous but not sole author, was one of the first British zoologists to grapple with one of the principal attendant issues which devolved from the 'Species Debate'; how to impose a degree of order and stability onto the

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[23] K. de Queiroz, 'Systematics and the Darwinian Revolution', *Philosophy of Science*, 55, 2 (Jun., 1988), 238-240

[24] de Queiroz, 'Systematics', 254-255.

confusing and increasing profusion of names that naturalists gave to the same or similar species.[25]

Nomenclature was a hugely controversial topic throughout the first half of the nineteenth century, for two principal reasons. The first touched upon delicate scientific egos and issues of personal authority. Since Linnaeus, the rule of priority in nomenclature had been rigidly enforced. This meant that the first scientific, binomial name given to a species, either by its discoverer or by the first person to describe it in print, was to be kept for the sake of clarity. As important, it was to be maintained for the sake of *stability*. If subsequent naturalists had given the species other names, these were relegated to the status of junior synonym and were regarded as invalid.[26] This rule was widely acknowledged, but as a glance at any zoological work from the 1820s and 1830s will quickly reveal, it was far from being universally observed. Naturalists were quick to impose new names of their own devising on already discovered and described species if they felt that the old names were either inappropriate or inadequate. Increasingly, a name could be considered inappropriate if, for example, it needlessly alluded to Classical mythology; naming animals after Greek and Roman gods and mythological figures seems to have been a favourite sport of eighteenth-century naturalists.[27] Indeed, the Strickland committee would impose a blanket ban on the use of classically-inspired binomials and rule that naturalists should strive to allude instead to identificatory features in their scientific naming. Had naturalists observed the spirit as well as the letter of the priority rule, much controversy could have been avoided. The constant re-naming of species, often on the basis of minute differences in the plumage of different specimens of the same bird (for

[25] See H. Strickland, 'Report of a Committee Appointed To Consider of the Rules by Which the Nomenclature of Zoology may be Established on a Uniform and Permanent Basis', *Report of the Twelfth Meeting of the British Association for the Advancement of Science* (1842), 110-111.
[26] M. E. G. Miracle, 'On Whose Authority? Temminck's Debates on Zoological Classification and Nomenclature, 1820-1850', *Journal of the History of Biology*, 44, 3 (Fall, 2011), 450.
[27] See H. Strickland, 'Rules for Zoological Nomenclature', *Annals and Magazine of Natural History*, 1 (1837b), 173-176.

example), called into question the validity of the work of the naturalist who first identified the species. This challenged his credibility and undermined his authority, leading to bitter and often lengthy 'Controversies' in the pages of middle-brow natural history journals and 'in-house' scientific publications.

As the number of known and described species increased, particularly from the early-1800s onwards, nomenclature became more closely tied to the 'stuff' of zoological knowledge; specimens and specimen collections. Assiduously cultivated in national and provincial museums, and private institutions such as the Zoological Society of London, late-Georgian and early-Victorian zoology collections differed greatly from their eighteenth-century predecessors. Naturalists who sought to make sense of the natural world were confronted by a staggering amount of empirical data, in the form of skins, skeletons, drawings and descriptions. By 1820, over four thousand species and varieties of bird were recognised, most of which were represented in European collections in the form of multiple specimens.[28] This created a need for consolidation.

The key, increasingly, came to be seen in the use and development of the type-concept. Given its critical importance to the work of most, if not all of the most prominent European zoologists, the type-concept has fared poorly at the hands of historians of science since Paul Farber's comprehensive work during the 1970s and 1980s.[29] This may be due to modern perceptions of type being too-closely associated with the politically and theologically 'safe' theory of the archetype devised by Richard Owen in the 1840s, one of the principal rivals to

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[28] See P. F. Farber, *Discovering Birds: The Emergence of Ornithology as a Scientific Discipline, 1760-1850*, 2nd edition (Baltimore, MD: Johns Hopkins University Press, 1997), 97-120.

[29] See P. L. Farber, 'The Type-Concept in Zoology during the First Half of the Nineteenth Century', *Journal of the History of Biology*, 9, 1 (Spring, 1976), 93-119; 'The Development of Taxidermy and the History of Ornithology', *Isis*, 68, 4 (Dec., 1977), 550-566; and *Discovering Birds: The Emergence of Ornithology as a Scientific Discipline, 1760-1850*, 2nd edition (Baltimore, MD: Johns Hopkins University Press, 1997).

Darwin's evolutionary theory; or perhaps to its Platonist overtones.[30] Yet, as Farber states, the type-concept 'functioned as a central organising idea' in zoology and was far more complex, and more productive, than habitually assumed.[31] Farber sought to draw out the type-concept from under the shadow of contemporary biology. In doing so, he perceived that the notion was, in his words, a 'constellation' of concepts which zoologists working in different specialities, and to different ends, understood in different ways. The most important, in Farber's view, were the 'classification type-concept', the 'collection type-concept', and the 'morphological type-concept'.[32] The first two are closely-related and were used almost universally by naturalists to order collections; determine species and higher taxa; and, by the quinarians at least, to produce systems of 'natural' classification.[33]

In the hands of Macleay, Vigors, and particularly Swainson, the classification type-concept quickly transcended its original parameters as a convenient tool for identifying and delineating groups in an artificial, rational system of classification, such as Linnaeus'. In artificial systems, one member of a taxon is used, as the name-bearer or as an 'ideal' model', to characterise the next higher taxon.[34] In this way, the species acts as the 'type' for the genus, the genus as the 'type' for the family, and so on up the taxonomic hierarchy. The use of type specimens on which to pin species names greatly facilitated this process, and allowed naturalists to put into order the chaos in which they increasingly found themselves. It also served to create stability, as Strickland was careful to note in 1844: 'We may obtain a great amount of fixity, in the position at least, if not in the extent of our groups, by invariably selecting a *type*, to be permanently referred to as a standard of comparison. Every family, for

[30] See Desmond, *Archetypes and Ancestors*, for a full discussion of Owen's 'archetype' and its contested origins.
[31] Farber, 'Type-Concept in Zoology', 93.
[32] Farber, 'Type-Concept in Zoology', 93-95.
[33] Farber, 'Type-Concept in Zoology', 113-117.
[34] Farber, 'Type-Concept in Zoology', 113.

instance, should have its *type-subfamily*, every sub-family its *type-genus*, and every genus its *type-species*.'[35] However, for naturalists of Macleay's stamp, dissatisfied with Linnaeus' rigid hierarchical classification and determined to find the true, 'natural' system of nature which reflected actual groupings of species, this interpretation of the classification type could not suffice.

As will be seen, Macleay's quinarian system, and both Vigors' and Swainson's later variants, sought to build a system of classification which reflected the unity of plan which, they believed, underpinned the whole of creation. Unlike their European counterparts, such as Lamarck and Cuvier, they did not base their systems on the examination of internal anatomical structures, instead focussing their attention largely on external morphological features in much the same manner as their eighteenth-century predecessors. This curious throwback, when European naturalists were working with reference to cutting-edge developments in comparative anatomy, can be drawn to the practical constraints of zoology in the 1820s and 1830s, when preservation techniques were far from failsafe and naturalists were forced to rely on skins for their zoological knowledge.[36] It was on the basis of these details of external anatomy, such as beak structure and feather placement, that the ornithological followers of quinarianism made their classifications.

That quinarianism wielded greater influence in ornithology than in any other branch of natural history was due greatly to the personality and executive flair of Vigors who, by 1822, had emerged as the leader of a group of zoologists centred on the Linnean Society. At this time the Linnean was the premier natural history society in Britain, and second only, perhaps, to the

[35] H. E. Strickland, 'Report on the Recent Progress and Present State of Ornithology', *Report of the Fourteenth Meeting of the British Association for the Advancement of Science* (1844), 219.
[36] The close connection between preservation techniques and zoological theory is explored in greater depth in Farber, Development of Taxidermy and the History of Ornithology', 550-566.

Royal Society in prestige and the eminence of its membership.[37] However, from its inception in 1778 as the repository of Linnaeus' private papers the Linnean had been dominated by the influence of botanists zealously wedded to the 'Great Master's' legacy. This took the form of an over-worshipful and mulish disinclination to tamper with Linnaeus' classification in any way, despite the vast accession of information that had occurred in the intervening fifty years which had served to render his system, created with reference to eighteenth-century knowledge, increasingly inadequate. Disaffection with this state of affairs came principally from the zoologist members of the society, who felt increasingly marginalised by the overweening dominance of botany in British scientific counsels. The Zoological Club of the Linnean Society (henceforth the Zoological Club), the first focus of strictly zoological research in Britain, was established in response, with Vigors performing what would become his habitual role as an all-powerful Secretary.[38]

The Zoological Club, which was quickly overshadowed by the Zoological Society, was to prove hugely important in the development of zoology, and particularly ornithology, in Britain over the next decade. Vigors was determined that the Club embrace and further the quinarian cause, he himself having become a convert by 1823, if not earlier. Primarily an ornithologist, Vigors adapted Macleay's system and applied it to birds with considerable success. In its fundamental principles, Vigors' system (figures 3 and 4) did not differ greatly from Macleay's own, as can be seen when comparing the diagrammatic representations that both men created. Vigors adhered to the concepts of affinity and analogy elaborated by Macleay and identified five orders of birds. Four of these, *Raptores* (birds of prey), *Grallatores*

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[37] A. T. Gage, W. T. Stearn, *A Bicentenary History of the Linnean Society of London* (London: Linnean Society of London, 1988); and T. Kennett, *The Lord Treasurer of Botany. Sir James Edward Smith and the Linnean Collections* (London: Linnean Society of London, 2016).

[38] See H. Scherren, *The Zoological Society of London: A Sketch of its Foundation and Development, and the Story of its Farm, Museum, Gardens, Menagerie and Library* (London: Cassell, 1905), 1-24; N. A. Vigors, 'An Address Delivered at the Sixth and Last Meeting of the Zoological Club of the Linnean Society of London, on the 29th of November, 1829', *Magazine of Natural History*, 3 (1830) 201–226.

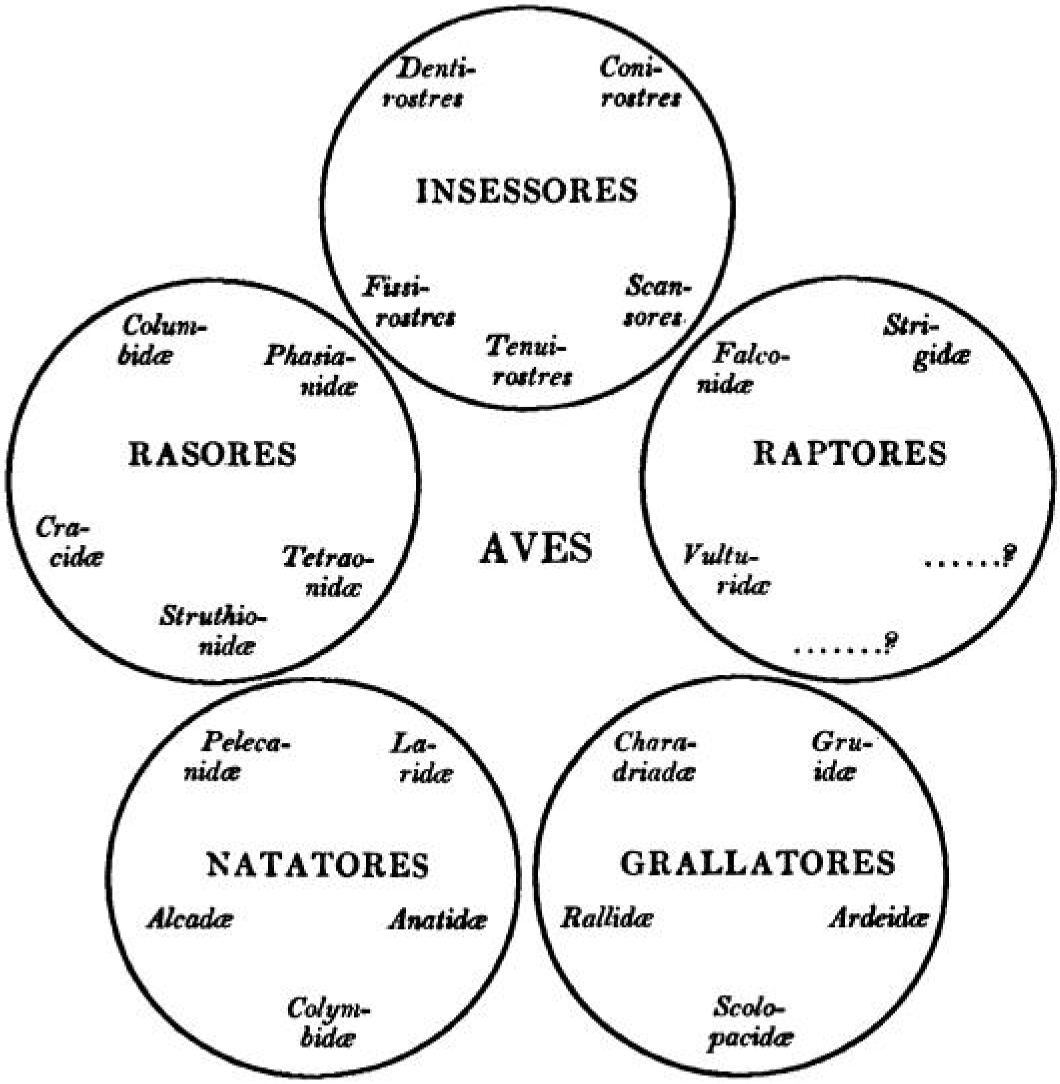

Figure 3. Vigors' arrangement of the Class *Aves* (1824).

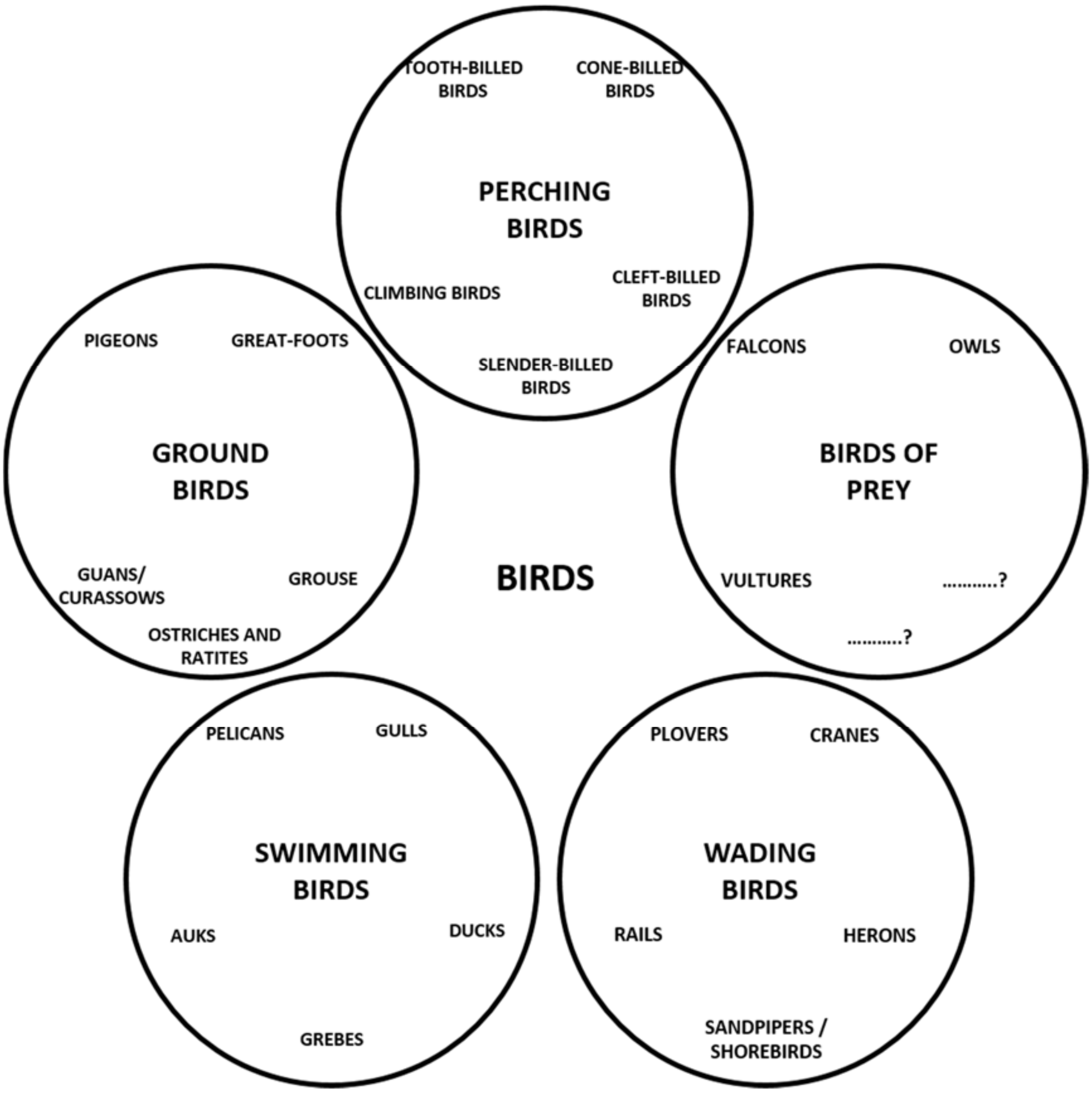

Figure 4. Vigors' arrangement of the Class of birds (author's interpretation). An important point to note is that Vigors intended the circles to be 'osculant', or touching, as in Macleay's original arrangement (see figures 1 and 2.). At each osculant point, Vigors saw analogies between the Families in different Orders. So, for example, he believed that there were analogies (common points of anatomical structure) between ducks and rails, which belonged to different Orders (swimming birds and wading birds respectively) and which served to link them together. On comparing Vigors' arrangement of birds, it can be seen that it differs markedly from that proposed by Swainson. Not only did Swainson draw more elaborate analogies between Orders and Families than Vigors, but he also arranged the Class differently. Where Vigors sees wading birds as most closely related to birds of prey and swimming birds, Swainson believed the group was related to swimming birds and ground birds. This disagreement has considerable consequences for the two naturalists' respective understanding of *Aves*, and fed the growing controversy between them from c.1830 onwards.

(wading birds), *Natatores* (web-footed birds), and *Rasores* (a loose order which encompassed birds from pigeons to ostriches) were adaptations of extant Linnaean orders. To these he added the *Incessores*, or 'perching birds' such as finches. Where gaps appear in the circles of affinity, such as in his arrangement of the *Raptores*, Vigors here supposes the future discovery of species which will neatly slot into place.

Quite why Vigors deemed quinarianism to be peculiarly applicable to ornithology is not clear.[39] Given the state of early-nineteenth century natural history, one reason must be that ornithology had for long been the least neglected branch of zoology and was also widely popular. There was a considerable and growing body of material, in the form of specimens and written descriptions, on which to base new and innovative systems. That ornithology also happened to be Vigors' particular bailiwick should also be taken into account. The political and personal should never be discounted as factors in scientific development and they are particularly crucial to our understanding of not only how quinarianism gained such a hold over British zoologists. As this study demonstrates, Vigors was, for a short period between 1825 and 1836, perhaps the shrewdest operator in London's scientific institutions. His determination to position himself at the head of a new, distinctively 'British' science frequently led him act in ways that would eventually bring about his downfall and which opened up divisions with his fellow naturalists. This was to be nowhere more important, or as damaging, as the venomous mutual hatred between Vigors and the final quinarian onto the field, William Swainson.

Swainson had stayed studiously aloof from Vigors' institutional machinations for much of the 1820s. After an early skirmish in 1824, Vigors and Swainson were to fall out spectacularly in 1830 and carry on a very public feud in the pages of the *Magazine of Natural*

[39] N. A. Vigors., 'Observations on the Natural Affinities that Connect the Orders and Tribes of Birds', *Transactions of the Linnean Society of London*, 14, 3 (May, 1825), 399-400.

History, one of the most popular ‘middle-brow’ science publications of the period. By most accounts a difficult man, Swainson had already established himself as a zoological artist and field naturalist of great talent by the time he embraced quinarianism in the early 1830s.[40] However, as befitted an individualist, Swainson’s understanding and development of Macleay’s system was highly idiosyncratic, to the extent that Aaron Novick, a modern historian of early-nineteenth century biological taxonomy, has suggested that he not be regarded as a quinarian at all.[41]

There is some force to this argument. Swainson, a High Tory, wrapped his system in a cloud of politico-religious verbiage that struck a note quite at variance with his fellow quinarians. He also developed a highly-complex system of affinities and analogies, the connections between species of different families and orders, which far exceeded anything suggested by either Macleay or Vigors. Expressed diagrammatically, the differences are plain (figures 5 and 6), particularly in the *multiple* points of analogy Swainson proposed in opposition to the more conservative identification of singular points by Macleay and Vigors.

Whilst Macleay and Vigors saw in all natural groups, such as birds, a circular tendency from the least complex to the most complex, Swainson went another step further. He discerned a tendency to lesser and greater *perfection* in natural groups that expressed itself in a distinctive understanding of type. For Swainson, each primary grouping in nature, for example birds, could be separated into *three* sub-divisions: the typical; the sub-typical; and the aberrant, which was actually a compound of three circles. In figure 6, Swainson’s arrangement of birds, the typical group is the perching birds (*incessores*); the sub-typical the birds of prey (*raptores*); and the waders, ‘swimming birds’, and ‘ground birds’ the three aberrant groups. Each of these

[40] D. M. Knight, ‘High Church Science: William Swainson and William Kirby’, *Paradigm*, 2, 4 (2001), 1-8.
[41] A. Novick, ‘On the Origins of the Quinarian System of Classification’, *Journal of the History of Biology* (2015) [Epub ahead of print], 1-39.

groupings could be sub-divided in turn into the typical, sub-typical and aberrant. Members of the typical group, Swainson explained, are the ‘most perfectly organised’:

> [T]hat is to say they are endowed with the greatest number of perfections, and capable of performing, to the greatest extent, the functions which peculiarly characterise their respective circles. This is universal in all typical groups; but there is a marked difference between the types of a typical circle, and the types of an aberrant one. In the first we find a combination of properties concentrated, as it were, in certain individuals, without any one of these preponderating, in a remarkable degree, over the others; whereas in the second it is quite the reverse: in these last, one faculty is developed in the highest degree, as if to compensate for the total absence, or very slight development, of others.[42]

[42] W. Swainson, *A Treatise on the Geography and Classification of Animals* (London: Longman, 1835), 242.

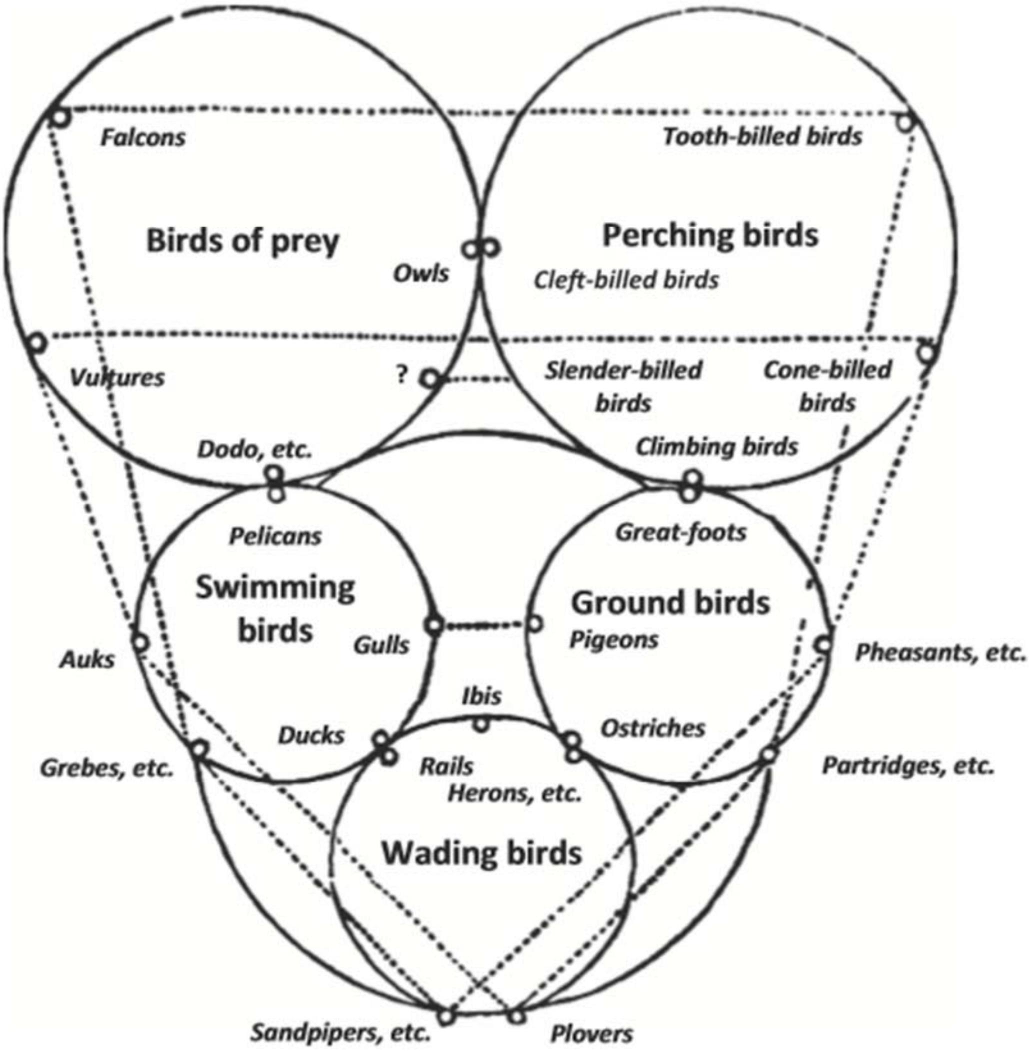

Figure 5: Coggon's (2002) interpretation of Swainson's quinarian arrangement of birds. It is useful to compare this with Vigors' diagram of the same class, which is considerably less ambitious; the disparity between the two hints at the systems' different purposes. Swainson's theory, as the diagram suggests, was complex and led him down some dubious paths, most (in)famously his analogy between turtles and birds of prey, and the platypus and birds on account of their similar beaks.[43] Interestingly, he early on drew a line of relation between birds and reptiles, but did so by finding a 'missing link' in the chain of affinity and analogy in pterosaurs, extinct flying reptiles that were just becoming known to palaeontologists.[44]

[43] Swainson, *Natural History of Birds*, 5-6.
[44] Swainson, *Natural History of Birds*, 4-5.

The appearance of these main variants at regularly-spaced intervals over the space of fifteen years, and their quite different methodological, institutional and ideological motivations and applications, necessitates a broadly-chronological analysis, in which their formative themes are weighed and considered. As so many of the principal quinarian naturalists have slipped into obscurity, the first chapter is heavily weighted towards their work and a re-evaluation of their place in early nineteenth-century scientific culture, particularly that of Macleay and the original theory he advanced in *Horae Entomologicae*, quinarianism's *ur-text*. Beginning with an analysis of the origins of quinarianism, it is explained why the theory took this particular form and what factors, scientific and otherwise, shaped Macleay's intellectual development.[45]

This analysis requires us to fully appreciate the extent of the unprecedented advances made during this time in the understanding of the natural world in order to locate quinary theory in its scientific context. The progress of zoology from 1800 onwards was so rapid as to make impossible the identification of one key factor in quinarianism's rise. There were numerous convergent factors which profoundly changed natural history, particularly ornithology, the most radical of all the branches of British natural history during this period and particularly influenced by quinarian systematics. Some of these aspects have been exhaustively-studied. Without exception, historians have acknowledged the role of a vast increase of specimen collections, and the zeal and industry of scientific travellers, collectors, and colonial officials.[46]

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[45] Other principal works that are considered, and which were of central importance to the spread of the quinary theory, include 'Remarks on the Identity of Certain General Laws which have Been Lately Observed to Regulate the Natural Distribution of Insects and Fungi', *Transactions of the Linnean Society of London*, 14, 1 (1825), 46–68; *Annulosa Javonica* (London: Kingsbury, Parbury & Allen, 1825); and 'On the Dying Struggle of the Dichotomous System', *The Philosophical Magazine*, 7 (1830), 431-445.

[46] For general histories, see: S. Atran, *Cognitive Foundations of Natural History: Towards an Anthropology of Science* (Cambridge: Cambridge University Press, 1990); N. Jardine, J. A. Secord, E. Spary (eds.), *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996); D. M. Knight, *The Age of Science* (London: Basil Blackwell, 1986); S. F. Cannon, *Science in Culture: The Early Victorian Period* (New York: Science History Publications, 1978). Useful histories of ornithology include Farber, *Discovering Birds*; F. B. Gill, *Ornithology, Second Edition* (New York: W. H. Freeman and Company, 1995); P. Bircham, *A History of Ornithology* (London: Collins, 2007). The work of important individual collectors and naturalists addressed in this thesis is analysed in M. Cocker, C. Inskipp, *A Himalayan Naturalist: The Life and Work of Brian Houghton*

This was largely a product of imperial expansion. Although Britain emerged from the Napoleonic Wars a country plagued by internal dissension, it had also acquired foreign territories, a process which continued throughout the 1820s and on to the end of the nineteenth century and beyond. Seventeen new colonies were added to Britain's territories between 1815 and 1827 alone. This extension of commerce and colonisation opened up fresh vistas to British naturalists, and whole new fields of investigation.[47]

However, there was more to this progress than the mere accumulation of materials. The *mode* of investigation also changed. Whilst the number of known species had remained small, there was no imperative upon the naturalist to regard species as anything more than isolated, self-contained groups. By 1800, the systems of classification that dominated well into the eighteenth century, and that had long sufficed to elucidate the natural world, were shown to be inadequate. Confronted with a profusion of new species, many of which were unlike anything previously identified and confounded by their exuberant variety, naturalists were forced to revise their limited views of the natural world. This led them to find in Nature the apparent affinities between species, the lowest taxonomic group then recognised, and between species and higher taxonomic groups such as genera and families. The application of insights drawn from other developing disciplines, particularly comparative anatomy and studies of geographical distribution, as a means of finding their way through the 'mighty maze' that lay

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Hodgson (Oxford: Oxford University Press, 1988); A. Datta, *John Gould in Australia: Letters and Drawings* (Victoria: Melbourne University Press, 1997); A. Desmond and J. Moore, *Darwin* (London: Penguin Books Ltd., 1992); D. Donald and J. Munro, *Endless Forms: Charles Darwin, Natural Science and the Visual Arts* (New Haven, CT: Yale University Press, 2009); J. Endersby, *Imperial Nature: Joseph Hooker and the Practices of Victorian Science* (Chicago, IL: Chicago University Press, 2008); J. Hemming, *Naturalists in Paradise: Wallace, Bates and Spruce in the Amazon* (London: Thames & Hudson, 2015). Finally, the following studies assess the relation of collectors to museum culture; S. J. M. M. Alberti, 'Placing Nature: Natural History Collections and Their Owners in Nineteenth-Century Provincial England', *The British Journal for the History of Science*, 35, No. 3 (Sep., 2002), 291-311; S. T. Asma, *Stuffed Animals and Pickled Heads: The Culture and Evolution of Natural History Museums* (Oxford: Oxford University Press, 2001); A. Pavord, *The Naming of Names: The Search for Order in the World of Plants* (London: Bloomsbury, 2005).

[47] J. Gascoigne, *Joseph Banks and the English Enlightenment: Useful Knowledge and Polite Culture* (Cambridge: Cambridge University Press, 1994); J. Gascoigne, 'The Royal Society, natural history and the peoples of the "New World(s)", 1660-1800', *The British Journal for the History of Science*, 42, No. 4 (Dec., 2009), 539-562.

before them represented a radical departure from the dominant methodological norms, and involved a swing towards the 'philosophical' practices of European naturalists that relied upon the generalisation of data and materials.[48] As Vigors, writing in 1825 at the height of his campaign to make quinarianism the dominant zoological system in Britain, noted, the naturalist had 'ceased to dwell merely upon the wonders of the individual, as he caught a glimpse of the newer and more specious wonders displayed in the extensive affinities of the whole'.[49] In other words, the investigation of nature was no longer simply the minute work of collection and observation. The mind was to be as employed as the eye, directed to the investigation of the properties of the individual as a means of divining the grander system of nature.

This methodological shift was recorded and debated in a vast and hitherto largely-unexplored literature. Macleay, Vigors, Swainson, Gould and their peers communicated the details of their own work, with one another and with the European scientific community at large, both in published monographs and journal articles, and in copious private correspondence.[50] The bulk of Macleay's papers, held by the University of Sydney, were inaccessible for the purposes of this study.[51] However, correspondence to fellow naturalists survive in British collections, principally in the Linnean Society of London, which holds the papers of William Kirby (1759-1850), a fellow entomologist with whom Macleay corresponded between 1810 and 1825 and who acted as a sounding board for the younger naturalist during the writing of his *Horae Entomologicae*.[52] These letters give a crucial insight

[48] N. A. Vigors, 'Observations on the Natural Affinities that Connect the Orders and Tribes of Birds', *Transactions of the Linnean Society of London*, 5 (1825), 395-396; B. J. Strasser, 'Collecting Nature: Practices, Styles and Narratives', *Osiris*, 27, 1 (2012), 303-340.
[49] Vigors, 'Observations', 396.
[50] Macleay Correspondence, Swainson Correspondence, LS; Gould Papers, NHM; Harvie-Brown Collection, Jardine Papers, RSM. Gould's correspondence has also been collated and published: Sauer, G. C., Datta, A. (eds.), *John Gould the Bird Man: Correspondence. With a Chronology of his Life and Works, Volume 1, Through 1838* (London: Maurizio Martino and Natural History Museum, 1998); *John Gould the Bird Man: Correspondence. With a Chronology of his Life and Works, Volume 2, Through 1839-40* (London: Maurizio Martino and Natural History Museum, 1998).
[51] Macleay Natural History Collections, University of Sydney, Sydney.
[52] Macleay Correspondence, Box K, 2-254. LS.

into the scientific concerns that drove his work and the social background which shaped his quinarian theory.[53]

That Macleay's theory rapidly gained a powerful following in London's scientific circles was largely due to the efforts of Nicholas Vigors. A commanding figure who occupied successive important administrative posts in the Linnean and Zoological Societies, Vigors' career reveals much about scientific practices and the basis of zoology in early nineteenth-century Britain. Despite this, he is now the most overlooked of the principal quinarians, his contemporary reputation damaged by internal reforms at the Zoological Society in 1835, and in history by the decisive shift away from quinarianism in the 1840s.[54]

Though his name lives on in zoological taxonomy through the considerable number of species that he identified, Vigors' historical importance rests on his attempt to establish his own quinarian variant, extended primarily to ornithology, as the dominant methodology of a distinctively 'British' zoology. His vision of a 'national' science, which sought to draw upon a distinctively 'British' intellectual tradition and which would rival French scientific dominance, survives in a remarkable and little-studied series of articles published during the 1820s, analysed here for the first time.[55] Through this shrewd mobilisation of scientific journals, Vigors attracted the support of a small but vocal cadre of zoologists centred upon his own power bases of the Zoological Club of the Linnean Society and, from 1826, the Zoological Society of London; and conducted his vendettas with fellow naturalists.[56] Macleay, whose

[53] For example, Macleay Letters, K207, W. Kirby to W. S. Macleay, April 9 1821. LS.
[54] Desmond, 'The Making of Institutional Zoology', 161-164.
[55] The most important of these are Vigors, 'Observations', 395-517; 'Sketches in Ornithology; or, Observations on the leading Affinities of the more extensive groups of Birds', *The Zoological Journal*, 2 (1826), 36-70, 182-198; and 'A Reply to some Observations in the "Dictionnaire des Sciences Naturelles", upon the newly characterised groups of the Psittacidae', *The Zoological Journal*, 3 (1828), 91-124.
[56] Vigors' importance is highlighted in Minutes of Council of the Zoological Society of London, **I-IV.** ZSL; W. Kirby, Kirby, W., 'Introductory address explanatory of the views of the Zoological Club delivered at its

diplomatic posting to Cuba for ten years from 1826 had removed him from the centre of the action, periodically but effectively intervened in the internecine debates which began to rage on the issue in earnest around 1830.[57]

Imagery played a crucial role in a sustained rhetorical campaign conducted by Vigors and Macleay to diminish the status of continental science whilst drawing upon its best practice. The quinarians were slow to include images in their publications, but this was more than made up for in the series of folios produced by Vigors' protégée, John Gould (1804-1881), beginning in 1830.[58] Now remembered as a superlative naturalist-publisher and impresario, Gould's folios, and natural history folios in general, have been interpreted by historians as stimuli to public interest in natural history and as prestigious methods of establishing scientific reputations.[59] However, they also served a purpose analogous to the museum collections that

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foundation, November 29, 1823, *Zoological Journal*, 2 (1826), 1-8. Vigors' role is assessed by Desmond, 'The Making of Institutional Zoology in London, 153-185; T. Ito, *London Zoo and the Victorians, 1828-1859* (Woodbridge, Suffolk: The Boydell Press, 2014); P. C. Mitchell, *Centenary History of the Zoological Society of London* (London: Zoological Society of London, 1929).

57 W. S. Macleay, 'A Letter to J. E. Bicheno', *The Zoological Journal*, 4 (1829), 401-415; 'On the Dying Struggle of the Dichotomous System', *The Philosophical Magazine*, 7 (1830), 431-445. Vigors' and Swainson's furious argument over Vigors' attacks on French zoologists, considered here, is documented in a series of articles; W. Swainson, 'A Defence of "certain French Naturalists"', *Magazine of Natural History and Journal of Zoology*, 4 (Mar., 1831), 97-108; 'A Further Defence of "certain French Naturalists", *Magazine of Natural History and Journal of Zoology*, 4 (1831), 316-319; and 'The Final Statement of Mr. Swainson, in Reply to Mr. Vigors', *Magazine of Natural History and Journal of Zoology*, 4 (1831), 481-487. N. A. Vigors, 'A Reply to Art. I. No. XVIII of this Journal, in a Letter to the Editor', *Magazine of Natural History and Journal of Zoology*, 4 (1831), 319-337; 'Controversy between W. Swainson, Esq. F.R.S. L.S &c., and N. A. Vigors, Esq. A.M. F.R.S. &c.', *Magazine of Natural History*, 5 (1832), 110-111.

58 The first phase of Gould's folio output can be dated between 1830 and 1848, when he adhered to Vigors' quinarian classification. Those produced in this period and considered in this study include J. Gould, *Century of Birds from the Himalaya Mountains* (London: J. Gould, 1831); *Birds of Europe* (London: J. Gould, 1832-36); *A Monograph of the Ramphastidae* (London: J. Gould, 1834-35); *A synopsis of the birds of Australia, and the adjacent islands* (London: J. Gould, 1837–38); *Monograph of the Trogonidae* (London: J. Gould, 1838); *Birds of Australia* (London: J. Gould, 1840-48); and *A monograph of the Odontophorinae, or partridges of America* (London: J. Gould, 1844-50).

59 Several recent studies of Gould focus on this aspect of his career. See G. C. Sauer, *John Gould, The Bird Man: A Chronology and Bibliography* (London: Sotheran, 1982); I. Tree, *The Bird Man: The Extraordinary Story of John Gould* (London: Ebury Press, 2001); J. Smith, 'Gender, Royalty, and Sexuality in John Gould's "Birds of Australia"', *Victorian Literature and Culture*, 35, 2 (2007), 569-587. By far the best analysis of Gould as a naturalist is A. Datta, *John Gould in Australia: Letters and Drawings* (Melbourne: The Miegunyah Press, 1997). Gould's work is put into its wider context in Allen, *Naturalist in Britain*, 83-107 and *Books and Naturalists*, 155-180; Bircham, *History of Ornithology*, 159-182; A. S. Blum, *Picturing Nature: American Nineteenth-Century Zoological Illustration* (Princeton, NJ: Princeton University Press, 1993); D. Knight, *Zoological Illustration* (Folkestone: Wm. Dawson & Son Ltd, 1977); R. J. M. Olsen, *Audubon's Aviary: The Original Watercolours for The Birds of America* (New York: Skira Rizzoli, 2012).

provided the basis of zoological knowledge; ordered according to classificatory systems such as quinarian theory, their illustrations codified species definitions and were designed to be ‘read’ in the same way as stuffed specimens and skins and classified accordingly. The first of Gould’s folios, *A Century of Birds from the Himalaya Mountains* (1830), written in collaboration with Vigors, served to buttress both the latter’s authority and to showcase quinary classification in the most visible of ways. In conjunction with more ‘scholarly’, specialist publications and with the text in zoological folios, these images were mobilised to promote the dominance of the quinarians’ ‘philosophic’ zoology.[60]

Scientific illustrations are not, and were not intended to be, merely decorative, although men of science and publishers were not, and could not be, blind to the commercial value of including spectacular, vividly-coloured images in their works. As pioneering work by Lorraine Daston, Peter Galison, and Jonathan Smith has demonstrated with respect to eighteenth-century scientific culture and Darwinism, respectively, visual material played a vital role in both the codification and dissemination of science, and served an important rhetorical function.[61] Building upon their insights, and with reference to the zoological illustration of the 1820s, 1830s and 1840s, particularly those of Gould and Swainson, the third chapter of this study analyses how and why illustration was favoured as a repository of scientific authority, and what aesthetic and epistemological compromises were involved. In particular, it is shown how the rigid conventions of European natural history illustration and epistemology were exploited and mediated by Gould, Swainson and others in order to serve their own ends. As is demonstrated,

[60] J. Gould, *Century of Birds from the Himalaya Mountains* (London: J. Gould, 1830).
[61] Of particular importance in this small body of work are: L. Daston, P. Galison, *Objectivity* (New York: Zone Books, 2010), 55-104; W. J. T. Mitchell, *Picture Theory* (Chicago, IL: University of Chicago Press, 1994); J. Smith, *Charles Darwin and Victorian Visual Culture* (Cambridge: Cambridge University Press, 2006), 92-124, and ‘John Gould's "Birds of Australia"’, 569-587.

these were not always scientific, an important consideration which has not been fully explored by Daston and Smith.

Gould's early folios, from a *Century of Birds* (1830) to *Birds of Australia* (1840-48), were the most vivid and visual manifestation of quinarianism, and had a profile and influence which extended beyond the limits of London's scientific community. The period between the publication of the *Century of Birds* and Gould's departure for Australia in 1837, which resulted in the greatest of his folios, was quinarianism's 'high summer'. However, from 1837 onwards the decline of the theory was precipitous. By 1845, few if any self-respecting naturalists in Britain would have anything to do with it.[62]

Although the demise of quinarianism as a broad construct resulted from its problematic mixture of the empirical and the *a priori*, there were other factors at work. Deployed by Vigors in his campaign to establish a 'national' scientific culture in the 1820s and early 1830s, quinarian principles were mobilised from 1835 to buttress theologically-'safe' science from the incursions of radical materialists and a new spirit of professionalism. A reformist spirit pervaded British intellectual life throughout the 1830s, culminating in a series of vicious, internecine battles within several of London's key scientific institutions. The Royal Society, Royal College of Surgeons, and Zoological Society all experienced great upheaval between 1830 and 1835, in which the interests of rising, often radical 'professionals' came up sharply against the vested interests of the established scientific elites.[63] 'Church-and-King' men,

[62] H. E. Strickland, 'On the progress and the present state of ornithology', *Report of the British Association for the Advancement of Science for 1844*, 14 (1845), 170-221; P. Rylands, On the Quinary, or Natural System, of McLeay, Swainson, Vigors, &c.', *Magazine of Natural History*, 9 (1836), 130-138, 175-182; J. Coggon, 'Quinarianism after Darwin's "Origin": The Circular System of William Hincks', *Journal of the History of Biology*, 35, 1 (Spring, 2002), 5-7; M. P. Winsor, *Starfish, Jellyfish and the Order of Life* (New Haven, CT: Yale University Press, 1976), 83-84.
[63] Desmond, *Politics of Evolution*, 101-151, 236-334; H. W. Becher, 'Radicals, Whigs and Conservatives: The Middle and Lower Classes in the Analytical Revolution at Cambridge in the Age of Aristocracy', *The British*

epitomised by the venerable William Kirby, still predominated in the highest scientific circles and whilst few, if any, looked to the Bible as an encyclopaedia of science, almost all viewed the radical materialism espoused by the scientific reformers with distaste and alarm.[64] An ideological counter-attack was required, and William Swainson placed himself at its head.

Paradoxically, despite its complexity, it was to be Swainson's version of quinarianism which exerted the widest influence, reaching beyond the exclusive circles of metropolitan science, from which Swainson was largely excluded by virtue of his class, his temperament, and his loathing of Vigors, to the middle-classes and colonial naturalists. In his books for Dionysius Lardner's *Cabinet Cyclopaedia* and William Jardine's *Naturalist's Library*, which he illustrated himself with detailed engravings of birds and quinarian classificatory plans, Swainson was able to reach an audience that Macleay and Vigors showed little interest in engaging with. Both of these publishing enterprises were ambitious attempts to capitalise of soaring middle-class interest in natural history and science, and driven by Swainson's 'Declinist' belief that British science needed to 'recruit' new practitioners if it was to flourish.[65] However, though he wrote fourteen full-length books that ranged from general scientific treatises to taxidermy manuals, little attention has been paid to Swainson's prolific written output, let alone the way in which he mobilised text and image to disseminate his quinarian ideas.[66] Even David Knight, one of the very few modern historians to tackle

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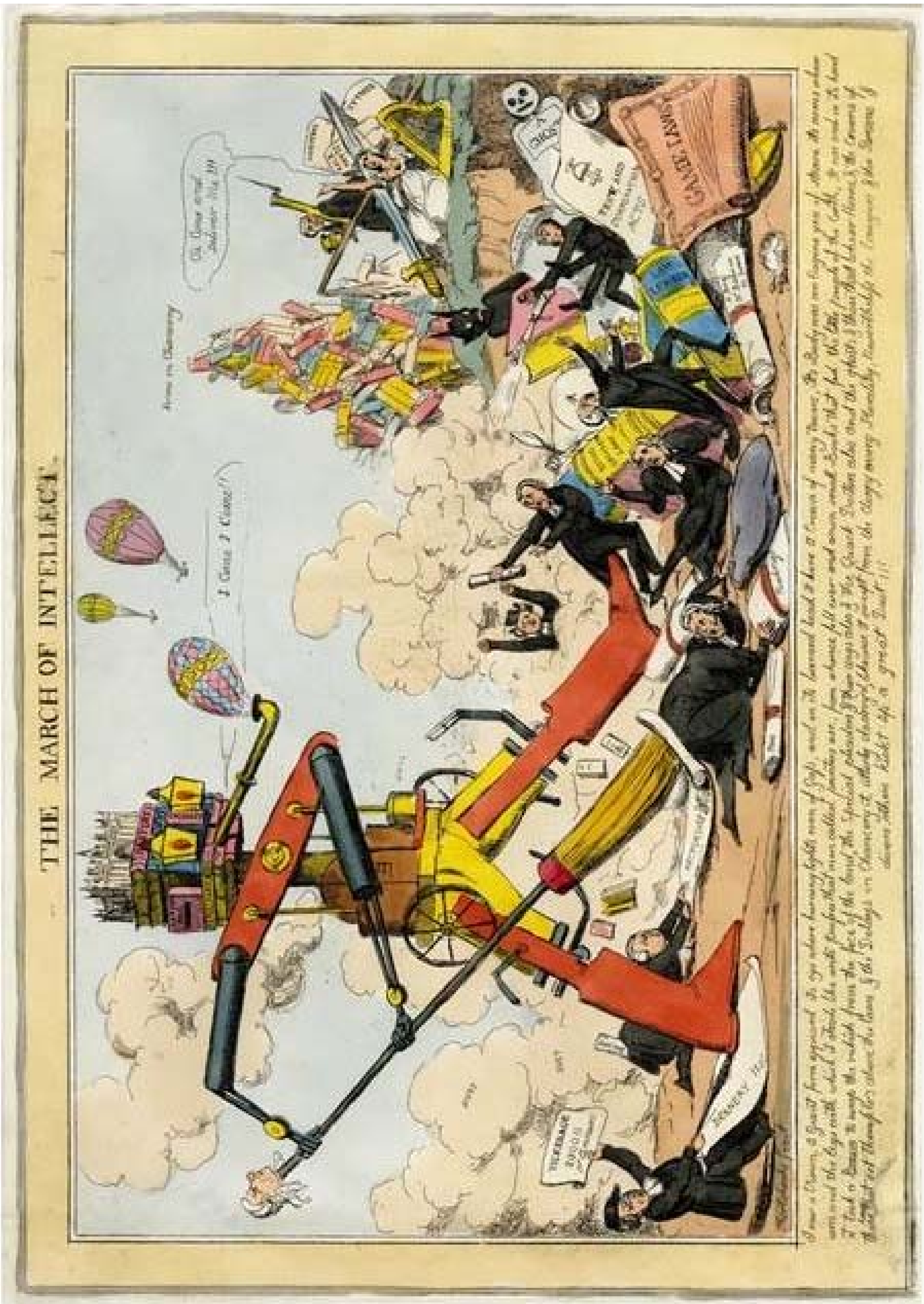
Journal for the History of Science, 28, No. 4 (1995), 405-426; L. P. Williams, 'The Royal Society and the Founding of the British Association for the Advancement of Science', *Notes and Records of the Royal Society of London*, 16, No. 2 (1961), 221-233.

[64] C. S. Varma, 'Threads that Guide or Ties that Bind: William Kirby and the Essentialism Story', *Journal of the History of Biology*, 42, No. 1 (2009), 119-149; J. F. M. Clark, 'History from the Ground Up: Bugs, Political Economy and God in Kirby and Spence's *Introduction to Entomology* (1815-1856)', *Isis*, 97, No. 1 (2006), 28-55.

[65] See C. Babbage, *Reflections on the Decline of Science in England, and some of its Causes* (London: B. Fellowes, 1830), particularly 40-56, for the strongest expression of the 'Declinist' viewpoint. Also J. Secord, *Visions of Science: Books and Readers at the Dawn of the Victorian Age (*Oxford: Oxford University Press, 2014*)*, 52-80, which assesses the 'Declinist' viewpoint and its reception in 1830s Britain.

[66] The most important of these was the first: W. Swainson, *A Preliminary Discourse on the Study of Natural History* (London: Longman, Rees, Orme, Brown, Green & Longman, 1834). The other principal works in which he deployed his quinarian theory were *A Treatise on the Geography and Classification of Animals* (London:



Longman, Rees, Orme, Brown, Green & Longman, 1835); and *On the Natural History and Classification of Birds* (London: London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836).

Figure 6. 'Shortshanks' [Robert Seymour], 'The March of Intellect', c.1828.

Swainson's curious career, writes off many of the books as regrettable pot-boilers that were written only to make their author some much-needed money.[67] This is misguided, as analysis of Swainson's books as easily-accessible quinarian manuals serves to cast considerable doubt on the oft-repeated contention that quinarianism, even in its later, theologically-charged variant, was restricted to an extremely-limited circle of elite naturalists.[68] This imbalance has resulted in an incomplete measure of scientific activity and its social context during this period, and is here redressed.

There is a wide literature on nineteenth century print media, however, within which Swainson's activities may be located.[69] Of particular note are studies which explore the roots and manifestations of the 'useful knowledge' movement, which gained ground from the early 1820s in Britain and dovetailed with widespread interest in natural history and discourse on the dissemination of knowledge and social control, and the memoirs of those such as the publisher Charles Knight (1871-1873) who played an active role in the debates on knowledge dissemination.[70] The concern felt by many in the overlapping circles of British science and government during the 1830s, at the danger of the 'wrong sort' of scientific knowledge becoming accessible to ever-wider sections of the population, has striking parallels with the

[67] D. Knight, 'William Swainson: naturalist, author and illustrator', *Archives of Natural History*, 13, 3 (Oct., 1986), 275-290; and 'High Church Science', 1-8.

[68] This interpretation of quinarianism's influence underpins Bircham, *A History of Ornithology*, 210-212; M. E. G. Miracle, 'On Whose Authority? Temminck's Debates on Zoological Classification and Nomenclature, 1820-1850', *Journal of the History of Biology*, 44, 3 (Fall, 2011), 445-481.

[69] R. Altick, *The English Common Reader: A Social History of the Mass Reading Public, 1800-1900* (Columbus, OH: Ohio State University Press, 1998); P. Anderson, *The Printed Image and the Transformation of Popular Culture 1790-1860* (Oxford: Clarendon Press, 1991); A. Buckland and B. Palmer, *A Return to the Common Reader: Print Culture and the Novel, 1850-1900* (Farnham: Ashgate, 2011); W. St. Clair, *The Reading Nation in the Romantic Period* (Cambridge: Cambridge University Press, 2004); A. Krishnamurthy (ed.), *The Working-class Intellectual in Eighteenth- and Nineteenth-Century Britain* (Farnham: Ashgate, 2009);. Secord, *Victorian Sensation*; S. Sheets-Pyensen, 'War and Peace in Natural History Publishing: The Naturalist's Library, 1833-1843', *Isis*, 72, 1 (Mar., 1981), 50-72.

[70] C. Knight, *The Old Printer and the Modern Press* (London: John Murray, 1854); *Passages of a Working Life during Half a Century* (London: Bradbury and Evans, 1864-65); A. Rauch, *Useful Knowledge: The Victorians, Morality, and the March of Intellect* (London: Duke University Press, 2001), 1-59.

immediate post-Napoleonic years (*fig.* 1). However, it also created new reading habits and readerships for natural history works, as Susan Sheets-Pyensen has persuasively demonstrated.[71] Swainson was deeply involved in the creation of these new readerships, the *Cabinet Cyclopaedia* providing him with a prominent platform from which to broadcast his quinarian ideas.[72] These were to travel far beyond Britain.

Swainson's books for Lardner, and many of Gould's early folios, such as the *Century of Birds,* are prime examples of the accommodation of the potentially-disconcerting fruits of imperial expansion with religious conventions and established social hierarchies. They also served to spread quinarian ideas back to colonial naturalists at the furthest outposts of empire. Although a self-consciously 'British' – or, indeed, 'English' – phenomenon, quinarianism lingered on in the colonial margins long after it had been forgotten in Britain.

Beyond the accumulation of natural history collections, colonial expansion had an immeasurable impact on the ways in which the natural world was studied and interpreted, by all sections of society. It is vital to remember that the accumulation of raw data was not accidental nor, primarily, the result of naturalists and collectors taking it upon themselves to send material back to Britain. British men of science called for more data, and collectors and naturalists from all over the world rushed to respond. John Gascoigne, Richard Holmes, John Hemming, and Richard Conniff, amongst many others have highlighted this development, which became more pronounced in the early decades of the nineteenth century as the methodologies of science shifted.[73] The new style of descriptive science owed much to the

[71] Sheets-Pyensen, 'War and Peace in Natural History Publishing', 50-72.
[72] A. L. Martin, *Villain of Steam: A Life of Dionysius Lardner* (Carlow: Tyndall Scientific, 2015); M. Peckham, 'Dr. Lardner's *Cabinet Cyclopaedia*,' *Papers of the Bibliographic Society of America*, 45 (1951), 37-58.
[73] Gascoigne, *Banks and the English Enlightenment*; R. Holmes, *The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science* (London: Harper*Press*, 2008); R. Conniff, *The Species Seekers: Heroes, Fools, and the Mad Pursuit of Life on Earth* (New York: Norton, 2011).

work of Alexander von Humboldt (1769-1859), the great German explorer and naturalist, who privileged the inductive accumulation of data as a necessary preliminary to theory construction, and was dependent upon the work of large numbers of 'field workers' on the colonial peripheries.[74] In recent years historians have shifted their focus to this colonial context and the relation between science and imperialism, with scholars following the early lead of George Basalla in broadening the scope of history of science beyond its traditional European focus.[75] Ideas about the natural world travelled and, as they did so, developed according to the particular environments in which naturalists found themselves, and the often wholly-new flora and fauna by which they were confronted.

Quinarianism was no exception, and in the final section of this study the impact of Macleay, Vigors, Swainson and Gould's publications on the shaping of colonial zoological work is assessed with particular reference to the work of Brian Houghton Hodgson (1800-1894). A typical 'colonial' naturalist, who combined official diplomatic duties with amateur scientific research, Hodgson is now seen as the 'father' of Himalayan zoology, and over the course of thirty years amassed a huge collection of zoological paintings.[76] A quinarian adherent, though it is not clear which variant he favoured, Hodgson's images bear the unmistakeable imprint of Macleay's basic principles, Swainson's writings for Lardner, and Gould's early folios. His illustrations, created with close reference to the principles of

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[74] N. Rupke, *Alexander von Humboldt: A Metabiography* (Chicago, IL: University of Chicago Press, 2005); A. Wulf, *The Invention of Nature: The Adventures of Alexander von Humboldt, The Lost Hero of Science* (London: John Murray, 2015); M. Dettelbach, 'Alexander von Humboldt between Enlightenment and Romanticism', *Northeastern Naturalist*, 8, 1 (2001), 9-20.
[75] G. Basalla, 'The Spread of Western Science', *Science*, 156 (May, 1967), 611-622.
[76] B. H. Hodgson, 'New Species of Scolopacidae, Indian Snipes', *Journal of the Asiatic Society of Bengal*, 6 (1837), 489-492; C. Allen, *The Prisoner of Kathmandu: Brian Houghton Hodgson in Nepal, 1820-43* (London: Haus Publishing Ltd., 2015); M. Cocker, C. Inskipp, *A Himalayan Naturalist: The Life and Work of Brian Houghton Hodgson* (Oxford: Oxford University Press, 1988); D. Waterhouse (ed.), *The Origins of Himalayan Studies: Brian Houghton Hodgson in Nepal and Darjeeling 1820-1858* (Abingdon, Oxon.: Routledge Curzon, 2004).

classification and visual conventions contained in these quinarian works, are compelling evidence that the impact of quinarianism was both reciprocal and far-reaching.[77]

In the weeks immediately following publication of the *Origin of Species*, Darwin wrote to Richard Owen, soon to reveal himself as one of the most implacable public opponents of evolution, and expressed his relief that his book had not been as mauled by critics as he had feared.

> You made a remark in our conversation to the effect that my book could not probably be true as it attempted to explain so much… Yet I assure you that its truth has often & often weighed heavily on me; & I have thought that perhaps my book might be a case like Macleay's Quinarian system. So strongly did I feel this, that I resolved to give it all up, as far as I could, if I did not convince at least 2 or 3 competent judges.[78]

As history demonstrates, Darwin need not have worried, at least in the long run. In our Darwinian world, it is important that we remember that Macleay and his fellow quinarians, in a few remarkable decades, persuaded their own share of competent judges, many of whom are now firm fixtures in the pantheon of British science. Only after this acknowledgement can we arrive at a clear understanding of the 'Darwinian Revolution', and the modern scientific worldview.

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[77] Hodgson Collections, Zoological Society of London, London.

[78] F. Burkhardt, J. A. Secord (eds.), *The Correspondence of Charles Darwin, Volume 7, 1858-1859,* (Cambridge: Cambridge University Press, 1992), **7.**, 430. C. Darwin to R. Owen, 13 Dec., 1859.

Chapter 1

Magic Circles: Quinarians and their Fellow Naturalists

The rapid rise, and even quicker fall, of quinarianism is one of the most intriguing episodes in nineteenth-century science. Known to historians, if at all, as a passing if remarkable fad, it had been almost wholly renounced by British naturalists from the middle of the 1840s.[1] Charles Waterton, the eccentric naturalist squire who harried Swainson throughout the 1830s, decried the 'series of circles which would puzzle Sir Isaac Newton himself; and which will tend to scare nine-tenths of the votaries of ornithology clear out of the field. Your nomenclature caused me jaw-ache'.[2] At the Glasgow meeting of the British Association for the Advancement of Science in 1840 Hugh Strickland (1811-1853), a consistent opponent of the theory, damned it with the faintest praise: '[a]ll systems, circular, quinary, dichotomous, etc. are not natural, but artificial and only of use in arranging museums'.[3] Most significant in shaping the judgement of historians was the biting and frequently-quoted critique it drew from the doyen of late nineteenth-century British naturalists, Alfred Newton (1829-1907):

> The success [the quinary system] gained was doubtless due in some degree to the difficulty which most men had in comprehending it, for it was enwrapped in

[1] Coggon, 'Quinarianism after Darwin's "Origin"', 6-7; M. P. Winsor, 'Considering Affinity: An Ethereal Conversation', *Endeavour,* 39, 1 (2014), 69-79.
[2] C. Waterton, *An Ornithological Letter to William Swainson* (London: R. Nichols, 1837), 2.
[3] For Strickland's Glasgow statement, see G. McOuat, 'Species, rules and meaning: The politics of language and the ends of definitions in 19th century natural history', *Studies in History and Philosophy of Science Part A*, 27, 4 (Dec., 1996), 503n 140.

> alluring mystery, but more to the confidence with which it was announced as being the long looked-for key to the wonders of creation, since its promoters did not hesitate to term it the discovery of *the* natural system, though they condescended, by way of explanation to less exalted intellects than their own, to allow it the more moderate appellation of the Circular or Quinary System.[4]

Twentieth-century historians took their cue from Newton's strictures, casting scorn on quinarianism's geometrical regularity and complex webs of connections, all of which seemed to be indicative of a highly artificial classificatory system rather than a reflection of the 'true' state of nature.[5]

It is not the purpose of this study to dust off quinarianism as a credible scientific theory with a modern application. No amount of ingenuity could do that. Many of the criticisms levelled at it from the 1840s onwards were both just and well-aimed, and with the transformation of our knowledge of the animal world over the succeeding century and a half even the theory's more empirically-sound aspects appear anachronistic. Like all scientific theories, including Charles Darwin's original theory of evolution, the development of quinarianism was contingent upon a complex of factors of which the strictly scientific jostled uncomfortably with the personal, political, and ideological. Indeed, the only respect in which quinarianism differed from other theories in this sense was in the overwhelming force that these

[4] A. Newton, 'Ornithology', in *Encyclopaedia Brittanica, 9th ed.* (London: A. &. C. Black, 1889), 15.
[5] G. De Beer, *Charles Darwin: Evolution by Natural Selection* (London: Thomas Nelson & Sons, 1963), 13; M. L. Blaisdell, *Darwinism and its Data: The Adaptive Coloration of Animals* (Cambridge, MA: Harvard University Press, 1992), 24.

extra-scientific factors exerted upon the minds of those who devised the theory and its variants, and the extent to which they guided its 'real world' application.

For this alone, quinarianism deserves the attention of historians of science, particularly given the sociological turn that recent studies have taken and the belated acknowledgement that rigorous 'objectivity' in the generation of scientific theory is more of an ideal than a reality. However, its real interest stems from the startling discovery that, from c.1824 to c.1844, quinarianism dominated the study of zoology in Britain, particularly in London's scientific circles. It provided the scientific basis for the establishment of another institution, the Zoological Society of London, founded in 1826 and which remains with us today.[6] As recent work by Aaron Novick has persuasively demonstrated, although almost wholly absent from the history of nineteenth-century science, except as a footnote to either the demise of 'Romantic' science or as a curious but misguided prelude to Darwinism, quinarianism was an important attempt to get to grips with the structure of nature and the natural system.[7] It is the contention of this study that it was also central to the development of modern zoology's institutional frameworks and intellectual practices.

Uncomfortably uppermost in the minds of many British naturalists in the first decades of the nineteenth century was the superiority of Continental biology, symbolised by the work of German transcendental morphologists. Despairing of London's ossified scientific institutions, they gradually brought about a transformation of the natural sciences between 1820 and 1860, drawing upon the latest European theoretical advances and the vast increase in knowledge of the natural world through the expansion of Britain's imperial interests to create

[6] Desmond, 'The Making of Institutional Zoology in London', 153-185, 223-250.
[7] Novick, 'On the Origins of the Quinarian System, 1-39. See also M. A. Di Gregorio, 'In Search of the Natural System: Problems of Zoological Classification in Victorian Britain', *History and Philosophy of the Life Sciences*, 4, 2 (1982), 225-254; and McOuat, 'Species, rules and meaning', 473–519.

an all-encompassing 'British' science. A synthesis of disparate, often conflicting elements and garbed in the traditional lexicon of British empiricism and natural theology, this 'philosophical' science meant different things to different naturalists. The young Charles Darwin, for example, a meticulous empiricist, referred to himself as a '*philosophical* naturalist'. Robert Knox (1791-1862), a transcendentalist of the first order, saw himself as a 'philosophical' anatomist. Despite the gulf between their chosen fields, both men adhered to a certain set of assumptions and topics in natural history. For a time, Darwin flirted with the same notion of ideal, 'transcendental' patterns in nature that Knox was to make the foundation of his career, before discarding the position in the 1840s and 1850s.[8] For Darwin and Knox, and a highly influential body of their contemporaries, a 'philosophical' naturalist was one who was interested in discovering the laws and order which governed the natural world, and who was not content merely to observe its workings and describe its flora and fauna.[9]

For some, 'philosophical' natural history had another, methodological meaning, with the traditional teleological arguments that had underpinned natural history in the eighteenth century, and which would be brought to a peak in the Bridgewater Treatises of the 1830s, increasingly inadequate. These accounted for the existence of organisms and their anatomical structures in terms of the function they were ordained to perform, or the niche in which God had placed them. As the historian of idealist biology in Britain, Philip Rehbock notes, in between the rejection of final causes and the efficient causes of Darwinian evolution and genetics came a period, roughly between 1820 and 1850, in which 'formal causes' dominated the field. Organisms were regarded as manifestations of ideal patterns, or 'forms', at once a

[8] E. Richards, 'The "Moral Anatomy" of Robert Knox: The Interplay between Biological and Social Thought in Victorian Scientific Naturalism', *Journal of the History of Biology*, 22, 3 (Autumn, 1989), 373-436, especially 374-375.
[9] See J. Endersby, 'Lumpers and Splitters: Darwin: Hooker, and the Search for Order', *Science, New Series*, 326, 5959 (2009), 1496-1499; D. L. Hull, *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science* (Chicago, IL: University of Chicago Press, 1988), 1-32.

harkening back to Platonic philosophy and a direct development of German transcendental idealism. The goal of the truly 'philosophical' naturalist was to discover these forms and their place in nature. [10]

This did not preclude a continuing emphasis on the traditional basis of British natural science, Francis Bacon's rigid inductivism, whereby generalisations are drawn from a mass of empirical data.[11] Transcendentalists on the Continent, particularly German *Naturphilosophen*, who took their lead from the philosophical writings of F. W. J. Schelling (1775-1854), particularly his *Ideas for a Philosophy of Nature*, in which Schelling developed the notion that the great plan of creation and organic forms could be discovered *a priori*, and not from the meticulous gathering of data.[12] As we shall see, whilst an influential body of British naturalists took their inspiration from their German counterparts at a time when Britain was under the spell of Romanticism, the pervasiveness of Baconian inductivism in British intellectual culture, and its conflation with notions of scientific 'respectability', worked against a thoroughgoing adoption of the German approach. Indeed, if their work was to be taken seriously, those who took their inspiration from the *Naturphilosophen* and the scientific musings of the poet Samuel Taylor Coleridge (1772-1834), who did much to introduce Continental Romanticism into Great Britain, felt compelled to cloak their idealism in the lexicon of inductivism and emphasise their empiricist methodologies.[13]

It was this synthesis of traditions, and the 'slipperiness' of the language with which naturalists articulated their theories, that lent British 'philosophical' science its unique,

[10] P. F. Rehbock, *The Philosophical Naturalists: Themes in Early Nineteenth-Century British Biology* (Madison, WI: University of Wisconsin Press, 1983), 9.
[11] A. Perez – Ramos, *Francis Bacon's Idea of Science and the Maker's Knowledge Tradition* (Oxford: Oxford University Press, 1988); G. Rees, (ed.), *The Oxford Francis Bacon*, Vol. VI: *Philosophical Studies c.1611 – c.1619* (Oxford: Oxford University Press, 1996).
[12] Schelling, F. W., *Ideas for a Philosophy of Nature: as Introduction to the Study of this Science*, trans. Harris, E. E., and Heath, P. (Cambridge: Cambridge University Press, 1988).
[13] D. Ospovat, *The Development of Darwin's Theory* (Cambridge: Cambridge University Press, 1981), 101-107.

transitional status and gave its central writings an often-paradoxical air which baffled both contemporaries and later commentators. At its heart lay a tension between the speculative methodology of the Continental *Naturphilosophen* and the concerns of the museum-based naturalists who dominated metropolitan scientific institutions. Interested, above all, to name and classify the hundreds of new species of plant and animal that poured into Britain courtesy of explorers, travelling naturalists and collectors, they sought to incorporate some of the central tenets of idealism, particularly its search for fundamental types, in their development of a taxonomic system that would better serve the needs of contemporary biology than that established by the great Swedish botanist, Carl Linnaeus (1707-1778), in the mid-eighteenth century.

Their complex attitude to Linnaean taxonomy, which combined a reverence for his system of nomenclature with a desire to establish a 'natural' system of classification which more accurately represented the divine plan of creation, and their efforts to make the resultant synthesis acceptable to a British audience, provides the central focus of this chapter. The analysis which follows is structured around three convergent themes, evaluating the foundations of quinarianism and asking why it was important to the development of institutional British zoology. First, a survey of the ways in which the vast increase in specimen collections and developments in techniques of specimen preservation spurred the rise of new taxonomic systems, of which quinarianism was only one, and the ambiguous, continued role of Linnean taxonomy throughout the early nineteenth century. Section two assesses the historical background to the publication of the two volumes of Macleay's *Horae Entomologicae*, particularly the years between 1818 and 1821, notable for the extent and strength of political and social unrest in Britain and which Adrian Desmond has viewed as formative to the direction of Macleay's thought. Section three analyses quinarian theory itself, focusing on Macleay's original variant, and determines what it was and, as importantly, what it was not, particularly its status as an essentialist taxonomy. Drawing on recent research by Mary Winsor, John Wilkins and others, it is argued that pre-Darwinian taxonomies, including quinarianism, were not essentialist in the manner understood by many historians of biology, who have confused typology with Aristotelian essences and Platonic forms.[14] Finally, quinarianism is set within the complex intellectual and political culture of the 1820s and 1830s, decades in which continental philosophical and methodological idealism exerted a profound influence on the development of British biology, but was distrusted by many naturalists as being a vector for political radicalism. Frequently characterised as a 'Romantic' scientific theory, for its apparent parallels to German *Naturphilosophie* and Platonist idealism, it is demonstrated, with reference to Macleay's *Horae Entomologicae* and other early writings, that quinarianism drew on a range of traditions and that much of the confusion surrounding the theory stems from Macleay's concern to present the theory as a development of the dominant Linnean tradition in British natural history, and not as a radical break with the past.

I.

The discovery of the New World in the late fifteenth century and the opening of maritime trade routes to the East – particularly as developed in the eighteenth and nineteenth centuries – transformed not only the economic power of Europe, but also its intellectual and cultural horizons. Precious metals may have been uppermost in the minds of the earliest explorers, the Spanish in Central and South America, for example, but it was the plants and

[14] See, particularly, J. S. Wilkins, *Species: A History of the Idea* (Berkeley, CA: University of California Press, 2009), particularly 47-129; M. P. Winsor, 'Non-essentialist methods in pre-Darwinian taxonomy', *Biology and Philosophy*, 18 (2003), 387-400; and 'The Creation of the Essentialism Story', *History and Philosophy of the Life Sciences*, 28 (2006a), 149-174.

spices that they brought back which had the greatest impact, both commercially and upon the European imagination. Whilst spices became vital components of the Old World diet, generating huge fortunes for the astute speculator in commodities, the sheer strangeness of many botanical specimens created an intense curiosity in the flora of newly discovered lands and the hope that many of them would be of medicinal value.[15]

The European appropriation of colonial goods accelerated in the eighteenth century to the point that the resources of national scientific institutions, such as Britain's Royal Society, were for a time almost entirely given over to the discovery and transplantation of 'useful' plant species.[16] The utilitarian slant to eighteenth-century natural history has been closely-studied by Paula de Vos, Marcy Norton, and Antonio Barrera-Osorio, among many others.[17] It had profound consequences, and not only for the progression of botany from being the semi-mystical province of herbalists and witches to an advanced discipline with its own systems of classification and taxonomy. It was accompanied by a general taste for collecting natural specimens of all kinds, from rocks and minerals to shells and animal specimens, and we find some surprising names in the roll of early European collectors. As early as the 1570s Francis Drake, taking his ease between robbing Spanish treasure galleons, was as avaricious a collector of natural specimens as of gold, and also a prolific zoological artist, keeping a vast book in which he painted birds and marine animals.[18] In this respect at least, and in his buccaneering

[15] J. Gascoigne, 'The Royal Society, natural history and the peoples of the 'New World(s), 1660-1800', *The British Journal for the History of Science*, 42, 4 (Dec., 2009), 539 – 562.
[16] Gascoigne, 'The Royal Society'; Gascoigne, *Banks and the English Enlightenment;* M. B. Hall, *All Scientists Now: The Royal Society in the Nineteenth Century* (Cambridge: Cambridge University Press, 1984); A. Rusnock, 'Correspondence Networks and the Royal Society, 1700-1750', *The British Journal for the History of Science*, 32, 2 (Jun., 1999), 155-169.
[17] P. de Vos, 'The Science of Spices: Empiricism and Economic Botany in the Early Spanish Empire', *Journal of World History*, 17, 4 (Dec., 2006), 399-427; P. de Vos, 'Natural History and the Pursuit of Empire in Eighteenth-Century Spain', *Eighteenth-Century Studies*, 40, 2 (Winter, 2007), 209-239; A. Barrera-Osario, *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution* (Austin, TX: University of Texas Press, 2006); M. Norton, 'Tasting Empire: Chocolate and the European Internalization of Mesoamerican Aesthetics', *The American Historical Review*, 111, 3 (June 2006), 660-691. This represents only some of the most notable studies, even confining our remit to the Spanish American empire.
[18] G. Williams, *Naturalists at Sea: Scientific Travellers from Dampier to Darwin* (New Haven, CT: Yale University Press, 2015), 2.

self-confidence, Drake set the tone for British naturalists who ventured out onto the open oceans, from Sloane in the 1680s and Dampier in the late 1690s to T. H. Huxley in the 1840s.

Up to the middle of the eighteenth century, official attitudes to voyagers who brought back with them vast collections had been markedly ambivalent. The directors of vast commercial operations such as the Dutch East India Company and its English equivalent and bitter rival often looked askance at the exorbitant amount of space taken up on their ships by collections of 'curiosities', which would otherwise be filled with stores and commodities. However, they were also prepared to use these vast collections to underpin and establish scientific institutions: the Dutch East India Company founded no fewer than five botanical gardens in the Dutch Republic, one at Leiden University, which was to become one of the hubs of European scientific research.[19] Assuredly, their central motivation was commercial, but they did encourage more scholarly investigations, albeit in an indirect way. Similarly, government sponsorship of expeditions was almost non-existent unless the demands of science could be clearly tied to the imperatives of commerce or national prestige, or unless they were lobbied by national institutions such as the Royal Society or by particularly well-connected individual men of science, such as Joseph Banks.[20]

This vast flood of information into British museum collections had a profound impact, not only upon the way in which such collections were managed, but also upon the classificatory systems by which they were arranged. Throughout the eighteenth and nineteenth centuries, the key repositories of natural history collections in Britain exercised great authority upon scientific standards, as well as upon the methods by which naturalists conducted their work.

[19] R. Porter, M. Teich, (eds.), *The Scientific Revolution in National Context* (Cambridge: Cambridge University Press, 1992), 121-124.
[20] Gascoigne, *Banks and the Enlightenment*.

The priorities of ‘museum’ naturalists, whose careers were centred upon institutions and who gloried in a certain social cachet denied to lowly ‘field’ naturalists and collectors, set the scientific agenda.[21] However, as Paul Farber notes, there was a great difference in the sheer dimension of eighteenth and nineteenth-century natural history: ‘the empirical bases were of wholly different magnitudes’.[22] In the eighteenth century, Buffon could consider writing a complete natural history of the earth.[23] By even the 1830s, even dreaming of such a project would have smacked of folly. Swamped by new specimens, donated by colonial governors, explorers, merchants, and soldiers, the overwhelming focus of naturalists, particularly in Britain, was set upon naming and ordering; the basic foundations of knowledge about the natural world.

The nature of these collections had a formative impact upon the ways in which naturalists interpreted the relations between species and established them in classificatory systems. The late-eighteenth and early-nineteenth centuries, the second great age of colonial expansion, resulted in countless numbers of exotic species augmenting British collections that had no apparent equivalents amongst European fauna. Reflecting the pattern of British economic and colonial expansion during these decades, these were primarily Asian and Australasian in origin. Accordingly, one of the principal technical problems facing naturalists back in London, and collectors in the colonies, was how to preserve these specimens so that they would survive the voyage and still be of scientific use.[24]

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[21] G. McOuat, ‘Cataloguing Power: Delineating 'Competent Naturalists' and the Meaning of Species in the British Museum’, *The British Journal for the History of Science*, 34, 1 (Mar., 2001), 1-28.
[22] P. L. Farber, ‘Discussion Paper: Natural History in the Nineteenth Century’, *Journal of the History of Biology*, 15.1 (Spring, 1982), 147.
[23] J. H. Eddy, ‘Buffon’s *Histoire Naturelle*: History? A Critique of Recent Interpretations’, *Isis*, 85, 4 (1994), 644 – 661; K. Padian, ‘An Enlightened Buffon’, *BioScience*, 49, 1 (Jan. 1999), 72 – 75.
[24] P. L. Farber, ‘The Development of Taxidermy and the History of Ornithology’, *Isis*, 68, 4 (Dec., 1977), 550-566.

Although seemingly prosaic, the development of effective methods of taxidermy was essential to the growth of museum collections and the development of classificatory theories. Well-preserved specimens, which gave as accurate a representation as possible of the animals in life, were crucial to naturalists' efforts to place species in their proper relation to one another. An enormous number of the specimens shipped back to the Old World prior to c.1850, when the first truly effective method of preservation was put to widespread use, were ruined by insect pests or fungus even before they arrived at their destinations and, even when catalogued, were vulnerable to insect depredation. Paul Farber cites a notable instance of this from 1749, when the bird and insect collections of Paris's Jardin du Roi were all but obliterated by mites.[25] Even in the 1840s, Alfred Russel Wallace (1823-1913) found great difficulties in preserving the specimens he painstakingly collected in the Malaysian rainforest.[26]

Bird skins were particularly vulnerable to the depredations of pests and moulds. The French naturalist, René-Antoine Ferchault de Réaumur, writing of the status of bird collections, put the problem thus:

> [T]hose who have begun to make any [collections] became weary of going on, having had the Mortification to see them every Day destroyed by ravenous Insects, in spite of all the care that had been taken to preserve them against their Teeth.[27]

Collectors themselves could do only so much. The first stage was to skin the carcass of the animal. Some methods called for the skull and other bones, such as those in the wings, to be

[25] Farber, 'The Development of Taxidermy', 550.
[26] A. R. Wallace, *My Life* (London: Chapman and Hall, 1905), 328-330.
[27] R.-A. F. de Reaumur, 'Divers Means for preserving from Corruption dead Birds, etc.', *Philosophical Transactions of the Royal Society*, 45 (1748), 305.

left in, although care had to be taken to empty the skull of its contents and then replace it within the skin. It was crucial to remove as much of the subcutaneous fat as possible in order to retard the processes of decay, which could otherwise spoil the skin, and then treat both the inside and outside of the skin with a compound that would also deter pests. The precise recipes for these preservative compounds varied between individual naturalists and collectors. Tesser Kuckahn (d.1776), a Dutch naturalist who in 1771 submitted a series of four letters to the Royal Society critiquing current practices and outlining his own, preferred to use two compounds, one made of turpentine and camphor; and a second, corrosive substance made from saltpetre, alum, sulphur and various other powders, all to be applied to the skin. The treated specimens were then dried in an oven and declared good for scientific use.[28] How well Kuckahn's method actually worked is unknown and it was largely superseded by the belated popularisation, from the 1830s onwards, of Jean-Baptiste Becoeur's (1718-1777) method of using 'arsenic soap', which remained the standard throughout the nineteenth century.[29]

The emergence of distinct disciplines within natural history, particularly ornithology, was therefore contingent upon the improvement of preservation methods and the establishment of large, permanent collections upon which to base classification systems and models of species distribution. However, this was only the first stage, and there are many instances of large specimen collections that were left in corners of museum basements, uncatalogued for decades and then discarded.[30] The scientific value of such collections depended upon someone assigning names to their contents.

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[28] T. S. Kuckahn, 'Four Letters from Mr. T. S. Kuckahn, to the President and Members of the Royal Society, on the Preservation of Dead Birds', *Philosophical Transactions of the Royal Society*, 60 (1771), 302-320.
[29] An excellent overview of naturalist's equipment and collecting techniques is given in A. Larsen, 'Equipment for the Field', in Jardine, N., Secord, J. A., Spary, E. C. (eds.), *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), 358-377.
[30] For example, Hodgson Collections, Zoological Society of London; Hodgson Collections in 13th Earl of Derby Bequest (1851), Liverpool Museum. Private Communications with Dr Tony Parker and Dr Clem Fisher, Liverpool Musuem. See also Waterhouse, *The Origins of Himalayan Studies*, 140-146.

As Gordon McOuat has pointed out, the very act of naming conferred social capital and scientific prestige. Naming new species defined who counted as a legitimate natural historian and who had access to the forums of scientific debate, be they academic journals or scientific societies.[31] This was fully recognised by naturalists of the era. As the Rev. William Kirby, the entomologist and founding chairman of the Zoological Club of the Linnean Society, declared:

> Names are the foundations of knowledge; and unless they have ‘a name’ as well as a ‘local habitation’ with us, the zoological treasures that we so highly prize might almost as well have been left to perish in their native deserts or forests, as have grown mouldy in our drawers or repositories. But when once an animal subject is named and described, it becomes a possession for ever, and the value of every individual specimen of it, even in a mercantile view, is enhanced.[32]

In a similar spirit, the comparative anatomist and transmutationist, Robert Grant whose radical political and philosophical position lay at the opposite end of the spectrum to that occupied by the conservative Kirby, noted that

> [M]any objects of zoology are scarcely of any appreciable value until they are identified and names are assigned to them by competent authorities. Sometimes an object, say a very rare shell, may not be of the value of one farthing until it is identified by a competent naturalist; and then being properly named, its value may

[31] McOuat, ‘Cataloguing Power’, 2.
[32] W. Kirby, ‘Introductory address explanatory of the views of the Zoological Club delivered at its foundation, November 29, 1823’, *Zoological Journal*, 2 (1826), 5.

be raised to 30, 40, 50 guineas. Yet it still appears no larger, not more beautiful, not heavier than a specimen which may not have the value of one farthing.[33]

What both statements emphasise is the mercantilist value that was attached to the naming of specimens. Collections that were poorly named lacked value in purely monetary terms as well as hindering scientific enterprise. However, until 1844 there was no fixed, or even generally-accepted set of rules or system by which names were conferred, with the result that in the first half of the nineteenth century natural history was dominated by a crisis of taxonomy that was, at least in part, driven by a pronounced utilitarian element. This had the result that the debate on species focused much more on the demarcation of species *boundaries*, and how to name and classify them, than on the reality of the concept itself.[34]

The increase in the number of known species placed established methods of ordering nature under great strain. From the middle of the eighteenth century, with the publication of the authoritative tenth edition of his *Systema Naturae* in 1758, Carl Linnaeus' taxonomic system had dominated the European natural sciences, finding particular favour in Britain.[35] A botanist and eventually the 'father' of an international intellectual community, Linnaeus (1707-1778) did two things which ensure, over 250 years after he first launched his ideas into the study of natural history, that scientists and historians still accord him a unique place in the history of biology.[36] The first is the most enduring: the introduction of a binomial system of

[33] Parliamentary Papers (1836), §1503. Grant to the BM enquiry.
[34] J. S. Wilkins, *Species: A History of the Idea* (Berkeley, CA: University of California Press, 2009), 91-96.
[35] Allen, *Naturalist in Britain*, 70-84; Wilkins, *Species*, 47-96; P. R. Sloan, 'The Buffon – Linnaeus Controversy', *Isis*, 67, 3 (1976), 356 – 375.
[36] For example, G. M. Reid, 'Carolus Linnaeus (1707-1778): His Life, Philosophy and Science and its Relationship to Modern Biology and Medicine', *Taxon*, 58, 1 (Feb., 2009), 18-31; M. P. Winsor, 'The development of Linnaean insect classification', *Taxon*, 25 (1976), 57-67.

naming which western taxonomists have followed ever since. This is a formal system of naming by which organisms are accorded a Latinate name composed of two parts. The first identifies the genus to which the organism belongs; and the second, specific name identifies the species within its genus. The specific name is, as implied, unique to the species to which it is assigned. This binomial is often followed by the surname of the 'authority'; the individual who either first discovered or who first conferred upon the species its Latin binomial.

So, for example, the golden eagle (its 'common name') is properly designated *Aquila chrysaetos*, Linnaeus, or *A. chrysaetos* for the sake of brevity. This indicates that the bird, first named by Linnaeus, is located in the genus *Aquila*, or 'true eagles', within the family Accipitridae and the order Accipitriformes, within the class Aves. Subspecies, the taxonomic rank subordinate to species, complicate the picture somewhat, and refer to populations or forms of a species which are sufficiently distinct to receive their own intraspecific rank. So, continuing with our example, there are currently six known subspecies of golden eagle, including the *nominate subspecies*, which is taken to be the *type* of the species and is almost always the first to have been given a Latinate binomial. For the golden eagle, this is *Aquila chrysaetos chrysaetos*, the European golden eagle and that familiar to ornithologists in Britain in Europe. There are five others: *A. chrysaetos homeyeri*, which occurs throughout Iberia*;* *Aquila chrysaetos daphanea*, the 'Asian' form of the species; *Aquila chrysaetos japonica*, or Japanese golden eagle; *Aquila chrysaetos kamtschatica*, or Siberian golden eagle; and finally *Aquila chrysaetos canadensis*, or American golden eagle. All of these differ in point of size and plumage from the type form, but not sufficiently to merit their removal from the species into specific groups of their own.[37]

[37] J. Watson, *The Golden Eagle* (London: Poyser, 2010), 47-60.

The second of Linnaeus' innovations was his system of classification, which deployed his naming procedure in a rank-based taxonomy. Linnaean taxonomy was originally based upon the identification of three 'kingdoms': animals; vegetable; and mineral, which was soon abandoned.[38] As would be expected from his own emphasis on botanical research, Linnaeus' classification of the vegetable kingdom was the most exhaustive and elaborate of the three, containing twenty-four classes.[39] His animal classification, which is of most relevance to this study, contained six classes: Mammalia; Aves; Amphibia; Pisces; Insecta; and Vermes, a somewhat amorphous grouping of 'animals of slow motion, soft substance… and inhabitants of moist places', or non-arthropod invertebrates. All of these classes were intended not as representative of natural groups, a point to which we will return again and again throughout this study, but only for use in the identification of specimens.[40] They were *artificial*.

Linnaean classification, and the system of naming which underpinned it, had the crucial effect of imposing stability upon how eighteenth-century Europeans ordered and interpreted the natural world. It solved that great problem of pre-Linnaean natural taxonomies, which were principally based upon the ordering of common names. Although the names by which the vast majority of people know species, common names have the disadvantage of being both highly variable, so that the same species may be known, simultaneously, by a whole range of monikers, and being used to describe entirely different species. One of the neatest examples of this is that of the blackbird. In Europe, the blackbird is a familiar garden species, a member of the thrush family. In North America, however, the blackbird is an icterid, a family only distantly related to thrushes and confined to the Americas. Linnean taxonomy clears up any

[38] Linnaeus worked out his system in his *Systema Naturae* (Stockholm: Impensis Direct. Laurentii Salvii, 1758-1759); Wilkins, *Species*, 70-74.
[39] A. Pavord, *The Naming of Names: The Search for Order in the World of Plants* (London: Bloomsbury, 2005).
[40] M. Ereshefsky, *The Poverty of the Linnaean Hierarchy: A Philosophical Study of Biological Taxonomy* (Cambridge: Cambridge University Press, 2000).

confusion: under the binomial system the European blackbird is called *Turdus turdus*, and the American blackbirds, of which there are five 'true' species, classified in the genus *Agelaius*.[41]

Linnaean binomials were almost universally adopted by European naturalists. However, his system of classification was attacked almost from the outset, particularly French naturalists of whom the Comte de Buffon (1707-1788) was the most bitter and the most determined.[42] For Buffon, who was remarkable for the variety of his interests even in a century of polymaths, the end goal of natural history was not the cataloguing of animals, or even the attempted ordering of nature. It was the discovery of general trends and laws in nature. Paul Farber, one of Buffon's most meticulous and perceptive modern commentators, observes that Buffon tried to steer a course between the extremes of system building on the one hand and radical empiricism on the other, seeing himself as the true successor of 'the great naturalists of antiquity', Pliny and Aristotle.[43]

Buffon's emphasis on discovering the *natural* relationships between different species and genera proved to be of great importance to how subsequent naturalists viewed taxonomical systems. His warnings were not particularly original: as Wilkins and Birkhead point out, the English ornithologist John Ray (1627-1705) had grappled with the competing claims of practicality, in the form of catalogues, and of 'truth' to nature as far back as the 1680s.[44] The problem was that individual naturalists, trained in different methods and disagreeing on the viability, or even the existence, of 'natural' characters, were effectively at liberty to base their classifications on whichever anatomical features interested them. This variability of

[41] A. Jaramillo, P. Burke, *New World Blackbirds: The Icterids* (Princeton, N. J.: Princeton University Press, 1999), 10-12.
[42] See Sloan, 'The Buffon – Linnaeus Controversy'. Also O. E. Fellows, S. F. Milliken, *Buffon* (New York: Twayne Publishers Inc., 1972).
[43] P. L. Farber, 'Buffon and Daubenton: Divergent Traditions within the *Histoire Naturelle*', *Isis*, 66, 1 (Mar., 1975), 66.
[44] Wilkins, *Species*, 65-67; T. Birkhead, *The Wisdom of Birds: An Illustrated History of Ornithology* (London: Bloomsbury, 2008), 17-51, especially 31-32.

taxonomical characters was not brought to an end by Linnaeus. In his *Preliminary Discourse* of 1834 Swainson noted:

> One arguing from the flight of bats, looks on it as that animal which constitutes the true passage from quadrupeds and birds. Another, looking to its general aspect, is disposed to place it among mice, fortified by the general name given by the French to the whole tribe of *chauve souris* [literally, 'bald mouse']. A third, chiefly influenced by the peculiarity of its teeth, arranges it in the same group as monkeys, and each, acting on his respective inferences, fashions his system accordingly.[45]

Others were inspired by the search for natural laws and relationships whilst sceptical of Buffon's adherence to the Great Chain of Being, a feature of his thought that he shared with Linnaeus.[46] The British zoologist Thomas Rymer Jones (1810-1880), a committed theist who edited Kirby's 'Bridgewater Treatise' for a mass-market audience in 1852, expressed deep reservations that the 'natural system', which reflected divinely-ordained nature, could be discovered at all.[47] Writing in the middle of the evolutionary debates of the 1860s, Jones cautioned the young readers of *The Animal Creation: A Popular Introduction to Zoology* against airy systematising:

[45] Swainson, *Preliminary Discourse*, 153.
[46] Wilkins, *Species*, 72, 75-76.
[47] W. Kirby, T. R. Jones (ed)., *On the Power, Wisdom, and Goodness of God, as Manifested in The Creation of Animals, and in Their History, Habits, and Instincts* (London: H. G. Bohn, 1852).

> In reviewing the multitudinous races composing the animal kingdom, it has of course been necessary to describe consecutively the different classes and order in which they are grouped by naturalists, as though they formed but one extended line, and this in a somewhat arbitrary manner to assign to each a place in the lengthy procession. To suppose that such is their natural arrangement would, however, be to fall into a very serious error. Although widely separated in our pages, the Tiger-beetle and the Tiger are, in their respective spheres of action, pretty much of equal rank, and we are inclined to think that in its own element the Cuttle-fish holds as high a place among the Mollusca as the Lion does among quadrupeds. The "vast chain of being," therefore, composed of numerous successive links, exists only in the imagination of the poet, and the young naturalist would be grievously misled by the adoption of such an idea.[48]

Despite the critique of Buffon and later naturalists, the importance of Linnaeus' achievement lent him a status that bordered on the quasi-divine in European natural history, and to many naturalists he was simply 'the Great Master'.[49] His dominance in Britain, in particular, was absolute, to the extent that reverence for his memory prevented the development of his original theory to take into account the new species that almost daily arrived in British collections. The key reason for this was the institution established in his honour by James (later Sir James) Smith (1759-1828) in 1788. The *raison d'être* of the Linnean Society of London was to provide a repository for Linnaeus' botanical and zoological collections, which Smith

[48] T. R. Jones, *The Animal Creation: A Popular Introduction to Zoology* (London: Society for Promoting Christian Knowledge, 1865), 570.

[49] For Linnaeus' prestige in British natural history, see W. T. Stearn, 'The Wilkins Lecture, 1985: John Wilkins, John Ray and Carl Linnaeus', *Notes and Records of the Royal Society of London*, 40, 2 (1986), 101-123; Allen, *Naturalist in Britain*, 40-42.

had purchased in 1783 after the Master's death, and to guide the study and application of taxonomy in British science.[50] The first of the 'new' London scientific societies, which sought to provide more specialist direction than that provided by the Royal Society, the Linnean was dominated from the outset by botanists, whose discipline had been given an immense stimulus by Linnaeus' work. This preponderance, and the elevation of botany over zoology, was reflected in the almost total dearth of major zoological work in Britain until the 1820s when zoology flowered in the most spectacular manner.

Whilst zoologists agreed that Linnaean binomials were the best tools for the task of imposing order on the chaos of nature, and that there should be a universally accepted series of rules which names were conferred, by the beginning of the nineteenth century there was general disagreement about what these rules should be. Indeed, a scan through an assortment of the principal European ornithological works published around 1800 reveals a bewildering array of synonyms as naturalists coined their own binomial names for species which had already been so treated. Louis Jean Pierre Vieillot (1748-1831), François Levaillant (1753-1824), and Conraad Temminck, the giants of European ornithology, were all prolific namers, coining new names to substitute older ones, including those conferred by the revered Linnaeus, where they felt that species had been incorrectly named.[51] The result was that where previously there had existed a chaos of common names, there now existed a similar and even more confusing array of binomials. Subsequent ornithologists took to listing these names in their own works. This continued long after the publication of the Strickland Rules in 1844. The illustrated folios of John Gould, whose own ornithological career was marked by a distinct propensity to name species that had already been named, provide many good examples of this. To take another random but entirely typical example, from the first volume of his *Birds of Asia*, he lists the

[50] By a quirk of history, an 'a' is dropped from Linnaeus' name in the society.
[51] Miracle, 'Temminck', 454.

taxonomic history of the Indian scops owl, *Scops pennatus*, noting no fewer than ten alternative binomials which had been assigned to the species by previous naturalists, including Edward Blyth, Brian Hodgson (1801-1894), Thomas Horsfield, and Thomas Jerdon. In his own work Gould, following the conventions established by Strickland, identified the species by the first binomial assigned to it, *Scops pennatus*, by Brian Hodgson.[52]

II.

Volume one of Macleay's *Horae Entomologicae* was published in the middle of one of the most turbulent periods in modern British history. Between 1818 and 1821, years characterised by Robert Patten as 'the Georgian Hinge', Britain came closer to revolution than at any other moment in the long nineteenth century, and the summer of 1819 marked the high point of radical unity.[53] Recurring crises of government were precipitated by a deep, post-war economic recession; 'Peterloo', a political reform meeting in Manchester on 16 August 1819, broken up by the volunteer Yeomanry and resulting in seventeen deaths, the bloodiest political event of the nineteenth century on English soil; the extremely-negative popular reaction to the repressive Six Acts (1819); the accession of a new and widely-reviled monarch, George IV, and the Queen Caroline Affair; and finally the Cato Street Conspiracy to murder prominent members of the Cabinet. Embattled, seemingly, on all fronts, Lord Liverpool's administration faced a scene of unparalleled social and political dislocation.[54]

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[52] J. Gould, R. Bowdler-Sharpe, *Birds of Asia* (London: J. Gould, 1850-1883), **I.**, text accompanying plate 13.
[53] R. L. Patten, 'George's Hive and the Georgian Hinge', *Browning Institute Studies*, 14, 'The Victorian Threshold' (1986), 37-69, 39-40.
[54] There is a huge literature on the social and political dislocations of the late Georgian period. A few of the most useful surveys include C. Calhoun, *The Question of Class Struggle: Social Foundations of Popular Radicalism during the Industrial Revolution* (Chicago, IL: Chicago University Press, 1982); E. P. Thompson, *The Making of the English Working Class*, revised edition (Harmondsworth: Penguin, 1968); I. McCalman,

In 1821 the *Quarterly Review*, established in 1809 and a reliable bell-weather of Coleridgean tory principles under its first editor, William Gifford (1756-1826), reminded its readers that they lived in troubled times:

> We live at a period when the human mind is every where acting under a powerful impulse. Whatever difference of opinion may be entertained respecting the causes from which it proceeds, or the consequences to which it leads, the existence of the fact itself admits of no dispute. Wherever our inquiries or personal observations extend, we find mankind restless and dissatisfied, and straining every faculty of mind and body for the improvement of their condition, to a degree of which no former age can furnish an example.[55]

This prelude to a lengthy dissection of the government's latest attempt to revise Criminal Law was unusually temperate by the *Quarterly's* usual standards and was, perhaps, even putting the case mildly. Periodical journalism at this time, as John Strachan points out, was almost invariably partisan, with Gifford and Francis Jeffrey, of the *Edinburgh*, becoming seen as figureheads of rival literary tribes of tories and whigs.[56] Gifford quickly marshalled an impressive roster of regular contributors, including such luminaries as John Wilson Croker, Coleridge, Robert Southey, and Walter Scott, so that by 1818 the *Quarterly's* annual circulation

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Radical Underground: Prophets, Revolutionaries and Pornographers in London, 1795-1840 (Cambridge: Cambridge University Press, 1988).

[55] [W. Gifford], 'Art. VIII. – *Report from the Select Committee on Criminal Laws, &c.; ordered by the House of Commons to be printed, 8th July, 1819*', *Quarterly Review*, 24 (1821), 195.

[56] J. Strachan (ed.), *British Satire, 1785-1840: Gifford and the Della Cruscans* (London: Pickering and Chatto, 2003). J. Cutmore (ed.), *Conservatism and the Quarterly Review: A Critical Analysis* (London: Pickering & Chatto, 2007), provides an excellent study of the *Quarterly's* role in the development of nineteenth-century conservativism and conservative ideology.

stood at 14,000.[57] A highly-interventionist and highly-politicised editor, described by Strachan as an enthusiast for 'literary bloodsports', Gifford set himself the congenial task of harrying radicalism wherever he met with it. Though no government stooge, his review of William Hazlitt's *Political Essays* in 1819, one of the relatively few occasions where he contributed directly to the *Quarterly* and in which he compared Hazlitt to a death's head hawk-moth, amongst other things, is notable for its ferocity. Gifford focused particularly on an 'alarming' passage in Hazlitt's volume in which the latter, identifying himself as such, noted that

> The true Jacobin hates the enemies of liberty as they hate liberty, with all his strength and with all his might, and with all his heart and with all his soul. His memory is as long and his will as strong as theirs, though his hands are shorter; he never forgets or forgives an injury done to the people, for tyrants never forget or forgive an injury done to themselves… His hatred of wrong only ceases with the wrong. The sense of it, and the barefaced assumption of the right to inflict it, deprives him of his rest. It stagnates in his blood – it loads his heart with aspic tongues deadly to venal pens. It settles on his brain – it puts him beside himself.[58]

A 'hideous' vision indeed, and one guaranteed to make the flesh of the *Quarterly's* tory readers creep. Gifford, nevertheless, sounded a soothing note, observing that 'a wise providence' kept the Hazlittian swarms at bay, limiting them to acts of 'paltry mischief'.[59]

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[57] H. Shine, H. C. Shine, *The Quarterly Review under Gifford: Identification of Contributors, 1809-1824* (Chapel Hill, NC: University of North Carolina Press, 1949); J. B. Cutmore, 'The "Quarterly Review" under Gifford: Some New Attributions', *Victorian Periodicals Review*, 24, 3 (Fall, 1991), 137-142.
[58] W. Hazlitt, *Political Essays, with Sketches of Public Characters* (London: William Hone, 1819), 167.
[59] [Gifford], '*Report from the Select Committee on Criminal Laws*', 196.

As the *Quarterly* demonstrates, between the end of the Napoleonic Wars and the height of the Chartist agitation in the early 1840s, the notion that movements of the lower orders could be towards 'legitimate', or even understandable aims, such as lower grain prices, was replaced by fear that they sought nothing less than the dismantling of society itself.[60] By the middle of 1819, the Hazlittian swarms were well in evidence. On 10 August, the Foreign Secretary and Leader of the Commons, Lord Castlereagh (1769-1822), observed to his brother that 'our Mob Reformers are getting very saucy'.[61] Six days later the Manchester Yeomanry, many of whom had suffered bruises in previous clashes with radical crowds, ran amok at a large meeting of reformers who had gathered on St. Peter's Fields in the city. Castlereagh bore much of the blame for the deaths that resulted, partly as it was his responsibility to explain the Yeomanry's actions to the House of Commons.[62] 'Peterloo', as it was swiftly dubbed, prompted a rash of protests across the country, particularly in the industrial north.[63] The Prime Minister commented glumly to Wellington that 'the state of Lancashire and its immediate neighbourhood is very alarming and deserves serious consideration'.[64] The government's response to such disturbances was to rush through a raft of legislation which banned 'seditious meetings' and imposed severe limitations on printers as to what they could publish, a reflection of the belief held by many in the Cabinet that the root of the 'Monstrous Evils' around the Peterloo affair lay in the popular press.[65]

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[60] R. D. Storch, 'Crime and Justice in 19th-Century England', *History Today*, 30, 9 (Sep., 1980), 34.
[61] Lord Castlereagh to Lord Stewart, 10 August 1819. *Castlereagh Papers*, PRO Northern Ireland. D3030/Q2/1.
[62] J. Bew, *Castlereagh: Enlightenment, War, and Tyranny* (London: Quercus, 2011), 463.
[63] The standard account of Peterloo remains Thompson, *Making of the English Working Class*, 734-768. R. Reid, *The Peterloo Massacre* (London: Heinemann Ltd., 1989) examines the role of the authorities. R. Poole, 'The March to Peterloo: Politics and Festivity in Late Georgian England', *Past & Present*, 192 (Aug., 2006), 109-153, offers a useful counterpoint to Thompson's 'class war' thesis. M. L. Bush, *The Casualties of Peterloo* (Lancaster: Manchester Centre for Regional History, 2005) breaks down the casualty lists.
[64] Lord Liverpool to the Duke of Wellington, 12 September 1819. *Wellington Papers*, Southampton University Special Collections. WP1/631/10.
[65] Chase, *1820*, 44.

The 'Six Acts' were explicitly anti-radical in nature. Any assembly in public and which involved flags and banners were prohibited, and the legislation allowed for the search of private dwellings without a warrant. Lecture halls and debating societies also found themselves under scrutiny and liable to be deemed disorderly and unceremoniously shut-down unless their activities were licensed by the local magistrates. This consolidated the Seditious Meetings Act of 1817, which temporarily impinged upon London's scientific societies. At first glance, scientific assemblies would appear to have been beyond the scope of such legislation. Yet, as the radical leader Samuel Bamford (1788-1872) admitted, reformers 'assembled under various pretexts… sometimes "botanical meetings"'.[66] The *Quarterly*, twitchily-ready to leap at the merest hint of sedition, implicated the Literary and Philosophical Society of Newcastle on the grounds that Thomas Spence had lectured there in the 1780s.[67] This prompted the society's secretary to reply that his members had recently dismissed the librarian because of his political and religious radicalism, which presumably placated Gifford. The matter even found its way into a Commons debate.[68] With such instances to hand, the response in Parliament and outside to the Acts of 1819 was fierce. George Tierney (1761-1830), the radical leader in the commons and *de facto* leader of the opposition, jeered that ministers were filled with 'wrath' against the people.[69] Mary Shelley (1797-1851), then in Italy with her husband, scoffed that England had become 'Castlereagh Land', and spoke for many when she adjudged the English as ground, pounded, hanged, and taxed into oblivion.[70]

The major act of mischief that Gifford and his *Quarterly* readership feared occurred the following year, and it was to the intervention of 'providence', divine or otherwise, that its

[66] I. Inkster, 'London Science and the Seditious Meetings Act of 1817', *The British Journal for the History of Science*, 12, 2 (Jul., 1979), 192-196, 193.
[67] *Quarterly Review, 1816-1817* (London: John Murray, 1817), 225-278, 511-52.
[68] *The Times*, 14 February 1817.
[69] *Hansard, 1820* (London), Volume XLI, 702-704.
[70] H. H. Hungser (ed.), *Letters of Mary Wollstonecraft Shelley* (Norwood, Mass.: Plimpton, 1918), 89-92.

failure was ascribed. The ‘Cato Street Conspiracy’, the attempt to murder Lord Liverpool and the many of his principal ministers, has commonly been relegated by historians as a sideshow to the principal political drama of 1820: George IV’s sensational attempt to divorce Queen Caroline and his subsequent, more successful determination to bar her from entering Westminster Abbey during the coronation.[71] To be sure, no other radical cause had quite the same potential for the display of subversive loyalty as the ‘Queen’s Business’. Though it captivated the attention of the nation for much of 1820, it had been rumbling on since 1817 and deferred by the government until the last possible moment.[72] As Charles Stewart (1778-1854) noted, with the country in such a parlous state any such agitation would be ‘fatal’.[73] So it almost proved. Hazlitt later noted, with palpable wonder, it ‘struck its roots into the heart of the nation; it took possession of every house or cottage in the kingdom’.[74] Henry Hobhouse (1776-1854), Under-Secretary at the Home Office and the department’s head until 1827, observed with alarm in his diary that the country ‘has been thrown into a ferment’ by the affair.[75] Superficially a royal domestic quarrel, starring a bloated, venal monarch and a silly, ‘not-very-virtuous queen’, in the extraordinary circumstances of 1820 the divorce action came to assume a greater symbolic significance that far outweighed its immediate constitutional importance.[76]

The agitations that surrounded Queen Caroline, and the riots that accompanied her death and funeral procession in 1821, are seen by several historians as central events in the history of popular politics, particularly the development and mobilisation of radical crowds of the sort feared by Gifford. The queen’s cause gave London radicals a legitimate reason to be

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[71] A. Clark, ‘Queen Caroline and the Sexual Politics of Popular Culture in London, 1820’, *Representations*, 31, Special Issue: The Margins of Identity in Nineteenth-Century England (Summer, 1990), 47-68; T. L. Hunt, ‘Morality and Monarchy in the Queen Caroline Affair’, *Albion*, 23, 4 (Winter, 1991), 697-722.
[72] Poole, ‘March to Peterloo’, 142-143.
[73] Lord Stewart to Lord Castlereagh, 13 April 1817. *Castlereagh Papers*, D3030/P/151.
[74] W. Hazlitt, ‘Commonplaces’ no. 73 (Nov. 15, 1823), in P. Howe (ed.) *The Complete Works* (London: J. W. Dent, 1934), Volume 20, 136.
[75] H. Aspinall (ed.), *The Diary of Henry Hobhouse (1820-1827)* (London: Home & Van Thal, 1947), 23.
[76] T. W. Laqueur, ‘The Queen Caroline Affair: Politics as Art in the Reign of George IV’, *The Journal of Modern History*, 54, 3 (Sep., 1982), 417-466, 417-418.

on the streets in an ostensible show of support for the monarchy that was, nevertheless, a mobilisation against the king and government authority. As Laqueur and Prothero note, even the formidable repressive apparatus developed by the Home Secretary, Lord Sidmouth (1757-1844), was helpless against such a massive mobilisation, particularly one which asked only that the queen's rights as consort be recognised.[77]

Still, the affair showed some of the weakness of the radical position. The re-mobilisation of radical platform politics after the repression of the 1790s was not matched by a similar base of parliamentary power. When the Whigs dropped the queen's cause, no amount of radical street theatre could revive her cause.[78] The Cato Street conspiracy was a graphic illustration of this relative weakness.[79] As Malcolm Chase argues, the conspirators sought to transform their local initiatives into a 'potent challenge' to authority. Like the radicals who were prominent in the Spa Fields Meetings in 1816 and 1817, the conspirators embraced a style of popular politics that centred on London's streets and taverns, and lines of continuity have been profitably drawn between this conspiratorial 'underground' and the revolutionary radicalism of Thomas Spence, 'one of the most sophisticated theoreticians of revolutionary radicalism in the capital'.[80]

Agitation was not confined to London, as contemporary accounts demonstrate. By January 1820, Arthur Thistlewood's (1774-1820) Cato Street plotters, were in regular contact with sympathisers in northern England, and there were widespread rumours that some sort of decisive action was imminent.[81] This extended even to the far north. On 1 March, the

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[77] Laqueur, 'The Queen Caroline Affair', 421; I. Prothero, *Artisans and Politics in Early Nineteenth Century London* (London: Dawson, 1979), 134-135.
[78] Laqueur, 'The Queen Caroline Affair', 421.
[79] J. Stanhope, *The Cato Street Conspiracy* (London: Jonathan Cape, 1962), though now dated, remains the standard work.
[80] M. Chase, *'The People's Farm: English Radical Agrarianism, 1775-1840* (Oxford: The Clarendon Press, 1988), 67.
[81] Chase, *1820*, 76-77.

commander of the army in Scotland, General Sir Thomas Bradford (1777-1853), reported to the Home Office that Scottish reformers had ‘expected something very important to take place’ either in late-January or early-February.[82] Similarly, a Home Office informant and Lancashire colliery manager named George Chippendale was adamant that radical members of the Oldham Union had travelled to London at the end of February in the expectation that they would soon participate in a general rising. His report to the Home Office observed that the ‘suppression of the diabolical attempt has cast a terrible Gloom upon them’.[83]

Years later, in a review of the memoirs of the radical leader Samuel Bamford (1788-1872), the *Quarterly* noted that the plot was similar to one planned in the spring of 1816, it too born of the post-war economic slump.[84] The terms in the Cato Street plotters’ manifesto were familiar, referencing the dire state of the economy and resentment of the government’s anti-sedition measures. That ministers had something to worry about was brought home to them later in 1820 when Thomas Preston (1774-1850), in whose house the plotters had met and who had previously been questioned by the Privy Council because of his alleged involvement, wrote an open letter to Castlereagh in which he gave a detailed account of the plot as part of a wider series of risings. This, he wrote chillingly, would have culminated in ‘a plan to take possession of a barge, to load it with destructive combustible, to lay it close to the House[s of Parliament], and then by explosion to blow it up, members and all together.’[85]

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[82] TNA, HO 102/32/218, 1 March 1820, q. in Chase, *1820*, 81.
[83] J. Foster, *Class Struggle and the Industrial Revolution* (London: Methuen, 1974), 288.
[84] ‘Art. III. – *Passages in the Life of a Radical*. By Samuel Bamford. Third Edition’, *Quarterly Review*, *Volume LXXIV* (London: John Murray, 1844), 193-194. See also Hewitt, M., ‘Radicalism and the Victorian Working Class: The Case of Samuel Bamford’, *The Historical Journal*, 34, 1 (Dec., 1991), 873-892.
[85] T. Preston, *A Letter to Lord Castlereagh: being a full development of the circumstances relative to the diabolical Cato Street Plot* (London, 1820).

Figure 2. G. Cruikshank, 'Poor John Bull', frontispiece to *The Free-Born Englishman* (London: J. Fairburn, 1819).

The 'providential' discovery of the plot did little to ease the immediate tensions that were widespread in the country, and did still less to bolster the flagging popularity of Liverpool's government. Hostility towards the administration extended beyond hardline radicals. As Chase notes, the Six Acts, passed in 1819 in an immediate response to 'Peterloo', were a point of widespread disaffection, particularly the Blasphemous and Seditious Libels Act (or Criminal Libels Act) and the Newspaper and Stamp Duties Act, which together served to make publishing newspapers and books not only more expensive, but downright dangerous, as caricatures from the period demonstrate (*fig.* 2).[86]

The ugly mood was caught by, amongst others, the poet Percy Shelley (1792-1822) and the caricaturist and satirist George Cruikshank (1792-1878). Shelley's sonnet, *The Mask of Anarchy*, was written directly in response to the events at St Peter's Fields, and paints an unremittingly-gloomy picture of a disturbed nation:

An old, mad, blind, despised, and dying King;

Princes, the dregs of their dull race, who flow

Through public scorn,- mud from a muddy spring;

Rulers who neither see nor feel nor know

But leechlike to their fainting country cling

Till they drop, blind in blood, without a blow;

A people starved and stabbed in th'untilled field;

[86] Chase, *1820*, 10-11.

An army, which liberticide and prey

Makes as a two-edged sword to all who wield.

Though destined to become one of the most famous literary reflections of the late-Georgian period, Shelley's poem was written whilst he was in Italy. It was directed against prominent members of the Liverpool administration, particularly the Ultra-Tory Lord Chancellor, Lord Eldon (1751-1838), and the perennially-unpopular Castlereagh, by now a by-word for political reaction.[87] The poem was not published until 1832, a decade after Shelley's death, by the inveterate radical journalist Leigh Hunt (1784–1859), by which time its immediate polemical force was lost.

The Liverpool government's post-war policies, characterised by Asa Briggs as 'patronising paternalism', rested on a key assumption about hierarchical and oligarchical power structures that was anathema to those, such as Shelley and Hunt, with radical sympathies.[88] Liverpool and Sidmouth, in particular, believed that both secular and religious authority should be concentrated in the upper tiers of the class structure, usually depicted as a pyramid, and exercise on behalf of 'the country', defined principally as those who owned land or otherwise maintained order: the judiciary, the armed forces, and the Church. Under this theory of representative government, the mass of the population, who owned no land, existed only to be governed and to serve.[89]

Cruikshank captured both the pyramidal ethos and the prevailing public mood in a series of acerbic cartoons, of which *Poor Bull & his Burden* (*fig*. 3) is one of the most explicit.

[87] J. Bew, *Castlereagh* (London: Quercus, 2011).
[88] A. Briggs, *The Age of Improvement, 1783-1867* (London: Longman, 1959), 215.
[89] Patten, *Georgian Hinge*, 39-40.

Figure 7. G. Cruikshank, *Poor Bull & his Burden*. Coloured etching, 15 December 1819. (British Museum.)

Published in December 1819, it shows a huge bull – signifying John Bull - chained to the ground, its mouth muzzled by the Gagging Bill. In front of it stands Wellington, recently appointed by Liverpool as Master of Ordinance in a move that radicals interpreted as further evidence of military suppression. The Duke, ominously for the bull, brandishes an executioner's axe and wears a butcher's apron. On top of the beast sits a pyramid of men: soldiers, tax-gatherers, clerics and bishops, ministers, the whole surmounted by a crown. The cartoon is accompanied by a line taken and adapted from William Cowper's account of the plague of frogs that struck Ancient Egypt: '"And the land stank – so num'rous was the fry" – What will become of these Vermin if the Bull should Rise…?!!!!!!!!!!!!' As Patten notes, the image was not original: Cruikshank's father had published a similar print of an overburdened John Bull in 1797.[90] However, published in the over-heated months after Peterloo, the reworked-image had a new and, to the authorities, sinister aspect.

For many of London's gentlemen naturalists, the prospect of domestic anarchy was a source of considerable alarm and had a direct bearing upon their work. For some, paternal influence played a part. The Rev. James Bicheno (1751-1831), father of the politically-conservative naturalist James Ebenezer Bicheno (1785-1851), responded to the Revolution in a lengthy politico-religious pamphlet ominously entitled *The Signs of the Times*. 'From the first moment of the French revolution', the elder Bicheno wrote, 'my own mind was deeply impressed with an awful apprehension of what was coming'.[91] Disorder, certainly, but for the Rev. Bicheno there was a positive aspect. Virulently anti-Catholic, he believed that the Revolution portended 'that great and finishing scene of God's judgments was disclosing… in

[90] Patten, *Georgian Hinge*, 41.
[91] J. Bicheno, *The Signs of the Times: In Three Parts. A New Edition, Corrected and Enlarged* (London: J. Adlard, 1808), iv.

which are to be overthrown all those Antichristian systems, civil and ecclesiastical, which have for so long been opposed to genuine Christianity.'[92]

J. E. Bicheno carried this unease, if not the anti-Catholic bias, into his own minor political career, as did the Rev. William Kirby. J. F. M. Clark sees in Kirby's promotion of traditional taxonomies not only methodological caution but also the influence of his pronounced Burkean political conservatism, particularly his distrust of 'dangerous' intellectual movements emanating from post-Revolutionary France. 'The worst irreligious and anarchistic elements of the French Revolution lay in materialist and atheist science', Clark notes, 'that rendered some science suspect in Britain'.[93] The promotion of such materialist science by political radicals, as Adrian Desmond has demonstrated with reference to the activities of reformers in London's medical community, inextricably bound together scientific materialism with revolution in the minds of men like Kirby, whose contribution to the *Bridgewater Treatises* in 1836 mobilised orthodox, Paleyan natural theology.[94]

Macleay responded to the political intellectual tumult in a different way. Desmond identified his quinarian theory as a reaction both to French, materialist temporalism and German, idealist *Naturphilosophie*. He also highlighted the role of politics. 'MacLeay had devised [quinarian theory] in the aftermath of the French Revolution', he wrote. 'As an Embassy attaché he had seen the social shambles caused by the ragged revolutionaries, and it was in this context of post-war Paris that his new science packed its ideological punch. The English upper classes blamed the Revolution on the poisonous philosophies of the Enlightenment…. In the reactionary Regency, MacLeay emasculated the system at a stroke'.[95]

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92 Bicheno, *Signs of the Times*, iv.
93 J. F. M. Clark, 'History from the Ground Up: Bugs, Political Economy, and God in Kirby and Spence's Introduction to Entomology (1815–1856)', *Isis*, 97, 1 (March 2006), 28-55, 32.
94 See, C. S. Varma, 'Threads That Guide or Ties That Bind: William Kirby and the Essentialism Story', *Journal of the History of Biology*, 42, 1 (Spring, 2009), 119-149.
95 A. Desmond, *Huxley: The Devil's Disciple* (London: Penguin, 1998), 89-90.

Philip Rehbock makes a similar point, identifying Macleay as a political and scientific reactionary.[96] However, this is to over-simplify what was a far more complex intellectual position, and one that has been consistently-misunderstood by historians of science.

III.

Unravelling the tangled scientific and philosophical strands within quinarianism is made difficult both by the complexity of the theory itself, and by the numerous sources and methodological traditions that Macleay cited as authorities in the *Horae*. For example, the emphasis on the number five, and the circular arrangement, persuaded many of Macleay's contemporaries, including Strickland and Darwin, and later historians that his theory was numerological.[97] This is not entirely correct, and builds upon a misunderstanding of Macleay's own complicated thinking. Though Macleay consistently argued for the existence of determinate numbers in nature, this was a necessary consequence of the system of parallel analogies.[98] Macleay's close study of the *Coleoptera* beetles had persuaded him of the empirical truth of this assumption, as Novick correctly points out.[99] Contrary to Mayr and Rehbock's contentions, there is no evidence in any of Macleay's writings that he held Pythagorean notions about the *a priori* primacy of numbers in nature.[100] Similarly, the system of 'osculent' circles, which has probably drawn more fire from Macleay's critics than any other

[96] Rehbock, *Philosophical Naturalists*, 26, 28.
[97] For example, M. T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley, CA: University of California Press, 1969).
[98] W. S. Macleay, 'Remarks on the Identity of Certain General Laws which have Been Lately Observed to Regulate the Natural Distribution of Insects and Fungi', *Transactions of the Linnean Society of London*, 14, 1 (1825), 46–68.
[99] Novick, 'On the Origins of the Quinarian System', 29.
[100] E. Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge, MA: Harvard University Press, 1982), 202-203; Rehbock, *Philosophical Naturalists*, 26.

feature of the quinary system, was originally conceived as an explanatory tool, and was not of inherent importance to the system itself. Macleay's chains of affinity, in which the first and last species bore an affinity to one another and so turned the chains back on themselves, obviously had no actual shape, or concrete existence, but could be expressed diagrammatically as such. Macleay was clear in the *Horae Entomologicae*. The chains of affinity 'might be represented by any curve, such a circle or ellipse, having this property'.[101] 'This property of a distribution', he stressed, 'for convenience only we have considered circular', and should only be regarded as 'symbols'.[102]

Historians have generally overlooked this caveat and, as a result, invested too much significance in Macleay's quinarian diagrams, tending to point to them as evidence of his mysticism.[103] However, it is important to note that Macleay was not the first to use a circular classificatory arrangement. Swainson identified the first modern usage in Fischer de Waldheim's *Tableaux Synoptiques* of 1805, in which de Waldheim arranged the animal kingdom in contiguous circles with man at the centre, intended also for explanatory purposes.[104] Nor was Macleay the last. Vigors, Swainson, Johann Kaup (1803-1873), Edward Newman (1801-1876), and Fries all adopted his circular arrangement for their own systems.[105] John Lindley (1799-1865), whose later quinarian arrangement of plants owed much to Swainson's work, opted for stars over circles, serving to further demonstrate the symbolic

[101] Macleay, *Horae*, **II.**, 163.
[102] Macleay, *Horae*, **II.**, 319; 164.
[103] See, for example, M. A. Ragan, 'Trees and Networks before and after Darwin', *Biology Direct*, 4, 43 (2009), 11-12; T. Bennett, *Pasts Beyond Memory: Evolution, Museums, Colonialism* (Abingdon, Oxon.: Routledge, 2004), 13-19.
[104] Swainson, *Preliminary Discourse*, 91; G. F. de Waldheim, *Tableaux synoptiques de Zoognosie, publiés à l'Usage de ses Élèves à l'Université Imperiale de Moscou* (Moscow: 1805).
[105] Vigors, 'Observations', 395-517; W. Swainson, *On the Natural History and Classification of Birds* (London: London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836); J. J. Kaup, 'Einige Worte über die systematische Stellung der Familie der Raben, Corvidae', *Journal für Ornithologie*, 2 (1854), xlvii–lvii; E. Newman, 'Further observations on the septenary system', *Entomological Magazine*, 4 (1837), 234–251; E. M. Fries, *Systema orbis vegetabilis primas lineas novæ constructionis: Plantae homonemeæ* (Lund: Typographica Academia, 1825).

nature of quinarian diagrams.[106] Far more important was the system of affinities and analogies which, being based on empirical observations, had a profound effect on many naturalists, including Hugh Strickland and Richard Owen (1804-1892), the latter of whom drew heavily on the distinction between affinity and analogy in his own work.[107]

Macleay's identification of affinities and analogies between discrete 'types' and circles has, however, also provided ample ammunition for those who detect in his theory essentialism run riot.[108] Over the past decade Mary Winsor, Ron Amundsen and John Wilkins have begun to question the veracity of this swingeing classification and whether pre-Darwinian naturalists were even essentialists at all.[109] Winsor and Wilkins both observe that the notion that Linnaeus believed in the fixity of species, a position which he abandoned early on his career, has been profoundly influential in shaping modern narratives of eighteenth and nineteenth-century biology, despite it being effectively debunked by Edward Greene as long ago as 1909.[110] Both Winsor and Wilkins go further, arriving at the startling conclusion, as Wilkins puts it, that 'nobody was essentialist to speak of in the sense that is antievolutionary [i.e. Aristotelian or Platonist] in biology'.[111] The question, then, is why were so many twentieth-century historians

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[106] J. Lindley, *A Systematic View of the Organisation, Natural Affinities, and Geographical Distribution of the Whole Vegetable Kingdom; Together With the Uses of the Most Important Species in Medicine, the Arts, and Rural or Domestic Economy* (London: Longman, Rees, Orme, Brown, Green and Longman, 1836).
[107] H. E. Strickland, 'Observations upon the affinities and analogies of organized beings', *Magazine of Natural History*, 2, 4 (1840), 219-226, and 'On the progress and the present state of ornithology', *Report of the British Association for the Advancement of Science for 1844*, 14 (1845), 170-221, 356; R. Owen, *On the Archetype and Homologies of the Vertebrate Skeleton* (London: John Van Voorst, 1848), 242.
[108] Rehbock, *Philosophical Naturalists*, 24-30; Desmond, *Darwin*, 89-90.
[109] R. Amundson, *The Changing Role of the Embryo in Evolutionary Biology: Structure and Synthesis* (Cambridge: Cambridge University Press, 2005); M. P. Winsor, 'Non-essentialist methods in pre-Darwinian taxonomy', *Biology and Philosophy*, 18 (1003), 387-400; 'Linnaeus' Biology was not Essentialist', *Annals of the Missouri Botanic Gardens*, 93 (May, 2006), 2-7; 'The Creayion of the Essentialism Story: An Exercise in Metahistory', *History and Philosophy of the Life Sciences*, 28 (2006), 149-174; Wilkins, *Species*; J. S. Wilkins, 'Essentialism in Biology', in K. Kampourakis, *The Philosophy of Biology* (New York: Springer, 2013), 1-25.
[110] Winsor, 'Linneaus', 2; Wilkins, *Species*, 70-74; E. L. Greene, 'Linnaeus as an Evolutionist', *Proceedings of the Washington Academy of Science*, 11 (1909), 17-26.
[111] Wilkins, 'Essentialism in Biology', 1.

of biology so united in depicting pre-Darwinian taxonomies as essentialist? The answer is important, for it offers an explanation for the neglect of quinarian sources by historians.

The problem centres on the use of the word 'essentialism', a term first used by Karl Popper in the 1940s and later identified by David Hull with typology, and the confusion that rests on treating the word 'essence' as meaning a single notion where, in fact, there are many.[112] Popper, in *The Open Society*, believed methodological essentialism to be the view

> held by Plato and many of his followers, that it is the task of pure knowledge or 'science' to discover and to describe the true nature of things; i.e. their hidden reality or essence. It was Plato's peculiar belief that the essence of sensible things can be found in other and more real things – in their primogenitors or Forms. Many of the later methodological essentialists, for instance Aristotle, did not altogether follow him in determining this; but they all agreed with him in determining the task of pure knowledge as the discovery of the hidden nature of Form or essence of things. All these methodological essentialists also agreed with Plato in holding that these essences may be discovered and discerned with the help of intellectual intuition; that every essence has a name proper to it, the name after which the sensible things are called; and that it may be described in words. And a description of the essence of a thing they called a 'definition'.[113]

[112] K. Popper, *The Open Society and Its Enemies* (London: Routledge, 1950); David L. Hull, 'The Effect of Essentialism on Taxonomy: Two Thousand Years of Stasis', *British Journal for the Philosophy of Science*, 15 (1965), 314-326; 16, 311-318.
[113] Popper, *The Open Society*, **I**., 34.

In his seminal 1965 paper, provocatively-titled ‘The Effect of Essentialism on Taxonomy – Two Thousand Years of Stasis’, Hull, Popper’s former student, characterised this interpretation of methodological essentialism as ‘typology’, the consequences of which have been explored at length by Winsor.[114] He identifies a ‘received view’ of pre-Darwinian taxonomic methods that equated typology, the dominant method of classification used by almost all naturalists before Darwin, including Macleay and the quinarians, with essentialism.

Curiously, Mayr himself provides some material that the ‘received view’ is in dire need of revision, not least for his characterisation of the period between c.1750 and c.1850 as a time of ‘empiricism’, which undercuts his vision of essentialism rampant.[115] As Peter Buerton notes in an invaluable historical survey of Mayr’s thoughts on the nature of biological species, Mayr prided himself on frequently changing his mind on the issue and recognised that problems arose when his varying conceptual assumptions were associated under unchanged definitions such as ‘species’ or, indeed, ‘essentialism’.[116]

Mayr, one of the greatest biologists of the twentieth century, stands at the heart of the ‘essentialism story’. Paradoxically, it was his efforts to resuscitate taxonomy in the 1950s which set in train the chain of events which led to the ‘essentialism story’ assuming a canonical status and which coloured subsequent historians’ views of pre-Darwinian natural history. This has been studied in great detail by Mary Winsor and developed further, with slight variations, by Wilkins, Robert Wilson, and Ingo Brigandt.[117] The context of Mayr’s thinking in the 1950s

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[114] Hull, ‘Two Thousand Years’, 317.
[115] E. Mayr, ‘The Biological Meaning of Species’, *Biological Journal of the Linnean Society of London*, 1 (1969), 311-320.
[116] P. J. Buerton, ‘Ernst Mayr through Time on the Biological Species Concept – a Conceptual Analysis’, *Theory in Biosciences*, 121 (2002), 81-98, 81.
[117] R. A. Wilson, ‘Promiscuous Realism’, *The British Journal for the History of Science*, 47, 2 (Jun., 1996), 303-316, 311-313; R. A. Wilson, ‘Realism, Essence, and Kind: Resuscitating Species Essentialism?’, in R. A. Wilson (ed.), *Species: New Interdisciplinary Essays* (Cambridge, MA: MIT Press, 1999), 189-208; P. E. Griffiths, ‘Squaring the Circle: Natural Kinds with Historical Essences’, in Wilson (ed.), *Species*, 209-228; I. Brigandt, ‘Natural Kinds in Evolution and Systematics: Metaphysical and Epistemological Considerations’, *Acta Biotheoretica*, 57 (2009), 77-97.

and 1960s is of some importance, and should further caution us about accepting the narrative at face value. Mayr was trained as a museum taxonomist, and was then engaged in 'rescuing' the discipline from the violence it had suffered during the preceding decades at the hands of biologists for whom experimental science was all. During this time, taxonomy had been consistently attacked for its feeble metaphysical basis and innate subjectivity at a time when biologists who specialised in genetics or physiology regarded taxonomic divisions as purely artificial.[118] Mayr countered these perceptions by arguing, first, that species were not taxonomic inventions but were real objects that taxonomists alone were equipped to investigate; and, second, that the way species evolve and the process of speciation was central to understanding evolution and that this, again, required the skills of the taxonomist.[119] This was the basis of his famous 'Modern Synthesis'.

Much like Vigors before him, Mayr had an agenda of his own in pursuing this line of thought, the result of which was a recasting of taxonomy in line with 'population thinking', the notion that species are populations rather than individual concepts, and henceforth explicitly identified with Darwin. This necessarily required an 'other', a label for the opposite of population thinking, and Mayr struck upon 'typological thinking', which he understood as a means of defining species based upon degrees of difference or similarities in morphological characters compared to a basic type. As Buerton notes, Mayr then linked this understanding of type to Plato and Platonic forms, with their implicit denial of variability and the claim that the form, not the animal itself, is the 'real' thing.[120] This conscious minimisation of the difference between two quite distinct conceptions and lumping together as 'typological' and 'essentialist', terms which Mayr used almost as synonyms, had serious consequences. To Mayr's identification of 'types' with Platonic forms must be set a large part of the blame for the

[118] Winsor, 'The Essentialism Story', 156.
[119] Winsor, 'The Essentialism Story', 156-157.
[120] Buerton, 'Mayr', 89.

confusion about the use of the word by pre-Darwinian naturalists such as Macleay, Vigors and Swainson, and highlights the dangers of polysemy in the reading of nineteenth-century scientific texts.[121]

The other frequently-identified inspiration for pre-Darwinian naturalists is Aristotle and his system of logical essentialism. Curiously, Mayr did not much engage with Aristotle, but other contemporaries did, notably the Oxford zoologist Arthur Cain and the American historian of science, David Hull. To them can be traced the second strand of the 'essentialism story' which, following Cain, stated that Linnaeus employed Aristotelian logic in the creation of his taxonomic hierarchy.[122] The only reason, according to Cain, that Linnaeus believed that species had to sit within a genus was that Aristotle had so decreed it. His explanation is based upon the notion that Aristotelian definition of an entity required that its 'essence' be fully known, as only its essential characters could be mentioned in a definition and not any other properties present, be they incidental or always present.[123]

Aristotle's conception of 'essence' was implicitly tied to his system of logical formalism in language. There has, and continues to be, great confusion of essentialism as applied to words and to scientific concepts which Cain, as William Stearn observed in 1959, was manifestly guilty of. An expert on Linnaeus' writings, Stearn noted that Linnaeus' practice 'was empirical rather than in accordance with formal logic'.[124] As the American analytic

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[121] See L. Daston, 'Taking Note(s)', *Isis*, 95, 3 (Sep., 2004), 443-448.
[122] A. J. Cain, 'Logic and Memory in Linnaeus' System of Taxonomy', *Proceedings of the Linnean Society of London*, 169 (1958), 144-163.
[123] Winsor, 'The Essentialism Story', 164.
[124] W. T. Stearn, 'Four Supplementary Linnaean Publications: *Methodus* (1736), *Demonstrationes Plantarum* (1753), *Genera Plantarum* (1754), *Ordines naturales* (1764)', in C. Linnaeus, *Species Plantarum: A Facsimile* (London: The Ray Society, 1959), 73.

philosopher W. V. O. Quine noted in the 1950s, Aristotle believed essences to be about words rather than objects, which Gareth Matthews and David Charles have recently emphasised.[125]

Despite this, the notion that Aristotle was a scientific essentialist has become deeply entrenched, with Quine's description of *logical* essentialism being used to back up Cain's claims and often deployed as a definition of *biological* essentialism:

> Aristotelian essentialism is the doctrine that some of the attributes of a thing (quite independently of the language in which the thing is referred to, if at all) may be essential to thing and others accidental. E.g. a man, or talking animal, or featherless biped (for they are all the same *things*), is essentially rational and accidentally two-legged and talkative, not merely qua man but qua itself.[126]

As Gareth Matthews points out, what Quine does not say here is whether what he calls 'Aristotelian essentialism' is Aristotle's own doctrine. Matthews goes on to warn that, quite aside from its mistaken application to biology, Quine's formulation of Aristotelian essentialism 'may only be Aristotle-inspired and not the real thing'.[127] Wilkins identifies the same passage as being one of the root causes of the mistaken characterisation of pre-Darwinian taxonomies as 'essentialist' in the classical mould, not least because this 'seems to be the very first use of "Aristotelian essentialism".[128]

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[125] D. Charles, *Aristotle on Meaning and Essence* (Oxford: Oxford University Press, 2002); G. B. Matthews, 'Aristotelian Essentialism', *Philosophy and Phenomenological Research*, 50 (1990), 251-262.
[126] Quine, 1953b, 173.
[127] Matthews, 'Aristotelian Essentialism', 251.
[128] Wilkins, 'Essentialism in Biology', 5.

Tracing exactly which traditions influenced Macleay is made difficult by the frequent 'slipperiness' of his writing style and the shifting meanings of the terms that he used. Polysemy is more than a point about semantics, particularly, as Wilkins notes, because of the ways in which various inferences are made by appealing to one or other disconnected sense of 'essentialism' and 'type'. The confusion of logical essentialism, which Aristotle certainly did adhere to, and biological essentialism, which he certainly did not, is a good example. Macleay's portrayal of his theory as one 'discovered' solely through empirical observation muddies the waters still further. Rehbock has too much faith in the literal truth of Macleay's words, which should be taken with a pinch of salt. Macleay's concern to portray quinarianism as an empirically-derived theory was partly a response to the still-dominant trend in normative British science. This privileged *a posteriori*, Baconian inductivism, particularly in the post-Napoleonic context in which idealism, of any sort, was frequently associated by naturalists of a Tory persuasion, such as William Kirby, with dangerous European political ideas.[129] However, whatever the means by which he hit upon quinarianism, Macleay later became convinced through his close study of beetles that the theory was nothing less than the design upon which God had planned the natural world, a design which was, moreover, Pythagorean in its neat elegance.

Perhaps the most compelling aspect of the 'received view' is that its origins can be traced back no further than the 1950s and to the highly-influential work of David Hull, which means that one of the most dominant tenets of the history of biology is of a very recent vintage indeed.[130] Both Winsor and Wilkins point, quite rightly, to a lack of evidence that corroborates Hull's interpretation of early nineteenth-century biology, which paints an unedifying picture of

[129] See W. Kirby, *On the Power, Wisdom and Goodness of God as Manifested in the Creation of Animals and in their History, Habits and Instincts* (London: W. Pickering, 1835); Knight, 'High Church Science', 1-8.
[130] Hull, 'Two Thousand Years', 314-326.

naturalists 'frozen' in the grip of Aristotelian and Platonic texts.[131] Certainly, it is very difficult indeed to identify a classically essentialist attitude on the part of quinarian naturalists, who drew from a range of traditions and considerations, not the least of which was the pressing need to find a practical classificatory framework that would help them to sort and understand a vast and rapidly increasing body of empirical data. So pressing was this need that there is real cause to question whether naturalists working in the early decades of the nineteenth century really adhered to philosophical positions at all in their formulation of taxonomies, or simply devised the systems and then gave them a retrospective gloss the better to legitimise them in the eyes of fellow naturalists.

As with the classificatory systems that had preceded it, quinarianism's success depended on a coherent system of nomenclature and a reassigning of genera and specific names. Macleay set about this task with enthusiasm, and in the works which followed the *Horae*, particularly the *Annulosa Javonica* (1825), a collaborative effort with the entomologist and ornithologist Thomas Horsfield (1773-1859), he reclassified whole orders of insects in quinarian genera and orders.[132] Later, like Swainson, he attempted to extend this entomological taxonomy to fish, with little success.[133]

Macleay was also attacked by contemporary naturalists for seeking to destroy Linnaeus' artificial system. This line has been adopted by Aaron Novick, the most recent historian to analyse the origins of Macleay's theory, who argues that the 'dogmatic indolence' of British naturalists, wedded to Linnaean principles, was a primary factor in pushing Macleay to develop

[131] Winsor, 'Pre-Darwinian Taxonomy', 388.
[132] W. S. Macleay, *Annulosa Javonica*, (London: Kingsbury, Parbury, and Allen, 1825).
[133] W. S. Macleay, 'On the Natural Arrangement of Fishes', *Calcutta Journal of Natural History*, 2 (1841), 263–275; W. Swainson, *The Natural History of Fishes, Amphibians, & Reptiles, or Monocardian Animals* (London: Longman, Rees, Orme, Brown & Longman, 1839); W. Swainson, *A Treatise on Malacology, or Shells and Shellfish* (London: Longman, Rees, Orme, Brown, Green & Longman, 1840).

the natural system.[134] Crucially, unlike Wilkins, Novick does not distinguish between Linnaeus' own beliefs as to the contingent and temporary nature of his system, and his flirting with natural classification later in his career, and the far more rigid conception of Linnaean systematics by British naturalists.[135] This misapprehension that the British Linneans, against whose 'indolence' Macleay was certainly acting against, best represented Linnaeus' thinking is damaging to our understanding of what it was, exactly, that Macleay was trying to achieve. Whilst the widespread adherence to Linnaeus' theory did have great institutional ramifications, notably the setting up of the Zoological Society and its research program based explicitly on natural classification, Macleay and his fellow break-away zoologists sought to *build* upon Linnaeus' principles, which they believed had been interpreted with a degree of rigidity that the 'Great Master' would not have countenanced, and appropriate them for their own, natural system.

Between the appearance of the second volume of his *Horae Entomologicae* and his emigration to Australia in 1838, Macleay published several key articles that highlight his attitude towards Linnaean taxonomy and undercut Novick's conclusions.[136] One of the most interesting of these, in that it clearly demonstrates the analogies between Macleay's theory and the broader 'Romantic' view of natural science, is his 'Letter' to his fellow naturalist J. E. Bicheno, published in *The Zoological Journal* in May 1829. Secretary to the Linnean Society between 1825 and 1832, and a fellow of the Royal Society, Bicheno was an influential member of the colonial-scientific elite. Much interested in contemporary social and political questions, he had first made his mark with *An Inquiry into the Nature of Benevolence* (1817), a thorough and critical exploration of the Poor Law system, and in his correspondence with the Marquis

[134] Novick, 'Origins of the Quinarian System', 8-11.
[135] Macleay, *Horae*, **I.**, 'Preface', xiii; 50-51.
[136] Macleay, *Annulosa Javonica*; 'A Letter to J. E. Bicheno', *The Zoological Journal*, 4 (1828-1829), 401-415; 'Remarks on the Comparative Anatomy of Certain Birds of Cuba', *Transactions of the Linnean Society of London* (London: R. Taylor, 1833), 1-46

of Bute revealed himself as a vocal opponent of Chartism and the extension of suffrage.[137] Later in life, in a parallel with his contemporary Alexander Macleay, Bicheno was appointed Colonial Secretary of Van Diemen's Land (1843-1848), where he botanised on his farm outside Hobart and delivered lectures at the town's Mechanic's Institute.[138]

A prolific author of entomological and ornithological papers, usually published under the auspices of the Linnean Society, Bicheno was, from the outset, ill-disposed to the quinarian theory, which he judged to be antithetical to Linnaean systematics and excessively complicated. Later, in the High Tory *Quarterly Review*, after pouring scorn on Macleay's attempt to draw a line of relation between fish and vertebrates through the lamprey, he had this to say:

> Of a system, indeed, it has been well said by one of the most distinguished naturalists of the age – 'Mr. Macleay's whole system, on paper, appears very harmonious and consistent, and bears a most seducing aspect of verisimilitude; but it has not yet been so thoroughly weighed, discussed, and sifted, as to justify our adopting it *in toto* at present' … [I]ts weakness is most apparent where its triumphs should have been the greatest, and its author, while indulging the dream of being supported by 'evident analogies', was in fact relying on very deceitful analogies.[139]

Macleay's response was a spirited defense of his system which drew upon themes he had already laid down in lengthy introductions to both *Horae Entomologiae* and *Annulosa*

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[137] Letters of James Bicheno to the Marquess of Bute 1840, National Library of Wales, Bute Estate 2, L83/411,471.
[138] [Anon.], 'James Ebenezer Bicheno, Esq., F. R. S.', *The Gentleman's Magazine*, 36 (1851), 436.
[139] J. E. Bicheno, 'Systems and Methods in Natural History', *The Quarterly Review*, 41 (1829), 320-326.

Javonica. Revealingly, Macleay chose as his outlet the journal of the Zoological Society of London, established by Raffles, Davy and Vigors three years previously. *The Zoological Journal*, the editorial board of which was presided over by Vigors, provided the quinarians with a friendly academic forum throughout the late 1820s and early 1830s.[140] Macleay attempted to clear up a misapprehension about quinarianism to which Bicheno and later observers fell prey, namely that it was an attempt to traduce the work and memory of Linnaeus. This was not the case – or, at least, this was what Macleay claimed, hailing Linnaeus' 'justly celebrated' artificial system as the foundations of modern classification.

The important item here is Macleay's concern to historicise Linnaeus' work and set it in the context of the gradual expansion of natural knowledge at the beginning of the eighteenth century. Of the system he observes that 'it enables the traveller at once to give a name to the object he describes, and the reader to know it by that name'.[141] Like all 'artificial' systems, Linnaeus' centred upon the preconceived importance of certain arbitrarily-chosen external features, ordering and classifying species on the basis of similarities between these structures. The principal advantage of this is that, when written with the rigour and precision of Linnaeus, it lent itself to quick identification, presupposing a close acquaintance with Linnaean principles.[142] However, although 'very convenient for the description of newly-discovered animals', Macleay judged Linnaeus' system to be inadequate when presented with a sudden increase in the number of species, as had happened from the turn of the nineteenth century, with the result that Linnaeus' work, based on the species known to him at the time, was inadequate.

[140] J. Bastin, 'The First Prospectus of the Zoological Society of London: New Light on the Society's Origins', *Journal of the Society for the Bibliography of Natural History*, 5 (1970), 369-388; Mitchell, *Zoological Society of London*, 2-8.
[141] Macleay, *Horae*, **I.**, 12-13.
[142] Winsor, 'Linnaeus's Biology', 4-5.

> [S]uch catalogues only suit for giving popular accounts of a few of such remarkable plants and vertebrated animals, as are directly connected with the habits of man. They seem to proceed, not only on the idea of all design, all order being absent in the creation as a whole, but also as if the infinitely greater part of organized forms need scarcely have been created…[143]

The artificial system, thus understood, depends solely upon observation and may even be said to require the exercise of no other faculty than that of vision.[144] By contrast, Macleay strove to demonstrate that the natural system could only be arrived at through a 'cautious process' of inductive and analogical reasoning.[145]

The note of Romantic fervour which so easily creeps into Macleay's writings seems in curious juxtaposition to these protestations of blameless inductivism. Like that of his fellow entomologist, William Kirby, Macleay's conception of fact-based science was swathed in references to religion and nature's glories:

> Organised nature is a complicated chain of beings, of which chain each species forms a link. Every new species added to our list, serves thus to increase our knowledge of this stupendous system, - a system that ought to excite in every breast the most intense interest; not merely as one of the works of our Creator, but as that

[143] Macleay, *Annulosa*, viii.
[144] Macleay, *Horae*, **I.**, xii.
[145] Macleay, *Horae*, **I.**, xiii.

> particular work of the Divine Hand, which has been designed with direct reference to ourselves.[146]

This could almost have been written by Kirby. In his much-lauded *Introduction to Entomology*, written between 1815 and 1826 with William Spence (1783-1860) and constantly in print until the 1870s, Kirby declared that one of the authors' principal and 'favourite objects has been to direct the attention of their readers "from nature up to nature's God"', and went on to rail against the 'perversion of intellect' that had led some naturalists to a materialist conception of the natural world.[147] Kirby's science, as J. F. M. Clark points out, reflected a variety of social and political circumstances, first and foremost the ideological ramifications of the French Revolution and the materialist implications of a temporalised nature.[148] Ospovat, without commenting much further, locates Macleay's theory in the same context, noting that in the immediate post-Waterloo years, the search for a natural system 'took a peculiar turn'.[149] This was to put the case mildly.

IV.

The manner in which Macleay's original theory was adopted and modified by naturalists of wildly divergent political opinions is one of the most curious and potentially-confusing aspects of the entire quinarian episode. Ospovat is certainly correct in seeing

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[146] Macleay, *Annulosa*, x.
[147] Kirby and Spence, *Introduction*, **I**., 'Preface', xi.
[148] J. F. M. Clark, 'History from the Ground Up: Bugs, Political Economy, and God in Kirby and Spence's *Introduction to Entomology* (1815-1856)', *Isis*, 97.1 (March, 2006), 28-55, 31.
[149] Ospovat, *Darwin's Theory*, 101.

Macleay as influenced by the highly-charged political and intellectual atmosphere of the immediate post-Napoleonic period, which bore the indelible imprint of the French Revolution and the subsequent period of political, cultural and intellectual reaction.[150] Unfortunately neither Ospovat nor subsequent historians investigated this much further, with some, including Mayr, Novick, and Winsor, ignoring it altogether.[151]

This excessive emphasis on the scientific context is misleading, as the science which emerged between 1800 and quinarianism's precipitous decline in the 1840s was overtly ideological and politically motivated, particularly in the decade immediately following the end of the Napoleonic Wars. Although based, fundamentally, upon the tried and trusted empirical methods which had guided British science since Francis Bacon first enshrined the principle of observation in his *Novum Organum*, principles to which every naturalist of the era was wise to pay lip service, it was a transitional science which drew upon the languages of 'old' and 'new' ways of looking at nature, increasingly drawn from literature and the visual arts.[152] The most important of these new cultural influences was, undoubtedly, Romanticism.

The influence of Romanticism upon British culture was at once profound and difficult to quantify. Studies of 'Romanticism' are extremely diverse, referring to a chronological span or a state of mind; to the activities of poets and painters; chemists and physiologists. Lacking a superficial coherance, it can potentially be a problematic term, and commentators have traditionally, and still profitably, fallen back upon interpretations of the inconsistent, shifting groups of friends and associates who we now define, broadly, as 'Romantics'.[153] Consistency, as David Knight points out, was not seen as a virtue, and we cannot define those associated

[150] Ospovat, *Darwin's Theory*, 101-113.
[151] Mayr, *The Growth of Biological Thought*; Novick, 'Origins of the Quinarian System', 1-39; Winsor, *Starfish*, 82-86.
[152] F. Bacon, *Essays Civil and Moral, Advancement of Learning, Novum Organum, &C.* (London: Ward, Lock, Bowden, 1892).
[153] For example, J. Uglow, *The Lunar Men: The Friends who made the Future, 1730-1810* (London: Faber & Faber, 2003); Holmes, *The Age of Wonder.*

with the Romantic movement as we would members of a political party.[154] The influence of Romanticism affected different disciplines, in different countries, at different times, which makes generalisations yet more difficult, even undesirable.

The amorphous nature of Romanticism has encouraged an increasing number of commentators, primarily working in the field of literary criticism and theory but increasingly in the history of science, to speak not of 'Romanticism' but of a multiplicity of 'Romanticisms'.[155] In this they draw upon a long-established trope in intellectual history, effectively sparked by Arthur Lovejoy's classic essay which poured scorn on any idea of a homogenous 'Romanticism'.[156] The rejection of a reductive, monolithic 'Romantic' construct complicates standard accounts of Romanticism's origins and its influence, particularly the long-established Enlightenment-Romantic dichotomy. Across the humanities and the sciences, between which there was considerable intellectual cross-fertilisation, Enlightenment values persisted well into the nineteenth century, particularly in the sciences, with their continuing emphasis on inductive methodologies and the enduring importance attached to the gathering of information and the power of human reason. Many elements that became major Romantic fixations, such as the 'feeling' for nature, were well-established by the second half of the eighteenth century and, in the British context, have been drawn back even further, Marshall Brown detecting presentiments in Alexander Pope's poem 'Windsor Forest'.[157]

Such accounts, which identify a 'late-Enlightenment' and 'pre-Romanticism', better illustrate the complexities of late-eighteenth century intellectual culture, a dialectical approach

[154] D. Knight, 'Romanticism and the Sciences', in Cunningham and Jardine, *Romanticism and the Sciences*, 13.
[155] S. Curran (ed.), *The Cambridge Companion to British Romanticism*, 2nd Ed. (Cambridge: Cambridge University Press, 2010); A. Day, *Romanticism* (London: Routledge, 1996); R. J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago, IL: University of Chicago Press, 2010); N. Saul (ed.), *German Romanticism* (Cambridge: Cambridge University Press, 2009).
[156] A. O. Lovejoy, 'On the Discrimination of Romanticisms', *PMLA*, 39.2 (Jun., 1924), 229-253.
[157] M. Brown, 'Romanticism and Enlightenment', in S. Curran (ed.), *British Romanticism* (Cambridge: Cambridge University Press, 1993), 28.

which serves as a corrective to the misleading binary of Enlightenment vs. Romanticism. Instead, Romanticism grew from Enlightenment thought and was ‘revolutionary’ in the older sense of the term; less a sweeping away and more a recollection of the past, whilst still moving forward. The politically-radical aspects of late-eighteenth century literature and scientific culture may be more usefully-described as ‘late-Enlightenment’, whilst the multiplicity of ‘Romanticisms’ proper, emphasising inner, spiritual anxieties at the expense of external concerns, can be understood to characterise inherently-conservative modes.

Taking into account narratives of multiplicity and fragmentation, and warnings against the ‘glib’ reaching across of linguistic, cultural and chronological boundaries in search of comparisons and associations, certain persistent trends do begin to emerge across the spectrum of Romantic thought.[158] Long seen as inherently ‘anti-scientific’, in reality the intellectual culture of Romanticism privileged science, which was viewed as integral to the wider Romantic project of synthesising art, philosophy, and experience. Its self-identification was largely based on antitheses and forces which it sought to counter and redress: the march of secularisation and the diminution of the divine as a guarantee of the unity of nature; the tendency, driven by European expansion across the globe and the exponential increase in empirical knowledge of plants and animals, towards the fragmentation of scientific disciplines; and the persistent dualism of mind and matter, body and spirit, subject and object.[159]

This searching into the hidden and mysterious envisaged Nature not as a completed creation but rather as an active agent.[160] The mechanistic metaphors which characterised

[158] M. Eaves, ‘The sister-arts in British Romanticism’, in Curran (ed.), *British Romanticism*, 238.
[159] Gascoigne, *Banks and the English Enlightenment*, 78-110; D. M. Knight, ‘The Application of Enlightened Philosophy: Banks and the Physical Sciences’, in R. L. R. Banks *et al* (eds.), *Sir Joseph Banks: A Global Perspective* (London: Kew, 1994); P. Thorslev, ‘German Romantic Idealism’, in Curran (ed), *British Romanticism*, 82-103.
[160] Schelling posited nature as an absolute: productivity rather than product, which raised nature about the perception of objects and the subjective forms of human understanding, knowable only through intellectual intuition. F. W. J. Schelling, *Entwurf eines Systems der Naturphilosophie* (1799).

natural theology in Britain, from the writings of William Derham (1657-1735) to William Paley (1743-1805), were rejected out of hand by Coleridge and his followers, and mechanical metaphors replaced by organic ones. Nature, 'magnificent and noble', is seen as God's work in progress, compelling an attitude of admiration, even of humble worship, attended by the belief that knowledge is given only to those who deserve it, who can look beyond the world of resemblances to the 'truth' beyond; a highly personalised, not top idiosyncratic response in stark contrast to the aridity of Paley's conception of God as divine watchmaker.[161]

That the sciences lacked sharp frontiers, and that many men of science were polymaths whose activities and social circles embraced what we would now understand as the humanities, served to further expose nineteenth-century British science to philosophical developments on the Continent. Much has been made of British Romanticism's indebtedness to its German precursor, with Coleridge's year-long foray to Göttingen in 1798 viewed as particularly decisive.[162] Coleridge had absorbed German anti-mechanistic philosophy, itself a response to the inherent tensions in the Enlightenment project, and ever after deplored the general trajectory of British science, dismissing Sir Isaac Newton as a 'mere materialist'.[163] For Coleridge, as for his protégée, the chemist and later founding member of the Zoological Society Humphry Davy (1778-1829), the meaning of natural science was not mere dissection and analysis, a study of dead things, but rather the personal interaction with nature and the natural world.[164]

By the middle of the 1830s, Coleridge's conception of the proper role of the natural sciences was already under fierce attack. His presence at the 1835 meeting of the British

[161] W. Paley, *Natural Theology, or Evidences and Attributes of the Deity* (London: Richardson & Co., 1802), chapters 1 and 2.
[162] C. U. M. Smith, 'Coleridge's "Theory of Life"', *Journal for the History of Biology*, 32. 1 (Spring, 1999), 33-36.
[163] E. L. Griggs, *Collected Letters of Samuel Taylor Coleridge* (Oxford: Oxford University Press, 1956-1971), **II**, 709.
[164] Knight, 'Romanticism and the Sciences', 15.

Association for the Advancement of Science drew considerable comment, much of it derisive.[165] However, for the first three decades of the nineteenth century Germano-Coleridgean natural philosophy exercised a formative influence upon Britain's scientific community. Although principally affecting the physical sciences, elements of the Romantic worldview also transformed the study of animals.

Macleay always strenuously denied that he was directly influenced by any study of German Romanticism.[166] Whether or not Macleay's system was underpinned by any of the *a priori* assumptions at the heart of idealist philosophy is a matter for much debate, and the multiplicity of the arguments emphasises the inherent ambiguities of the quinarian system. Rehbock suggests that whilst Macleay studied at Cambridge at the same time as the university experienced an upsurge in academic interest in German idealism, his writings show little, if any evidence of the influence of the *Naturphilosophen*.[167] This is echoed by Novick, who does identify striking parallels with the similar circular system devised by the German naturalist Elias Fries, published in 1821.[168] Certainly, Macleay's concern to distance himself from German idealist, Romantic philosophy is suggestive, for it demonstrates that he was acutely aware of the disreputable connotations that many British intellectuals attached to it. These revolved less around Romanticism's political iterations which, in Britain at least, were generally conservative and reactionary, and far more around the pantheistic overtones which the more religiously-orthodox detected in the Romantic exaltation of Nature.[169]

Pantheism, in its most general form the view that God is identical with and not distinct from the universe, was regarded with considerable suspicion by eighteenth- and nineteenth-

[165] Holmes, *The Age of Wonder*, 235-304, 435-466.
[166] Desmond, 'The Making of Institutional Zoology', 153-85, 223-50.
[167] Rehbock, *Philosophical Naturalists*, 26-28.
[168] Novick, 'Origins of the Quinarian System', 29-30. E. M. Fries, *Systema mycologicum: sistens fungorum ordines, genera et species, huc usque cognitas, quas ad normam methodi naturalis determinavit* (Lundæ: Ex Officina Berlingiana, 1821).
[169] Ospovat, *The Development of Darwin's Theory*, 101-108.

century moral philosophers as being necessarily opposed to theism. This is not to say that all philosophers who occupied pantheistic positions thought there was any need to abandon traditional religion: not even by Spinoza, whose name was regularly invoked with righteous horror by the orthodox.[170] Perhaps the most controversial tenet of pantheism is its rejection of any hope for personal immortality and the salvation of the individual soul, central to Christian theology of whichever denomination, although Spinoza provocatively claimed that 'something' of the human mind remains eternal after the death of the body.[171]

In British Romanticism, particularly in the form associated with and developed by Coleridge, the threat of pantheism, which seemed to veer dangerously towards atheism, was countered with a shift to panentheism. A constructed term which, understood literally, means 'all in God', panentheism considers God and nature to be inter-related: nature in God and God in nature. Crucially, this avoids the pantheist identification of God with the world, stressing the active presence of God in nature and the significance of the material and the non-divine. In the eighteenth and nineteenth centuries, panentheism developed in response to a complex set of factors, principal of which were philosophical idealism and the expansion in knowledge of the natural world, a prominent example of the understanding of God being affected by events in the corporeal world.[172]

Coleridge, in this as in so many aspects of his literary and philosophical development, took his lead from the German philosopher F. W. J. Schelling (1775-1854). Developed in response to perceived contradictions in the Kantian system, Schelling's speculative *Naturphilosophie* was extremely influential on the Continent.[173] In no way opposed to rigorous

[170] S. Hampshire, *Spinoza and Spinozism* (Oxford: Oxford University Press, 2005), 175-199.
[171] B. Spinoza, *Ethics* (London: Penguin, 1996 ed.), e5, 23.
[172] J. A. Bracken, 'Panentheism from a Trinitarian Perspective', *Horizons*, 22 (1975), 7-28; P. Clayton, 'Panentheisms East and West', *Sophia*, 49 (2010), 183-191; W. B. Drees, 'God and Contemporary Science: Philip Clayton's Defense of Panentheism', *Zygon*, 34 (1999), 515-525.
[173] F. W. Schelling, *Ideas for a Philosophy of Nature: as Introduction to the Study of this Science*, trans. E. E. Harris and P. Heath (Cambridge: Cambridge University Press, 1988).

scientific experiment and observation, Schelling believed that results must be incorporated into a wider metaphysics, preferably one that sought the unifying principle in nature and which simultaneously overcame the alienation between man and nature caused by the adherence to mechanistic natural philosophy. From the outset, Schelling argued for the need for a first cause in natural philosophy, which he believed would unify the philosophical system and transform its status into that of a science. It would also, he believed, guard against the pernicious danger of scepticism.[174]

Schelling concluded that in order to grasp natural organisms as a dynamic reality, the naturalist and philosopher must find a perspective whereby the idea determines the parts, and the parts determine the idea. In Schelling's thought, the Kantian opposition of mechanism and teleology is replaced by participation: the whole is manifest in the part, and the part is involved in the creation of the idea. The part, in this analysis, is not distinct from the whole but is an expression of it. In turn, the whole develops in and because of the part.[175] Only then, Schelling believes, can we grasp nature's 'self-construction', and escape from a misleading notion of nature as revealed and constructed by our subjective categorisations. Then, he believes, we can discern the 'pure forms' of nature, and the task of *Naturphilosophie* becomes the determination of nature's *a priori* forms.[176]

For naturalists in Britain, particularly zoologists and anatomists who were increasingly dissatisfied with the basis upon which current classifications of nature were founded, Schelling's *Naturphilosophie* offered intriguing possibilities of both intellectual and institutional renewal. Whether or not quinarian theory was conceived within an idealist,

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[174] P. Guyer, 'Absolute Idealism and the rejection of Kantian Dualism', in K. Ameriks (ed.), *The Cambridge Companion to German Idealism* (Cambridge: Cambridge University Press, 2000), 37-56; T. Pinkard, *German Philosophy 1760-1860: The Legacy of Idealism* (Cambridge: Cambridge University Press, 2002), 172-199.
[175] F. C. Beiser, *The Fate of Reason: German Philosophy from Kant to Fichte* (Cambridge, MA: Harvard University Press, 1993), 324-329; Pinkard, *German Philosophy,* 172-199.
[176] Nassar, 'Schelling's Critique', 131.

Romantic framework, it found great favour with some of Macleay's most prominent contemporaries, notably the Rev. William Kirby, in whose High Tory hands quinarianism became nothing less than a weapon of orthodoxy against the forces of radicalism and atheism.[177] However, a paradox lies at the centre of quinarianism's rise to fashion. Certainly, its apparent success in imposing a rigid order upon the natural world was all but guaranteed to appeal to the more conservatively-minded of naturalists, including Kirby and William Swainson, yet it was brought to the highest pitch of influence by Vigors, who was radical in his politics and was prominent in the institutional battles between reformers and conservatives in 1830s London.[178] This makes any attempt to explain the popularity of Macleay's system, and the development of its subsequent iterations, solely in terms of the strong links between it and well-established traditions of natural theology, extremely problematic.

New conceptions of what organisms were, and where they fitted in to the order of nature, had a pronounced impact on all aspects of natural history and changed the ways in which information about animals was communicated. Difficulties quickly arose, with naturalists struggling to find the words to describe their new theories and to sketch out their intellectual pedigrees. Quinarianism, which stressed the importance of natural affinities and analogies, was a case in point: Macleay and Kirby clashed early in 1821 when Macleay took umbrage at Kirby's comments about his own treatment of 'Lamarck's absurd System' in the *Horae*.

> All I objected to [Kirby replied] was your taking up the cudgels for [Lamarck] in other respects with so much warmth; which I thought might do hurt. You will

[177] J. F. M. Clark, History from the Ground Up: Bugs, Political Economy, and God in Kirby and Spence's *Introduction to Entomology* (1815–1856).
[178] Desmond, 'Making of Institutional Zoology', 153-185.

> observe that his great object is to prove that almost the whole of the animal world were self-generated, & that his whole system is artfully wrought up to confirm this idea – I conceive that the Evil principle knows the Test of Nature as well as that of Scripture, & might inspire his Disciple with the knowledge of the former that it might be perverted & made to fight against the Truth of the latter. I call his doctrine an atheistical one as it really is, but I no where call him an atheist.[179]

As Jonathan Smith remarks, in reference to Darwin's difficulties with expressing his evolutionary theory, and as Macleay and Kirby's exchange demonstrates, language was a slippery commodity for nineteenth-century naturalists.[180] The quinarians would frequently be attacked throughout the 1820s and 1830s by others who misunderstood, sometimes willfully, the tenor of their arguments. As for Darwin, illustration offered the quinarians another way to communicate and codify the theory, and in the late 1820s they found a man with the skills to both set their taxonomic theory in the middle of the scientific mainstream and bring it before a broader audience; John Gould.

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[179] William Kirby to W. S. Macleay, 28 May 1821. *Correspondence of Alexander Macleay*. Linnean Society. Box 2, 209.
[180] Smith, *Darwin and Visual Culture*, 3-6. D. Kohn, 'Darwin's Ambiguity: the Secularisation of Biological Meaning', *British Journal for the History of Science*, 22 (1989), 215-239, explores similar issues.

Chapter 2

The Bird Man and his Apprentice: The Ascendancy of Nicholas Vigors

Although fundamentally concerned with taxonomy and classification, the leading quinarians of the 1820s located themselves and jockeyed for position within a complex philosophical and ideological framework. By the mid-1820s, Macleay had been overshadowed as the theory's most passionate proponent, his place assumed by the Irish zoologist Nicholas Vigors. One of the founding triumvirate of the Zoological Society of London (ZSL), much of the credit for quinarianism's extraordinary rise to prominence in the late 1820s and 1830s must be attributed to Vigors, whose bullish energy and administrative flair carried all before him.[1] Secretary to the Zoological Society during the first seven years of its existence, a crucial period of consolidation and controversy within the sphere of institutional zoology, Vigors displayed considerable shrewdness in his attempts to mobilise the principal outlets for scientific theory, including journals and museum displays, to further the spread and acceptance of quinarianism amongst his fellow men of science.[2] In the short term he was astonishingly successful, establishing the *Transactions* of the Zoological Society as one of the principal organs of

[1] Mitchell, *Centenary History of the Zoological Society*, 2. For the early history of the society, see Minutes of Council of the Zoological Society of London, **I.**, 1826-1828, ZSL; [Anon.], *Reports of the Auditors of the Accounts of the Zoological Society for the Year 1830, and of The Council, read at the Anniversary Meeting, April 29th, 1831* (London: Richard Taylor, 1831); H. Scherren, *The Zoological Society of London: A Sketch of its Foundation and Development, and the Story of its Farm, Museum, Gardens, Menagerie and Library* (London: Cassell, 1905); Ito, *London Zoo*.
[2] See Vigors, 'Observations on Natural Affinities, 395-517; Desmond, 'Making of Institutional Zoology', 153-185; Miracle, 'On Whose Authority?', 445-481.

metropolitan British science and gathering around him a coterie of like-minded naturalists whose combined efforts brought quinarianism to a surprisingly broad audience.

All of this was achieved within less than a decade. In 1833 Vigors, an Irish landowner and scion of an established Ascendency family, turned his attention to national politics. Entering the 'Reform' parliament as the MP for Carlow, a constituency in which lay the family estates, he served at Westminster until 1835, being returned again for the same seat in 1837 and representing the seat until his death in 1840. Although he rarely spoke in debates, Vigors latched on to the loose and shifting coalition of progressive, Radical MPs and displaying the single-mindedness which characterised his zoological career, quickly scaled back his administrative commitments at the ZSL.[3] This was an echo of Lord Lansdowne's resignation as President of the ZSL in 1830, as his political career revived with the fortunes of Whiggery.[4] It may also have been in response to the growing discontent of the ZSL fellows and membership at a time of violent political dissent, which in 1835 resulted in the ejection of many original Council members, an episode recorded in the Society's minute books and chronicled by Desmond.[5] However, Vigors' political activities in the early 1830s did not signify a complete retreat from the affairs of the Society. Tabling his resignation at a meeting of the ruling Council in 1833, he moved quickly to appoint his deputy, John Gould, as his successor as Superintendent of the Society's Museum, then located at Bruton Street. The motion was passed without recorded dissent.[6]

[3] O' Macdonagh, *O'Connell: The Life of Daniel O'Connell 1775-1847* (London: Weidenfeld & Nicholson, 1991), 421.
[4] [Anon.], *Reports of the Auditors,* 11.
[5] [Anon.], *Statement by the President and certain members of the Council of The Zoological Society, in reply to observations and charges made by Colonel Sykes and others, at the General Meeting of the Society on the 29th of April last, and at the monthly meeting on the 2nd of the same month* (London, Richard Taylor, 1835); ZSL Minutes of Meetings, II., 29 April, 6 May and 9 May, 1835. Zoological Society of London; Desmond, 'Making of Institutional Zoology', 231-241.
[6] ZSL Minutes of Council, III, 75-76. Feb. 27 1833.

Gould owed much to this early act of patronage, though it was far from being the only instance of Vigors' largesse towards his talented protégée.[7] But how far he would have progressed on his own formidable merits had Vigors not spotted him in 1826 is highly debateable. Gould was not entirely unknown by this point, having opened up a taxidermist's shop in Windsor several years previously and completed several commissions for King George IV, amongst other clients.[8] Entering the open competition held by Vigors at the Zoological Society's new museum, Gould breezed past the opposition. As an obituarist noted many years later, 'Gould's artistic talent in bird-stuffing, which he had assiduously cultivated for some years, rendered him *facile princeps* among the competitors, and obtained him the appointment'.[9]

Though later taxidermists, notably the Newcastle naturalist John Hancock (1808-1890), would eclipse Gould's efforts both in terms of accuracy and sheer artistry, Gould's work preparing London Zoo's deceased inmates was crucial in establishing his scientific reputation and educating him in animal anatomy.[10] Few studies of naturalists from the era much mention taxidermy, perhaps seeing it as a 'sideshow' to the real business of specimen (skin) preservation, without which none of the great collections that underpinned naturalists' classificatory efforts would have been possible.

Gould's most recent biographer, Isabella Tree, has described Gould's elevation to the staff of the Zoological Society in terms reminiscent of Charlie Bucket's lucky discovery of the Golden Ticket.[11] Certainly, his employment under Vigors was a perfect introduction to the largely closed circles of metropolitan science, in which social rank counted for a great deal.

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[7] F. H. Waterhouse, *The Dates of Publication of some of the Zoological Works of the late John Gould, F. R. S.* (London: R. H. Porter, 1885), vii.
[8] Datta, *Gould in Australia*, 30; Sauer, *John Gould*, 91-93.
[9] P. L. Slater, 'Gould's artistic talent', *Proceedings of the Royal Society of London*, 33 (1882), 17-19.
[10] D. Lowther, L. Jessop, 'John Hancock and the Laemmergeyer of the Alps', *Northumbrian Naturalist: Transactions of the Natural History Society of Northumbria*, 79 (2015), 54-63.
[11] Tree, *Bird Man*, 23.

The American ornithologist, John James Audubon (1785-1851), and later Gould's rival as a publisher of illustrated zoological folios, bitterly resented this position, as he griped in an 1835 letter to his friend John Bachman:

> Gould is a man of great industry, has the advantage of the Zoological Society's Museums, Gardens, &c – and is in correspondence with Temminck, Jardine, Selby, James Wilson and the rest of the Scientific Gentry.[12]

Vigors, whose lineage secured him easy and early access to these rarefied echelons, was quick to recognise Gould's ornithological potential and set about instructing the taxidermist in the details of taxonomy and classification. The honing of Gould's powers of observation would later have profound consequences on the history of science when, in January 1837, Charles Darwin returned from his circumnavigation of the globe bearing a package of finches collected from the Galapagos Islands.[13] Gould, by this time already one of Britain's most respected taxonomists, quickly identified the drab little birds as new to science and promptly assigned them names.[14] The discoveries were reported to the press, an announcement appearing in *The Morning Herald* which, as was standard journalistic practice, was then picked up and repeated by two other newspapers as well as the venerable *Athanaeum*. 'Mr. Gould likewise described 11 species of the bird brought by Mr. Darwin from the Gallapagos [sic] islands', it was reported, 'all of which were new forms, none being previously known in this country'.[15]

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[12] J. J. Audubon to J. Bachman, 20 July 1835, in R. Rhodes (ed.), *The Audubon Reader* (New York: Alfred A. Knopf, 2006), 492-493.
[13] Datta, *Gould in Australia*, 82-90.
[14] P. Skipwith, *Great Bird Illustrators and their Art, 1730-1930* (London: Hamlyn, 1979), 86.
[15] *Morning Herald*, 12 January 1837, 5. See also F. D. Steinheimer, 'Charles Darwin's bird collection and ornithological knowledge during the voyage of H. M. S. "Beagle", 1831-1836', *Journal of Ornithology*, 145 (2004), 300-320.

However his real service, not noted by the *Herald's* reporter, was to note that the birds, which exhibited an extraordinary variety of beaks but were otherwise almost identical, were members of the same, newly-discovered genus.[16] Having pointed this out to Darwin, Gould's role in the formulation of evolutionary theory was at an end. He set sail on his own expedition to Australia, which cemented his reputation as both a naturalist and a publisher, effectively marking the end of this early phase of his career.

This episode indicates the pace of Gould's ascent through the ranks of the 'Scientific Gentry', and poses interesting questions about what factors lay behind his apparently effortless rise. There was more to this than simple luck and talent, although Gould certainly had both. Vigors' patronage not only allowed Gould a foot in the door of London's elite scientific institutions: his wide network of correspondents, as Audubon observed in 1835, was spread throughout the British Isles. Sir William Jardine (1800-1871) and Prideaux John Selby (1788-1867), each of them prominent naturalists by 1830, rarely headed south from their respective homes in Dumfriesshire and Northumberland, but both were to become central figures in Gould's life. They also furthered his financial interests in the provinces, both Jardine and Selby performing sterling work drumming up subscriptions to Gould's folios amongst their fellow naturalists in Scotland and the north of England. They were also committed quinarians, and Selby deployed quinarian taxonomy in his *Illustrations of British Ornithology*, published in nineteen parts between 1821 and 1833, which the pair followed with the collaborative *Illustrations of Ornithology* in 1836. Selby's earlier work, described by his biographer C. E. Jackson as the British equivalent of Audubon's *Birds of America,* therefore ranks as one of the very first such works to use Macleay's theory in an ornithological context.[17]

[16] See J. Weiner, *The Beak of The Finch* (New York: Vintage, 1994), and Datta, *Gould in Australia*, 82-90.
[17] P. J. Selby, *Illustrations of British Ornithology* (London: Constable, 1821-1833), 2 vols; P. J. Selby, W. Jardine, *Illustrations of Ornithology* (London: W. H. Lizars, 1836); C. E. Jackson, *Prideaux John Selby: A Gentleman Naturalist* (Stocksfield: Spredden Press, 1992), 41.

Despite its origins in entomology, and that it had been devised with specific reference by Macleay to just one group of insects - coleoptera beetles – quinarianism, through the work of a small cadre of naturalists centred around Vigors, was to become almost exclusively identified with ornithology in the 1820s and 1830s, with attempts made, not least by Macleay, to apply it to other branches of the animal world.[18] The enthusiasm of individual ornithologists for the theory does not explain its almost complete dominance of the field by 1835. This has been noted before by historians of science, who tend to regard quinarianism's rise in terms of an aberration in the otherwise orderly progress of British science towards its Darwinian apotheosis. The aim of this chapter is to establish how and why quinarianism developed from being the obscure creation of a young entomologist into one of the dominant zoological theories of its day.

The discussion which follows is broken into three parts. First, it is necessary to analyse the political background to Vigors' jockeying for position in the principal zoological institutions of 1820s Britain: the Zoological Club of the Linnean Society and, after that was wound up in 1829, the Zoological Society of London. In the second, I outline the scope of Vigors' activities and set them in the context of the development of his own quinarian variant, and the particular type-concept that underpinned it. Vigors' own iteration of quinarian theory was qualitatively different to both Macleay's original theory and Swainson's iteration, and was deployed by him with the express intention of both transforming British institutional zoology and of establishing his own dominance in the sphere of metropolitan science. This involved a 'toning down' of the 'Romantic' qualities of Macleay's theory in the creation of a 'national' system of natural classification that would counter dangerous, materialist and transformist ideas then emanating from France. Finally, we consider how Vigors found in John Gould a perfect collaborator in his attempt to bring his quinarian theory to the attention of a wider

[18] W. S. Macleay, 'Two drafts of a classification of Mammalia on Quinary principles'. MP, MSS 5A/240-241.

audience, beyond the comparatively rarefied circles of London's scientific societies. Taking Gould's first folio *A Century of Birds from the Himalaya Mountains*, published in 1830, it is demonstrated how the illustrated folio became a conduit for quinarian ideas.

I.

The founding of the Zoological Society of London marked Nicholas Vigors' apotheosis as both a specialist zoologist and a gentleman-naturalist. Here, at last, was a British institution that would rival, and hopefully supplant Paris' Jardin des Plantes as the ultimate arbiter and central authority of European zoology.[19] He was not alone, of course, in his desire to see a resurgence of a newly national, British zoology. Stamford Raffles, the colonial administrator and founder of Singapore, had discussed the practicalities of establishing a zoological society in London as far back as 1816, receiving the tacit encouragement of Sir Joseph Banks, the formidable, long-serving President of the Royal Society.[20] Banks' successor as President, the chemist Sir Humphry Davy, was more enthusiastic, giving Raffles and Vigors active support in drumming up interest for a zoological society amongst the luminaries of metropolitan science and the overlapping, exalted political circles in which he moved. It was Davy who argued that aristocratic patronage was crucial to the development of the Society, and he was instrumental in persuading Lord Lansdowne to take over the Presidency on the death of Raffles.

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[19] D. P. Miller, 'Between Hostile Camps: Sir Humphry Davy's Presidency of the Royal Society of London, 1820-1827', *The British Journal for the History of Science*, 16 (1983), 1-47; Ito, *London Zoo,* 21-25.
[20] S. Raffles, *Memoir of the Life and Public Service of Sir Thomas Stamford Raffles* (London: Murray, 1830).

‘[T]his gives it [the Zoological Society] a chance of existence,’ Davy wrote to Thomas Knight, ‘for both his [Lansdowne’s] influence and talent are likely to be useful to a nascent So[ciety]’.[21]

Their success in securing the backing of not only the vast majority of London-based zoologists, many of whom were already members of the Linnean Society’s zoology ‘ginger group’, the Zoological Club, but also of an impressive list of politicians, statesmen and clergymen, is testament both to Davy’s powers and to the growing interest in all branches of natural history in the early decades of the nineteenth century.[22] This ‘popular’ element in the development of modern zoology has long been recognised, with the rapid expansion of the Zoological Society’s Regent’s Park gardens and menagerie being seen by Harriet Ritvo as indicative of an insatiable public curiosity for the natural world. There was, of course, far more going on here, as Ritvo notes, with the public display of animals becoming tied to Britain’s increasingly expansionist imperial policies and the captive animals themselves as symbols of Britain’s dominion over foreign landscapes and their peoples.[23]

With all of this focus on the more dramatic aspects of the Zoological Society’s history, the story of its museum and collections has receded into the background. For the ‘serious’ naturalists who sat on the Society’s Council and swelled the ranks of its ordinary membership, the creation of a museum was one of the new institution’s immediate priorities. The Council’s appointment of Vigors, already the Society’s Secretary and *de facto* leader, to head the museum was a statement of their intent to buttress the ‘popular’ appeal of the Regent’s Park menagerie with a strong research programme.

[21] Miller, ‘Between Hostile Camps’, 30-32; H. Davy to T. A. Knight, 10 Dec. 1826. Humphry Davy Papers, Royal Institution, London. HD/26/D/2m.
[22] [Anon.], ‘Prospectus of a Society for Introducing & Domesticating New Breeds Or Varieties of Animals ... Likely to be Useful in Common Life: And for Forming a General Collection in Zoology’, 1 March 1825. Zoological Society Archives.
[23] Ritvo, *Animal Estate*, 1-42; 205-242.

Swainson greatly resented Vigors' personal ascendancy. Macleay, a more equable character, appeared content to leave Vigors to it, providing rhetorical and scientific support when needed before removing himself from the fray completely by emigrating to Australia.[24] However, before the appearance of these divisions in the quinarian camp, before the founding of the Zoological Society, the three men worked briefly in uneasy partnership. Surviving correspondence between Vigors and Swainson dating from 1822 to 1826, exchanged during the crucial prelude before the zoologists of the Linnean Society broke away, cast a searching light not only on the rapid deterioration of their personal relationship, which had dire consequences for the longevity of the quinarian system, but also upon the range of methods employed by Vigors in promoting and establishing the theory in an institutional context.

The founding of the Zoological Club of the Linnean Society in 1822 resembled a 'dry run' for that of the ZSL four years later. Its leading figures were the same, almost to a man, with William Kirby and Vigors to the fore. Characterised by Adrian Desmond as a band of jingoistic, 'narrow systematists', the group was motivated by a common goal, 'urging the claims of the new "British zoology" against the French savants'.[25] It was also, crucially, a forum for careerist zoologists who were determined, like Vigors, to inject a little professionalism into the study of natural history in Britain. In this it differed somewhat from the Zoological Society, in which the claims of the careerists centred on Bruton Street had to compete with Humphry Davy's eccentric ambitions to run the Society and its Gardens as an ornamental game park.[26] However, some of its leading lights would not follow Vigors and Kirby, and these included Swainson.

[24] For example, W. S. Macleay, 'A Reply to Some Observations of M. Virey in the Bulletin des Sciences Naturelles, 1825', *The Zoological Journal*, 4 (1829), 47–51; 'A Letter to J. E. Bicheno', *The Zoological Journal*, 4 (1829), 401-415; 'Remarks on the Comparative Anatomy of Certain Birds of Cuba, with a Review of the Present State of the Nomenclature of Its Parts', *Transactions of the Linnean Society of London*, 16, 1 (1833) 1-46.
[25] Desmond, *Politics of Evolution*, 136.
[26] Desmond, *Politics of Evolution*, 136 -137.

It is for his illustrations, and his subsequent career as an author of popular, accessible works of natural history, that Swainson is principally known today. However, to Vigors, searching for fellow soldiers in his Linnean campaign, it was Swainson's wholehearted adherence to the 'natural' theory of classification which marked him out as a potentially useful ally. It is not clear when Swainson was converted to MacLeay's quinarian system but, on the evidence of his personal correspondence with his fellow naturalists, it cannot have been any later than 1822.[27] Significantly, for Vigors' purposes, at this point Swainson outranked him in the informal hierarchy of metropolitan science, having been elected as a Fellow of the Linnean Society before he had sailed for Brazil and, on his return, to the Royal Society on the recommendation of Sir Joseph Banks, its all-powerful president.[28] Swainson was also fully in agreement with Vigors' attempt to supplant gentlemanly amateurishness with gentlemanly specialism in the councils of London's scientific institutions.[29]

In an autobiographical fragment published in 1840, Swainson ruefully noted that, 'bred up with somewhat aristocratic notions', during his military service he had become accustomed 'to command rather than obey'.[30] Combined with his personal abrasiveness, this trait boded ill for his career prospects. In 1822 he had applied to become successor to William Leach as Keeper of the British Museum's Zoological Collections. The post went instead to a chemist, J. G. Children (1777-1852), an appointment which outraged Swainson's friends and appears to have permanently embittered Swainson himself towards not only the British Museum, but British scientific culture as a whole.[31]

[27] In the evidence of his communications with Vigors, it is likely to have occurred between 1820 and 1824.
[28] Knight, 'Swainson: naturalist, author and illustrator', 275-290.
[29] D. Knight, 'William Swainson: Types, Circles, and Affinities', in J. D. North, J. J. Roche (eds.), *The Light of Nature: Essays in the History and Philosophy of Science Presented to A. C. Crombie* (Lancaster: Kluwer Academic Publishers, 1985), 85-86.
[30] W. Swainson, *Taxidermy, with the Biography of Zoologists* (London: Longman *et al*, 1840), 347.
[31] Knight, 'William Swainson: Types, Circles, and Affinities', 84. Children, despite his lack of qualifications, made a considerable success of his new role, becoming widely regarded as a diligent administrator.

As so often in the years pre-dating Vigors' association with the Zoological Society, it is not clear whether the two men had had any previous dealings with one another, nor exactly when they first communicated with one another about Macleay's system. However, it seems highly unlikely that in that great age of letter writing, in which men of science maintained wide correspondence networks, they would have worked in ignorance of one another.

A subsequent letter, dated 19 April 1824, suggests that it was Vigors who initiated proceedings and, as there is no previous evidence of quinarianism in Swainson's writings, it seems likely that it was this interchange which sparked off Swainson's own passionate advocacy of the theory. Offering to talk over his own quinarian arrangement with Swainson, Vigors acknowledged the force of opinion ranged against the 'natural' theory in the Linnean – and, by extension, against himself. 'Any innovation', he griped, 'particularly in <u>nomenclature</u>, would raise <u>the envy against me at once</u>... If I can get my views tolerated at first it is all that I can do'.[32]

This hostility was deeply rooted amongst the botanists who, at that date, dominated the Linnean's presiding council and who set the tone for good botanical practice throughout Britain. An idea of what Vigors was up against, and the stirrings of dissent of which his own activities were the ultimate manifestation, can be gained from a letter written twenty years before to the Newcastle-based naturalist, William Turner (1761-1859). His correspondent, the botanist John Thornhill, notes the first stirrings of an 'improving tendency' whilst deprecating the efforts of the newcomers to improve it:

[32] Vigors to Swainson, 19 April 1824. LS, SC. 914.

> Linnaeus has not been so happy in his choice of Terms that the innovators of his System are forced to use a great many words to express that which he clearly expresses in one.
>
> That the system of Linnaeus is not strictly regular or natural is admitted by himself but those who have attempted to amend it if they are not Giants striving to pull down a Jove are Pygmies nibbling at the Work of a Giant.
>
> Great as was Linnaeus he could not do everything and has often misplaced Plants in his Genera either by trusting to others or from having only dried Specimens, perhaps from these causes combined; but his system of Botany stands and I presume will long stand unrivalled and alone.[33]

It was precisely this acknowledgement of the Linnean system's inadequacy to cope with the proliferation of known species, and the simultaneous refusal to do anything about it, which so incensed Vigors and his fellows in the Linnean Society. The reluctance of British botanists to use other or revised methods of classification can be attributed to a combination of factors which transcend mere obstructiveness, however. As Scharf notes, although early nineteenth-century naturalists were locked in a culture that was suspicious of innovation, the Linnean system and 'all things Linnaean' had become closely associated with British national pride, a development encouraged by Sir James Smith's lengthy tenure as President of the society.[34] Anti-French sentiment also had its part to play in their aversion to 'natural' systems, many of which were derived from the work of French botanists and zoologists such as Lamarck and

[33] Thornhill to Turner, 18 August 1804. Newcastle Literary and Philosophical Society. DWE 044.
[34] S. T. Scharf, 'Identification Keys, the "Natural Method", and the Development of Plant Identification Manuals', *Journal of the History of Biology*, 42, 1 (Spring, 2009), 73-117; Allen, *Books and Naturalists*, 131-137.

Cuvier. Conversely, Francophobia was prominent also in the packaging of quinarianism as a characteristically 'British' system, despite its indebtedness to the work of European naturalists.

The establishment of the Zoological Club in 1822, a Cave of Adullam for those disaffected with the keepers of Linnaeus' memory, marked the beginning of the first serious attempt to update and revise the Linnean system.[35] There were several strands to these activities, which under Vigors inevitably assumed the character of a military campaign. One of the most important was the emphasis placed upon the publication of articles imbued with the quinarian spirit in the Linnean Society's in-house journal, the *Zoological Transactions* (*ZTLS*), which he adjudged 'an efficient instrument' for the dissemination of quinarian systematics.[36] The principal research forum available to fellows of the society, Vigors was determined to overcome the journal editors' initial wariness of his system and engaged in a number of acrimonious disputes during the course of 1824. On 5 July, he professed to being 'extremely hurt' by their conduct, but this served only to encourage him to rally his supporters for a concerted assault on the editorial board. His actions were sufficiently effective for him to inform Swainson on 20 August that the editors now 'come favoured to meet' the views of 'you, Macleay & myself'.[37] This atmosphere of happy consensus was short-lived.

Earlier that month Vigors had approached Swainson, who had by now completed his pioneering lithographic work, *Zoological Illustrations* (1820-23) and was basking in a rare burst of approbation, with a request that the latter contribute an article to the *ZTLS* on the ornithology of Mexico. Swainson had recently published an article in *The Zoological Journal* in which he had praised Vigors' 'able disquisition' on the present state of ornithological nomenclature and made some scathing statements on the backwardness of zoology in Britain,

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[35] Ito, *London Zoo,* 22.
[36] Vigors to Swainson, 16 October 1824. LS, SC. 921.
[37] Vigors to Swainson, 20 August 1824. LS, SC. 918.

particularly the insistence of zoologists on acting ‘on the *spirit*, and not on the *letter*’ of Linnaeus’ work, that chimed well with Vigors’ own thoughts. For example,

> While Botany had been progressively advancing, Ornithology has remained nearly stationary. Our elementary books and our voluminous systems, as Mr. Vigors truly observes, speak the language of a remote period; and display a lamentable picture of our Zoological proficiency to the rest of Europe. Better indeed had there been no such terms as *Order* and *Genus*, for they have acted like a magical spell, upon minds that otherwise perhaps might have burst the trammels of nomenclature, and like Linnaeus, have “dared think for themselves”.[38]

Swainson’s contempt for the rigidity of the British Linneans and concern for the ‘embarrassing’ state of British ornithology seemed well-calculated to appeal to Vigors. Although Swainson’s reply to Vigors’ overture is missing, the tenor of the correspondence that followed suggests that he was happy to comply.[39] However, the subsequent deterioration of the relationship between the two ornithologists was rapid. Vigors’ conception of his role as a champion of ‘natural’ systems made him unwilling to brook opposition or foot-dragging and his demands of Swainson, which had ballooned to include diagrams of his system and a paper on the *Laniidae* (shrikes and ‘butcher birds’), were such that the latter was unable to keep up. This elicited a brusque comment from Vigors that Swainson’s tardiness was holding up his own plans to publish his own quinarian arrangement of the *Falconidae* (now understood to include around sixty species of falcons and caracaras, but which then had a far broader remit

[38] W. Swainson, ‘An Inquiry into the natural Affinities of the Laniidae, or Shrikes; preceded by some Observations on the present State of Ornithology in this Country’, *The Zoological Journal*, (1824), 292.
[39] Vigors to Swainson, 20 August 1824. LS, SC. 918.

including eagles and hawks) and threatened to undermine the whole quinarian tone of the next number of *ZTLS*.[40]

The final break between Vigors and Swainson occurred two months later, and can be attributed to more than a clash of personalities. In a previous missive, Vigors spoke revealingly about the importance of the British Museum to the success of 'our exertions in zoology', and hinted deliberately at the 'difficulties' that had existed between the museum and Swainson since 1822.[41] Having now also recruited Macleay and Thomas Horsfield (1773-1859), a botanist and close associate of both Vigors and Stamford Raffles, to contribute articles to the *ZTLS*, Vigors' loss of patience with Swainson is plain. '[W]e must all endeavour to pull together', he warned, ample indication that, already, the quinarian camp was dividing.[42] He revisited the theme, with cold ferocity, a month later. Refusing to put forward Swainson's name for election to the Zoological Club, Vigors declared that '[w]e feel a disinclination to urge any man who is not an ardent volunteer in the same cause'. He continued, with heavy irony:

> It is cordial and efficient cooperation that we require, & not cold and constrained compliance. Join us then, if you can, with perfect cordiality, with head & heart, with all the veins as the Irish now say. We shall rejoice to have you in our ranks, but hope we may not be considered as soliciting the union of any man with us merely to add a name to our list, or a paltry fee to our purse.[43]

[40] Vigors to Swainson, 7 September 1824. LS, SC. 920.
[41] Vigors to Swainson, 16 October 1824. LS, SC. 921.
[42] Vigors to Swainson, 16 October 1824. LS, SC. 921.
[43] Vigors to Swainson, [undated] November 1824. LS, SC. 922.

This extraordinary outburst, which goes far to explain Swainson's later allegation that Vigors was a bureaucratic dictator, marked the end of their tepid attempt at collaboration. Despite the Club's primary emphasis on ornithology, Swainson would play only a marginal role in the remaining five years of its existence, by which time it had been wholly superseded by the Zoological Society, which from the outset placed more emphasis on zoology as both a classificatory science and a means of demonstrating Britain's growing imperial commitment. Barron Field (1786-1846), oblivious of the sour turn taken by Swainson's relationship with Vigors, enthused, 'It must be very gratifying to see the March of Zoology in England. The popularity of the science is greatly indebted to Vigors and his lucky hit of the Regent's Park Menagerie'.[44] Swainson thought otherwise. In one of his most popular books, *A Preliminary Discourse on the Study of Natural History* (1834), he blasted the Society, comparing it unflatteringly with the Linnean, still 'the first' in terms of the quality of its scientific publications, and deplored its wasted potential:

> There is probably no society in Britain, which, under other regulations, might do so much to restore zoology to her legitimate elevation as the Zoological Society. And yet, as present constituted, it seems eminently calculated to encourage that superficial and almost useless taste for natural history now so prevalent, and which arises from the custom of regarding it as an amusement rather than as a science, where there are ample funds, as in the present case, a judicious management may unite, in equal proportions, popular recreation with the encouragement of legitimate science; for the attraction of the former would raise funds for paying for

[44] Barron Field to William Swainson. December 1 1828. LS, SC. [un-numbered]

> the latter, and thus the highest objects might be combined with those that were more ornamental than useful.[45]

II.

Although the events of 1835 and 1836 would prove Swainson's misgivings about the running of the Zoological Society to be well-founded, the scientific direction of the Society's museum was in capable hands. John Gould's biographer, Isabella Tree, argues that, between them, Vigors and Gould sought nothing less than to transform the status and study of zoology from their Bruton Street rooms.[46] By the mid-1830s, the ZSL museum's collections were superior to the British Museum's zoological collections, a remarkable achievement for an institution less than a decade old.[47] Although Vigors and his protégée were both intensely ambitious, they were sincere in their determination to rescue zoology from the secondary position it had for so long occupied in British natural history. That they believed they could affect such a change from the Zoological Society's museum may strike us as strange, particularly if we have as our point of reference the practices and methodology of modern zoology, which is far more dependent upon field work than upon the study of museum specimens.[48] So, before turning to Vigors' political machinations and the methods he employed

[45] William Swainson, *A Preliminary Discourse on the Study of Natural History* (London: Longman *et al*, 1834), 439.
[46] Tree, *Bird Man*, 17-18, 21.
[47] [Anon.], *Reports of the Council and Auditors of The Zoological Society of London, read at the Annual General Meeting, April 29, 1835* (London: Richard Taylor, 1835), 16-17; Ito, *London Zoo*, 37.
[48] For example, see C. W. Pettitt, *The Value and Valuation of Natural Science Collections: Proceedings of the International Conference* (Manchester: Manchester University Press, 1995), 94-103; G. H. Pyke, P. R. Ehrlich, 'Biological Collections and Ecological/environmental Research: A Review, Some Observations and a Look to the Future', *Biological Reviews of the Cambridge Philosophical Society*, 85, 2 (Nov 2009), 247-266.

to carve quinarianism into the framework of British zoology, it is first necessary to address the role of collections within that framework, in particular the origins and uses of the type specimen and type concept.

The type concept had been in use before the nineteenth century, but only began to develop beyond its most basic iteration, as an aid in classification and nomenclature, with the vast growth in collections made possible by European colonial expansion and improvements in specimen preservation.[49] Paul Farber notes that during this period, the type concept was in reality a 'constellation' of concepts that zoologists used in different specialities, and was assigned to different levels of organisation, from the level of individual organs up to species and genera, and accordingly interpreted in widely differing ways.[50] Farber identifies three main usages of 'type' during the first half of the nineteenth century: the classification type-concept, by which one form, be it a species, genus, or family, was chosen by naturalists to serve as a 'model' upon which to base classifications; the collection type-concept, which emerged from the growth of museum collections and served a similar function to the classification concept, except that it referred to a particular specimen in a collection rather than a general group; and the morphological type-concept, which grew from the development of comparative anatomy after 1800 and, broadly speaking, came to be used to distinguish the fundamental *plans* upon which organisms were based.[51]

Vigors and the other quinarians, whose deployment of the type concept varied depending upon their political and theological affiliations, used these three concepts in conjunction, and it is often not clear to which they refer in their writings. For Vigors, attempting to arrange the collections of the Zoological Society museum, the classification and collection

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50 Farber, 'Type-concept', 93.

51 Farber, 'Type-concept', 105-116.

type-concepts would have been of most immediate use. During a period when the empirical base for the natural sciences expanded exponentially, the classification type-concept helped museum-based naturalists to arrange specimens in a rational manner. It could be applied to several taxonomic levels and was a highly-convenient way of condensing knowledge.

The classification type-concept was implicit to the conventions of nomenclature, principally the binomial system established by Linnaeus, used by all naturalists in nineteenth-century Britain, Vigors and Gould included. The type species was used to establish the generic name carried by the species within a given genus. To take a random example, when Linnaeus assigned a binomial, *Lanius excubitor*, to the first member of the shrike family to be so treated, the Great Grey Shrike, the generic *Lanius* was afterwards given to all ‘true’ shrikes and the family name Laniidae derived from it. If, as happened with the Laniidae, the genus was later split or sub-divided, the group that contained the type-species, in this case the Great Grey Shrike, was given the original name. This convention was followed by Vigors and his naturalist allies, and was later adopted by Hugh Strickland in his 1844 ‘Report’ which standardised the rules of zoological nomenclature.[52]

The value of this to museum-based naturalists, including Vigors and later Gould, is clear. Strickland spoke for the majority of his colleagues when he stated;

> We may obtain a great amount of fixity, in the position at least, if not in the extent of our groups, by invariably selecting a *type*, to be permanently referred to as a standard of comparison. Every family, for instance, should have its *type-subfamily*, every subfamily its *type-genus*, and every genus its *type-species*. But it must not be

[52] Strickland, ‘Report’, 110-111.

> supposed, with some theorists, that these types really exist as such in nature; they are merely examples or illustrations selected for convenience to serve as permanent fixed points in our groups, whatever be the extent which we may give to their boundaries. By adhering to this notion of types we may often indicate these groups with greater precision than it is possible to do by means of definition alone.[53]

Lorraine Daston interprets this notion of type, which underpins naming, as an 'art of transmission' primarily intended to *stabilise* nomenclature. With the proliferation of new species at the beginning of the nineteenth century, it was crucial to provide a relatively stable catalogue of names which were detached from shifting theories, of which quinarianism was only one amongst many, and tackle the excessive synonymy which blighted both zoology and botany in the decades around 1800.[54] There was also a second purpose to this stabilisation of nomenclature, inherent in the transient nature of much scientific work, then as now characterised by a tendency to sudden and total supersession; the necessity for naturalists to preserve the empirical and theoretical basis of their work.

It is here, perhaps, that we can find the key to the importance of museum collections to the development of zoology and the corresponding status of museum-based naturalists such as Nicholas Vigors. As Daston notes, the name of a species is not inherent in the entire population of the species, still less in some abstract 'plan' or archetype, but in a single, 'concrete individual specimen' that was either the first of its kind to be collected or the first to be identified as a new species. Upon this type specimen the naturalist's conception of the 'general idea' of the species has been mapped, so that the individual specimen then acts almost as the symbol of the

[53] Strickland, 'Report', 219.
[54] L. Daston, 'Type Specimens and Scientific Memory', *Critical Inquiry*, 31, 1 (Autumn, 2004), 154-156.

particular species or genus which it represents. The rendering of the abstract concept, the species or genus, into the concrete, the type specimen or *holotype*, was a radical and highly effective solution to the problems which had afflicted early systematists. That this process involved some fairly complex philosophical problems was not foremost in the minds of nineteenth-century naturalists, for whom the practicalities of classification outweighed the metaphysics.[55] The investiture of scientific authority in type-specimens made collecting such specimens a key priority and elevated the status of the museum-based naturalist. The pressing problem of distinguishing new species amongst the ever-swelling empirical base with which they were presented encouraged museum naturalists to regard type-specimen collections as the base upon which to build systems of classification and generalise into histories of life.

They also had a knock-on effect upon scientific publications. Large collections, such as that amassed by Vigors and Gould at the Zoological Society's Bruton Street museum, made possible the creation of large-scale zoological monographs, encompassing entire families of species and genera, which in turn increased the importance of the specimen collections. A glance at any of the illustrated folios and atlases from the period highlights the authors' repeated references to particular collections and specimens from which the illustrations were derived. For example, in Vigors' and Gould's *Century of Birds*, the descriptive notes for *Enicurus scouleri* (or Little Forktail), a small, black and white plumaged flycatcher, note that the illustration (plate 1) represents a specimen in the collection of 'Dr. Scouler of the Addisonian Museum of Glasgow'. The authors note that a further specimen is in the collection of the British Museum, the only two examples of the species then in European hands.[56]

Although these folios contained descriptions of the species depicted, and so acted almost as specimen catalogues, the majority of naturalists continued to regard the specimens

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[55] Daston, 'Type-specimens', 157.
[56] Gould, *Century of Birds*, Tab. XXVIII, *Enicurus scouleri*.

themselves as the ultimate arbiters in classification. Kirby and Spence (1783-1860), in their *Introduction to Entomology*, noted that if 'keying' a specimen fails, 'the *dernier resort* is a reference to the cabinet [collection] from which the description was drawn'.[57] The expansion of museum collections, theoretically at least, gave researchers an ever more comprehensive empirical base to consult, particularly as they increasingly had more than one specimen to consult for descriptions, as in the example of *Enicurus scouleri*. However, the reality was more ambiguous, with some museum superintendents jealously guarding their prize specimens from rival naturalists, or institutions limiting access to their collections to fellows and members of the society, access to which came at a cost which few 'ordinary' researchers could afford.[58]

The classification and collection type-concepts came to be understood by naturalists in different ways, depending greatly upon their conceptions of the purposes of classificatory systems. For naturalists creating 'artificial' systems of classification, or keys of identification, both types were principally a means of characterising groups. However, by the early-nineteenth century the majority of zoologists were actively seeking more 'natural' systems which better and more accurately described the 'true' order of nature, as the Creator himself had arranged it. In their classificatory systems they therefore tried to reflect natural groupings. However, as Farber observes, this did not necessitate the use of the classification type-concept as a 'reflection of a real relationship in nature'. The type-species or type-genus usually remained either the best-known or first-described forms that could be used to get a broad idea of a genus or family.[59]

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[57] William Kirby and William Spence, *Introduction to Entomology* (London: Longman, 1826), IV, 553.
[58] See Swainson's criticism of the ZSL; Swainson, *Preliminary Discourse*, 428-441; and D. Cash, *Access to Museum Culture: the British Museum from 1753-1836* (London: British Museum, 2002), 165-96.
[59] P. L. Farber, 'The Type-Concept in Zoology during the First Half of the Nineteenth Century', *Journal of the History of Biology*, 9, 1 (Spring, 1976), 113-114.

The quinarians went several steps further and understood the classification type as a reflection of real relationships in nature. Like Cuvier, Swainson envisaged a static, unchanging Creation and sought a 'natural' method of classification. Unlike Cuvier, who based his system upon his findings in comparative anatomy and perceived *four* fundamental types, or *embranchements*, in organisms, Swainson's belief in an underlying unity of plan led him to stress the general morphological features, behaviour, habits, and function of animals.[60]

Swainson's emphasis on external features as classificatory characters, combined with the *a priori*, Romantic underpinnings of the quinarian theory, lent his conception of type a special complexity. In his relatively 'popular' *Treatise on the Geography and Classification of Animals*, written in 1835 as one of many such books written for Dionysius Lardner's 'Cabinet Cyclopaedia', Swainson argued that by taking into account habits and behaviour *alongside* external morphology, naturalists could see natural groups as a circular series that 'in its progress from a given point, either actually returns, or evinces a tendency to return, again to that point, thereby forming a circle'.[61] This point, at which the series returns back on itself, forming the characteristic quinarian circles, Swainson saw as the 'PRIMARY TYPES OF NATURE' [Swainson's emphasis]. Each of these circles contained another three groups: the typical, the subtypical, and the aberrant. The typical included those species that are the 'most perfectly organised' or, in less opaque terms, those species which are judged to be most representative of all the members of their group. The status of the other two, the subtypical and aberrant, is peculiar. The latter was conceived of as a compound of three groups of the same rank as the typical and subtypical, and encompass those forms which diverge most strongly from the typical but which display sufficient characteristics in common with the typical forms to warrant inclusion within the same larger grouping. The subtypical, as the name would

[60] Farber, 'Type-Concept in Zoology', 114; Knight, 'High Church Science', 1-8.
[61] W. Swainson, *A Treatise on the Geography and Classification of Animals* (London: Longman *et al*, 1835), 224.

suggest, is intermediate between the typical and the aberrant, and contains forms which, in Swainson's words, are 'in short, symbolically the type of *evil*':

[T]he most powerfully armed, either for inflicting injury on their own class, for exciting terror, producing injury, or creating annoyance to man. Their dispositions are often sanguinary; since the forms most conspicuous among them live by rapine, and subsist on the blood of other animals.[62]

This lurch into the symbolic is jarringly at odds with the dispassionately 'scientific' tone adopted by Swainson elsewhere in his book, and indeed with his descriptions of the typical and aberrant forms. Although not alone amongst the quinarians in his emphatic belief that type forms were proof of a divine Creator, a belief which allowed the fundamentals of the theory to be reconciled with traditional natural theology, Swainson was unique in his liberal use of metaphor and mystical language. David Knight, one of the few historians of science to study Swainson, has ascribed this tendency to Swainson's High Tory churchmanship. However, this seems an inadequate explanation, particularly when comparing the writings of Swainson and the equally conservative Reverend Kirby, whose entomological writings, whilst always drawing the reader back to the divine, do so in a manner much more consistent with the traditional arguments of Paleyan natural theology.[63]

This brings us to Vigors. Like all theories, quinarianism encompassed a number of variants and was intended by its adherents to accomplish different ends. For Swainson, like Macleay before him, quinarian 'natural' classification was a means to a greater end, their

[62] Swainson, *Classification of Animals*, 245.
[63] Knight, 'High Church Science', 3-5.

conception of type as a reflection of the Divine Mind underpinning a belief in the system as an accurate picture of creation. As Macleay argued, the artificial system is ‘the miserable resource of the feeble mind of man, unable to comprehend in one view the innumerable works of the creation; whereas the natural system is the plan of the creation itself, the work of an all-wise, all-powerful deity.[64]

Vigors, by contrast, steered clear of such grandiose claims. It is not clear from his writings whether he believed in a stable Creation, but he certainly used the quinarian system in a different, more practical way. Unlike Macleay or Swainson, Vigors’ immediate priority as the superintendent of a natural history museum was to impose order upon the nomenclatural chaos which so markedly afflicted European zoology between c.1800 and 1840. As he wrote in 1824:

> Nomenclature itself is variable. From its very nature it cannot remain stationary: it must be enlarged to suit the increasing bulk of materials which is meant to regulate; it must be altered to meet the more accurate information of every day. But the principles which direct its art never vary. Standing on the philosophical basis upon which they were placed by Linnaeus, they are suited to every change of the science; in every alteration of views, in every modification of knowledge, they remain the same, unchanged, unchangeable. Ought it not to be the undeviating principle therefore to which we should adhere, and not the inconstant name?[65]

[64] Macleay, *Horae,* viii-ix.
[65] Vigors, ‘Observations’, 190.

As Vigors knew too well, the problem with this was that naturalists could not agree on which principles should govern nomenclature. Vigors himself was an enthusiastic and vituperative participant in the many disputes on the subject which enlivened 1820s zoology, clashing with such ornithological heavyweights as Desmarest, Louis Vieillot and Coenraad Temminck. Eulalia Gasso Miracle's analysis of Vigors' quarrel with Temminck identifies three central points of disagreement. First, whether or not the genus was a better taxonomic category than the old Linnaean 'section'; second, what should be done with intermediate species which did not easily fit in any established genera; and finally, what were the best characters to use when defining a genus.[66]

Miracle's study is perceptive and, although not considered at much length in her paper, highlights Vigors' understanding of the type-concept in terms which differ considerably from Swainson and Macleay. The most important aspect of the dispute to consider here is the status of intermediate species. Like Temminck, Vigors believed that there were no absolute divisions in nature, a belief which led him to assent to Macleay's original notion of organic life in an unbroken chain of affinities. This apparent degree of unity presented a stark problem for naturalists, particularly those who wished to devise a system of classification and nomenclature which accurately reflected the divine order of nature. Cuvier, who believed in a static order of nature in which living forms had been slotted into their niches in the natural world, could happily deploy an artificial system in which animals, displaying only minor degrees of variation, could be comfortably grouped around a basic type which displayed clear-cut essences.[67] Vigors, seeing no such divisions, nevertheless saw the value of the approach and

[66] Miracle, 'Temminck', 456.

[67] See E. A. Eigen, 'Overcoming First Impressions: Georges Cuvier's Types', *Journal of the History of Biology*, 30, 2 (1997), 179-209; U. Kistner, 'Georges Cuvier: Founder of Modern Biology (Foucault), or Scientific Racist (Cultural Studies)?', *Configurations*, 7, 2 (1999), 175-190.

deployed an essentially artificial method which established boundaries around a group of species which, more or less, resembled the type species of each genus.[68]

An acknowledged expert in bird morphology and taxonomy, Vigors called upon his vast experience to assess the morphological differences and similarities between species and the types before deciding where to place them. He can be seen to have used what Farber identifies as the classification type concept, which served as a model with which to characterise a species or genus, with the express intention of creating a *stable* system. In his system only species have a fundamental reality, whilst genera are artificial, intellectual constructs. This was as idiosyncratic, in its own way, as was Swainson's own system. However, Vigors' was the more immediately successful, if success can be judged upon its widespread acceptance within a particular field of study.

The reasons for this can be traced back through Vigors' published articles. Unlike Swainson, who was also a 'declinist' but whose inability to penetrate the inner sanctum of metropolitan science consigned him to snipe from the side-lines, Vigors actively fought to establish a re-invigorated, 'national' science. Although in Macleay's theory he found a tool with which to achieve this end, quinarianism alone would not be sufficient. Indeed, several crucial aspects of Macleay's theory, not least its borrowings from *Naturphilosophie*, actively worked against it in the context of British science. Vigors was shrewd enough to detect this relatively early on: by 1824, at least, he was busily engaged in repackaging quinarianism as a uniquely 'British' theory, uniquely suited to the needs of British scientists.

[68] Miracle, 'Temminck', 460; Vigors, 'Observations', 196.

One of the most telling salvoes in this sustained barrage of calculated chauvinism came, appropriately enough, in his extended clash with the French naturalist, Antoine Desmarest. In the pages of *Zoological Journal*, Vigors delivered himself of a peerless manifesto of 'British' zoology, couched in a curious combination of belligerent rhetoric and painstaking, not to say nit-picky, taxonomic debate. Desmarest, who like Temminck before him, questioned Vigors' notion of genera, particularly his subdivision of the *Psittacidae* which, in Desmarest's opinion, was 'without any value, or any apparent regard to the mode of life of the animals that compose them'.[69] This was a relatively routine critique but it drew from Vigors a stinging response:

> [A]t a period when a new impulse has been given to our science in this country, and a new school of Zoology, if I may so express myself, is forming itself among us, it becomes us to be doubly guarded as to its interests, and not to suffer its rising reputation to be at once overborne by the mandates of assumed authority... The time has however gone by, when any individual will be allowed to assume the right of prescribing how Nature is to be investigated. Natural History is no longer an occult science on which a few of the *soi-disant* initiated will be exclusively authorised to issue their edicts, as if from an oracle.[70]

This flight of rhetoric can be interpreted in several ways; as a jab both at Linnaeus' cadre of devoted followers in Britain, and as directed against the powerful and highly influential group of French naturalists, with Cuvier and Geoffroy at their centre, whose work dominated European zoology. That Vigors should have directed his fire against the very men whose work

[69] A. Desmarest, *Perroquet: Dictionnaire des sciences naturelles, Vol. 29* (Paris: Le Normant, 1828), 20-21.
[70] N. A. Vigors, ''A Reply to some Observations in the "Dictionnaire des Sciences Naturelles", upon the newly characterised groups of the Psittacidae', *The Zoological Journal*, 3 (1828), 92-93.

he built upon should not strike us as strange, for he was concerned to remove the study of zoology in Britain from under the long shadow of the Jardin des Plantes.

One of the ways in which he sought to achieve this was to set quinarianism within the traditions of British philosophy. Macleay, conscious of the critical parallels that could be drawn between his theory and the German *Naturphilosophen*, had previously executed a similar manoeuvre, emphasising that he had arrived at his theory through painstaking observation, rather than through the application of *a priori* concepts.[71] That he was not altogether successful in this attempt can be deduced by the authority whom Vigors called upon in support of his theory; the doyen of British empiricists, John Locke.

Vigors' appeal to Locke was more than patriotic window-dressing for the consumption of traditional British naturalists. The fundamental elements of Locke's epistemology were a prominent vein which ran through Vigors' own thinking, particularly on species. Whilst he stopped short of Locke's thoroughgoing nominalism, he agreed with his belief that genera, at least, are abstract ideas 'with names annexed to them' for the purposes of the readier improvement and communication of knowledge; 'an artifice of the understanding, or the easier signifying such collections of ideas, as it should often have occasion to communicate by one general term; under which divers particulars, as far forth as they agreed to that abstract idea, might be comprehended'.[72] However, Locke's belief that the inability to agree upon systems of ordering the natural world, to 'rank and sort things', because of the inherent limitations of our faculties was a powerful argument against the sort of *a priori* thinking that underpinned Romantic science. '[W]e in vain pretend to range things into sorts', Locke wrote, 'and dispose

[71] Macleay, *Horae,* **I.**, ii-xxvii.
[72] Vigors, 'Reply', 97-100.

them into classes, under names, by their real essences, that are so far from our discovery and comprehension'.[73]

Locke's scepticism about the ability of man to comprehend the underlying order of nature, which had contributed towards the notorious hostility of eighteenth-century British naturalists towards airy theorising, posed practical problems. As Vigors noted, as the genera of natural history are based upon the similarities which our, admittedly limited, understanding makes most evident, increases in knowledge 'and the more accurate acquaintance which we are enabled to make with their qualities' can lead to a chaotic taxonomic situation.[74] This was, of course, exactly the problem which so afflicted early nineteenth-century natural history, leading to the proliferation of taxonomic systems, artificial and natural, and the bewildering confusion of names attached to almost every species. In this untenable situation, Locke's species relativism was untenable, although it is notable that Vigors rejected it for reasons of practicality, rather than on philosophical grounds. He did so with uncharacteristic diffidence. Noting the huge and continuing increase in the numbers of known animals, he argued that

> [i]t consequently happens that the original groups, which at first were proximate in our ideas to species, cease to continue so; and the mind seizes upon intervening characters of distinction by which it is enabled to reduce the increasing subjects within a comprehensible compass. *The limits of species may perhaps be capable of being defined*… but until our knowledge of nature is perfect, - a period little to be expected, - the next proximate groups to species must ever be subject to variation [my emphasis].[75]

[73] Vigors, 'Reply', 98.
[74] Vigors, 'Reply', 100.
[75] Vigors, 'Reply', 103.

In a nod to Macleay and the *Horae Entomologicae*, Vigors illustrated the absurdity of those naturalists who stuck to the established Linnean genera and orders by citing the example of Coleoptera beetles, of which Linnaeus identified 42 different species in 1758.[76] As the 'original tens increased to hundreds', new characteristics were selected in order to distinguish groups within the order, including minute differences on the rear pair of legs and the abdomen, with the result that these new groups 'became proximate to species [and] they virtually became genera in their turn'. This, Vigors argued, was not only poor taxonomy, confusing the true relationships between different species and genera, but intellectually lazy.[77] However, he recognised the value of such minute research and inveighed against the tendency in 'modern science', by which he meant the unreserved idealism of Continental naturalists, to criticise such painstaking research, arguing that the discoveries made through such work were essential to the 'higher speculations of science'.[78]

It is here that Vigors' essential caution and moderation become apparent. Having gingerly stepped around Locke's objections to the possibility of any knowledge beyond the immediately sensible, and slammed the presumptions of idealists, he carved out a 'middle way' between the two extremes, arguing that the 'analytick' and 'synthetick' modes of research were co-dependent. 'The very minuteness of our mode of research thus eventually conduces to its comprehensiveness', he argued, 'and upon these very details are founded the highest and most generalising views of the science'.[79] Although arguing that species were the only taxonomic group with any objective reality, he stated that only through the recourse to *characters*,

[76] C. von Linné, translated by W. Turton *A general system of nature: through the three grand kingdoms of animals, vegetables, and minerals, systematically divided into their several classes, orders, genera, species, and varieties, Volume 1* (London: Lackington, Allen, and Co., 1806).
[77] Vigors, 'Reply', 103-104.
[78] Vigors, 'Reply', 104-105.
[79] Vigors, 'Reply', 104.

morphological features arbitrarily-chosen by the naturalist, could the divisions and subdivisions between them be recognised and a classificatory system accordingly devised.

> The naturalist seeks out the typical characters of his larger groups at the point where they appear most strongly developed, and then tracing their various modifications until they may be said to evanesce, and give place imperceptibly to the succeeding characters of the neighbouring groups, he fixes upon these various modifications as ideal marks of separation between his ideal subdivisional groups. He is in this manner guided, not by detecting distinct or opposing characters, but by tracing out the modifications of the same.[80]

Having stated the methodology of his quinarian classification, Vigors then delivered a lengthy and highly revealing statement of his aims for a distinctively British zoology, developed in response to the boundaries of her expanding empire. Implying that Desmarest's attack on his work had been motivated by narrow, nationalistic interests, Vigors charitably acknowledged his indebtedness to the 'eminent services in Zoology of our continental neighbours'. Expressing his 'pride' in being one of that select band of 'enlightened Zoologists in this country' who had sought to overturn the practices that had impeded the development of scientific practices and institutions throughout the preceding decades, he took credit for 'opening the eyes of our rising naturalists to the improvements of the continental schools'.[81] What followed this is a peerless statement of Vigors' ambitions:

[80] Vigors, 'Reply', 105.
[81] Vigors, 'Reply', 122.

> It has been one of our chief objects to point out the true merits [my emphasis] of the founders of these schools; - not, however, with the view of following in their wake, in timid submission of their ordinances, but in the hope of emulating their progress… of assuming, in short, that forward station in Zoology, which the genius, the industry, and the mighty resources of this Empire confer upon us as a right, and impose upon us as a duty, to assert.[82]

As rhetoric, this passage is notable enough, but it reads somewhat curiously in light of his attack on Desmarest for letting narrow national pride over-ride his scientific judgement. Nonetheless, it is a distillation of all the principal themes which guided the development of British zoology in the 1820s and 1830s, and demonstrates the clear link between the expansion of Britain's overseas interests and the progress of British zoology. The explicit implication that Britain's naturalists were automatically better qualified to further the advancement of their discipline than their French and German counterparts is particularly noteworthy and, at this stage at least, distinctly premature. However, as a political document it reveals a little of why Vigors, and not Macleay or Swainson, became quinarianism's most effective advocate in the late 1820s.

[82] Vigors, 'Reply', 122.

III.

Vigors' combination of political acumen and scientific ability had, by 1829, secured for him a reputation as one of the foremost zoologists then active in British science. However, achieving dominance in the elite circles of London's scientific institutions was to win only half the battle. As with any novel scientific theory, the relative success of quinarian classification depended on both its continued verifiability, or how well it continued to elucidate the growing mass of empirical data, and also upon how well its proponents were able to communicate it to a wider audience. If the postmodern turn has demonstrated anything, it is that language can be a slippery commodity, with the meaning of scientific language, in particular, fluid and arbitrary and rooted in power-knowledge relations. The use of extant-terminology, already loaded with connotations, to describe novel aspects of scientific theories is fraught with difficulties, as Darwin, who could not quite wean himself off writing about 'creation' would later discover.[83]

A potential way to avoid some misunderstandings was to turn to illustration. As we have seen, Macleay and Vigors, and later Swainson, all took pains to represent their quinarian theories diagrammatically, which offered a somewhat clearer exposition of quinarian principles when words failed. Only in 1830 did Vigors turn to the more conventional, and crowd-pleasing form of visual imagery offered by natural history illustration. The key figure here was his protégée, John Gould.

A solitary painting by Nicholas Vigors survives. Painted in oils on canvas and simply entitled 'Toucan', it was painted in 1831 and is now part of the Natural History Museum

[83] See Smith, *Darwin and Victorian Visual Culture*, 33-42.

Figure 8. N. A. Vigors, *Toucan*, oil on canvas. NHM. Oil Paintings Collection.

collections (*fig.* 6).[84] It is a fairly competent depiction of what is probably a specimen of Cuvier's toucan, then considered to be a distinct species but now considered, along with the Red-billed toucan, with which it freely interbreeds, to be sub-species of the White-throated toucan.[85] Though the plumage is clumsily-treated by the standards of an artist of Edward Lear's calibre, for example, the picture nevertheless offers the viewer a reasonable grasp of the overall 'look' of the bird: its key characteristics by which naturalists could identify it, such as bill shape and relative size, plumage colour, even a rough indication of habitat.

However, when it came to publishing his own illustrated folio, Vigors was undoubtedly wise to avoid the temptation to avoid providing the images himself. Relatively few naturalists, as David Allen demonstrates, had the degree of draughtsmanship required to illustrate publications as lavish as the natural history folio, and so employed artists to do the work for them.[86] So, when Vigors came to dip his toe into the illustrated folio market, he turned to Gould.

This was a more unusual decision than might be immediately evident. Though Vigors had, by this time, a fairly sure grasp of Gould's professional competence, the latter had never published anything before, let alone a publication on such an impressive scale as an illustrated folio, a format which carried with it a range of unique problems. Nor was Gould an established zoological artist, in the manner of Audubon, for example, or their future fellow quinarian, William Swainson. Indeed, Gould's abilities as an artist have been picked over by historians for over a century, the at times heated debate centring upon the extent of his involvement in the illustration process. Contemporary reviewers often ascribed authorship of the images in Gould's folios to Gould himself, an understandable conclusion given Gould's life-long habit of signing them with his own name. However, this is misleading, as Tree notes. In reality, as a

[84] N. A. Vigors, *Toucan*, oil on canvas. NHM. Oil Paintings Collection.
[85] J. Wilkes (ed.), *Encyclopaedia Londinensis; or, Universal Dictionary of Arts, Sciences, and Literature, Volume XXI* (London: G. Jones, 1826), 685-686.
[86] Allen, *Books and Naturalists*, 155-203.

wealth of primary evidence demonstrates, from the surviving preliminary drawings held by Kansas University, to the textual components of the folios, written by Gould himself, Gould's role in the illustration process was to provide basic drawings that his artists would then 'work up'.[87] At the start of his career, his principal artist was his wife, Elizabeth.

No less than Nicholas Vigors, Elizabeth Gould (1804-1841) was central to her husband's early success. It is no exaggeration to state that, without her artistic talents and her remarkable ability to keep pace with his demands, Gould would not have been able to so quickly and so firmly establish his place as Britain's premier publisher of zoological works. Little is known about Elizabeth Gould's early life and the one study of her life, written by Alec Chisholm, remains the standard work for historians.[88] Born to a military family in Ramsgate, she met Gould whilst working as a governess in London, a life which held little appeal for her.[89] Accounts differ on how she first met Gould: Tree speculates that he spotted her sketching at the Zoological Gardens.[90] However, more prosaically, it is likely that they met through Elizabeth's brother, Charles Coxen (1809-1876) who, like Gould, then worked as a taxidermist in London. In Gould's correspondence is a brief reference to their relationship: 'With Coxen is connected the Birdstuffer of the Zoological Society, Mr. Gould, who resides at the Society's house in Bruton Street'.[91] Coxen would reappear as an important figure in the Goulds' story. In 1834 he emigrated to New South Wales and rapidly established himself as a natural history collector of some renown, after traversing the sparsely-populated Liverpool Plains, bounded on three sides by mountain ranges.[92] Gould recruited him early on as a correspondent-collector, and Chisholm notes that Coxen's regular consignments of Australian zoological specimens to

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[87] John Gould Ornithological Collection, University of Kansas, Lawrence, Kansas; Tree, *Bird Man*, 32-33.
[88] A. H. Chisholm, *The Story of Elizabeth Gould* (Melbourne: Hawthorne Press, 1944).
[89] A. H. Chisholm, 'Elizabeth Gould: Some "New" Letters', *Journal of the Royal Australian Society*, 49, 5 (1964), 321.
[90] Tree, *Bird Man*, 30.
[91] Sauer, *The Bird Man: A Chronology*, 15.
[92] A. H. Chisholm, 'Coxen, Charles (1809–1876)', *Australian Dictionary of Biography, Volume 3* (Melbourne: Melbourne University Press, 1969), 487-488.

London were a major factor in Gould's decision to undertake his great Australian expedition in 1838.[93]

No records survive of Elizabeth Gould's artistic training. Like many of her social background, it is likely that she was taught to draw by a governess or at school, an 'accomplishment' befitting a respectable young lady.[94] By 1829, when she married Gould, Elizabeth was a skilled draughtswoman and her new husband was not slow to call on her talents; her first recorded zoological illustrations, accurate depictions of Gould's taxidermy preparations that were bought by his fellow naturalists, date from 1830. In a note to Sir William Jardine, written in September 1830, Gould wrote that Elizabeth was preparing three drawings commissioned by Jardine, for his *Illustrations of Ornithology*, at a cost of £1.16.0.[95] Tree's comment that Elizabeth 'surrendered [herself] completely to the great designs of John Gould' is unfair in its connotations of unwilling labour, but acknowledges the extraordinary extent to which Elizabeth contributed to her husband's career.[96] However, like Gould himself, Elizabeth was an active participant in the scientific culture of the 1820s and 1830s, one of a very few who made their living from natural history and one, moreover, with scientific connections.

Accordingly, Elizabeth was the natural choice of both John Gould and Vigors when they decided to publish an illustrated monograph of Himalayan bird specimens. As Vigors later wrote in the preface to the *Century of Birds*, that Gould had happened across the specimens at all was a remarkable piece of good fortune.[97] The exact provenance of the collection is uncertain. However, it is clear that Tree's assertion that it was 'one of the first major

93 Chisholm, 'Coxen, Charles', 488.
94 E. Jordan, '"Making Good Wives and Mothers"? The Transformation of Middle-Class Girls' Education in Nineteenth-Century Britain', *History of Education Quarterly*, 31, 4 (Winter, 1991), 440; R. Russell, *The Business of Nature: John Gould and Australia* (Canberra: National Library of Australia, 2011), 10.
95 Sauer, *The Bird Man: A Chronology*, 22.
96 Tree, *Bird Man*, 29.
97 Gould, *Century of Birds*, 'Preface' [unpaginated].

acquisitions of the society' is unfounded.[98] Evidence in the ZSL's minute books from October 1831 demonstrates that they were not donated to the museum or to Vigors, but had been acquired directly by Gould:

> Letter read from Mr John Gould expressing his gratitude to the council and fellows of the soc for the encouragement afforded him in the publication of his work on the "Birds of the Himalayan mountains" by presenting to the soc the whole of the specimens amounting to 120 from which the drawings were taken. Thanks ordered and to be pointed out in the next General Mtg.[99]

Similarly, Vigors stated that the collection had been acquired by Gould, but does not stipulate whether the purchase had been made in his capacity as an employee of the museum.[100] The trail then runs cold, but given Gould's connections to London's specimen dealers and taxidermists, including his brother-in-law Charles Coxon, it is possible that he was alerted to their presence on the market through this route.

Gould's coyness about revealing the provenance of the Himalayan bird skins is revealing. Fifty years later, after Gould's death, *The Times* commented: 'In 1830 the accident, as it would seem, of his acquiring a fine series of birds from the hill countries in India determined his life's work in that direction'.[101] Almost nothing was then known of Himalayan fauna though, as we will see later in this study, Brian Houghton Hodgson (1801-1894), a British diplomat in Nepal, was making huge strides in this direction that were largely ignored to his

[98] Tree, *Bird Man*, 27.
[99] ZSL Minutes of Council, **II.**, 5th October, 1831.
[100] Gould, *Century of Birds*, 'Preface' [unpaginated].
[101] 'John Gould' *The Times*, 6 February 1881.

fellows back in London.[102] The bundle of some hundred or so ragged bird skins that Vigors and Gould pored over in their museum workroom was therefore invested with considerable scientific significance, and it can be no coincidence that both men chose this as their moment.

The eighty lithographs contained in Gould and Vigors' monograph are Elizabeth's work, translated from Gould's initial sketches. As even Tree, who generally takes a jaundiced view of the Goulds' marriage dynamic, notes, Gould's drawings were an integral part of the production; 'it is easy to see from the finished plate how much the picture relies on Gould's initial conception'. However, there is some justification in her qualifying remark that it is not quite so easy to imagine the finished plate from looking at the original sketch.[103] Vigors elegantly acknowledged Elizabeth's role by naming a species of sunbird in the Himalayan collection, *Cinnyrus gouldiae*, in her honour (*fig*. 7).[104] Not yet sufficiently competent an ornithologist to write the descriptions of the species himself, Gould left the text to Vigors who, in 1831, was rated as one of the foremost ornithologists in Europe. Gould limited himself to producing the work, a part which he fulfilled with great success. Such was his efficiency that he grumbled about Vigors' tardiness in supplying him with the letterpress. Though the relationship was to remain of critical importance for at least the next five years, Gould would never again delegate this work to Vigors, or indeed to anyone else.

When the first part of the *Century* appeared in December 1830, its production secured by Gould's success in drumming up the necessary custom, it immediately made his name.[105] A month earlier, the ornithologist Prideaux John Selby, whose own *Illustrations of British*

[102] Waterhouse (ed.), *The Origins of Himalayan Studies*, particularly 138-187.
[103] Tree, *Bird Man*, 33.
[104] Gould, *Century of Birds*, TAB. XLVI.
[105] [Anon.], 'Gould's Birds', *Westminster Review*, 35, 2 (Jan. – April 1841), 271-303.

Figure 9. E. Gould, *Cinnyris Gouldiae*, in J. Gould, *Century of Birds from the Himalaya Mountains* (London: J. Gould, 1831), TAB XLVI. ZSL.

Ornithology was still in production, wrote to his co-author Sir William Jardine after receiving an initial, 'teaser' illustration:

> Gould is about to publish Illustrations of Ornithology from the Himalaya Mountains. He has received an importation of very valuable skins from that interesting part of Asia, the majority of them quite new, the figures are of the natural size drawn & lithographed by Mrs E Gould, & the letter press is to be furnished by Vigors. The specimen he sent me is very tolerable.[106]

Selby's letter, as Tree notes, had the effect of piquing Jardine's interest, and Gould immediately sent the Scottish naturalist a copy of the first part of the folio, to the latter's great satisfaction.[107] Both Jardine and Selby became subscribers to the full folio, the final part of which, number twenty, finally appeared in April 1832, by which time Gould's next project, the far more ambitious, seven volume *Birds of Europe*, was well into the planning stage.[108]

There are several features of the *Century of Birds* that are immediately noteworthy. First, the illustrations themselves. Fortunately, all of the original final pattern plates for this folio have survived and have been recently digitised by the University of Kansas, one of the primary repositories of Gouldiana.[109] Printed on hard paper of a lower quality than that used for the final folio, many are covered in paint marks and scuffs, testament to repeated consultation. These demonstrate that though the preparation of the 'patterns' for this work was

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[106] P. J. Selby to W. Jardine, 30 November 1830. Newton Library, Cambridge University. The final part of Selby and Jardine's *Illustrations* would not be completed until 1834.
[107] Tree, *Bird Man*, 36-37.
[108] Sauer, *The Bird Man: A Chronology*
[109] John Gould Ornithological Collection, University of Kansas, Lawrence, Kansas (KU).

Figure 10. E. Gould, *Otus bengalensis*. Original pattern plate. KU.

Figure 11. E. Gould, *Otus bengalensis*, in J. Gould, *Century of Birds from the Himalaya Mountains* (London: J. Gould, 1831), TAB. III. ZSL.

left to Elizabeth, Gould maintained overall supervision. The final pattern for the lugubrious-looking Bengal Eagle Owl, for example, which would have served as a model illustration for the final coloured lithographs, bears his inscriptions, ‘The whole of the first [watercolour] wash rather too red’, and ‘Face much too strongly coloured’ (*fig.* 8). Whether Gould’s comments had any effect on the colourists is another matter, however: as each illustration was hand coloured, there was an unavoidable degree of variability in the final appearance of each plate, so that no two copies of a *Century of Birds* are the same. Certainly, that in the Smithsonian Collections has an even redder tint than the pattern plate (*fig*. 9).

The composition of each image is strongly redolent of eighteenth century traditions of zoological illustrations, including their total absence of background, beyond a supporting branch or rock, the better to display their key classificatory features. As Jonathan Smith observes, the ‘bird-and-branch’ mode of representation remained influential well into the nineteenth century, characterised by the rather stiff, formal manner of their depiction, as seen clearly in Elizabeth Gould’s drawing of the Eurasian jay (*fig.* 10). Even Thomas Bewick’s engravings for *A History of British Birds*, justly celebrated for their fine detail and sense of habitat, do not so much locate the birds in their natural habitat as position a generic landscape behind the bird and its branch, rather redolent of George Stubbs’ paintings of exotic mammals in idealised classical landscapes.[110] As in so much that he did, Audubon’s lively, dynamic backgrounds for the *Birds of America* were the exception to the rule in the early nineteenth century, and not all who viewed them were favourably impressed. For example, though he recognised the American’s expertise, the English publisher Neville Wood carped that not only were Audubon’s plates ‘of a needless size’, but also that ‘the birds are almost overwhelmed, in many cases, by the mass of herbage which surrounds them.’ He continued:

[110] Smith, *Darwin and Visual Culture*, 12-13. See also J. Uglow, *Nature’s Engraver: A Life of Thomas Bewick* (London: Faber & Faber, 2006), 242-262, 293-305.

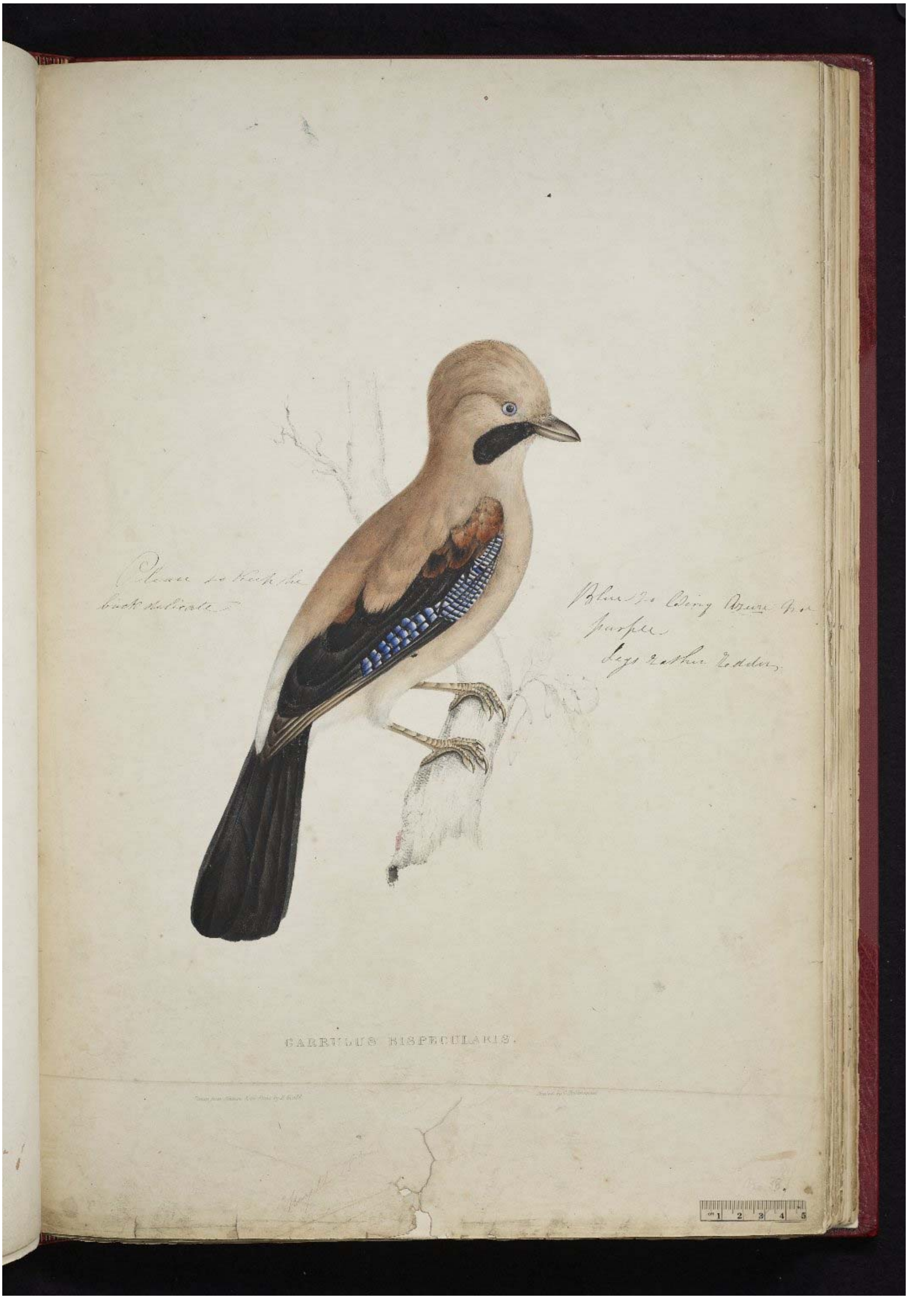

Figure 12. E. Gould, *Garrulus bispecularis*. Original patter plate. KU.

> If some of the plates were hung up as pictures, they would be taken for botanical instead of ornithological paintings; the figures of the flowers are certainly better done than those of the birds, and thus the attention is apt to be drawn exclusively to the former. This we consider a great defect; for the flowers and trees, if introduced at all, should rather be to set off the birds, as in Jardine's *Naturalist's Library*, where the principal figures are coloured, and the surrounding herbage, drawn in a light sketchy style, is uncoloured.[111]

Naturalistic backgrounds, which were to become a hallmark of Gould's folios, were introduced by him only in the *Birds of Europe*, and not developed fully by the Gould *atelier* until the 1840s with the *Birds of Australia*.

Paradoxically, one of the most immediate markers of the *Century's* originality is what it does not contain, and this, in the main, is detailed descriptions. As Vigors repeatedly observed, for many species there simply was not enough information: on where they were collected; their habitats; their habits and behaviour. Given the state of some of the skins, he could not even be sure of what they looked like in life, and he recorded casting his net wide, from Oxford's Ashmolean Museum and Glasgow's Hunterian to the private collections of Charles Shore (1796-1885), in search of other specimens that could help to confirm his identifications and classifications.[112] For Vigors, for whom the folio was less an artistic enterprise than a scientific one, this presented a problem, for the illustrations were intended to serve as proxies for the type-specimens that were central to ornithology during these decades and upon which he had based his classifications. Indeed, though all the species included in the

[111] N. Wood, *The Ornithologist's Text-Book, being Reviews of Ornithological Works; with an Appendix, containing Discussions on Various Topics of Interest* (London: John W. Parker, 1836), 77-79.
[112] N. A. Vigors, 'Preface', in J. Gould, *Century of Birds* [unpaginated].

Century, where they had not already been discovered and named, were allotted new names and classified according to his quinarian taxonomy, Vigors often had very little to base his conclusions. This is exemplified in his description of the black-crested tit (*Parus melanolophus*), a small passerine which is now considered to be a sub-species of the coal tit, found in Britain.[113]

> This is another of the same beautiful group as the last [*Parus erythrocephalus*], and inhabits the same locality. It bears, however, a still closer resemblance to the smaller Titmice of Europe; its markings and general form being nearly the same, while it is adorned with a crest equal in size to that of our crested species, *Parus cristatus* [crested tit].
>
> The head is covered with a black crest; the sides of the cheeks and occiput are white; the sides of the neck and the whole of the breast, black; the back is black tinged with silvery grey; the wings and tail brown; the sides of the chest and under tail-coverts rufous; the bill is black; the tarsi brown.
>
> The Plate represents the bird of the natural size.[114]

This brevity compares strikingly with Gould's own scientific descriptions later in the 1830s, which regularly stretched to two or three sides of imperial folio. Nonetheless, Vigors' often palpable discomfiture did not detract from the favourable reviews of the work, which almost always focused on the quality of Elizabeth Gould's lithographs. Wood's praise was lavish. 'To

[113] T. K. Shrestha, *Birds of Nepal: Field Ecology, Natural History and Conservation, Volume II* (Kathmandu: Bimala Shresthra, 2001), 71-72.
[114] Gould, *Century of Birds*, text accompanying Tab. XXX., Fig. 2, 'Parus Melanolophus' [text not paginated].

criticise any of the plates would be useless, as, in our opinion, they are all equally well executed'.[115] Crucially, they were 'correct', as well as beautiful.[116]

Wood's was not a throwaway comment. For naturalists of the era, 'truth' and beauty were not always synonymous, and many doubted the utility, even the desirability of publishing expensive illustrated works at all. Gould was not one of their number though Swainson, in 1840, was not alone in carping that Gould catered too much for the luxury market; 'We trust [Gould] will hereafter reprint these expensive volumes in such a form as that may be accessible to naturalists; and thereby diffuse science, instead of restricting it to those only who are wealthy'.[117] As had already been evident in the production of the *Century*, the production of illustrated zoological folios required a keen awareness of the compromises, financial, aesthetic and scientific, that had to be made if the work was to be a commercial success. The creation of the images was also a complex undertaking which involved not only the deployment of new and largely untested reprographic methods, but also artistic and editorial mediation on a grand scale. Illustrations in ornithological folios were far from being simple, value-free depictions of birds. Instead, they were shaped by an interlocking set of epistemological and ideological factors, and their success as zoological illustrations depended greatly upon the naturalist's skill in manipulating the visual conventions of natural history to his own ends.

[115] Wood, *Ornithologist's Text-Book,* 74.
[116] Wood, *Ornithologist's Text-Book,* 75.
[117] Swainson, *Taxidermy,* 384.

Chapter 3

Beauty and Truth: Aesthetics and the Mediated Image in Early Nineteenth-Century Zoology

As Vigors, supported by Macleay and other sympathetic naturalists, extended the influence of ‘natural classification’ in Britain’s zoological institutions, quinarian theory began to appear in an increasing variety of contexts. Museum collections had long been arranged according to the taxonomic systems adhered to by their curators, so it was not surprising that Vigors and Gould established those of the Zoological Society on firmly quinarian lines from the outset.[1] Having long been familiar to readers of the Linnean Society’s *Journal* and the Zoological Society’s *Transactions*, with the success of the *Century of Birds from the Himalaya Mountains* quinarian theory began to appear in other publishing contexts. It also shaped how folio illustrations looked, and what information the viewer was encouraged to take away. This was a result of their intended functions, both as scientific tools and aesthetic objects, and the compromises that this entailed.

Gould’s success in successfully striking these compromises as a publisher and businessman has become the dominant leitmotif for his biographers.[2] However, just as the

[1] Datta, *Gould in Australia*, 53-54. Horsfield would later attempt a quinarian arrangement of the EEIC collections: T. Horsfield, F. Moore, *A Catalogue of the Birds in the Museum of the Hon. East-India Company* (London: W. Allen, 1854-58).
[2] Tree, *Bird Man*; Datta, *Gould in Australia*; M. Lambourne, *John Gould: Bird Man* (London: Osberton, 1987).

aesthetic qualities of his publications have overshadowed their scientific content, so too have Gould's skills as an impresario obscured his work as a zoologist. Initially, much of this was of a radical nature. No great theoriser himself, at the outset of his career Gould's theoretical horizons were set by Vigors. Having enjoyed little in the way of a formal education, he gained a formidable grounding in ornithology from Vigors who, by the late 1820s, was Britain's pre-eminent authority on birds.[3] It was inevitable, given Vigors' standing within the Zoological Society, that his quinarian theory should have been rapidly established as the dominant taxonomic system, and still more so that Gould, presumably without any prior training in the discipline, should have become imbued with his ideas.

Gould's subsequent career, up until c. 1848 when the last part of his *Birds of Australia* came off the presses, is a compelling demonstration of the various means by which quinarianism was disseminated through the illustrated folio, and the ways in which zoological illustration was harnessed both to establish taxonomies and careers. *Birds of Australia*, arguably the most scientifically-important of all of Gould's publications, is also the last in which Vigors' quinarian taxonomy is applied. He had quietly but decisively dropped the system by the time the first number of his next great folio, *Monograph of the Trochilidae*, appeared in 1849.[4] This was accompanied by a marked shift in the aesthetics of his folios, which from 1849 no longer bear the visual imprint of Edward Lear (1812-1888) and, with the exception of those plates contributed by the great German wildlife artist, Josef Wolf (1820-1899), may justly be viewed as artistically-inferior to those of the first third of his career.

By the 1850s, the purpose of the illustrated zoological folio was beginning to change. In the first half of the nineteenth century, just as it had done for at least the previous hundred and fifty years, the illustrated folio had been one of the principal means by which important

[3] Tree, *Bird Man,* 18-19.
[4] J. Gould, *Birds of Australia* (London: J. Gould, 1840-48), **I.**, 'Introduction' [unpaginated].

discoveries in natural history had been presented to the scientific world. Accordingly, Gould's early publications performed several simultaneous and inter-related functions. First, and most straightforwardly, the illustrations acted as proxies for specimens, particularly when those specimens were the sole representative of a species or were otherwise difficult to access and view. In an age before photography and when specimens were often nothing more than skins, and flattened and bedraggled ones at that, illustrations served to give a reasonably-accurate impression of how the animal would look in life. This is reflected in the standard composition adopted by naturalists and their artists in their depiction of animals, almost uniformly pictured in profile and so readily identifiable by informed readers.[5] At the close of the nineteenth century this attitude was summed up by Alfred Newton, who stated that 'the chief object of zoological plates is that of affording sure means of recognising specimens on comparison.'[6]

The second function, to which this chapter will pay close attention, was to inform ways of seeing. Nineteenth-century natural history was highly visual and becoming even a competent naturalist, let alone one at the top of his profession, meant learning how to see like one. Josef Wolf's maxim, 'We see distinctly only what we know directly', could serve as a mantra for all naturalists of this period.[7] The methodology of eighteenth and early-nineteenth century science therefore privileged naturalists' ability to draw, and so record details of specimens which might otherwise be lost, either when drying them, in the case of plants, or skinning them, in the case of animals.[8] In learning how to draw, naturalists worked to and imbibed a set of conventions by which their depictions of specimens were to be governed and by which they were to be judged as scientific. In particular, they privileged an illustrative style which clearly enabled

[5] Knight, *Zoological Illustration*, 1-37. For a more general discussion, see A. S. Blum, *Picturing Nature: American Nineteenth-Century Zoological Illustration* (Princeton, N. J.: Princeton University Press, 1993).
[6] A. Newton, *A Dictionary of Birds* (London: A. & C. Black, 1893), 25.
[7] K. Schulze-Hagen, 'Art versus Science', in K. Schulze-Hagen, A. Geus, (eds.), *Joseph Wolf (1820-1899). Animal Painter* (Marburg an der Lahn: Basilisken-Presse, 2000), 219.
[8] Allen, *Naturalist in Britain*.

species to be recognised, identified, and classified, thus serving to codify natural knowledge and stabilise conceptions of species. These were the fundamental bases upon which an individual's authority as a naturalist were founded.[9]

The epistemological processes involved in this specific form of illustration have only recently begun to be addressed by historians, Jim Endersby, Jonathan Smith, Lorraine Daston and Peter Galison the most thought-provoking.[10] At the heart of Western scientific practice lies the broad acceptance of imagery as conveying reliable information about nature; a 'realistic' depiction of the natural world. Yet, as Endersby notes in relation to botanical illustration, precisely by learning conventions of depiction naturalists were also determining what they *could not* see.[11] However, notions of 'truth' and 'objectivity' being as historically-contingent as any other epistemic construct, it is important to determine exactly what eighteenth- and nineteenth-century men of science understood by 'truth' and to distinguish it from its modern connotations.

Naturalists like Macleay, Vigors, and Gould, sought to represent the underlying reality of nature, that not readily accessible to the eye or to the reason. However, they had also to demonstrate their rootedness in empirical observation. Unwilling, or perhaps unable, to adopt the thorough-going idealism of the *Naturphilosophen*, they adapted transcendentalism in ways consistent with their own, different political and institutional positions. As such, their publications, and those of his peers, are littered with the phrases 'drawn true to life', 'natural size', and 'true to nature'.[12] This did not mean that they were drawn from nature, in the sense that a modern-day wildlife artist might go out and paint animals alive and in their natural habitat, an essentially passive exercise of observation in which the artist tries to impose himself

[9] B. Dolan, 'Pedagogy through Print', 275-304.
[10] Endersby, *Imperial Nature*, 112-169; Daston, Galison, *Objectivity*, 35-39, 55-114.
[11] Endersby, *Imperial Nature*, 112.
[12] See, for example, Gould, *Century*, Tab. VI, *Muscicapa melanops*.

as little as possible. Although at great pains to ensure the fidelity of their images, naturalists and their artists exercised intervention in the production of illustrations in order to create ‘perfect’ pictorial specimens. Although often drawn with reference to a particular specimen or skin, in which case it was acknowledged in the accompanying text, the images were more frequently aggregate depictions of several specimens, prior observations, and even pre-existing drawings of the same or similar species.[13] Viewed in the modern context, these are less ‘objective’ images than exercises of artistic and empirical synthesis.

The aggregation of aesthetics, scientific conventions, and concern for scientific status has complex implications for the status of the illustrated folio. Intended to appeal to both ‘serious’ naturalists, working within established methodological and theoretical frameworks, they had also to attract a more general audience if they were to prove commercially viable. This chapter focuses on the first of these considerations, analysing the folios as scientific artefacts and demonstrating how zoological imagery was mediated in order to serve both the scientific and political ends of the ‘philosophical naturalists’ as they scrambled their way to ascendency in 1820s and 1830s London. This discussion is divided into two principal sections. The first provides context and explores the technological and scientific factors behind the rise of the illustrated zoological folio as a vehicle for information about the natural world. Examining the structure of the folio, it is asked why the format continued to be popular with naturalists as a tool by which natural knowledge was fixed and codified when other, more practical formats were available. The second, drawing upon and developing the methodology established by Daston and Galison in their ground-breaking study *Objectivity*, distinguishes exactly what was meant when naturalists referred to ‘scientific’ illustrations, and identifies the

[13] For example, Gould, *Ramphastidae*, Tab. VIII, *Ramphastos Swainsonii*, the figure of which was a composite image not created with reference to any specimen at all, but rather from Swainson’s own personal observations of the bird in its Brazilian habitat, and from a ‘sketch’ drawn by an unknown artist, for whom Swainson ‘was enabled to vouch’. Nevertheless, on this basis alone Gould pronounced the bird ‘distinct’.

definitive characteristics of quinarian illustration, with particular reference to the first examples from the 1820s and early 1830s. Building upon previous discussion of the philosophical and practical bases of quinarianism in this study, it is shown that the construction of the images was intimately connected to their role as 'type' images and debates amongst naturalists regarding the status of illustrations as scientific resources.

I.

Natural history, to an unusual extent, has always depended upon books. Indeed, the very existence of natural history as a subject was, and remains, contingent upon the recording and codification of knowledge in print. Without the identification of its particulars, and unless the different species of plants and animals encountered in nature could be distinguished and ascribed a name, our experience of nature would be purely sensuous. Books, whether in the form of cheap handbooks, field guides, or huge folios, were working tools for the nineteenth-century naturalist, deploying a system of nomenclature, scientific and vernacular, and at least a basic scheme of classification in an attempt to render the bewildering diversity of nature, and profusion of recognisable species, simple and easy to understand.

By contrast, the role of illustration in natural history books has an altogether more ambiguous history. This may strike us as surprising: natural history is perhaps the most visual of all the sciences, and illustrations can tell the naturalist, at a glance, all of the essential identificatory features of a species. It also has a long history: the first illustrated natural history book, Conrad von Megenberg's *Das Puch der Natur*, appeared in Augsberg in 1475, a mere quarter century after Johann Gutenberg introduced his printing press. It was a best seller by the standards of the time, going through six editions by 1500 and enjoyed a wide circulation.[14] This was not the beginning, of course. The flora and fauna of Europe were being studied in the field, and depicted, centuries before the advent of movable type and the woodcut block. Illustrated manuscripts, such as the famed Egerton 747, which originated in Salerno around 1300 and is now held by the British Library, suggest that artists of the period were perfectly capable of depicting plants and animals with considerable accuracy.[15]

Natural history illustration was bound by a rigorous set of conventions. Many of these conventions were entrenched during the late eighteenth-century and privileged clarity of outline over colour, a response to the concerns of naturalists in the Linnaean era, which were overwhelmingly directed towards the identification of specimens in drawers than live animals in a state of nature. These conventions proved to be deeply entrenched well into the 1860s and 1870s, causing Wolf to complain to his biographer:

> Some of the ornithologists don't recognise nature – don't know a bird when flying. A specimen must be well dried before they recognise it… Among the naturalists there were some who are very keen about scientific correctness, but who have no artistic feeling. If a thing is artistic, they mistrust it. There must be nothing right in perspective. There must be nothing but a map of the animal, and in a side view. They only know a bird when they handle the skin. It is impossible, for instance, for a mere museum man to know the true colour of the eyes.[16]

[14] W. A. Locy, 'The Earliest Printed Illustrations of Natural History', *The Scientific Monthly,* 13, 3 (Sep., 1921), 238-258, 238, 239-251.
[15] Allen, *Books and Naturalists*, 24; M. Collins and S. Raphael (eds.), *A Medieval Herbal: A Facsimile of British Library Egerton MS 747*, (London: British Library, 2003).
[16] A. H. Palmer, *The Life of Joseph Wolf, Animal Painter* (London: Longmans, 1895). See also Schulze-Hagen, *Joseph Wolf*, 219.

The allusion to ‘maps’ and map-making is revealing, for the illustrations were indeed designed to quickly direct the viewer towards the most salient points of interest, those points of anatomy, colouring, and general ‘look’ by which a species would be recognised and classified. In this, they bear a resemblance to the simplified illustrations found in wildlife field guides today.

Pure scientific illustration in the eighteenth-century manner so despised by Wolf had ancient precedents: illustrations in medieval herbals, of which it is easy to scoff on account of their apparent crudeness, display a similar stylisation that served merely to remind their learned viewers of a plant’s general appearance, with only the key characters highlighted.[17] The subsequent development of botanical illustration owed much to these herbals: the ability to recognise plants with medical applications had, for thousands of years, been recognised to be of the most pressing importance, and it is not surprising that botany should have had such a marked head start over all the other branches of natural history. By contrast, zoological illustration particularly of birds, developed in response to more light-hearted pastimes, with an emphasis on distinguishing between different types of birds seen by several authors as the by-product of the passion of medieval nobles for falconry.[18] The Emperor Frederick II’s treatise on ornithology and falconry, *De Arte Venandi cum Avibus*, written in the 1240s, is an exemplar

[17] E. S. Rohde, *The Old English Herbals* (New York: Dover Publications, 1971, repr. of Longmans, Green, 1922), 193.
[18] Allen, *Books and Naturalists*, 25: F. N. Egerton, ‘A History of the Ecological Sciences, Part 8: Frederick II of Hohenstaufen: Amateur Avian Ecologist and Behaviourist’, *Bulletin of the Ecological Society of America*, 84, 1 (Jan., 2003), 40-44.

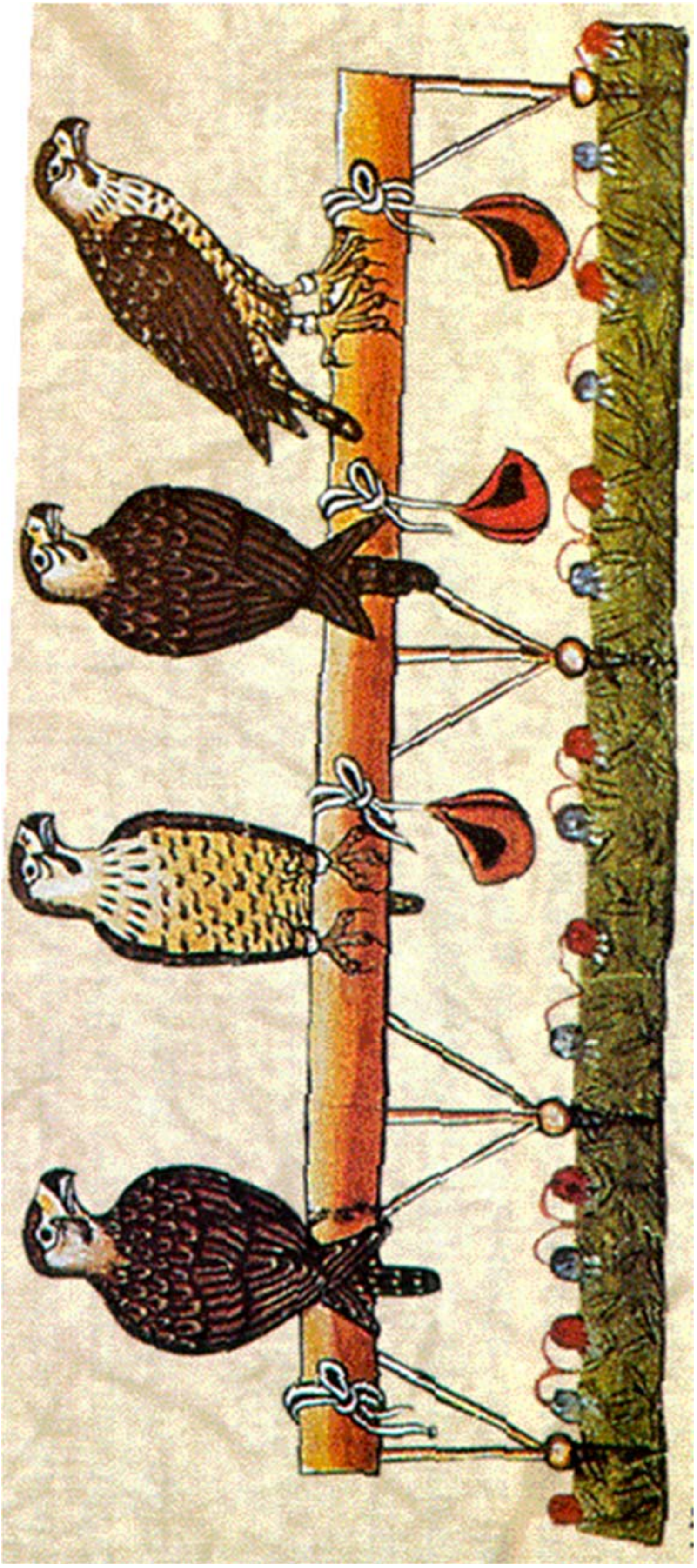

Figure 13: Illustration of falcons, Emperor Frederick II, *De Arte Venandi cum Avibus*, Bibliotheca Vaticana, Pal. lat. 1071.

of its kind. Gloriously illustrated with strikingly life-like illustrations of falcons and hawks, Frederick's book is principally dedicated to the minute description and classification of his avian subjects, his intention to describe things as they are ('que sunt, sicut sunt') a reminder that the concerns of eighteenth and nineteenth-century naturalists were far from new (*fig.* 11).[19]

The proliferation of print in the nineteenth century brought illustrated natural texts to a wider audience. However, publishing remained an expensive business well into the 1850s. The heavy paper duties imposed in 1815 by a government suspicious of radical pamphleteers were halved in 1836, followed by the repeal in 1855 of the Stamp Act of 1712, which had imposed duties on almanacs as well as on newspapers.[20] As Martin Hewitt demonstrates, the repeal of the act owed more to the concern of William Gladstone (1809-1898), then Chancellor of the Exchequer, to shore up the waning popularity of a government mired in the Crimean War, and little to the radical campaigns for an end to taxes on knowledge that dated back to the 1830s.[21] This was followed up in 1860 by Gladstone's Budget which proposed the repeal of all paper duties. The persistent suspicion of universal access to print, and paper-makers' fear of cheap French imports, was such that the proposals were quickly defeated in the House of Lords, and it was left to Gladstone to force them through in the following year by tacking them on to a reduction in income tax.[22] The impact of these measures was considerable. In 1856, *The*

[19] Birkhead, *Wisdom of Birds*, 137-139; C. H. Haskins, 'The "De Arte Venandi cum Avibus" of the Emperor Frederick II', *The English Historical Review*, 36, 143 (Jul.,1921), 337-339; W. B. Yapp, 'The Illustrations of Birds in the Vatican Manuscript of "De arte venandi cum avibus" of Frederick II', *Annals of Science*, 40 (1983), 597-634.

[20] H. Dagnall, *The Taxation of Paper in Great Britain 1643-1861: A history and documentation* (Edgware: Harry Dagnall & The British Association of Paper Historians, 1998), 15.

[21] M. Hewitt, *The Dawn of the Cheap Press in Victorian Britain: The End of 'Taxes on Knowledge*', 1849-1869 (London: Bloomsbury, 2013), 59-75.

[22] Hewitt, *Dawn of the Cheap Press*, 80-83; R. Shannon, *Gladstone: Peel's Inheritor, 1809-1865* (London: Penguin, 1999), 414, 416-417, 436-442.

Spectator noted the rush of printing speculation that immediately followed the Stamp Act's repeal:

> Under the Newspaper Stamp Act, which received the Royal assent on the 15th June 1855, newspapers to be sold for a penny sprung up in numerous towns. In the course of a few weeks many of them ceased to appear, and at the close of the year only a few were surviving in the larger towns.[23]

Naturalists were not slow to exploit the reduced prices, either, or the developments in technology that had accompanied them. After centuries of stasis, the book trade was at last liberating itself from archaic technology that had not substantially changed since Megenberg printed his natural history. Though partly stymied by paper taxes, the demand for printed materials reached such a level by 1800 that the development of faster means of production had become an insistent demand. Cast-iron presses had replaced wooden presses by 1800, and in 1807 steam-power was brought to bear on the printing industry in the form on an all-purpose paper making machine, followed seven years later in London by the first commercial steam press. Although type-setting remained frustratingly-bound to the old ways, not changing until later in the nineteenth century, by 1830 the speed of presses had increased some twenty-fold.[24]

Again, the immediate benefit was felt by newspaper and magazine publishers. Book production, with typical runs of one or two thousand, had less need for factory methods, and it was not until the 1830s that mechanised methods began to be adopted by book publishers. However, the new printing techniques opened up a whole range of formats to naturalists and

[23] [Anon.], 'Progress of Speculation', *The Spectator*, 5 January 1856, 34.
[24] Allen, *Books and Naturalists*, 181-186.

natural history publishers, with a gradual switch from the huge folios of the eighteenth century to cheaper octavos and duodecimos, which used less paper and were popular with amateur naturalists.

That zoologists, in particular, should have stuck to the folio as long as they did is one of the most curious aspects of the history of natural history publishing. William MacGillivray (1796-1852), the Scottish ornithologist and artist, may have counselled his friend and collaborator Audubon to adopt a smaller, more manageable format for his projected American ornithology, but Audubon was far from being alone amongst their contemporaries in thinking big. Despite the increasing popularity of cheaper works, the golden age of the illustrated natural history folio still lay in the future in 1830, with vast ornithological works a characteristic feature of British zoology well into the 1860s.

Figure 14. P. Paillou, *The Heron*, in T. Pennant, *British Zoology* (London:

Cymmrodorion Society, 1761-66).

Onithology's premier place in the zoological branch of natural history during the early-nineteenth century can be traced back to Thomas Pennant (1726-1798), friend of Banks and Gilbert White (1720-1793) and who played an important role in widening the British market for bird books. Essentially a populariser who had little interest in Linnean classification, seeing no reason to move from John Ray's 'natural' system, Pennant's *British Zoology* (1761-1766) was the first major contribution to the subject since Ray and Willoughby's *Ornithologia* of 1675.[25] The work, despite its title, leans heavily towards ornithology, and in a foreshadowing of things to come, Pennant employed Peter Paillou (c.1720-1790) as illustrator.[26] Unusually, given their expense, the illustrations in the first edition were hand coloured throughout, and in contrast to the somewhat terse descriptions which reveal Pennant's sketchy zoological knowledge, are of considerable quality (*fig.* 12).[27] In later editions, published by Gilbert White's brother, Benjamin, and aimed towards a more popular market, the engravings are far fewer in number and uncoloured.[28]

Pennant's work blazed a trail. It the seventy years between the publication of *British Zoology* and the first of John Gould's folios, at least five major, multi-volume illustrated works on birds were published in Britain.[29] Of these, Prideaux John Selby's *Illustrations of British Ornithology*, published in parts between 1821 and 1833, is the most notable, both for the extraordinary quality of its plates, many of which were executed and engraved by Selby (1788-

[25] T. Pennant, *British Zoology* (London: Cymmrodorion Society, 1761-66).
[26] C. E. Jackson, *Bird Etchings: The Illustrators and their Books, 1655-1855* (Ithaca: Cornell University Press, 1985), 106-108; V. Dickenson, *Drawn from Life: Science and Art in the Portrayal of the New World* (Toronto: University of Toronto Press, 1998), 164.
[27] Pennant could produce some solid zoological work. For example, T. Pennant, 'Account of the Different Species of the Birds, called Penguins', *Philosophical Transactions (1683-1775)*, 58 (1768), 91-99.
[28] T. Pennant, *British Zoology, Fourth Edition* (London: Benjamin White, 1776-1777).
[29] W. Lewin, *The Birds of Great Britain, with their Eggs*, first edition (London: W. Lewin, 1789-1794), 7 vols.; E. Donovan, *The Natural History of British Birds* (London: Rivington, 1794-1819), 10 vols.; W. Lewin, *The Birds of Great Britain, with their Eggs*, second edition (London: W. Lewin, 1795-1801), 8 vols., G. Graves, *British Ornithology* (London: G. Graves, 1811-1821), 3 vols.; P. J. Selby, *Illustrations of British Ornithology* (London: Constable, 1821-1833), 2 vols.

1867) himself. At least one contemporary reviewer believed that Selby had successfully reconciled the artistic and the scientific:

> The most masterly work, on the whole, that has yet appeared on the birds of Britain. The first edition is on the system of Temminck, with one or two improvements… The descriptions of habits, nidification, &c., are sufficiently full for a systematic work, and always correct… [T]he plates now claim our attention… Every individual of the families *Falconidae* (diurnal birds of prey) and *Strigidae* (owls) would make a perfect picture of itself, so beautifully and correctly are they executed… [they] have certainly never been equalled – even by Gould and Audubon.[30]

Selby's biographer, Christine Jackson, echoes this praise, judging the images as being the high point of engraving in Britain, and also for being one of the last such works to use the technique (*fig.* 13).[31]

From 1830, naturalists began to abandon the technique which, though capable of remarkable results, as Selby's and Audubon's plates amply demonstrate, carried with it great disadvantages. To start with, they were hugely expensive to produce: engraving is a highly-skilled illustrative process which, almost always, required the services of a professional engraver. William Withering (1741-1799), an English botanist who produced the first flora of national scope for a non-specialist audience, incurred printing costs of over £500, or around

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[30] N. Wood, *The Ornithologist's Text-Book, being Reviews of Ornithological Works; with an Appendix, containing Discussions on Various Topics of Interest* (London: John W. Parker, 1836), 40-41.
[31] C. E. Jackson, *Prideaux John Selby: A Gentleman Naturalist* (Stocksfield: Spredden Press, 1992), 39-50.

£40,000 in today's values, in the production of *The Botanical Arrangement of All the Vegetables Naturally Growing in Great Britain* (1787).[32] For others, without Withering's personal wealth, the decision to produce an illustrated folio could be ruinous. Even Audubon, particularly in the early stages of the production of *Birds of America*, frequently found himself at the edge of a financial abyss.[33]

Naturalists were prepared to run these risks so that their folios attracted subscribers. Allen characterised the part-work folio as 'a book masquerading as a periodical', and has painted a vivid picture of the daunting difficulties that naturalists faced in embarking on such ventures, likening it to the erection of a large building.[34] For John Gould and his fellow publisher-naturalists, it had the advantage that money was paid by subscribers in advance, which could then be banked and cashed before the final printer's bill had to be paid. It also allowed the production of illustrations, which was both a lengthy and expensive process, to be staggered. Indeed, although it had clear financial attractions, the process was principally artist-driven. Scientifically worthy the works had to be, but it was the illustrations that reeled in the subscribers.

The more colourful these illustrations, the better. Many naturalists, such as the botanist Joseph Dalton Hooker (1817-1911), intended their publications for a specialised scientific audience. Accordingly, the illustrations which he included in his works conformed to a rigidly 'scientific' standard: sparse, monochromatic line drawings which related the essential information about the plants they depicted. It is notable that the plants are very rarely shown in their habitat, a feature reflected in zoological works well into the 1850s. These works sold

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[32] Allen, *Books and Naturalists*, 99.
[33] W. Souder, *Under a Wild Sky: John James Audubon and the Making of the Birds of America* (Minneapolis, MN: Milkweed Editions, 2014), 195-227.
[34] Allen, *Books and Naturalists*, 155-156.

Figure 15: P. J. Selby, ‘Tufted Pochard, Male’, in *Illustrations of British Ornithology* (London: Constable, 1821-1833), Vol. 2, *Water Birds*. GNM.

poorly: although meeting the needs of knowledgeable botanists, they held little appeal for the growing ranks of amateurs, being both expensive and highly technical. However, although he dismissed colour illustration as a waste of money, even Hooker dipped his toe into the colour folio market with *Rhododendrons of the Sikkim-Himalaya* (1849), the product of his famous expedition into northern India and Nepal in 1845.[35] Employing the superlatively-talented botanical artist Walter Hood Fitch (1817-1892), Hooker's folio was a sensation; despite being priced well-beyond the means of most Britons, it is credited by Hooker's latest biographer, Jim Endersby, with launching the young botanist's career and sparking off a nationwide craze for rhododendrons.[36]

Hooker's task was made considerably easier with the introduction to Britain of lithography and its widespread adoption in the 1820s.[37] The lithographic process was invented in late eighteenth-century Germany by Alois Senefelder (1771-1834) and first showcased in Britain in 1801. By 1819, Charles Hullmandel (1789-1850) had opened his first lithography establishment in London, and in the same year was awarded the Society for the Advancement of the Arts' Silver Medal.[38] Less costly than engraving and, particularly after the print 'revolution' of the 1820s, became increasingly popular with artists for the control it allowed them over the reprographic process. Previously the artist's initial conception, often set out in a preliminary detailed watercolour, had to be interpreted by trained engravers. Artists with the

[35] J. D. Hooker, *The rhododendrons of Sikkim-Himalaya : being an account, botanical and geographical, of the rhododendrons recently discovered in the mountains of eastern Himalaya, from drawings and descriptions made on the spot, during a government botanical mission to that country* (London: Reeve, Benham, and Reeve, 1849-51), 2 Vols.
[36] Endersby, *Imperial Nature*, 121.
[37] This is described in detail by Knight, *Zoological Illustration*; C. E. Jackson, 'H. & N. Hanhart: printers of natural history plates, 1830-1903', *Archives of Natural History*, 26, 2 (June, 1999), 287-292.
[38] C. Hullmandel, D. Redman, D. Napier, J. Barraud, 'Papers in Polite Arts', *Transactions of the Society, Instituted at London, for the Encouragement of Arts, Manufactures, and Commerce*, 37 (1819), 53.

skill to engrave their own work were exceptional and even artist-engravers such as Thomas Bewick were occasionally let down by poor work from the printers.[39]

Senefelder's process, by contrast, could be learned quickly by anyone, though mastery of the technique was achieved by only a select few, including Fitch in botanical illustration and Edward Lear in ornithological work. Hullmandel outlined his technique in his letter to the Society for the Arts. Drawing directly onto a smooth slab of fine-grained limestone with a greasy, 'soapy' pencil or crayon, the lithographer did not need the special skills and paraphernalia required for engraving. The fatty acids contained in the wax react with the limestone, creating an insoluble 'lime soap' that soaks up ink but repels water. Once the image is drawn, the entire stone surface is covered in a solution of nitric acid and gum arabic, 'fixing' the drawing on the stone. The surface is then washed and, while still damp, rolled with printing ink and sent through a press, producing a monochromatic reversed image.[40] Although trained engravers were capable of remarkable effects, lithography allowed for free, sweeping lines that are difficult in *intaglio* printing processes. This was quickly discovered to be of particular use in the depiction of birds. William Swainson was one of the first into the field with the first series of his *Zoological Illustrations* (1820-1821), in which he deployed lithography with a verve that should remind historians that his skill both as an artist and ornithologist pre-dated his quinarian enthusiasm (*fig.* 14). However, its full potential was first demonstrated in Lear's extraordinary plates for his own *Monograph of the Psittacidae* (1830) and for John Gould's early folios.[41]

[39] J. Uglow, *Nature's Engraver: A Life of Thomas Bewick* (London: Faber & Faber, 2006), 157-158.
[40] Hullmandel *et al*, 'Papers in Polite Arts', 53-57. See also A. Senefelder, *The Invention of Lithography* (New York: Fuchs and Lang, 1911 ed.).
[41] W. Swainson, *Zoological Illustrations* (London: Baldwin, Cradock & Joy, 1820-21), 3 vols; E. Lear, *Illustrations of the family of Psittacidae, or parrots: the greater part of them species hitherto unfigured, containing forty-two lithographic plates, drawn from life, and on stone* (London: E. Lear, 1832).

Figure 16: W. Swainson, ‘Groove-billed aracari’, *Zoological Illustrations*, first series (1820-23), pl.44. ZSL.

The adoption of lithography as the dominant illustrative process by naturalists in the 1820s reflected the optimisation of illustration techniques to keep pace with shifting emphases in zoological discourse. As well as being a cheaper alternative to engraving, lithography allowed naturalists to depict their subjects with a greater degree of realism than had previously been possible except by employing the most skilled engravers. Most importantly, the process gave naturalists far greater control over the production of the images. Unless the naturalist himself, or the artist he employed, was skilled in the technique, as in the case of Selby, an engraver would be tasked with copying the initial watercolour paintings or drawings to the printing surface.[42] Given that the engraver would not necessarily be well-versed in animal anatomy, for example, this was an interpretive process fraught with potential difficulty, as Audubon found to his cost in his dealings with the Edinburgh engraver W. H. Lizars (1788-1859) in the production of the first plates of *Birds of America*.[43]

The final considerations to note in the continuation of the folio format are structural. The folios Gould produced adhered to a layout dictated by a combination of precedent, the demands of museum-based naturalists, and the constraints imposed by Gould's socially-elite audience. As the subscription lists appended to all of the folios demonstrate, there is a degree overlap in these two groups, with a high proportion of the aristocratic individual subscribers holding fellowships or higher positions in the scientific societies also targeted by Gould.[44] Of the subscribers to *A Century of Birds*, Lord Stanley (1775-1851) was later the president of the Zoological Society, and the Duke of Somerset (1775-1855) was President of the Royal Institution and later of the Linnean Society. Similarly, many of the individual subscribers were also well-established naturalists and men of science in their own right. Vigors and Swainson both owned copies of the folio, as did Audubon, Cuvier, Thomas Hardwicke, Thomas Pennant,

[42] C. E. Jackson, *Gentleman Naturalist*. Selby produced many of the engravings for his book of British birds.
[43] M. R. Audubon, E. Coues, (eds.), *Audubon and his Journals* (London: John C. Nimmo, 1898), **I.**, 79-342.
[44] Gould, *Century of Birds*, 'List of Subscribers'.

Prideaux Selby, Sir William Jardine, John Edward Gray, and J. E. Children of the British Museum. The scientific concerns of these men demanded that the folio adhere to a structure and format, including the use of standardised terminology and the order in which descriptions of species and higher taxa are arranged, that facilitated its use as a source of scientific authority. This had then to be balanced with the more general intellectual interests of those like Lady Caroline Fox (1767-1845), the bluestocking niece of the Whig statesman Charles James Fox, and Frances Mary Currer (1785-1861), a niece of Robert Clive and a prolific book collector whose personal library at Eshton Hall was reckoned by contemporaries to be surpassed only by those of Earl Spencer (also a subscriber), the Duke of Devonshire, and the Duke of Buckingham.[45]

Sara Scharf, analysing a closely-related branch of natural history publishing, notes that the great majority of nineteenth-century botanical identification manuals are composed of three parts, each of which complement one another in the final aim of identifying the specimen at hand. The first part usually contains at least one identification key which guides the reader through a series of steps towards the organism which s/he wishes to identify and an associated entry in the next section. This contains descriptions, sometimes accompanied by illustrations, which are arranged according to the taxonomy adhered to by the author(s). Finally, there is an alphabetical index, which directs the more expert reader immediately to the description required.[46]

This basic 'tripartite' structure holds good with similar ornithological publications from the nineteenth century through to the present. Gould's folios can also be seen as adhering to a

[45] A. Lister, 'The Lady of Eshton Hall', *Antiquarian Book Monthly Review*, 12 (1985), 382–9; Z. Kinsley, 'Dorothy Richardson's Manuscript Travel Journals (1761-1801) and the Possibilities of Picturesque Aesthetics', *The Review of English Studies*, New Series, 56, 226 (Sep., 2005), 611-631, 620.
[46] S. T. Scharf, 'Identification Keys, the "Natural Method," and the Development of Plant Identification Manuals', *Journal of the History of Biology*, 42, 1 (Spring, 2009), 73-117, 83-84.

similar overall structure, although one with several crucial modifications. His first work is, in this respect, something of an outlier, containing only a Preface, Introduction, list of subscribers, list of plates, and descriptive section (including illustrations). There is no key, still less an index. However, the list of plates serves also to *act* as a key. Organised according to the quinarian hierarchy of higher taxa and listing species by their Latinate and common names, it guides the reader to the appropriate page. This basic structure, combined with the detailed descriptions and standardised, quinarian nomenclature and taxonomy, would suggest that Gould and Vigors presupposed a certain degree of ornithological knowledge on the part of a large section of their readership: at the very least, the ability to trace a species by its position within its 'natural' grouping and Latinate binomial. This layout could also be a response to the lack of available information about many of the species figured. As Vigors' occasionally-sparse descriptions attest, sometimes all that was known of a species was its name and the ragged skin which bore it.[47]

Gould's other single-volume folios of the 1830s, the monographs on the *Ramphastidae* (toucans) and *Trogonidae* (trogons), both deal with single families of birds and are accordingly more detailed, the former even containing an appendix composed by Richard Owen (1804-1892), already a famed comparative anatomist and a lifelong friend of Gould, which described and analysed the more notable aspects of the toucans' bizarre anatomy.[48] The Introduction to *Monograph of the Ramphastidae* includes highly-detailed descriptions of the species in the genus, a world away from the sparse notes in *A Century*, which contain minute categorisations of species and their specific characteristics. In a reflection of the standards of the age, Gould's tabular arrangement of the species within the family *Ramphastidae* is written in Latin. Again, the list of plates doubles here as an identification key, the place of the identification key proper

[47] For example; Gould, *Century of Birds*, Tab. XI, *Lanius Erythropterus.*
[48] R. Owen, 'Anatomy of the Toucans', in J. Gould, *Monograph of the Ramphastidae* (London: J. Gould, 1834-35).

taken by the list of subscribers, a telling comment on the compromise between commerce and science ever-present at the heart of Gould's works.[49]

However, the issue of scientific authority, and zoological originality, was never far from Gould's mind. That the folio represents a real contribution to ornithology is clear upon even a cursory reading. Gould presented here numerous species that were new to British zoology and which he had himself identified for the first time, such as the 'Chestnut-eared aracari', which he had very recently described in the *Proceedings of the Zoological Society*.[50] In the preface to the *Ramphastidae*, we find Gould at pains to distinguish the work from previous works on the family by pointing to the many new species described and figured in the folio for the first time, and also their arrangement:

> [Motivated] from a desire to revise and set faith in as clear a light as possible the numerous species which this family contains, endeavouring at the same time to show their affinities to each other, by which they seem to divide themselves even into more minute groups than those of genera, - groups which are characterised by peculiar and unvarying though subordinate points of difference… [A]dhering to the established genera of Ramphastos and Pteroglossus, I have thrown the members of each together, as far as my views go, according to the indications of nature in their natural affinities.[51]

[49] Gould, *Ramphastidae*, 'Introduction', xxi.
[50] *Proceedings of the Zoological Society,* 1836, part I, p. 119.
[51] Gould, *Ramphastidae*, 'Preface'.

Having thus unambiguously declared his allegiance to the natural system, as well as the claims of his work to pre-eminence, Gould fortifies his position in the descriptive part of the work by liberally citing the work of other, more established ornithologists. He begins this process at the very outset of the work, dedicating it to the eminent Dutch naturalist Coenraad Temminck (1778-1858), ‘in testimony of the highest esteem for his valued and extensive labours in the field of Natural Science’.[52] Temminck’s work is cited throughout, an appropriate expression of respect which also served to set Gould’s work within an established and prestigious tradition.

The principal structural differences between the zoological folio and the identification guides, both botanical and ornithological, stemmed from one principal factor. The keys in botanical works of the eighteenth and nineteenth centuries, and those in late nineteenth-century ornithological guides such as Coues’ seminal *Key to North American Birds*, all relied upon the reader having a dead specimen to hand in the process of identification. In the case of Gould’s folios, this was clearly impossible given the pioneering nature of many of the early folios, all of which described species which were known only by one or, at most, a handful of specimens. In the case of those known only by a single specimen, the illustration and description were drawn from the *type specimen*, the skin from which the species was identified, named, and henceforth anchored. Indeed, the illustration served a purpose broadly analogous to the type specimen, many of which found their way into Gould’s private collection, guarded jealously, and therefore of limited access to other naturalists.[53]

This single detail transforms the status of the illustrations in these folios, from being accompaniments to the accompanying description, which always assumed priority in identificatory guides, to assuming equal weight with the text. Indeed, the two cannot be used

[52] Gould, *Ramphastidae*, ‘Preface’.
[53] Gould, *Birds of Australia*, ‘Introduction’, i-xi.

effectively without reference to the other, given their shared origin in the same specimen(s). That these specimens were often limited in what they could tell naturalists about the living animal only served to tie the illustration more closely to the written description. Gould recognised the limitations inherent in museum specimens in his description of the 'Red-billed toucan': 'The present species, as its name implies, is distinguished by the brilliant colouring of its beak, which loses its original brightness immediately after death, so that the specimens exhibited in our museum might often be mistaken, upon a superficial glance, for another species.'[54]

[54] Gould, *Ramphastidae*, Plate 3.

Figure 17. E. Lear, *Ramphastos erythrorhynchus*, in J. Gould, *Monograph of the Ramphastidae* (London: J. Gould, 1834), Tab. III. ZSL. [Courtesy of James Godwin.]

The illustration (*fig.* 15), considered as specimen revivified and corrected through reference to the detailed notes which Gould required his collectors to include with their shipments, therefore could bear surprisingly little resemblance to the type skin from which it was derived. There are a host of issues that spin off from this about artistic intervention which will be addressed a little later, but first it is instructive to regard these images within the specific conception of 'objectivity' which informed notions of a satisfactory scientific illustration.

II.

The removal of one layer of mediation in the production of these images, and the resultant concentration of control in the hands of the individual naturalist, is an indication of increasing specialisation in natural history in the first decades of the nineteenth century. Large, 'sumptuous' folio illustrations became increasingly theory-laden, their composition and colouring intended to do more than please the eye of the reader.[55] Further, they were to be interpreted in close conjunction with the written description which accompanied them. As well as continuing to serve their time-honoured function as identification tools, allowing the reader to compare a specimen or a sighting with the illustration in front of him, colour illustrations were increasingly intended to serve as proxies for type specimens. These *iconotypes* were of particular importance where the species they depicted were poorly represented in European specimen collections or otherwise difficult to access, serving as the nomenclatural types of zoological names.[56] The large format adopted by the likes of Prideaux Selby and John Gould, in which species were depicted to as near life-size as possible and in great detail, was not only

[55] Dolan, 'Pedagogy through Print', 275-277.
[56] N. P. Taylor, 'Iconotypes and Cacti in Curtis's Botanical Magazine', *Curtis's Botanical Magazine,* 20, 3 (2003), 177-179.

intended to impress subscribers. By making the salient identificatory features more visible, it gave museum naturalists a better grasp of where the animals stood in relation to other species than smaller illustrations and so, theoretically, aided the construction of more accurate classificatory systems.

This was of particular importance for zoology. For centuries, despite the promising start made by Aristotle, zoology had lagged behind botany, particularly in the field of systematics. As Atran notes, there was little advance of zoological systematics for the two centuries before Linnaeus presented his system to the world in the 1740s.[57] Several of the reasons behind this were simple enough, but they clearly indicate why the discovery of so many new species of animal from c.1750 threw zoological systematics into disarray. First, the number of known plant forms far outstripped those of animals, which encouraged botanists to establish sophisticated systems of classification relatively early on. Second, the manner of preserving plant specimens was altogether simpler and more effective than those used to preserve animals. Herbaria of dried botanical specimens were durable and easily accessed, in stark contrast to the use of alcohol as the main method of preserving complete zoological specimens. As Paul Farber notes, although suggested by Robert Boyle as far back as 1663, alcohol came into general use only at the start of the eighteenth century and was ineffective at preserving skin and plumage, the structure and colours of which quickly deteriorated.[58] Finally, live animals were simply harder to capture than plants and correspondingly more difficult to display in menageries which, in comparison with botanical gardens, were far less representative of world, or even regional, fauna.[59] This all meant that the influx of zoological specimens into Europe in the eighteenth century placed extant systems of classification under great strain, exposing their

[57] Atran, *Cognitive Foundations*, 188-190.
[58] Farber, 'Development of Taxidermy', 551-553.
[59] Atran, *Cognitive Foundations*, 190.

inadequacies and making the search for more sophisticated taxonomies, such as those devised by botanists in preceding centuries, an urgent priority.[60]

This placed considerable emphasis on specimen collections as a means of codifying species definitions and the construction of classificatory systems. The problems with this were numerous. The most serious is that, from early on, naturalists realised that dead specimens, either as flattened skins or stuffed into an approximation of their appearance in life, were of secondary importance to the understanding of animals. Although giving an impression of external appearance, skins revealed little of the relation of external anatomy to the functioning of internal organs, behaviour, or movement. Unlike botanists, who could largely ignore the internal structure of plants in the search for structural similarities owing to the ease of differentiating them on external appearance alone, zoologists found it extremely difficult to disregard internal anatomy. Much more complex than internal plant structures, internal organs showed themselves more indicative of 'natural' affinities.[61] However, whatever their preference, zoologists had to work with the materials at hand, and the result was the curious paradox that, despite recognising the limitations of dried specimens, zoologists began to invest external characters with the same level of importance as features of internal anatomy and classify organisms accordingly.[62]

The emphasis on specimen collections, and particularly type specimens, as the principal repositories of zoological authority meant that the illustrations in the folios had therefore to be representative of the *species* and not merely of one individual of the species. This entailed the development of a particular kind of scientific objectivity which Daston and Galison, in their formative analysis of scientific visual epistemologies, term 'truth-to-nature', closely linked to

[60] See P. Corsi, *The Age of Lamarck: Evolutionary Theories in France, 1790-1830* (Berkeley, CA: University of California Press, 1988), 1-23.
[61] Wilkins, *Species*, 97-127.
[62] Atran, *Cognitive Foundations*, 190-194.

what has been persistently misidentified by many historians of science as ‘essentialism’, as explored in the previous chapter.[63] Typological thinking and Daston and Galison’s theory of scientific representation highlight the surprising homogeneity in methods deployed by naturalists, working with a diverse but far from perfect specimen base, who sought to interpret the nineteenth-century natural world, and it would be easy to conclude from their aggressively-selective approaches to both classification and illustration that they truly adhered to a classical essentialism. This, however, would be quite mistaken, and to see why we need first to recognise that ‘objectivity’ and ‘subjectivity’ are historically-contingent concepts that have changed radically over the course of the past two hundred years.

Objectivity in illustration and depiction, as now understood to mean the rigorous delineation of a specimen in a manner unclouded by preconception and prejudgement, and preferably with the aid of a mechanical device that would eliminate human error, was new to the nineteenth century. Dubbed by Daston and Galison as ‘mechanical objectivity’, this way of seeing and interpreting the world was intimately tied to the new focus of the biological sciences from the mid-century onwards, away from the classificatory concerns of the preceding decades and towards an understanding of the structures and relationships between organisms that characterised the immediate post-evolutionary period.[64]

By contrast, early-nineteenth century naturalists sought to represent the underlying reality and order of nature, and used classificatory systems as one of their principal methodological tools. The images they produced were intended to facilitate this search for natural laws, which became one of the most characteristic of all nineteenth-century scientific preoccupations. Here, art and science converged in tangled judgements of truth and beauty, themselves products of a broader philosophical and cultural shift in which traditional, teleological explanations of

[63] Daston and Galison, *Objectivity*, 42.
[64] Daston and Galison, *Objectivity*, 83.

organisms and their structure were under intense pressure and, by many naturalists, rejected altogether.

There are small but telling signs that can serve as our starting point. Gould's folios, and those of his peers, are littered with the phrases 'drawn true to life' and 'true to nature'.[65] This did not mean that they were drawn from nature, in the sense that a modern-day wildlife artist might go out and paint animals alive and in their natural habitat, an essentially passive exercise of observation in which the artist tries to impose himself as little as possible. Although at great pains to ensure the fidelity of their images, naturalists and their artists exercised intervention in the production of their images in order to create 'perfect' pictorial specimens. Although often drawn with reference to a particular specimen or skin, in which case it was acknowledged in the accompanying text, the images were more frequently aggregate depictions of several specimens, prior observations, and even pre-existing drawings of the same or similar species.[66] Even when the birds were set in an approximation of their natural habitat, a method Gould deployed from 1832, when viewed in the modern context these are less 'objective' images than exercises of artistic and empirical synthesis.

Images that depicted *individual* animals were regarded with deep suspicion by many naturalists, who regarded them as insufficiently scientific for their purposes. Initially, this seems curious, if not absurd: after all, what better demonstration of the exercise of empirical values than the depiction of the individual? However, they did not meet with the particular requirements of museum-based naturalists, a prominent number of whom disparaged the use of any imagery at all, who feared that imagery would dull the perceptive faculties and simply

[65] See, for example, Gould, *Century*, Tab. VI, *Muscicapa melanops*.
[66] For example, Gould, *Ramphastidae*, Tab. VIII, *Ramphastos Swainsonii*, the figure of which was a composite image not created with reference to any specimen at all, but rather from Swainson's own personal observations of the bird in its Brazilian habitat, and from a 'sketch' drawn by an unknown artist, for whom Swainson 'was enabled to vouch'. Nevertheless, on this basis alone Gould pronounced the bird 'distinct'.

encourage superficial observation. As Anne Secord and Brian Dolan have noted, this conflict, particularly acute amongst botanists but which rippled out across the whole field of natural history, centred on whether images constituted knowledge, what place imagery had in the increasingly specialised disciplines of the 1830s and 1840s, and the tensions between pleasure and work, entertainment and intellectualism.[67]

When an artist or publisher flouted or was unaware of these unwritten rules, the personal and financial costs could be severe. Some of the folios which appeared in the 1830s, such as Edward Lear's *Monograph of the Psittacidae* (1830), contained only images.[68] The full, sorry tale of Lear's struggles to raise enough subscriptions to keep the project going, and his eventual slide into near bankruptcy, has been ably told by his biographers.[69] What is important to note here is that, though a tour de force of the lithographer's art and one of the most visually-stunning of all the works in its genre, Lear's 'Parrots' was nevertheless adjudged a failure by many of his naturalist contemporaries. Despite portraying parrots in a way that was true to life, down to the very last feather, his figures were drawn from life studies of individual birds and therefore deemed to be useless to the museum naturalist.[70]

As not all of Lear's original subscribers saw the work through to its end, even in its truncated form, there are few complete copies remaining.[71] Regarded purely as an art object, the folio is a triumph. There are few more iconic zoological images than Lear's plate of the red

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[67] B. Dolan, 'Pedagogy through Print', 275-304; A. Secord, 'Botany on a Plate: Pleasure and the Power of Pictures in Promoting Early Nineteenth Century Scientific Knowledge', *Isis*, 93, 1 (March, 2002), 28-57.
[68] E. Lear, *Monograph of the Psittacidae* (London: E. Lear, 1830).
[69] P. Levi, *Edward Lear: A Biography* (London: Macmillan, 1995); V. Noakes, *Edward Lear* (London: William Collins & Sons, 1968), 28-38.
[70] Peck, 'Lear', 168.
[71] R. M. Peck, 'The Natural History of Edward Lear', *Harvard Library Bulletin*, 22, 2 (Summer-Fall 2011), 29.

Figure 18. E. Lear, *Macrocercus aracanga*, in E. Lear, *Monograph of the Psittacidae* (London: E. Lear, 1832), Tab. II.

and yellow macaw (*fig.* 16), and we have to turn to Audubon for a comparable level of artistry. What is startlingly apparent, and was liberally commented upon by his contemporaries, is the impression of being in the presence of a living creature with a distinct, individual character. This was a novel feature in zoological illustration and was one of the two principle reasons why the work did not find much favour in scientific circles, which privileged a very different aesthetic. The reason for this vividly life-like appearance was simple enough: Lear, from the outset, was determined to draw all the species in his great work from living specimens. Many of the original sketches and watercolours he produced survive and testify to his concern to depict, as accurately as possible, the individual bird which sat and preened before him. By contrast, when we look at the best examples of ornithological illustration from the first years of the nineteenth century, such as Barraband's illustrations for François Levaillant's various folios and Pelletier's for Thomas Horsfield's *Zoological Researches in Java and the Neighbouring Islands* (1824), their origins in mounted specimens are clearly apparent. Indeed, even more than Elizabeth Gould's early depictions, they merit Ann Datta's acid characterisation as 'perfect drawings of a stuffed bird mounted on a stump'.[72]

Despite this, Lear's theory-free, objective depictions of individual animals transgressed one of the guiding tenets of the 'truth to nature' ethos adhered to by the vast majority of naturalists he hoped to entice with his folio. For them, 'truth' was the ur-epistemic virtue or, as Goethe succinctly put it, the elimination of the accidental, the impure, and the discovery of the unknown.[73] This involved fixing the empirically variable, which Lear's depictions emphatically did not, nor did they profess to. This process necessarily required a degree of artistic intervention and often aggressive selection, intended and designed to find and

[72] Datta, *Gould in Australia,* 54.
[73] J. W. Goethe, trans. S. Miller, *Scientific Studies* (New York: Suhrkamp, 1988), 25. At this stage, the commitment to finding the underlying reality did not entail any overt commitment to ideas developed from Plato's concept of the forms: in Britain, this came only later in the 1830s and then principally in comparative anatomy.

emphasise those characteristics deemed to be constant and certain. In Linnaeus' time, these qualities did not include colour or even pattern, one of the principal reasons behind his oft-quoted diatribe against the time and money wasted on expensive colour illustrations in scientific work, which would be repeated, in diluted form, by the British botanist Joseph Hooker a century later.[74] Instead, they encompassed form, number, and proportion, all of which were characters deemed sufficiently stable upon which to base a definition of species.

No ornithologist, nor even particularly interested in birds beyond their aesthetic possibilities, Lear badly misjudged his audience. Aiming his publication squarely at the highest end of the scientific market, as the subscription list appended to the beginning of the folio demonstrates, he failed to realise that without an accompanying letterpress, including essential details about the species, their habitats and general appearance, the plates were nothing more than pretty pictures.[75]

That Lear's illustrations were some of the most accurate depictions of birds yet seen also limited their use to museum naturalists. This seems strange until we consider the particular epistemological norms, and exactly what constituted an 'objective' image, which prevailed during this period.[76] The standards that governed the Lear's method of working were, to modern wildlife artists, impeccably correct. Taking great pains to observe the behaviour and characteristic attitudes of live birds, either in the Regent's Park Gardens or Lord Derby's private menagerie at Knowsley, the plates he created were effectively portraits of individual birds.[77] Later in the century, as wildlife art began to diverge from zoological illustration and become a recognised artistic genre in its own right, this method of working would become the

[74] Endersby, *Imperial Nature*, 123.
[75] E. Levi, *Edward Lear: A Biography* (London: Macmillan, 1995), 60-72.
[76] L. Daston, (Ed.), *Things that Talk: Object Lessons from Art and Science* (Brooklyn, NY: Zone Books, 2004), 9-24.
[77] Fisher, *Natural History*, 168-171.

norm.[78] In the context of 1820s and 1830s zoology, it served no discernible purpose. Overwhelmingly preoccupied with the identification of species, their ‘natural’ arrangement, and the stabilisation of nomenclature, zoologists demanded that illustrations adhered to certain key standards.

The first among these, was that the image ought to represent not the specimen in front of the artist, but an idealised *type*; or, in other words, the exemplar of that species. Type specimens, as we have seen, were regarded by naturalists less as characterised by Daston as ‘reasoned images’, type images were products of a way of seeing, established by atlases in the eighteenth century, which strove to look beyond what naturalists deemed to be the superfluous – the detail variations found in every species – to discern the underlying ‘truths’.[79] This exercise of aesthetic and ontological judgement, which involved the undisguised projection of the self on scientific inquiry, would be deplored by later generations of scientists as being ‘unscientific’. Nevertheless, the images they favoured served three principal functions: the standardisation of knowledge; the codification of knowledge; and the dissemination of knowledge. Judged by these standards, John Gould’s folios, for example, were immensely successful.[80]

The conscious looking-beyond of the superficial and ‘superfluous’ would be deplored by later scientists, working in the age of ‘mechanical objectivity’ as an explicit imposition of the self upon the workings of scientific method. However, reasoned images, such as those in Gould’s folios, and the exercise of aesthetic and ontological judgements which determined

[78] N. Hammond, *Modern Wildlife Painting* (Sussex: Pica Press, 1998), 14-16.
[79] Daston, Galison, *Objectivity*, 60.
[80] See, for example, [Anon.], ‘Gould’s Birds’, 271-303; [Anon.], ‘Bibliographical Notices: Gould’s Birds of Australia’, *The Annals of the Magazine of Natural History,* 9 (June 1842), 337-339; [Anon.], ‘Gould’s Ornithological Works’, *Science*, 13, 328 (May 17, 1889), 387-388.

them, served several primary functions essential to natural history at this transitional stage of its development, particularly its emphasis on classification: standardisation; codification; and finally the distribution of knowledge. The latter was particularly important at a time before efficient and effective techniques of preservation became the norm rather than the exception. As Daston and Galison comment, the images were 'almost always more lifelike (and intact)' than the specimens that they described. Idealised and, to varying degrees revivified, these were often the only record for domestic naturalists of the discovery of new species, particularly important in the great decades of exploration leading up to 1840.[81]

The construction of the reasoned image, emphasising the typical, the ideal, the average (here understood without its pejorative connotations), was only possible through the exercise of a great breadth and depth of experience on the part of the individual naturalist who, if he himself was not responsible for the image, would take an extremely close interest in the process of image-making. The continued and largely-redundant debate about whether or not Gould was 'responsible' for the illustrations with which he became synonymous has served to partly obscure this aspect of his own work.[82] Where he was, perhaps, unusual was in the close attention which he concentrated upon the figures at every stage of their production, a degree of obsessive editorial control against which Joseph Wolf (1820-1899), the most ruggedly individualistic and the most talented of Gould's artists, would repeatedly jib.[83]

Gould's control over the appearance of the images was most direct during the early and middle years of his career as a publisher, with Elizabeth Gould, William Hart and Hans Richter serving as his principal artists. Each had a distinctive style, Elizabeth's clearly influenced by

[81] Daston and Galison, *Objectivity*, 63.
[82] Allen, *Naturalists in Britain*, 236, comments disapprovingly on Gould's 'hogging' of limelight which would otherwise go to his artists.
[83] Sauer, *The Bird Man: A Chronology,* 11-12.

Lear, and those of Hart and Richter directed heavily by Gould himself.[84] None were naturalists, although it is safe to assume that all, through working so closely with Gould over such extended periods, would have imbibed at least some ornithological and zoological knowledge. For all three, Gould would usually provide an initial pencil sketch, often but not always with the addition of some body colour, which indicated how he wished the final plate to appear. From these rough sketches, sketched from specimens and with recourse to his considerable fund of knowledge, his artists would then work up watercolours, which would be scrutinised by Gould and over which he liberally scrawled directives to 'lighten here' and 'darken there'. This process of presentation, critique, and revision would be repeated through the initial pattern plate stage, where initial lithographic prints were taken and coloured according to the watercolours, to the final run of finished lithographs.[85] When we consider the amount of work involved in the production of just one lithograph for one folio, Gould's success in running several of these multi-volume ventures at once, as he frequently did throughout his career, is all the more astonishing.[86]

The evidence of the illustrations does much to prompt a re-evaluation of Gould as a man of science, as well as acting to buttress his already formidable name as a publisher. The images for which he was ultimately responsible, as originator and as editor, emphasised the universal characters of the species they depicted: this, conversely, required an intimate knowledge of the variable and the particular. He often required his artists to distil into the folio images a broad range of exemplars or, in the case of those species known only by the type

[84] C. E. Jackson, 'H.C. Richter – John Gould's unknown bird artist', *Journal of the Society for the Bibliography of Natural History*, 9, 1 (1978), 10-14.
[85] C. E. Jackson, M. Lambourne, 'Bayfield: John Gould's Unknown Colourer', *Archives of Natural History*, 17, 2, (1990), 194-195; M. Lambourne, 'John Gould and Curtis's Botanical Magazine', *Curtis's Botanical Magazine*, 11, 4 (Nov., 1994), 186-197.
[86] C. E. Jackson, 'H. & N. Hanhart: printers of natural history plates, 1830-1903', *Archives of Natural History*, 26, 2 (June, 1999), 287-292; D. M. Knight, *Zoological Illustration* (Folkestone: Wm. Dawson & Son Ltd, 1977), 17, 34-35; Allen, *Naturalist in Britain*, 87; Allen, *Books and Naturalists*, 160-162.

Figure 19. J. J. Audubon, *Grus americana*, in J. J. Audubon, *Birds of America* (London: Robert Havell, 1827-1838), **III**, Tab. CCXXVI.

specimen, to revivify them according to his own knowledge and experience of broadly comparable species in illustrations of considerable size and great detail.[87]

Indeed, the large format of the folios was driven by the perceived need to depict the species as near to life-size as possible. This, again, was a result of the illustrations' origins in specimen collections and the demand of museum naturalists that the images should reveal as much information about the species as the specimen itself. Although Gould habitually worked on this large scale, using 'Elephant folio' size, only Audubon stretched the concept to its absolute limits, producing illustrations to 'Double Elephant folio' size which, as the name suggests, is double that used by his British counterpart, with each print measuring 40" x 26". This allowed Audubon to squeeze in even the largest species of birds indigenous to North America, such as the Whooping crane, a species standing over five feet tall, at their natural size, even if they appeared a little contorted as a result (*fig.* 17).[88]

However Audubon, unlike Gould, was burdened by no particular ideological baggage. As Roberta Olsen, Audubon's most recent interpreter, notes, the only European naturalist he held in any great regard was the French polymath and author of the epic *Histoire Naturelle*, Georges-Louis Leclerc, Comte de Buffon (1707-1788), whose work was consciously set in opposition to Linnean tenets and which arranged species principally according to the environment in which they were found.[89] Although a highly skilled field naturalist, Audubon was deficient in the detailed knowledge, particularly of taxonomy, so privileged by early nineteenth century zoologists. At an early stage in the production of *Birds of America,* he turned to William MacGillivray (1796-1852), the Scottish-born zoologist and artist, who provided the detailed ornithological notes published concurrently as the *Ornithological Biographies* (1830-

[87] Farber, 'Type-Concept in Zoology', 93-119.
[88] Olsen, *Audubon's Aviary*, 40-108.
[89] O. E. Fellows, S. F. Milliken, *Buffon* (New York: Twayne Publishers Inc., 1972); J. S. Wilkins, *Species* (Berkeley, CA: University of California Press, 2009), 75-79.

1839) and upon which the scientific reputation of *Birds of America* principally rests. An artist above all else, the large scale of Audubon's illustrations seems to have been motivated greatly by his desire to create a beautiful work of art which would appeal to European, and particularly the British aristocracy, and so propel him to fame and fortune.[90]

Gould, of course, also sought fame and fortune, and successfully accrued both. Melding the qualities of businessman, scientist and artist, he recognised that the sheer size of the 'Elephant folio', and the great cost involved in its production, immediately conferred upon it an enviable status as a prestige commodity. Whilst the folios' structure, descriptions, and the format of the illustrations they contained were designed to cater to the demands of his naturalist peers, the illustrations themselves were also often things of great beauty and could be appreciated, if only superficially, solely on an aesthetic level. However, as has been insufficiently appreciated by his biographers, the commercial imperative was not the sole impulse driving the production of the folios. In conjunction with his prolific writing of articles and notices for scientific journals, they were intended also to bolster and enhance his credentials as a man of science, no small challenge given his status as a social outsider. As such, they had to reflect, and promote, the dominant zoological theory of the day. As explored in the preceding chapter, the extent to which Gould adhered to quinarianism from intellectual conviction is open to doubt. Although his initial employment by the Zoological Society and immediately close association with Vigors, whose star was very much in the ascendant, had about it something serendipitous, it is unlikely that a man so proverbially shrewd should not have quickly identified quinarianism as presenting a promising path to speedy career advancement. Whatever prompted him to take up the theory, his close identification with

[90] J. Chancellor, *Audubon: A Biography* (London: Weidenfeld & Nicolson, 1978), 7-12, 245-250; Olsen, *Audubon's Aviary*, 6-39.

quinarianism in the 1830s accounts, at least in part, for his extraordinarily rapid rise from taxidermist in 1829 to renowned explorer of Australia by 1840.

Chapter 4

Quinarian Autumn: Seeds of Decline

At the start of the 1830s, thanks largely to the energy of Nicholas Vigors, quinarianism exerted an extraordinary level of influence in British zoology. Alongside Vigors himself, by now supreme in his personal ascendancy over the Zoological Society following the Council's decision to abandon Davy's quixotic plans for an exotic game park, the theory attracted the support of such prominent figures as William Kirby, Prideaux John Selby and Sir William Jardine.[1] Swainson, resentful of Vigors' institutional power and increasingly alienated from London's scientific institutions, blazed out his own, lonely trail. Although marginalised from the power centres of the Linnean and Zoological societies, his remained a powerful voice, even if, as he himself so often and so bitterly observed, it called out from a self-imposed exile.[2]

The apparently-successful application of quinarianism to ornithology encouraged some of its supporters to concentrate their attention once again on entomology. Reprising much the same role as in 1822, during the establishment of the Zoological Club of the Linnean Society, and again in 1826 at the Zoological Society, Vigors was at the forefront of these efforts. In 1833 he was one of the founding members of the Entomological Society and was immediately, and almost inevitably, elected as one of its Vice-Presidents. With Kirby elected as the Society's

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[1] W. Kirby, 'A Description of Some Insects which Appear to Exemplify Mr. William S. MacLeay's Doctrine of Affinity and Analogy', *Transactions of the Linnean Society of London*, 14 (1825), 93–110. The second volume of Selby's *Illustrations of British Ornithology* (London: Constable, 1821-1833), is arranged on quinarian lines, as was his collaborative volume with Jardine.

[2] Swainson, *Taxidermy*, 348-351. This appears in Swainson's fragment of autobiography in a 'Bibliography of Zoology' in this strange and ill-ordered work. Swainson's final years are described in detail by B. Brockie, 'The Decline and Fall of William Swainson', *New Zealand Geographic*, 50 (Mar-Apr., 2001), 89-101.

Honorary Life-President, and Horsfield as another Vice-President, it seemed to many of their contemporaries that quinarianism was once more in the ascendant.[3]

However, the success of quinarianism was far from uncontested. From 1830 onwards, a rising chorus of disapproval began to be heard in Britain's scientific circles, and not only from those inveterate opponents of all 'natural' systems. The principal forums for these attacks, and the spirited defences they provoked, were the popular and specialist journals that began to proliferate during the early 1830s, including *The Philosophical Magazine*, *The Magazine of Natural History*, and, from 1833, the Entomological Society's in-house *Entomological Journal*. As with the quinarian articles of the 1820s, in these later publications were combined the rhetorical, political, personal and scientific concerns that drove scientific debate.

The heat with which the quinary, septenary, dichotomous and other systems of classification were debated suggests that there was more perceived to be at stake than simply the correct way to arrange zoological specimens in museum collections. The febrile political atmosphere of the late 1820s continued into the early 1830s, and the increasingly-venomous disputes over classification occurred against the backdrop of the great battles over parliamentary reform, Catholic emancipation, and the new Poor Laws. Scientific societies were far from being immune to these political and social cross-currents. Many of their leading lights were actively involved in national and regional politics. Vigors was one of the few to plunge into the Parliamentary fray, in 1833, but Selby, Jardine, and Kirby all occupied positions of considerable power in their home counties, as Justices of the Peace, magistrates and, in Jardine's case, deputy lieutenant for Dumfriesshire. These last three were all conservative in

[3] [Anon.], 'Establishment of the Entomological Society of London', *The Entomological Magazine*, 1 (1833), 390-394.

their religion and politics, and Kirby, for one, was explicit in deploying his scientific work for explicitly political ends.

This was a characteristic throughout the 1830s, an ‘age of uncertainty’.[4] In his study of London’s medical community during these turbulent years, for example, and notwithstanding the narrow source base at his disposal, Desmond convincingly demonstrates that post-Revolutionary French theories of nature, particularly Lamarck’s evolutionary theory and Geoffroy’s ‘unity of plan’, were adopted by physicians and surgeons who deployed them in an attempt to destroy the power of the conservative Royal College of Physicians and Royal College of Surgeons.[5] That the attempt was ultimately unsuccessful, as a group of Coleridge’s disciples at the Royal College of Surgeons took the initiative and developed a sophisticated theory of change to challenge that of the radicals’ own, did not wholly quell fears of a revival of ‘dangerous’ French ideas, as the furore over the publication of the *Vestiges of the History of Natural Creation* in 1844 amply demonstrates.[6]

Desmond’s narrative fits broadly, but not without certain important qualifications, within a well-established trope in the writing of early-nineteenth century British history, in which a radical reaction to events in France gained brief momentum before running out of steam in the face of a concerted and increasingly sophisticated political and cultural conservatism, and the progressive agenda assimilated into a Whiggish-led liberalism. In the twentieth century, the liberal idea of progress dominated interpretations of the period c.1790 to

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[4] D. Eastwood, ‘The Age of Uncertainty: Britain in the Early Nineteenth Century’, *Transactions of the Royal Historical Society*, 8 (1998), 91-115.
[5] Desmond, *Politics of Evolution*, 236-275.
[6] See T. H. Huxley, ‘Vestiges of the Natural History of Creation’, *British & Foreign Medico- Chirurgical Review* 13 (1854), 425-439. Important studies of the debate, its causes and impact on the public, include Secord, *Victorian Sensation*, particularly 364-402; J. H. Brooke, ‘Richard Owen, William Whewell, and the Vestiges’, *The British Journal for the History of Science*, 10, 2 (Jul., 1977), 132-145; N. Rupke, ‘Translation Studies in the History of Science: The Example of “Vestiges”’, *The British Journal for the History of Science*, 33, 2 (Jun. 2000), 209-222; Yeo, R., ‘Science and Intellectual Authority in Mid-Nineteenth Century Britain: Robert Chambers and ‘Vestiges of the Natural History of Creation’’, *Victorian Studies*, 28 (1984), 5-31; M. J. S. Hodge, ‘The Universal Gestation of Nature: Chambers’ ‘Vestiges’ and ‘Explanations’’, *Journal of the History of Biology*, 5 (1972), 127-151.

c.1850, reflected in the titles of some of British history's classic texts: Elie Halevy's *The Liberal Awakening*, covering the period between 1815 and 1830, and *The Triumph of Reform*, from 1830 to 1840; Llewellyn Woodward's triumph of Whiggish historiography, *The Age of Reform*; Asa Briggs' *The Age of Improvement*.[7] Historians working in the latter decades of the twentieth century, including John Derry and Eric Evans, played upon similar themes, their interpretations emphasising the inevitability of reform, a stately progression by which the governing elites managed to adapt to the unprecedented social and economic transformation of early nineteenth-century Britain without giving up either their power or their status.[8] As Eastwood points out, the interpretive hegemony of the 'decade of reform' following Halevy's great account underplays both just how closely Britain came to revolution in the first years of the 1830s, and the pervasive fear of just such an eventuality amongst established social and political elites. Citing William Lubenow's celebration of the 'nineteenth-century revolution in government' as a 'comforting paradigm of the way in which peaceful institutional change can occur in traditional political and social structures troubled and torn by massive economic and social dislocation', he rightly notes that such retrospections do little justice to contemporaries' deep anxieties.[9]

These anxieties did much to shape the development of scientific debate during the 1830s, and the battles over the quinarian and other 'natural' systems, conducted in scientific journals and council meetings, must be viewed in this context. The following analysis traces the beginnings of quinarianism's decline in Britain, and argues that the reformist spirit which

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[7] E. Halevy, *The Liberal Awakening* (London: Ernest Benn, 1926); E. Halevy, *The Triumph of Reform (1830-1841)* (London: Ernest Benn, 1927); L. Woodward, *The Age of Reform 1815-1870* (2nd edition, Oxford, 1962); A. Briggs, *The Age of Improvement, 1783-1867* (London, 1959).
[8] E. J. Evans, *The Forging of the Modern State. Early Industrial Britain 1783-1870,* 3rd edition (Abingdon, Oxon: Routledge, 2001), 177-269; J. Derry, *Reaction and Reform. England in the Early Nineteenth Century* (London: Blandford Press, 1963); Eastwood, 'Age of Uncertainty', 94; N. Gash, *Aristocracy and People: Britain 1815-1865* (1979), 350; P. Mandler, *Aristocratic Government in the Age of Reform, 1830-1852* (Oxford: Oxford University Press, 1992).
[9] Eastwood, 'Age of Uncertainty', 94-95; W. C. Lubenow, *The Politics of Government Growth: Early Victorian Attitudes Towards State Intervention 1833-1848* (London: David & Charles, 1971), 188.

swept through British intellectual life in the years up to 1836 was only one amongst several interlocking factors behind the growing opposition to the theory. It is demonstrated, with reference to the many articles which proliferated in popular and specialist journals alike, that a lack of cohesion amongst the quinarians themselves, and a growing incompatibility of the theory with the swiftly-changing social and religious currents of the 1830s, had a devastating effect on perceptions of the theory and its wider applicability. It is also shown that attempts by Swainson and others to put quinarianism to service as a vehicle for counter-reform did little to convince their fellow naturalists of its scientific merits, damaging its credibility as an 'objective' theory.

The analysis is divided into three principal sections. The first takes as its focus Vigors' final years of influence, between 1830 and 1833, analysing his very public dispute with Swainson, ostensibly about the relative influence exerted by French naturalists in the formulation of British zoology, and which assesses the impact of such clashes on the status and reputation of the quinarians. This is followed by the scrutiny of the increasingly-virulent attacks in print on quinarianism, particularly with respect to its application to entomology and ornithology, with particular reference to Macleay's response to John Fleming (1785-1857), one of the most important interventions in the quinary debates of the early 1830s.[10] It is demonstrated that although rumours of quinarianism's demise were greatly exaggerated in 1833, in its original variant it was increasingly viewed as inadequate in the highly-politicised atmosphere of the mid-1830s.[11] Finally, the focus shifts to the reception of Swainson's quinarian writings of the mid- to late-1830s, in which he elaborated a version of the theory that drew explicit parallels with Christian theology and Biblical teachings. By setting Swainson's writings in the context of the ascendency of scientific conservatives from 1836 onwards, it is

[10] Macleay, 'Dying Struggle', 431-445.
[11] 'D.D.', 'Exposure of the Fallacy of the Septenary System in Natural History', *The Entomological Magazine*, 1 (1833), 434.

demonstrated that his fervent attempts to buttress orthodox religion were regarded with alarm by the scientific establishment, which regarded his allusions to theology in place of empirical evidence as deeply ‘unscientific’. This destroyed his already-faltering reputation, and precipitated the final collapse of quinarianism in Britain’s scientific circles.

I.

At the start of 1831, Vigors’ personal prestige appeared impregnable. The Zoological Society, of which he remained Secretary, was after five years already recognised as one of Britain’s premier scientific institutions. Its Gardens were still popular with the respectable middle classes and aristocracy, and its museum collections had so expanded under his supervision that the Bruton Street Museum was already cramped and over-stocked.[12] As an ornithologist, he ranked amongst a dozen Europeans who constituted a cosmopolitan, zoological elite, his name invoked in the same circles as William Yarrell (1784-1856), Geoffroy Saint-Hilaire, Anselme Desmarest (1784-1838), René Lesson (1794-1849), Eduard Ruppell (1794-1884), Johann Baptiste von Spix (1781-1826), Johann Natterer (1787-1843), Conraad Temminck (1778-1858), and Prince Charles Bonaparte (1803-1857). These were, as Farber rightly notes, the ‘central core’ of internationally-recognised authorities, whose work set the tone, and the pace, of scientific debate.[13]

Swainson’s place in this company was altogether less-secure than Vigors’. This was partly Swainson’s fault. Though he had earned plaudits for his *Zoological Illustrations* of 1821

[12] See [N. A. Vigors], *Catalogue of The Animals preserved in The Museum of The Zoological Society, April 1829* (London: Richard Taylor, 1829).
[13] Farber, *Discovering Birds*, 104-105.

and was subsequently elected a Fellow of the Royal Society at Banks' personal recommendation, Swainson's financial recklessness during the 1820s and ill-fated investment in Mexican mining companies left him perpetually scrabbling about for work.[14] Although proverbially-disputatious, as Swainson's personal fortunes declined he focused his ire on Vigors. Although it effectively marked the end of any prospect of future collaboration, their clash did not mark the high-water mark of their mutual enmity. In 1831, they struck out at one another again, and this time in the most public of ways, in the *Magazine of Natural History*. The aggressor was Swainson, who took exception to comments made by Vigors about the eminent French naturalists Lesson and Desmarest in 1828.[15] This slashing article was the product of Vigors' campaign to establish a distinctively 'British' zoology with reference to a French 'other'. Swainson, who had visited Paris in the early 1820s and less chauvinistic views about French naturalists, was also stung by Vigors' article, though why he waited three years before launching into print is a mystery.[16]

Before descending into the detail of the debate, it is first necessary to note the forum in which the dispute took place. Whereas their previous clash took place via private correspondence, in 1831 Swainson chose to attack Vigors' in one of the most popular natural history journals of the day. The *Magazine of Natural History* was established in 1828 by John Claudius Loudon (1783-1843), one of the most remarkable men of the Georgian period. Now principally remembered for his horticultural work, at one point in the early 1830s Loudon edited and published five major periodicals simultaneously. In an age where naturalists were prodigiously hard-working – according to his biographer, the prolific popular author J. G. Wood led a life in which recreation was reduced 'almost to the vanishing point - Loudon's

[14] Swainson, *Taxidermy*, 345-350.
[15] Vigors, 'A Reply to some Observations in the "Dictionnaire des Sciences Naturelles"', 91-124.
[16] See Swainson, 'A Defence of certain French naturalists', 105-106. Strangely, Swainson does not mention his Paris expedition in his brief 'memoir' in Swainson, *Taxidermy*, 338-352.

obsessive determination and strength of will was notable.[17] Allen recounts a characteristic episode with palpable astonishment. After having had his arm amputated in 1826 after a botched operation, Loudon pressed his surgeon to allow him back to work so relentlessly that he was back to work the following day.[18]

Loudon was also an extremely shrewd publisher. Under his editorship, the *Magazine of Natural History* (*MNH*), for a brief time, successfully navigated the fine line between 'popular' appeal to the interested amateur, and more specialist content that engaged Britain's growing class of dedicated gentlemen naturalists. Though it never enjoyed the same commercial appeal as the *Gardener's Magazine*, with which Loudon had earlier made his name, the *MNH* became a popular forum for the publication of scientific, particular zoological research, and for the airing of private grievances.[19]

Loudon and his successor as editor, Edward Charlesworth (1813-1893), were sedulous in setting aside a considerable portion of the *MNH* for letters, a tactic that was designed to stoke the sort of controversy between naturalists that would keep readers engaged. As Allen, Cantor, and Shuttleworth, amongst others, have noted, the life of the average early-nineteenth century journal was short and brutal. As in the illustrated folio market, competition between publishers was intense and editors were unscrupulous in their determination to keep circulation figures high.[20] This was particularly acute for 'general' publications including the *MNH*, a manifestation of a 'broad' scientific culture in which purely scientific concerns and demarcations between men of science, men of letters, and scientific popularisers were

[17] Allen, *Books and Naturalists*, 69.
[18] Allen, *Books and Naturalists*, 69.
[19] Allen, *Books and Naturalists*, 186.
[20] Allen, *Books and Naturalists*, 181-203. L. Henson, G. Cantor, G. Dawson, R. Noakes, S. Shuttleworth, J. R. Topham (eds.), *Culture and Science in the Nineteenth-Century Media* (Burlington, VT.: Ashgate, 2004); G. Cantor, S. Shuttleworth (eds.), *Science Serialized: Representation of the Sciences in Nineteenth Century Periodicals* (Cambridge, MA: MIT Press, 2004), 1-16; G. Cantor, G. Dawson, G. Gooday, R. Noakes, S. Shuttleworth, J. R. Topham, *Science in the Nineteenth-Century Periodial: Reading the Magazine of Nature* (Cambridge: Cambridge University Press, 2004).

blurred.[21] However, as recent historiography seeks to demonstrate, and as the 1831 dispute between Vigors and Swainson highlights, the mission of these journals was more than mere popularisation and dissemination. The medium shaped the message, and the journal was, in various ways, constitutive of knowledge. Zoological debate was made by zoologists in conjunction with editors and publishers, who had their own, often nakedly-commercial agendas.[22]

Swainson's first article appeared in the *MNH* in March 1831. From the outset, he attacked the whole culture of disputatiousness that characterised zoology at this time, and which Vigors had so turned to his advantage:

> If we were called upon to describe those signs which indicate the decline of science in any age or country, we should at once enumerate the three following: - First, The denial of the greatest and most acknowledge truths by bold and specious reasoners. Secondly, The Zealous adoption by some, and the unqualified rejection by others, of theories or systems *which neither party understood*. Thirdly, The substitution of flowery and sententious oratory for the results of deep and patient research. If to these we added a spirit of dissention and of invective, against all who thought differently from ourselves, we should not overcharge that picture which zoological science, in this country, has exhibited during the last few years.[23]

[21] Cantor *et al*, *Science in the Nineteenth-Century Periodical*, 28.
[22] C. Hamlin, 'Review: Games Editors Played or Knowledge Readers Made?', *Isis*, 96, 4 (Dec., 2005), 634-635
[23] Swainson, 'A Defence of certain French naturalists', 97.

This condemnation of scientific fractiousness reads oddly when emanating from Swainson's pen. His meaning becomes clearer a few paragraphs further on, and Vigors more clearly his target.

Commenting upon the advances made in British zoology over the previous decade, Swainson acknowledged that it had indeed made strong advances but, he added, 'it is yet in its infancy'. Rather than Vigors' strident outbursts of invectice, 'more calculated to foment bitter feeling among individuals, and to bring national reproach upon us all', Swainson advocated 'mildness and conciliation', which would 'insure [British zoology] respect, and its voice will then be listened to.'[24] In contrast to 1824, Swainson was now convinced that quinarianism represented a marked advance in man's understanding of the natural world. 'We have caught a glimpse of some mighty truths', he intoned. However, he again counselled caution. 'Yet, seeing but the shadow, we must not fancy we have caught the substance; or, to drop metaphor, because we have discovered a *part* of the natural system, we must not arrogantly imagine we have grasped the whole; that all further enquiry, discussion, or opposition is to cease'. He condemned Vigors' hostility to France, and his apparent belief that there existed a 'conspiracy' amongst French naturalists against their English counterparts, as rank foolishness.

> When personal and national invective is thus substituted for fair and temperate discussion, it is really time to be serious. We are certainly carrying matters too far; and our "infant school" may probably be compared to the boys in the story, who got possession of a little puddle, from which they bespattered every passenger who refused to take a *sup*.[25]

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[24] Swainson, 'A Defence of certain French naturalists', 98.
[25] Swainson, 'A Defence of certain French naturalists', 98.

Swainson's scorn for Vigors' narrow parochialism contrasted with his deep respect for the two naturalists targeted by the latter's invective. Lesson, one of the great ornithologists of the age, was doubly-admirable because he was 'not a man who merely theorises in his closet, and frames systems "called natural" within the walls of a museum'. This was a clear stab at Vigors, safe in his Bruton Street bailiwick, and Swainson twisted the knife by comparing Lesson's apparent readiness to quote and build upon the work of British naturalists, including Raffles and Horsfield, with Vigors' accusation that Lesson showed '"striking injustice to the merits of British naturalists"'.[26] Desmarest was described in similarly-glowing terms, and to Vigors' detriment. As for the charge of French national jealousy, one of the most important planks of Vigors' platform during the late 1820s, Swainson rejected it out of hand. He compared the Zoological Society of London's refusal to grant him access to its museum with the gracious largesse of Lesson at the Jardin des Plantes.

> Does such conduct, to a stranger and a foreigner savour of the accusations so repeatedly insinuated by Mr. Vigors?' Swainson demanded, 'or does it not rather evince how much the Institution, of which he is the secretary and the chief adviser is behind all the others, whether of France or of England, in the march of liberality? If "jealousy" exists, on which side of the channel is it most conspicuous?[27]

This was strong stuff and, it seems, very much to the taste of Loudon, who ensured that the collected edition of the *MNH* for 1831 contained every instalment of the controversy which

[26] Swainson, 'A Defence of certain French naturalists', 99.
[27] Swainson, 'A Defence of certain French naturalists', 106.

followed. What is important here is that the clear division which existed between Swainson and Vigors had its roots in more than mere personal animosity. At this stage, Swainson was the defender of scientific pluralism, and not only because of his cosmopolitan fondness for France. It was contingent upon naturalists, at a time when the boundaries of knowledge were being pushed further and further back, to consider the views of others and that 'the true lovers of science' France and England, the two most advanced nations in Europe, work together. Further, Vigors' attacks and 'unkindly feelings' had damaged Britain's reputation in the 'republic of science'. '[I]f the contagion be not timely checked,' he warned, 'it will undermine all that is to give energy to individual exertion, and all that is to make us respected in the eyes of foreigners'. It was also, he added with what would soon become a habitual piety, an exercise of 'temperance, moderation, and self-denial' that was required of good Christians.[28]

Vigors' reply, in the next number of the *MNH*, was revealing. Vigors' professed abhorrence of any trace of 'personal animosity' in scientific debate must have raised eyebrows amongst even Vigors' closest supporters, but what follows has the ring of truth behind it. In contrast to Swainson's vision of a British science made stronger by debate, Vigors' advocated strength through unity, and deprecated *open* dissention of any sort.

> [H]ow disgraceful to the reputation of any country are all those internal dissensions, those "plus quam civilia bella," which degrade the fields of science into an arena of contention; - in order to prevent the continuance of such an evil, as far as I am myself concerned, I have made an appeal to the writer of the article in question [Swainson], through the medium of his friends, in the hope that, when the truth is laid before him, he may of his own accord make due reparation for expressions

[28] Swainson, 'A Defence of certain French naturalists', 107.

which I am fain to believe originated in some strange and untoward misconception.[29]

This was Vigors at his disingenuous, hectoring, and dictatorial worst. As befitted this veteran of the Peninsular War, his language was that of war. Noting, with evident satisfaction, how many of his friends had rallied round both he and his 'cause', he invoked the 'cavaliers of older times', imagining the sense of 'exhilaration and triumph… to hear in the stress of war the generous cheers of their companions in arms advancing "to the rescue"'.[30]

The accusations levelled against the quinarians, to the effect that they were a close-knit clique, were given added potency by what followed. As is often the case, partisans of the two belligerents joined in the fray, although Swainson and Vigors did not follow the course later adopted by Darwin and his bête noir, Richard Owen, and conducted the principal fighting themselves. In his next contribution to the exchange, Swainson lamented the involvement, on Vigors' side, of Edward Turner Bennett (1797-1836), then the vice-Secretary of the ZSL and later Vigors' successor as Secretary.[31] He again asked whether 'such language' as Bennett had used of Lesson and Desmarest 'would not breed dissensions among us, or would not deeply injure the reputations of MM. Desmarest and Lesson, if left uncorrected'.[32]

Vigors responded to this 'unprovoked and wanton outrage' with a lengthy denunciation of Swainson and the nay-sayers, and a spirited defence of his own record as a zoologist and a

[29] Vigors, 'A Letter to the Editor', 207.
[30] Vigors, 'A Letter to the Editor', 207.
[31] Swainson, 'A Further Defence', 316-317; Bennett, E. T., 'Evidences in Proof of certain Statements contained in the "Gardens and Menagerie of the Zoological Society delineated". In a Letter to the Editor', *Magazine of Natural History and Journal of Zoology*, 4 (1831), 199-206; J. C. Edwards, 'Bennett, Edward Turner (1797–1836)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004
[32] Swainson, 'A Further Defence', 319.

gentleman.[33] There is little that is ‘scientific’ about this article, and the following extract serves as an abstract for the whole:

> [Swainson] has the audacity to accuse another of having abused the authority intrusted to him as editor of a scientific journal, by introducing into that work private communications addressed particularly to private individuals, and not intended for the public; of abusing the same power, by making a spirit of dissension and of invective the conspicuous feature of that journal; of equally abusing the influence which he is alleged to possess as the ostensible agent of a scientific institution, by rendering that institution far behind all others, whether of France or England, in the march of liberality; of being the detractor of men of merit; of not acting in accordance with his own recorded professions; of rendering his professions of *truth* being his guide utterly worthless, by not putting them in practice… In the circle of society in which Mr. Swainson appears to revolve, such insinuations may perhaps be little regarded… but among gentlemen and men of honour the case is different… I am here, in fact, left with but one alternative. I will meet this asperser of my honour upon his own grounds.[34]

Vigors also had little time for Swainson’s ‘cant’ about the ‘decline of science’ in Britain. This was a recurrent theme in Swainson’s writings and personal correspondence. In 1834, he wrote to Charles Babbage, the mathematician and fellow ‘Declinist’, lamenting the

[33] Vigors, ‘A Reply to Art. I’, 319-337.
[34] Vigors, ‘A Reply to Art. I’, 320-321.

absence of a 'distinct Society composed *exclusively* of men of *known* and eminent talent where, in short, the Elite of the Science of the country should be *alone* admitted'.[35] Little could be more offensive to Vigors than this aspersion of the Zoological Society. '[W]hen did science, our science [zoology] at least, stand on a higher elevation than at present?', he asked.[36] That Swainson could regard himself as blackballed from the gentlemanly circles that Vigors moved in was made abundantly clear. '[H]e has heaped injury upon me in exchange for kindness; he has loaded me with insult in return for forbearance. On the head of the aggressor let the odium rest!'.[37]

Such episodes made for entertaining reading. Whilst they contributed little to the esoteric realm of scientific theory, by providing a forum for clashes between naturalists, and their proxies, publications such as the *MNH* provided a great service to zoology during these years, bringing debates about the 'big' questions before a 'low' scientific culture. The *MNH*'s editorial policy also ensured that it avoided the financial abyss which claimed so many of its more determinedly-specialist competitors. The *Zoological Journal*, for example, lasted only nine years despite having the weight of Britain's zoological elite behind it. It was the first British journal devoted exclusively to zoology, and informed its readers in 1824 that

> Original Memoirs and Monographs will take the precedence in our pages. The subjects of Zoological Classification – Comparative Anatomy – particularly Class, Families, Genera, and Species – Animal Chemistry – Palaeontography and Nomenclature are amongst the most important.[38]

[35] W. Swainson to C. Babbage, 8 April 1834. Add. Ms. 37, 188, fol. 303. British Museum.
[36] Vigors, 'A Reply to Art. I.', 336.
[37] Vigors, 'A Reply to Art. I.', 337.
[38] '[Anon], 'Introduction', *The Zoological Journal*, 1 (1824), iv.

The editor of this high-minded journal was Nicholas Vigors.

Although Vigors' stinging critique of Desmarest and Lesson did much to stimulate debate in British scientific circles, it is doubtful that it improved his personal reputation, or that of the ZSL, in France. This was alluded to in a short letter sent by Lesson to Loudon, which rebutted Vigors' accusations of French 'jealousy' of British zoological eminence. He also flung a casual gibe at Vigors' prolixity, quoting a personal conversation with Desmarest, who did not deign to reply to Vigors in print. '"I shall take good care to not answer this"', Desmarest reportedly said after reading Vigors' original article. '"If I write but one or two pages, they will come down upon me with a quarto volume at least"'.[39]

[39] R. Lesson, 'Letter to the Editor, in Defence of certain French Naturalists', *Magazine of Natural History and Journal of Zoology*, 4 (1831), 488.

II.

The vigor with which zoologists debated during the 1830s certainly helped to bring the emerging discipline before a wider audience, but it was not to everyone's taste. In 1836, soon after returning to Britain, Charles Darwin called in at a meeting of the ZSL and recorded his impressions in a letter to the botanist, John Stevens Henslow (1796-1896):

> I am out of patience with the Zoologists, not because they are overworked, but for their mean quarrelsome spirit. I went the other evening to the Zoological Soc. where the speakers were snarling at each other, in a manner anything but like that of gentlemen.
>
> Thank Heavens, as long as I remain in Cambridge there will not be any danger of falling into any such contemptible quarrels, whilst in London I do not see how it is to be avoided.[40]

Although it is likely that Darwin stumbled in to a meeting dominated by the internal battles over reform that dominated ZSL business during 1836, disputes over zoological theory also became increasingly heated during these years. The evangelical emphasis on investigating nature as a means of 'knowing God' and the order of nature, and the providentialist streak which made searching for 'natural' classificatory systems a controversial mission, drew parson-naturalists into zoological debate in increasing numbers.[41] Although the parson-

[40] C. Darwin to J. S. Henslow, 1 October 1836. F. Burkhardt, J. A. Secord (eds.), *The Correspondence of Charles Darwin, Volume 1 1821-1836* (Cambridge: Cambridge University Press, 1985), 512.
[41] Farber, *Discovering Birds*, 88-91;

naturalist had almost disappeared by the end of the nineteenth century, rendered obsolescent by educational reforms and the drive for scientific professionalisation, from the days of Gilbert White until the mid-1800s he played a respected and prominent role in British scientific culture.[42]

One of the most prominent in the early 1830s was John Fleming, a minister of the Free Church of Scotland and, soon after leaving Edinburgh University in 1805, a founding member of the Wernerian Society and a close associate of its president, the prominent geologist Robert Jameson (1774-1854).[43] Fleming's evangelical beliefs gave his geological and, later, zoological work a distinctive cast. As Desmond notes, for Fleming revelation 'overshadowed' natural theology, making any attempt to *explain* God's actions through nature redundant and potentially pernicious.[44] For Fleming, scriptural authority took precedence over scientific evidence, and played an important part in his controversial denunciation of Cuvier in 1826.[45] However, he was no ossified reactionary: his scriptural emphasis led him to advocate a revolutionary theory of successive geological epochs that prefigured Charles Lyell's 'Uniformitarian' vision that proved so important to moulding Darwinian evolution.[46]

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[42] See J. W. Haas, Jr., 'The Reverend Dr William Henry Dallinger, F. R. S.', *Notes and Records of the Royal Society of London* (2000), 53-65 for a discussion of the parson-naturalist tradition, and F. M. Turner, 'The Victorian Conflict between Science and Religion: A Professional Dimension', *Isis*, 69, 3 (Sep., 1978), 356-376 for a lucid overview of the place of parson-naturalists in the reforms of the mid-nineteenth century. Allen, *Naturalist in Britain*, 18-23, 64-82.

[43] A. Bryson, 'Memoir of Rev. John Fleming, D. D., F. R. S. E.', *Transactions of the Royal Society of Edinburgh*, 22 (1861), 655-656. See also D. T. Moore, 'Geological collectors and collections of the India Museum, London, 1801–79', *Archives of Natural History*, 10 (1981–2), 399-428 for details of Fleming's geological work, and C. C. Gillispie, *Genesis and Geology: A Study in the Relations of Scientific Thought, Natural Theology, and Social Opinion in Great Britain, 1790-1850* (Cambridge, MA: Harvard University Press, 1951), 123-124.

[44] Desmond, *Politics of Evolution*, 64.

[45] J. Fleming, 'The Geological Deluge, as Interpreted by Baron Cuvier and Professor Buckland, Inconsistent with the Testimony of Moses and the Phenomena of Nature', *Edinburgh Philosophical Journal*, 14 (1826), 205-239.

[46] J. Burns, 'John Fleming and the Geological Deluge', *The British Journal for the History of Science*, 40, 2 (2007), 205-225.

Fleming's approach to taxonomy converged with the quinarians' on several fundamental points. For example, he too believed naturalists to have been 'too servile' in their imitation of Linnaean classification, and he praised the development of British zoology in the years after 1815.[47] However, he diverged from the quinarian line in almost every other respect. He broadly agreed with James Bicheno's attempt to draw a dividing line between artificial classificatory systems, whose principal purpose was to *distinguish* species, and natural systems, which described their relation to one another, and shared Bicheno's scorn for the quinarians' attempt to both distinguish *and* order species as they are in nature.[48] His own system was curiously simple, a binary or dichotomous system in which oppositional 'positive' and 'negative' characteristics of a species (for example, 'bird has crest', 'bird does not have crest') were used for its identification.[49]

Detailed discussion of Fleming's system lies outside the scope of this study. What is important is that, persuaded of its truth, Fleming took aim at Macleay. Significantly, he bracketed Macleay's system with Lamarck's theory of progressive development of species, implying that quinarianism shared evolutionary tendencies by association.[50] He pinpointed the weaknesses in Macleay's attempt to draw links between the vertebrates and invertebrates in an extended discussion, before concluding that Macleay had so 'confounded' the meaning of affinity and analogy that his whole system was flawed. '[I]ts author, while indulging the dream of being supported by "evident affinities," was in fact relying on very deceitful analogies'.[51]

Macleay's response to this was one of the most spectacular diatribes in the quinarian annals.[52] Much of what Macleay wrote was a reworked statement of quinarian principles. What

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[47] J. Fleming, 'On Systems and Methods in Natural History.', *Quarterly Review*, 41 (1829), 302-304.
[48] Fleming, 'On Systems and Methods', 308-309; Bicheno, 'Systems and Methods in Natural History', 320-326.
[49] For the details of this system, see Fleming, 'On Systems and Methods', 311-318. Macleay rebutted any notion of a dichotomous system. Macleay, *Horae*, **I**., 188.
[50] Fleming, 'On Systems and Methods', 318-319.
[51] Fleming, 'On Systems and Methods', 326.
[52] Macleay, 'Dying Struggle', 431-445.

was novel about this article was his contemptuous dismissal of Fleming and concerted attack on the participation of clergymen in scientific debate. In a letter to Vigors, which he fully intended to be published, Macleay damned the ‘worthy clergyman’s ‘orthodox spirit of theological hate’. In a piece of sustained raillery, he dismissed Fleming as a dilettante who, bored in his parish ‘in a remote part of the kingdom’, had only taken up zoology as ‘a resource against *ennui*’.

> [M]easuring Nature by his own capability of observing her, he stumbled on the Binary System, probably because the ins and outs of the pulpit appeared to him to be the most interesting division of his flock; and because the minister and his precentor furnished him with the most obvious subdivision of the contents of the pulpit. With the scanty museum afforded by his glebe, he came in due process of time, as may be seen from the Quarterly, to distinguish accurately the hare from the rabbit, and the dwarf from the common elder. Practical knowledge being thus acquired, and some theory from such rare authors as Linnaeus, Cuvier, and Lamarck, our naturalist set up as a contributor of Natural History articles to the Edinburgh Encyclopedias; a class of works, that, so far as we have yet seen, has presented us with nothing in zoology but stale compilations miserably travestied. Flattered by a success in this drudgery, which few naturalists would have contested with him, he then compiled his “Philosophy of Zoology;” a book which rests its sole claim to distinction on the Doctor’s formerly supposed discovery of the Dichotomous System.[53]

[53] Macleay, ‘Dying System’, 433.

Part of the reason for Macleay's anger was Fleming's accusation that he wrote for pleasure. Macleay, along with his fellow gentlemen-naturalists, would have considered it 'bad form' to be seen to be actively trying to turn their activities to profit. 'I have never degraded natural history into book-making, nor considered the science as a mode of making money by puffing'.[54]

However, it was towards the Biblical foundations of Fleming's system, particularly his unquestioning acceptance of the Book of Leviticus, that Macleay directed his main argument.

> It is really surprising how this eleventh chapter of Leviticus is shovelled into our faces by various writers [Macleay snapped]. Another clerical naturalist has supported the quaternary division, because in this very chapter grasshoppers are divided into four kinds, the word translated "beetle" in the Bible being considered by Hebrew scholars to allude to a kind of Locust… Another clergyman afterwards, looking also to Scripture, declared seven to be the correct number. Where Doctors differ, who shall decide? Clergymen, it must be allowed, whether Catholic or Protestant, have too great a propensity to silence all inquiry with a text. It is a very convenient mode of getting rid of an antagonist; as they have only to raise the hue and cry against him for disputing a Bible truth, and the affair is settled.[55]

This strongly-worded attack on the influence of theology in the study of natural history emphasises that, although naturalists of the period were almost unanimous in their belief in a divinely-ordered world, this did not translate into a fundamentalist reading of the Bible as a

[54] Macleay, 'Dying System', 433.
[55] Macleay, 'Dying System', 434.

scientific text. To underscore the point, and fully record his distaste for clergy's meddling in scientific matters, Macleay urged them 'at the same time bear in mind that the cause of religion is more hurt than aided by absurd and inconsiderate zeal. The Bible was intended to direct our moral conduct and religious belief. No one but a madman, a fanatic, or an interested knave, can pretend to tell us that it is an encyclopaedia of science'.[56]

Macleay's attack on the direct influence of religious principles and beliefs on zoology is a reminder that the Darwinians' belief in the mutual incompatibility of religion and science was hardly new. It also highlights a crucial transformative process. What was started in the 1830s, albeit fitfully, and what Macleay's article illustrates, was an epistemological redefinition of science as entailing critical research based solely on empirical verification, without the mediation of religious principles. However, this took place within an ongoing debate about the character of the scientific community and its function in society, itself framed within a religiously-orthodox framework.

By the middle of the 1830s, the parameters of this framework were starting to change. In the first half of the decade, the position of the Church of England was weak, though this should not be confused with a rising tide of irreligion; faith mattered a huge deal, both personally and politically, and atheism was widely abhorred.[57] Radicals, such as Richard Carlile (1790-1843), pilloried the Church for being corrupt and the lackey of reactionary Toryism.[58] The influx of materialist, atheistic ideals that Desmond views as being so important to the development of medicine in London in the 1820s was accompanied by a general

[56] Macleay, 'Dying System', 436.
[57] R. Brown, *Church and State in Modern Britain 1700-1850* (London: Routledge, 1991), 170-230. See also M. Ruse, 'The Relationship between Science and Religion in Britain, 1830-1870, *Church History*, 44, 4 (Dec., 1975), 505-522; G. Parsons (ed.), *Religion in Victorian Britain, Interpretations* (Manchester: Manchester University Press, 1988), and *Religion in Victorian Britain: Traditions* (Manchester: Manchester University Press, 1988).
[58] See, for example, R. Carlile, 'To Lord Brougham', *The Gauntlet*, 8 (1833), 113; G. Holyoake, *The Life and Character of Richard Carlile* (London: Holyoake and Co., 1855), 8.

contempt for incompetent clergy, who were unevenly distributed and heavily outnumbered in the new industrial towns and cities by non-conformist ministers.[59] Radicals' complaints that non-resident vicars held many of the wealthiest livings further stoked disenchantment with the Church, suspicions that were partly vindicated by the findings of the Ecclesiastical Revenues Commission, appointed by Lord Grey immediately on the Whigs coming to power in the 'Reform' parliament of 1832.[60] In addition, a tide of government legislation towards the end of the decade ran very strongly against the Church. Calls for the repeal of the Test and Corporation Acts, and for Catholic Emancipation in Ireland, undermined the traditional status of the Church within the state and led more conservative Anglicans to fear that the Church of England would, eventually, be disestablished.[61] This was a major factor in fiercely-Tory reflex action of twenty-one bishops to vote against the Reform Bill in the House of Lords in 1831, which consigned it to defeat and provoked rioting in Nottingham, Bristol, and across the south-west.[62] This has been preceded in 1830 by a pronounced anti-clericalism in the Swing Riots that had erupted in Kent.[63]

Macleay's scathing references to Fleming as a dilettante, and quite possibly incompetent priest should be viewed against this wider culture of anti-clericalism. Indeed, his explicit presentation of quinarianism as founded on empirical evidence rather than on Biblical authority can be seen as a reflection of a wider suspicion on the role of religion, particularly in man's investigation of nature. This served the theory well during the late 1820s and into the early 1830s, but by 1836 the radically-inspired reforms which had threatened to overturn the ruling circles of several of London's scientific societies, including the ZSL, had run out of

[59] Chase, *1820*, 13-17.
[60] Parsons, *Traditions*, 21.
[61] See D. de Giustino, 'Finding an Archbishop: The Whigs and Richard Whately in 1831', *Church History*, 64, 2 (Jun., 1995), 218-236; R. A. Soloway, *Prelates and People: Ecclesiastical Social Thought in England, 1783-1852* (London: Routledge & Kegan Paul, 1969), 243-247.
[62] Eastwood, 'Age of Uncertainty', 95-96.
[63] M. Holland (ed.), *Swing Unmasked: The Agricultural Riots of 1830 to 1832 and their Wider Implications* (Milton Keynes: FACHRS Publications, 2005).

steam. Indeed, the reforming process in institutional zoology took on a markedly-conservative tone, as Desmond has clearly demonstrated, with the new influx of specialists. including Richard Owen and William Broderip (1789-1859), taking an anti-radical stance and giving 'short shrift' to those 'malcontents' that remained.[64]

Accordingly, the basic positions in the science-religion relationship were reformulated, with two basic positions articulated. The first were 'liberals' (a term devoid here of political connotations) such as Charles Babbage and Baden Powell, whose 'liberalism' extended to stating the right of science to directly contradict the dictates of religion. For 'liberals', the Bible was concerned exclusively with man's moral and spiritual destiny.[65] Macleay can be seen, broadly, within this 'liberal' camp.

The 'conservative' position was more obscure. As Ruse notes, many naturalists who have been styled 'conservatives', such as William Whewell, did not question the advances made by science over the preceding decades, and concurred with the 'liberals' on the remit of the Bible in man's affairs.[66] However, 'conservatives' did take the Bible more seriously as both a record of early man and the 'beginnings' of nature. Whewell argued that in all historical sciences, including geology and zoology, 'the thread of induction respecting the natural course of the world snaps in our fingers' when scientists trace back to events with no modern counterpart. This left them free to refer to the Bible, for they had gone beyond the limits of science.[67] However, despite this difference, for both 'liberals' and 'conservatives', and those who hovered in between, the Bible and theology were primarily to do with man and his spiritual

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[64] Desmond, 'Making of Institutional Zoology', 223-250; Desmond, *Politics of Evolution*, 140-144. See also W. Broderip, 'The Zoological Gardens – Regent's Park', *Quarterly Review*, 56 (1836), 309-332.
[65] See B. Powell, *Revelation and Science* (London: Parker, 1833), 35; and *The Connexion of Natural and Divine Truth: or, The Study of the Inductive Philosophy Considered as Subservient to Theology* (London: Parker, 1838).
[66] Ruse, 'Science and Religion in Britain', 506-507.
[67] W. Whewell, *Philosophy of the Inductive Sciences* (London: Parker, 1840), **II.**, 145.

destiny. One of the very few who adopted the opposite position was Swainson, and this had dire consequences for both his reputation and for the fortunes of quinarianism.

III.

One of the curiosities of quinarianism's later years is that it should have been appropriated by the High Church interest and disseminated in 'popular' works. The theory had, of course, been adopted by naturalists of a broad range of religious and political positions, including the radical Vigors and that staunch High Tory, William Kirby. What was unusual in the 1830s was that the High-churchmen began to engage, in earnest, with the popular, 'low' scientific culture that in the 1820s was dominated by moderate, reforming Whigs and radicals. As Knight points out, it was Dissenters who took the lead on educational matters during the early-nineteenth century. Prominent in the expanding economy, they sought to educate a new class of managers and professionals for careers in the industrial age, and were active in establishing educational institutions, such as Literary and Philosophical Societies and Mechanics' Institutes, to diffuse higher culture amongst the middle and lower classes.[68]

That there was a great demand amongst the pious middle classes for religiously conservative, largely non-technical works on contemporary science has been demonstrated elsewhere by Topham and Clarke.[69] The most high-profile attempt to engage with this demand

[68] D. Knight, *Science and Spirituality: The Volatile Connection* (London: Routledge, 2004), 76-77. See also S. Shapin, and B. Barnes, 'Science, Nature and Control: Interpreting Mechanics' Institutes', *Social Studies of Science*, 7, 1 (Feb., 1977), 31-74; A. Thackray, 'Natural Knowledge in Cultural Context: The Manchester Model', *American Historical Review*, 79 (1974), 672-709.
[69] J. R. Topham, 'Science and Popular Education in the 1830s: The Role of the "Bridgewater Treatises"', *The British Journal for the History of Science*, 25, 4 (1992), 397-430. Clark, 'History from the Gound Up', 28-55.

was the ‘Bridgewater Treatises’, to which Kirby and Babbage contributed volumes, and which were all closely vetted by William Howley (1766-1848), the High-Church Archbishop of Canterbury, and successive Presidents of the Royal Society; Davies Gilbert (1767-1839), an arch-Tory MP; and the Duke of Sussex (1773-1843), brother of George IV. The surgeon Sir Charles Bell (1774-1842), who contributed a classically-Paleyan treatise on *The Hand, Its Mechanism and Vital Endowments*, captured the writers’ intention to beat the Whigs and reformers at their own game. ‘[F]rom the Chancellor [Brougham] to his little bookseller [Knight] (who writes better than any of us), the encyclopaedists are all writing the same stuff. And here are eight men more to wear the subject to the bone – all at the same work’.[70] As his recent biographer observes, Bell relied on the established idea that Nature revealed herself to those who studied her, a ‘guarantee of fundamental intelligibility built into the world around him’. This was viewed as the basis of a ‘safe’, or non-radical science.[71]

Swainson was not invited to contribute to the Treatises. Instead, he spent much of the 1830s producing volumes for Dionysius Lardner’s *Cabinet Cyclopaedia* and William Jardine’s *Naturalist’s Library*. Both of these publishing enterprises, and Swainson’s involvement in a ‘popular’ scientific culture, will be addressed in the following chapters. For now, it is the religious undertone evident in these works, and its reception by many of Swainson’s fellow naturalists, that is at issue.

By 1836 Swainson, by virtue of his self-assigned status as defender of the quinarian faith and Vigors’ and Macleay’s increasing marginalisation, was the most frequent target of a rapidly swelling anti-quinarian literature. One of the most damning denunciations appeared in

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[70] C. Bell to G. Bell, 3 September 1831, in G. J. Bell, *Letters of Sir Charles Bell, Selected from his Correspondence* (London: J. Murray, 1870), 320.
[71] C. Berkowitz, *Charles Bell and the Anatomy of Reform* (Chicago, IL: University of Chicago Press, 2015), 61-66.

the *Magazine of Natural History* written by the naturalist Peter Rylands (1820-1887), then only 16 years old but a precocious naturalist and frequent correspondent to the *MNH* and other naturalist's journals.[72] Rylands was an exemplar of the youthful, middle-class reader that publishers of 'popular' scientific works sought to recruit, and very quickly immersed himself in a successful career as a wire manufacturer. He was deeply involved in politics, a life-long liberal who presided at a whig banquet for Warrington electors, corresponded with Richard Cobden from 1843, and sat as a Gladstonian Liberal MP between 1868 and 1874, and again between 1876 and 1887.[73] He was also, originally, a non-conformist, though in the 1830s he joined the Church of England and later wrote several, heavily-evangelical pamphlets on the role and mission of the Church.[74] Originally appearing in two parts, the objections that Rylands raised to Swainson's system, and indeed the remarkably vituperative tone in which it was written, can tell the historian volumes about quinarianism's failure to engage its key target audience in its final years of influence in Britain.[75]

[72] P. Rylands, 'On the Quinary, or Natural System, of McLeay, Swainson, Vigors, &c.', *Magazine of Natural History,* 9 (1836), 130-138, 175-182; L. G. Rylands, *Correspondence and Speeches of Mr. Peter Rylands, M. P.* (Manchester: Abel Hayward & Son, 1890), **I.**, 6-7.
[73] Rylands, *Peter Rylands,* 5-43.
[74] Rylands, *Peter Rylands*, 11-12; P. Rylands, *The Mission of the Church; or, Remarks on the Relative Importance of Home and Foreign Missionary Effort in the Present State of the World* (London: Ward, 1845), and *Pulpit and the People* (London: Ward, 1847).
[75] Rylands, 'On the Quinary, or Natural System', 130-138, 175-182.

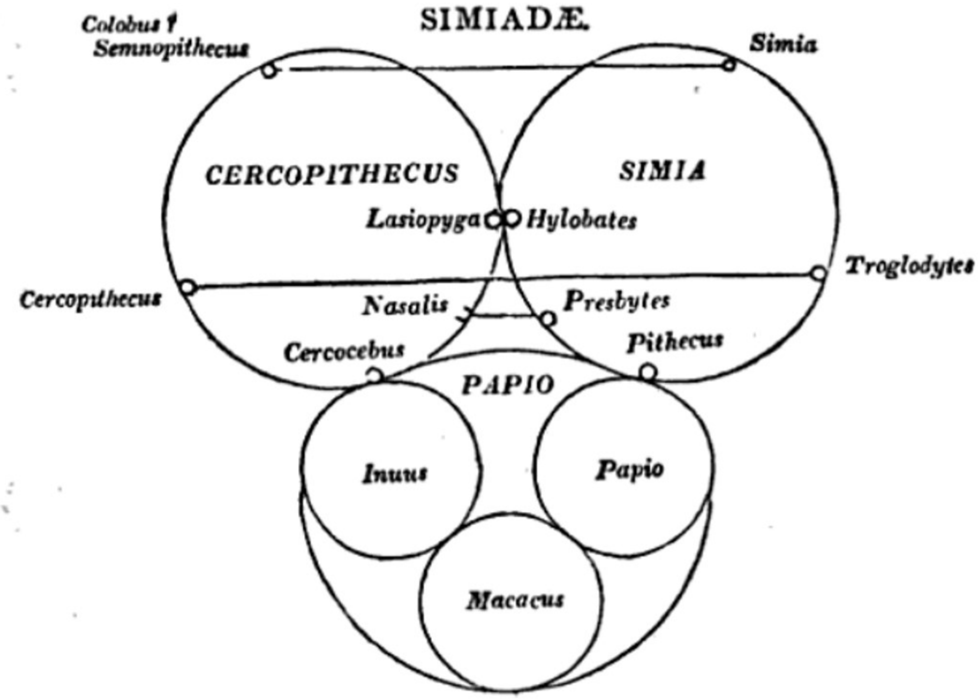

Figure 20: W. Swainson, Diagram displaying the affinities and analogies between Simidae, in *The Natural History and Classification of Quadrupeds* (London: Longman, Rees, Orme, Brown, Green & Longman, 1835), 72.

By the time that Rylands sent in his article, the *MNH* had run into financial difficulties. Loudon's successor as editor, the geologist and palaeontologist Edward Charlesworth (1813-1893), increasingly resorted to searching out the most controversial material, frequently contributing scorchingly critical editorials aimed at such luminaries as Buckland, Owen, and the American comparative anatomist, Louis Agassiz.[76] As Sheets-Pyenson notes, Swainson was a favourite of Charlesworth's, and he frequently 'begged' the now-embattled quinarian to

[76] S. Sheets-Pyenson, 'Darwin's Data: His Reading of Natural History Journals, 1837-1842', *Journal of the History of Biology*, 14, 2 (Autumn, 1981), 237. Also, Allen, *Naturalist in Britain*, 73.

respond to the frequent attacks on his system in the magazine.[77] It was within this general tone of sedulously-stoked controversy that Rylands launched his assault.

Critics of Swainson were spoilt for choice in 1836. By this time, he had written three volumes for Lardner, all of which had a pronounced quinarian tone. Rylands focused his attention upon two, the *Treatise on the Geography and Classification of Animals*, in which Swainson laid out the basic tenets of quinarianism, and *The Natural History and Classification of Quadrupeds*, both of which had appeared in Lardner's catalogue in 1835. The latter is a strange work in which Swainson gave full rein to his conception of analogies as symbols of divine providence, which led him into some startling flights of imagination. One of the most important parts of the work was the diagram drawn by Swainson which made very clear parallels between his quinarian variant and the Holy Trinity (*fig.* 18).[78] This was a gift for the evangelical Rylands, a young man on the make, and he seized it with both hands.[79]

He began his article by agreeing with the staunchly-orthodox James Rennie (1787-1867), then professor of zoology at King's College, London, that it was 'singular that, while hypothetical theories such as this are, in great measure, banished from other sciences, they should now reign as paramount in this department as alchemy and astrology did in the dark ages'.[80] After a general survey of quinarianism, and observing that no more 'artificial' system could be conceived of, he turned his attention to Swainson's extraordinary attempt to directly apply the principle of 'natural groups' to the Holy Trinity.

[77] Sheets-Pyenson, 'Darwin's Data', 237. Swainson responded to some of his critics in 'A Short Reply to My Reviewers', *Magazine of Natural History*, N.S. 2 (1838), 494-501.
[78] Swainson, *Quadrupeds*, 72.
[79] Rylands, *Peter Rylands*, **I.**, 10.
[80] Rylands, 'On the Quinary, or Natural System', 131.

> ‘*Intelligent beings* he divides into, first, God; second, spiritual beings; third, man; and then very seriously gives as a proof that each of these forms a circle of itself, containing three smaller circles, *the Trinity of God!!!*
>
> ‘In reference to the minor circles contained in his *natural* group of spiritual beings, he quotes from *Coll.* i. 16., where St. Paul speaks of “Principalities, powers, and rulers,” which, he considers, is referable to the three minor circles in question!!
>
> ‘Need the absurdity of this doctrine, I ask, be pointed out to the reading and intelligent community of Britain?’[81]

The same incredulity which pervades Darwin’s notebook jottings is evident here, as well as the sense that Swainson had wildly over-reached the proper boundaries of science. Rylands took offence at Swainson’s unusual shackling together of High Church doctrine and classification systems, and went so far as to imply that, intoxicated by his metaphysical speculations on the nature of matter, time and space, Swainson flirted with blasphemy.

> The belief that space, or in other words, *nothing*, is divisible into infinite portions, surprised us much, [Rylands thundered] but that time is eternal; that the past and future, “*are incalculable, for they are eternal*,” is an expression, which most certainly would have far better become the tongue of the infidel or the heathen, than have proceeded from the pen of a British author of the nineteenth century![82]

[81] Rylands, ‘On the Quinary, or Natural System’, 133-134.
[82] Rylands, ‘On the Quinary, or Natural System’, 134.

This would have surprised Swainson, whose ability to see symbols of God's providence and evidences of the underlying, divine plan of nature was apparently unlimited.[83] There is no evidence that he chose to respond to Rylands' remarks, just as he would later feign indifference to Waterton's public 'Letter', but in 1838 he did 'deviate from [his] usual silence' to respond to George Gray's criticisms of his ornithological systematics, and to Hugh Strickland, who had castigated him for extending his 'worse than useless' nomenclature to west African birds.[84] Swainson, whose publications throughout the 1830s suggested that he had taken to heart d'Alembert's dictum that one should '[w]rite as if you loved glory, but behave as if you were indifferent', affected detachment.[85] However, the note of defensiveness which creeps through the article gives the lie to his professed dislike of 'that captious and disputatious spirit which is now rife among naturalists, particularly the juniors' - a carefully-aimed swipe at members of the rising generation, including Rylands, whose concerns with finding a natural system of classification led them away from the quasi-theological, idealist line adopted by Swainson.[86]

Rylands' denunciation of Swainson was typical of the negative impressions which quinarianism attracted from the mid-1830s. Reviewers ruefully acknowledged Swainson's zoological expertise, particularly in conchology and ornithology, and his artistic skills, but deplored the lurch into Trinitarian metaphysics which so complicated his variant of quinarian theory.[87] '[C]ould we only transfer to our pages the result of Mr. Swainson's pencil as readily as we do now with that of his pen', sighed one.[88] Once again, his position typically

[83] See Swainson, *Quadrupeds*, 248, in which Swainson views a certain type of butterfly chrysalis, which displays a downward-pointing external 'spike', as pointing to the world, as the only habitation, where their innumerable types of evil are permitted to reside; or to that dark and bottomless region, where punishment awaits the wicked at *their* last great change'.
[84] Swainson, 'A Short Reply', particularly 495-496.
[85] Jean d'Alembert, 1759; quoted in L. Daston, 'The Ideal and Reality of the Republic of Letters in the Enlightenment', *Science in Context*, 4 (1991), 382.
[86] Strickland's famous 1841 paper would be hailed by Alfred Russell Wallace as the 'death knell' for quinarianism.
[87] See, for example, H. Strickland, 'Observations upon the affinities and analogies of organized beings', *Annals and Magazine of Natural History*, 2, 4 (1840), 219-226.
[88] [Anon.], 'Reviews. *Naturalist's Library. Ornithology. Vol. VII. Birds of Western Africa*. By W. Swainson', *Annals and Magazine of Natural History*, 1 (1837), 326.

idiosyncratic, he found himself out of step with the dominant trends in religion, politics, and science. On the one hand, his overtly-religious conception of the natural world found little favour even amongst scientific ‘conservatives’, who from the mid-1830s were concerned to develop a more sophisticated line on the role of religion in scientific work. Evangelicals and ‘liberals’, such as Rylands, who emphasised God as the origins of natural laws, saw Swainson’s commitment to seeing direct adaptation in every facet of the physical worlds, even up to the level of the cosmos, as metaphysical nonsense. On the other hand, as a prominent advocate of scientific reform, his position in relation to London’s scientific societies was irretrievably lost after the re-esablishment of elite control from 1836 onwards.[89] By all, he was viewed as going far beyond the realms of common sense. From this point onwards, Swainson’s marginalisation from the new, Peelite ‘star chamber’ of British science was complete.

Despite this, Swainson continued to write for Lardner and Jardine into the 1840s. The extent of his literary output is astonishing, though even this drew snide comments from reviewers.[90] This extensive body of work has been little analysed by historians, though it represents one of the most notable manifestations of popular print culture in the 1830s. In many of these books, Swainson used illustration to help drive home his ideas on classification, combining text and image in a remarkably-powerful synthesis designed to make quinarian principles comprehensible to a broad, non-specialist audience. His books had the key strengths of being rooted in his own deep knowledge of the natural world and, constructed around a framework that emphasised the examination of external anatomy, were intended to broaden the education of the slightly-educated. As such, their place within the broader print culture of the 1820s and 1830s, and their synthesis of old and new science, merits close attention if we are to arrive at a true judgement of their impact on scientific culture

[89] For this process at the ZSL, see Desmond, ‘Making of Institutional Zoology’, 231-243.
[90] [Anon.], ‘*Birds of Western Africa*’, 324.

Chapter 5

Quinarianism and the Limits of Fashion

In a society still in intellectual thrall to the principles of the Enlightenment, the pursuit of knowledge was held in the highest esteem as a worthy and virtuous ambition, with a particularly high value attributed to the acquisition of scientific knowledge. In the early years of this 'knowledge industry', in the 1820s and into the 1830s, the positive status of knowledge made its production and popularisation a morally responsible activity, with the dissemination of 'useful knowledge' the dominant leitmotif for both secular and religious authors alike.[1] For the quinarians, just as much as other naturalists of the age, science was a rhetorical and pedagogic activity, directed to self-improvement on the one hand and recruitment on the other, and they modified the means of the approach to appeal to different audiences. Gould's lavish books drew in the wealthy dilettantes, the gentlemen-specialists, and well-to-do metropolitan and provincial institutions. Vigors and Macleay disdained the dilettante, in line with their determination to rid science of the amateur and clerical interest. Only Swainson, and perhaps Kirby, engaged with the 'masses', bringing quinarian to an approximation of popular fashion that even Gould's spectacular folios could not match.

Alan Rauch is one amongst a growing number of scholars who seek to trace the extent to which early nineteenth-century culture was influenced by the dissemination of scientific knowledge, here invested with almost material properties, and conversely how scientific discourse was influenced by the wider culture, particularly the literary culture, in which

[1] Rauch, *Useful Knowledge*, 2-3.

scientists operated. The work of Rauch, Secord, George Levine, Richard Yeo, Gillian Beer, and others have demonstrated that there are no clear lines of intersection where science meets literature.[2] As Levine notes, science and literature are 'mutually shaped by their participation in the culture at large – in the intellectual, moral, aesthetic, social, economic, and political communities which both generate and take their shape from them'.[3] Bruno Latour and Jan Golinski have convincingly portrayed scientific endeavour as an activity of persuasion in which textual and visual resources are mobilised in an effort to recruit, to create networks that disseminated knowledge, and finally to establish authority.[4] Many prominent men of science, whose work challenged long-established beliefs about nature, God and the world, published books that were widely read and, as newspapers and journals of the period attest, widely discussed. Secord's study of the public sensation surrounding the publication of Robert Chamber's *Vestiges of the Natural History of Creation* has highlighted that scientific debates, which could rise to the abstract, were followed avidly by the expanding reading public, and even found their way into works of literature produced in its immediate aftermath.[5]

However, there has been little study of the great publishing campaigns of the 1820s and 1830s beyond that conducted by the Society for the Diffusion of Knowledge, and none at all which addresses the forays of the quinarians into the popular market.[6] The importance of science to the earnest guardians of working- and middle-class morality was two-fold. Science

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[2] G. Levine, A. Rauch (eds.), *One Culture: Essays in Science and Literature* (Madison, WI: University of Wisconsin Press, 1987); G. Levine, *Darwin and the Novelists: Patterns of Science in Victorian Fiction* (Chicago, IL: University of Chicago Press, 1992); Secord, *Victorian Sensation*, 41-110; Secord, *Visions of Science*, 1-23; R. Yeo, 'Science and Intellectual Authority in Mid-Nineteenth Century Britain: Robert Chambers and 'Vestiges of the Natural History of Creation'', *Victorian Studies*, 28 (1984), 5-31; R. Yeo, *Defining Science: William Whewell, Natural Knowledge, and Public Debate in Early Victorian Britain* (Cambridge: Cambridge University Press, 1993); G. Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth Century Fiction* (Cambridge: Cambridge University Press, 2009), 14-22, 73-96.
[3] G. Levine, 'One Culture: Science and Literature', in Levine and Rauch (eds.), *One Culture*, 5-6.
[4] C. Bazerman, *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science* (Madison: University of Wisconsin Press, 1988); Golinski, 'The Theory of Practice', 498-500; Latour, *Science in Action*; Shapin, 'History of Science', 157-211; G. N. Gilbert, M. Mulkay, *Opening Pandora's Box: A Sociological Analysis of Scientists' Discourse* (Cambridge: Cambridge University Press, 1984).
[5] Secord, *Victorian Sensation*, 155-190.
[6] A notable and valuable exception is Sheets-Pyensen, 'War and Peace in Natural History Publishing', 50-72.

was seen as the keystone of reason, with the associated advantages that its acquisition required self-discipline and would, theoretically, keep the dedicated seekers of truth on the moral straight and narrow. For Thomas Dick (1774-1857), a prolific author of 'improving' works which combined science and Christian philosophy, this message had a peculiarly personal resonance. Ordained as a Presbyterian moderator in 1803, in 1805 he was deposed by his Stirling presbytery and excommunicated for having committed adultery, and conceiving a child, with one of his servants. Seeking rehabilitation, in the eyes of God as well as his community, he dedicated the next ten years to teaching, founding a mechanic's institute in Methven, and extolling the virtues of natural knowledge as a means of appreciating the glory of God.[7] Dick's published works, of which his *Christian Philosopher* (1823) and *On the Improvement of Society by the Diffusion of Useful Knowledge* (1833) were the most successful, accordingly harped upon the greater pleasures to be had from the exercise of the intellect over less seemly passions. In the later work, he declared that

> [I]t is indispensable that every attempt to diffuse intellectual light over the human race be accompanied with the most strenuous exertions to promote the *moral renovation* of mankind. For vice and ignorance, especially among the lower orders, generally go hand in hand; and experience demonstrates that indulgence in evil passions and in unhallowed gratifications, destroys the relish for mental enjoyments, and is one of the most powerful obstructions to the vigorous exercise of the intellectual powers.[8]

[7] J. V. Smith, 'Reason, revelation, and reform: Thomas Dick of Methven and the "Improvement of society by the diffusion of knowledge"', *History of Education*, 12 (1983), 255–70 ; W. J. Astore, *Observing God: Thomas Dick, evangelicalism, and popular science in Victorian Britain and America* (Aldershot: Ashgate, 2001).
[8] Thomas Dick, *On the Improvement of Society by the Diffusion of Knowledge* (London: W. Collins, 1833), 26.

On the other hand, as the later furore over the *Vestiges* highlights, growing tensions attended the search for materialist answers to questions that had hitherto been the province of theologians and a matter for scriptural authority. Whilst one of the recurrent themes in the heated debates which attended the progress of technology and print culture was the danger of cheap books and penny periodicals, equally prominent was the risk posed by science, released from the shackles of religion, to the moral fabric of society. Numerous 1830s popularisers of 'useful knowledge', taking their lead from Herschel, Whewell, Sedgwick and the luminaries of London's scientific societies, made elaborate attempts to reconcile scientific progress with the 'truths' of religion and faith.

This chapter makes a relatively brief foray into this large body of literature. The first section analyses the social and political factors behind the 'useful knowledge' movement, and the attendant debates on the *desirability* and proper form of knowledge dissemination. This focuses upon the divergent opinions of two, very different men who adopted very different approaches in their common goal of ensuring that the search for knowledge did not subvert the social and moral order: the evangelical Thomas Dick; and Henry Brougham (1778-1868), the Whig politician and driving force behind the Society for the Diffusion of Useful Knowledge. This is followed by the analysis of two of Swainson's most popular books for Lardner's *Cabinet Cyclopaedia*, his *Preliminary Discourse* of 1834, and the *Natural History and Classification of Birds* of 1836. Long persuaded of the importance of illustration in natural history works, it is demonstrated that Swainson harnessed the potential of the inexpensive illustrated book to create theory-saturated illustrations that served a strong pedagogical purpose, spreading quinarian principles to a broad audience. In the final section, it is shown that quinarianism enjoyed one final outing in a popular scientific work, Robert Chambers' (1802-1871) notorious *Vestiges of the Natural History of Creation*. In a demonstration of its residual fascination for naturalists, and persistent power to divide opinion, Chambers once again brought quinary theory before a large audience, harnessing it to his own, idiosyncratic evolutionary system in an echo of the attempts of Macleay's detractors fourteen years before. Though Chambers' attempt to rehabilitate the theory was a failure, the episode serves to cast further doubt on the long-held assumption that quinarianism had disappeared from British scientific debate by 1841.

I.

At least in his own estimation, in the 1820s and 1830s Henry Brougham bestrode British political and intellectual culture like a lanky colossus. His life and oddly-fruitless political career, his transformation from one of the most effective gadflies that the House of Commons has ever seen to a politically-impotent, frustrated Lord Chancellor, have been so thoroughly studied as to warrant no extended repetition here.[9] Quite as much attention has been focused upon his far greater achievements as an educational, social, and legal reformer, particularly his involvement in the founding and direction of the Society for the Diffusion of Useful Knowledge (SDUK) in 1826, one of the paradigmatic educationalist enterprises that flourished in the late-Georgian age. Together with his fellow Whig, Lord John Russell (1792-1878), the utilitarian philosopher James Mill, and George Birkbeck (1776-1841), Brougham sought to exploit the advances in printing and distribution and publish relatively inexpensive, factual,

[9] To cite the principal works, A. Aspinall, *Lord Brougham and the Whig Party* (Manchester: Manchester University Press, 1927); C. New, *Life of Henry Brougham to 1830* (Oxford: Oxford University Press, 1961); R. Stewart, *Henry Brougham 1778-1868: His Public Career* (London: The Bodley Head, 1986).

improving works that would, as Thomas Spring Rice declared in 1828, 'direct the ability to read to useful ends'.[10]

The programme and stated aims of the SDUK emerged out of the unparalleled political and economic ferment of the 1820s and 1830s. The extended political crisis of Catholic Emancipation, which George IV, noted hysteric, was not alone in viewing as a precursor to the erosion of society by papal fanatics; popular pressure for Parliamentary reform, which regularly erupted into rioting, notably when the House of Lords threw out the initial bill in 1831; and the aftermath of the Reform Act, in which it became clear to radicals and democrats that they in fact suffered a serious defeat; and the continuing social upheaval attending rapid industrialisation and urbanisation, all combined to persuade many cautious observers that the country was in acute danger of social revolution. As Secord notes in his study of early Victorian reading habits, the 'rational understanding provided by science' seemed to offer a way forward.[11]

Brougham, who had been one of the most active advocates of franchise reform and whose stock with the radicals, high after his defence of Queen Caroline in 1820, had thereby plumbed new depths, seized upon the educational possibilities of science relatively early on. In 1825, before the SDUK's founding, Brougham set out his ideological stall in *Practical Observations upon the Education of the People*, in which he placed considerable emphasis on the value of a scientific education for literate workers.[12] His article, which duly appeared as a pamphlet and enjoyed a wide circulation, did not meet with unalloyed admiration. One of the first to dash off an outraged response was the biblical scholar Edward Grinfield (1785-1864),

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[10] 'Society for the Diffusion of Useful Knowledge', *The Times*, 19 May 1828; J. N. Hays, 'Science and Brougham's Society', *Annals of Science*, 20 (1964), 227-241.
[11] Secord, *Visions of Science*, 11-12.
[12] H. Brougham, 'Practical Observations on the Education of the People', *Edinburgh Review*, 82, (Jan., 1825), 508-510.

a veteran pamphleteer with a history of defending orthodox Anglican educational positions and taking querulous issue with Brougham's restless reforming instincts.[13] In his critique, Grinfield presaged a line of conservative scepticism towards the value of 'restless attempts' to improve the condition of the 'labouring orders.' Of Brougham's proposed three-tier system of educating infants, children, and adults, Grinfield thundered that 'it might have been hoped, that the great and acknowledged evils arising from our poor laws, would have taught the people of this country the danger and difficulty of intermeddling with those laws of Nature on which the whole fabric of society is reared'.[14]

Grinfield reserved his particular ire for the *content* of Brougham's proposed educational system. Defining as the 'great and important objects' of existing educational practices as establishing 'habits of order and obedience' and making 'the doctrines and duties of Christianity the motives of their conduct and the rules of their behaviour', Grinfield then turned, with ponderous irony, to consider the curriculum of one of Birkbeck's London 'adult schools'. Affecting wide-eyed wonder, he notes that lectures are given on mathematics, astronomy and geology, chemistry, and 'what surprises us most of all, *on the French language*'. Now well into his stride, Grinfield scoffs at the usefulness of lecturing '*English* workmen and mechanics on the *French* language', further observing that 'it is exactly on minds like these, "that a little learning is a dangerous thing"'.[15]

It must be noted that Grinfield did not wholly object to the education of the labouring classes, but it had to be education of the right sort. Noting, grudgingly, that 'the minds of the working orders are now arriving at such a degree of strength' that they would no longer be

[13] For example, E. W. Grinfield, *The Crisis of Religion: A Sermon preached at Laura Chapel, Bathwick, November 17, 1811; containing Strictures on Mr. Lancaster's System of Popular Education* (Bath: 1812); and *Thoughts on Lord Brougham's Education Bill* (Bath: 1821).
[14] E. W. Grinfield, 'A Reply to Mr. Brougham's "Practical Observations Upon the Education of the People"', *Edinburgh Review*, 42 (1825), 8.
[15] Grinfield, 'A Reply to Mr. Brougham', 12-14.

contented with ‘the simple food’ that had satisfied their recent ancestors, he looked approvingly upon the Society for Promoting Christian Knowledge and its addition to book catalogue of innocuous works on history, biography, ‘tales and voyages’, and elementary books on arts and manufacturing.[16] Scientific works, however, he viewed with alarm, evident in the strength of his language and wilful misinterpretation; the idea that rendering the poor ‘virtuous and happy’ by educating them in the sciences he damned as ‘absolute quackery’.[17] He implored his readers to scorn the ‘false direction’ in which Brougham attempted to lead them, and back to the ‘chiefly moral and religious’ education that had served Britain so well.[18]

Of course, in initiating this debate Brougham had far more than the labouring classes in his sights. As Secord notes, one of the less understood aspects of his programme, and that of the SDUK, was that it was aimed at everyone, at all stages of education.[19] Nor was there anything particularly novel about what he wanted to achieve. What Rauch calls the ‘encyclopaedic spirit’ had been a prominent feature in British culture even before its resurgence following the publication of Denis Diderot’s famous *Encyclopedie* in 1751, itself viewed by Robert Collison as being highly influenced by Ephraim Chamber’s *Cyclopaedia,* first published in 1728.[20] Although these eighteenth-century forerunners were well beyond the means of the majority of the population, what they did very well was to divert and entertain their readers whilst also instructing them, a feature which Brougham and other popularisers sought to emulate. This, as Rauch notes, was a function of their format; by the end of the eighteenth century, publishers of encyclopaedias had generally settled upon an alphabetical system of ordering their contents, allowing readers potentially endless diversion in the ‘odd

[16] Grinfield, ‘A Reply to Mr. Brougham’, 17.
[17] Grinfield, ‘A Reply to Mr. Brougham’, 21.
[18] Grinfield, ‘A Reply to Mr. Brougham’, iii-iv.
[19] Secord, *Visions of Science*, 14.
[20] R. L. Collison, *Encyclopaedias: Their History throughout the Ages* (New York: Hafner, 1966), 108.

and interesting juxtaposition' of entries that resulted.[21] Coleridge, for one, deplored them as unsystematic miscellanies, but their success was duly noted.[22] Although innovations in publishing meant that, by the 1820s, knowledge could be produced on a large scale, it had still to be entertaining, or at least provide interesting diversion, if it was to sell. Charles Knight assured the SDUK that his proposed *Penny Cyclopaedia* 'will be far from devoid of amusement', and the series sold well, even if their quality gave at least one fellow publisher, Henry Colburn (1784-1850), much to carp about.[23]

Brougham and SDUK committee were not attempting to *replace* an earnest religious education with an entertaining scientific one, as Grinfield and Thomas Dick so feared. The committee's reluctance to give the SDUK's publications an overtly religious gloss was one factor in this misapprehension, but was in reality a means of maintaining cohesion amongst the committee members themselves. As Brougham, looking back to 1826, noted, 'the adoption of it might open the door to the introduction of religious controversy among us, against our fundamental principles'; the committee may have been united in their educationalist aims, but they represented a mixture of religious and political opinion.[24] Confronted by the growing weight of scientific discovery and theorising emanating from the Royal Institution, the Royal Society, and other British scientific associations, as well as from across the English Channel, the SDUK sought instead to harness together science and faith in a secular education.

The typically-idiosyncratic way in which Brougham set about this can be seen most clearly in his *Discourse on Natural Theology*, first published in 1833 and which continued to be re-issued long after the SDUK was wound up in 1846. Brougham himself, as his biographer

[21] Rauch, *Useful Knowledge*, 32.
[22] T. H. Lefevre, *Poetry Realized in nature: Samuel Taylor Coleridge and early Nineteenth Century Science* (Cambridge: Cambridge University Press, 1981).
[23] C. Knight, 'Report of the Penny Cyclopaedia Committee', 20 June 1832, SDUK; 'Criticism', *Edinburgh Review*, 98 (1834), 1-2.
[24] H. Brougham, *Natural Theology: Comprising a Discourse on Natural Theology* (London: SDUK, 1833), 4.

Michael Lobban notes, had a 'highly unorthodox' take on natural theology, and it bore little resemblance in either its principles or the ends to which Brougham sought to direct it to that expounded by Paley.[25] At the outset of this work, Brougham stated unambiguously that his 'is not a treatise of Natural Theology'. Rather, he set out to explain 'the nature of the evidence' upon which natural theology rests, and demonstrate that 'it is a science, the truths of which are discovered by induction, like the truths of Natural and Moral Philosophy'. His second, associated aim, which reflected his educationalist agenda, was to 'explain the advantages attending this study'.[26]

Brougham's determination to single-handedly bring natural theology into line with the course of scientific progress, and demonstrate that the truths of faith could be proven by scientific induction, may have smacked of the perceived intellectual arrogance which so incensed many of his conservative contemporaries, but it merely reflected the work and aims of men such as Whewell and Sedgwick in London, and Cuvier in Paris. Indeed, in a supplementary essay to *Natural Theology*, Brougham expended considerable energy on the latter's paleontological and anatomical studies, offering his readers, in effect, a summary of Cuvier's seven-volume *Recherches* and demonstrating 'their application to Natural Theology'. A gifted synthesiser of other people's work, Brougham marshals and condenses Cuvier's work into forty-odd fact-laden, highly readable pages, revealing himself to be firmly in the 'Catastrophist' camp in the debate which then raged between naturalists who believed in a progressionist history of the earth and those, along with the geologist Charles Lyell (1797-1875), who adhered to 'steady-statism'.[27]

[25] Lobban, ODNB.
[26] Brougham, *Natural Theology*, 7.
[27] H. Brougham, *Analytical View of the Researches on Fossil Osteology, and their Application to Natural Theology* (London: SDUK, 1835), 408.

Throughout *Natural Theology*, Brougham persisted in referring to natural theology as a branch of the inductive sciences. As such, he ascribed to natural theology the same benefits that were accrued from the study of any other science and from the 'contemplation of scientific truth'.[28] In this manner natural theology and the researches of contemporary men of science were directed towards the same end – namely, 'the service rendered by this study to the doctrines of Revelation', and the moral and material improvement of mankind.[29] If his critics could, and did, find fault with his methods, seeing in them the seeds of national ruin, his aims at least were unobjectionable.

An alternative vision of mass education through print media can be found in the work of Brougham's near-contemporary, Thomas Dick. His *On the Improvement of Society by the Diffusion of Knowledge* (1833) is a profoundly Protestant, anti-secular, rabidly anti-Catholic treatise which, like Grinfield's 1825 pamphlet, takes great offence at the current fashion for scientific education. However, unlike Grinfield, Dick did not question the value of science – which, indeed, he valued highly – but rather the way in which it was conducted, and he did not approve of encouraging the masses to indulge in theorising. Where Brougham sought to relocate natural theology to a place amongst the inductive sciences, Dick believed that science itself was straying away from inductive principles and into territory that should rightfully be occupied by theologians and metaphysicians, with dire consequences for public morality. He poured scorn on the tendency amongst men of science, whom he does not mention by name, who devoted their labours to hypothesising at the expense of observation and the accumulation of *facts*, which he deemed the proper remit of the naturalist.

[28] Brougham, *Natural Theology*, 176.
[29] Brougham, *Natural Theology*, 176.

> [I]n the present day, there is still too great a propensity to generalize, without submitting to the trouble of observing phenomena, and noting their various modifications and attendant circumstances. The human mind is impatient, and attempts to reach the goal by the goal by the shortest and most rapid course, while observation and experiment are tedious and slow. Instead of surveying the material world with his own eyes, and investigating, by observation and experiment, its principles and laws, the man of genius frequently shuts himself up in his closet, and from a few scattered fragments of nature, constructs, in his imagination, a splendid theory, which makes a noise and a blaze for a little, like an unsubstantial meteor, and then evanishes into air. The system of nature, though directed in its general movements by a few simple laws, is too grand and extensive, and too complex in many of its parts, to be grasped by a few individuals, after a cursory survey.[30]

The implication here is that the great questions of science, particularly where they impinge upon philosophy and religion, should be left in the hands of the very few men who not only had the requisite expertise, but also did not conform to any dangerous notions.

For the 'ordinary' individual, Dick advanced a more modest science which was, primarily, based upon collecting. Ironically enough, in this he was not very far from the collecting-based zoology advanced by Swainson, zoology's arch-theoriser, in his works for Lardner, as we shall see in the following section. Dick viewed scientific knowledge in material terms: the accumulation of fragments, and the building up of collections, '*would have a*

[30] Dick, *On the Improvement of Society*, 96.

powerful influence on the progress of science [original emphasis]'.[31] He saw science as a collaborative enterprise, upon which the 'eyes and intellects of millions' must be focused in order that nature be thoroughly surveyed.[32] Seeking to encouraging the contemporary popular enthusiasm for natural history, first explored by the social historian David Allen almost forty years ago, Dick saw great virtue in this circumscribed version of it, not only for its potential to hone the intellect, and thereby discourage people from 'ignorant pleasures'; but also for the knowledge of God that could be gained 'by the visible effects he has produced, or the *external manifestations* he has given of himself to his creatures'.[33]

In common with Brougham, and indeed with the greater number of early nineteenth-century popularisers, Dick emphasised the 'pleasures' which attended the study of science and the exercise of the intellect, arguing that pleasure was 'annexed to the gratification of the principle of curiosity'. This taste for knowledge, he continued, was inherent in man, and God had ensured that it be thus, in order to 'exercise us to investigations of the wonders of creations he has presented before us, to lead us to just conceptions of his infinite perfections, and of the relation in which we stand to him as the subjects of his government'.[34] To emphasise the point, Dick rounds off his book with a resounding defence of the 'importance of connecting science with religion. Taking approving note of the increase in knowledge amongst the 'middle and lower ranks of society', and the influence of Mechanics' Institutes and other associations in encouraging the 'desires which are now excited for intellectual pleasures', he cautions that 'knowledge of true religion' has not kept pace with the development of intellectual movements – the blame for which he places on the heads of the 'men of enlightened understandings', so

[31] Dick, *On the Improvement of Society*, 95.
[32] Dick, *On the Improvement of Society*, 95.
[33] Dick, *On the Improvement of Society*, 107, 194.
[34] Dick, *On the Improvement of Society*, 108.

consumed with ‘*vanity* and *self-conceit*’ that they presumed to know the divine plan of creation.[35]

Thomas Dick occupied an ideological position somewhere in between the secularist Brougham and the biblical scholar Grinfield. The interplay of their respective ideas about the merits of a scientific education relative to traditional emphases on faith and morality, and the forums in which they chose to disseminate their opinions, reveals much about how science was inextricably bound to shifting notions of defining and maintaining canons of behaviour and conduct. All three men regarded education as vital to social control through self-improvement, although they disagreed profoundly on what subjects were appropriate for the minds of not only the working classes, but also those of the middle class. All of this suggests historians need to take a closer look at the popular scientific works about which they expended so much ink.

II.

Quinarianism has usually been characterised by historians of science as having a negligible public impact. Complex to the point of incomprehensibility, as the anonymous reviewer of Swainson’s volume noted in 1839, it ‘required a thorough knowledge of animated nature’ which very few in Britain had the means, or indeed the opportunity, to acquire.[36] This was an important observation, for it highlighted one of the principal reasons why the theory stubbornly failed to attract a popular following. Quinarianism can appear to have been a theory of the elites, with access to collections a necessary requirement. Even Swainson, whose

[35] Dick, *On the Improvement of Society*, 353-354.
[36] ‘Lardner’s Cabinet Cyclopaedia’, *Newcastle Courant*, 11 January 1839.

background was rather more modest, participated in the enthusiastic exchange of specimens which was one of the more notable features of early-nineteenth century natural history.

Few of the theory's main advocates ventured into the world of general, 'popular' scientific literature. Kirby was a partial exception, but his volume for the *Bridgewater Treatises* was so expensive that one reviewer refused to review it.[37] Jardine, as we shall see, was instrumental in one of the great popular publishing ventures of the 1830s. However, the strength of his commitment to quinarianism is difficult to gauge and it is reasonable to assume that, like his great friend Selby, Jardine bowed to the reputations and undoubted ornithological expertise of Vigors and Swainson.[38] This left only Swainson. On the face of it, Swainson's engagement by the publisher and scientific impresario, Dionysius Lardner (1793-1859), to contribute scientific volumes to his 'Cabinet Cyclopaedia' series may seem to have been a 'lucky break', as David Allen puts it, but perhaps only in the sense that he could not afford to turn Lardner down.[39] He was commissioned in 1833 to write fourteen volumes for the 'Cabinet Cyclopaedia', published by the venerable firm of Longmans, of which he completed nine, together with a further volume on entomology in collaboration with William Shuckard (1803-1862), librarian to the Royal Society.[40]

Like Brougham, Lardner was a man who would have been unusual in any age, and it is indicative or popular publishing's prominence that it attracted two men of such flamboyance and force of will. In the 1820s, he had enjoyed a successful career as a popular lecturer on scientific topics and was a regular speaker to the annual meetings of the BAAS, or 'parliament of science', becoming noted as a particular authority on mechanical engineering and railways,

[37] J. R. Topham, 'Publishing "Popular Science" in Early Nineteenth-Century Britain', in A. Fyfe, B. Lightman (eds.), *Science in the Marketplace: Nineteenth-Century Sites and Experiences* (Chicago, IL: University of Chicago Press, 2007), 135-168.
[38] Jackson.
[39] Allen, *Books and Naturalists*, 191.
[40] Swainson and Shuckard, *Natural Arrangement of Insects*

managing to quarrel with both Isambard Kingdom Brunel and Robert Stephenson in the process.[41] In 1828, his scientific stock stood sufficiently high that he was appointed to the chair of natural philosophy at the recently-founded London University, a project in which Brougham had been deeply involved with from the outset. The university reflected many of Brougham's most cherished tenets, offering students a secular, scientific education at a time when religious tests were still an entrenched part of Oxbridge life, and admitting female students on terms of equality with their male counterparts.[42]

In common with the publications of the SDUK, Lardner's *Cabinet Cyclopaedia* was conceived against the background of the 1820s print revolution and a pervasive concern to direct the curiosity of the British literate public down morally edifying paths. The *Cyclopaedia* was aimed squarely at the commercial classes, each of its one hundred and thirty three volumes priced at six shillings, relatively inexpensive compared with the *Bridgewater Treatises* but well beyond the means of the average mechanic or labourer. Lardner, as editor, expended great effort in attracting some of the most high-profile authors and scientific authorities of the day to contribute works to the series, which was intended to be 'a complete library of instruction, amusement, and general reference'.[43] Notable coups included Sir Walter Scott (1771-1832), who wrote volumes on the history of Scotland; David Brewster (1781-1868), the physicist and polymath dubbed the 'father of experimental optics' by William Whewell; and John Herschel (1792-1871), whose achievements in astronomy, mathematics and a host of other fields made him the most widely-respected man of science of the age.[44]

[41] J. Hays, 'The Rise and Fall of Dionysius Lardner', *Annals of Science*, 38 (1981), 527-542; Peckham, 'Dr. Lardner's *Cabinet Cyclopaedia*', 37-39.
[42] Peckham, 'Dr. Lardner's *Cabinet Cyclopaedia*', 43-44.
[43] 'Dr Lardner's Cyclopaedia', *The Times*, 4 December 1829.
[44] W. Scott, *History of Scotland* (London: Longman, 1830); D. Brewster, *Treatise on Optics* (London: Longman, 1831); J. Herschel, *A Preliminary Discourse of the Study of Natural Philosophy* (London: Longman, 1830).

It is worth pausing to consider Herschel's contribution for a moment. His *Preliminary Discourse on Natural Philosophy*, one of the first volumes published by Lardner in 1831, was hailed on its publication as the greatest work on the physical sciences since those of Francis Bacon in the 1600s. However, Secord has recently argued that Herschel's *Discourse* be viewed in a different light. In a convincing thesis, he argues that, as an inexpensive book that enjoyed large sales, its readers were far more likely to have viewed it, and used it, as a 'conduct manual', rather than as a contribution to philosophy or scientific method.[45] Conduct manuals were staples of early nineteenth-century publishers' catalogues and were intended primarily for the same audience as the *Cyclopaedia*, the knowledge-hungry middle classes. Whilst offering guidance on correct etiquette, such publications also outlined 'correct' modes of thinking and made clear the links between respectable intellectual pursuits and good character. Secord contends that the *Discourse* was principally seen as encouraging behaviour based on 'an understanding of reason as grounded in the practices of science', behaviour which was also grounded in the established societal order.[46] In common with Dick and Brougham, Herschel, from a far loftier scientific eminence, advocated the merits of induction from observed fact to general theory, a hierarchical conception of science in which the mass of scientific workers, involved in the collection of raw facts, would feed their observations to the very small circle of men best qualified to create from them general theories.[47]

The parallels between Herschel's *Discourse* and Thomas Dick's evangelical vision of natural science, with its division between the 'proper' province of the middle- and lower-class amateurs and that of the elite, including Herschel himself, are striking. As Walter Cannon notes, the work found a broad and appreciative audience. Read in its entirety, it encouraged the

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[45] Secord, *Visions of Science*, 81.
[46] Secord, *Visions of Science*, 81-82.
[47] See W. F. Cannon, 'John Herschel and the Idea of Science', *Journal of the History of Ideas*, 22, 2 (Apr.-Jun, 1961), 215-239; A. D. Cobb, 'Inductivism in Practice: Experiment in John Herschel's Philosophy of Science', *HOPOS*, 2, 1 (Spring, 2012), 21-54.

young Charles Darwin to embark upon a scientific career. It gave theologians comfort with its unambiguous statements of the God's existence and the benefits of faith; whilst the genteel plucked from it authoritative sentences to provoke, and draw to an end, drawing-room conversations.[48] However, the *Discourse* was also a product of the internecine warfare that raged in London's scientific and learned institutions throughout the late 1820s and early 1830s; in this particular instance, the furore which surrounded the election of a new president of the Royal Society in 1830. This widely-studied episode had its roots in the same combination of political and scientific factors that had prompted the founding of the Zoological Society in 1826, particularly the widespread concerns of careerists, dubbed 'Declinists', that the standard of British science was hamstrung by the continued dominance of gentlemen dilettantes upon society councils. Although the mathematician Charles Babbage (1791-1871), whose *Decline of Science in England* (1830) gave the malcontents an identity and a resounding manifesto, is the figure most closely associated with the movement, Herschel himself was prominent in his calls for reform and during the 1820s had often lamented the poor standards of research, particularly in scientific journals.[49]

Defeated by the Duke of Sussex, William IV's brother, in his bid to be elected as the Royal Society's President, Herschel turned his mind to Lardner's commission, and the book that resulted has shades of the youthful, philosophical radicalism that had led to his marginalisation from Cambridge's Analytical Society in 1819.[50] In common with Babbage and the vast majority of the 'Declinist' contingent, Herschel's calls for scientific reform stemmed from both a deep interest in, and assimilation of, Continental scientific advances, and a deep

[48] Cannon, 'Herschel', 220; Herschel, *Preliminary Discourse*, 7.
[49] J. F. W. Herschel, 'Treatise on Sound' from the *Encyclopaedia Metropolitana* (London: Rest Fenner, 1817-1845), 20 vols.
[50] H. W. Becher, 'Radicals, Whigs and conservatives: The Middle and Lower Classes in the Analytical Revolution at Cambridge in the Age of Aristocracy', *The British Journal for the History of Science*, 28, 4 (Dec., 1995), 405-426.

resentment of the continued aristocratic, conservative dominance of British science. An admirer of Brougham and his efforts to educate all ranks of British society, Herschel repeatedly stressed the power of knowledge and the importance of reading for all people, whatever their status or profession.

> It is hardly possible but the character should take a higher and better tone from the constant habit of associating in thought with a class of thinkers, to say the least of it, above the average of humanity. It is morally impossible but that the manners should take a tinge of good breeding and civilisation, from having constantly before one's eyes the way in which the best bred and the best informed men have talked and conducted themselves in their intercourse with each other. There is a gentle, but perfectly irresistible coercion in the habit of reading well directed over the whole tenor of a man's character and conduct, and because it is really the last thing he dreams of… It civilises the conduct of men – and *suffers* them not to remain barbarous.[51]

Secord's insights, and viewing the *Discourse* within the context of Herschel's ambiguous status in the framework of British science – an undoubted star, but one whose middle-class origins and philosophic radicalism often counted against him in these early years – demands that we look at Swainson's contributions to Lardner's *Cyclopaedia* in a similar critical light.

[51] J. F. W. Herschel, 'An Address to the Subscribers to the Windsor and Eton Public Library and Reading Room', in *Essays from the Edinburgh and Quarterly Reviews, with Addresses and other Pieces* (London: Longman, 1857), 13.

Swainson's first publication for Lardner bore more than a passing resemblance to Herschel's *Preliminary Discourse*, not just in its octavo format and chosen title. His *Natural History* (usually referred to in the historiography as the *Preliminary Discourse,* but referred to thus to avoid confusion with Herschel's book) chimed on the same themes of science as a collaborative activity; the advantages of the study of natural history as recreation; its close connection to religion; and strong 'Declinist' suggestions for the reform and improvement of scientific societies. It also, like Herschel's treatise, sought to teach: in part one, Swainson offers a cogent, general overview of the progress of zoology from Aristotle to Cuvier, rounding off his survey with the 'discovery of the Circular Nature of Affinities'; and, in part three, a comprehensive exploration of the principles underpinning the 'natural system' and instructions to budding naturalists on how best to study the productions of nature according to 'natural' methods.[52]

Envisaging, for a moment, a world that had 'never known evil', Swainson rhetorically asked his readers with what pursuit would mankind occupy his time, and what would be the object of his study. His answer was immediate and unequivocal:

> The works of God, as manifested in all visible nature, would be his only study. Surrounded by innumerable objects attractive by their beauty, wonderful by their construction, or interesting by their economy, his days would be spent in surveying the material world; - his heart enlarged, and his reason exercised, in meditating on all that he saw. Every new discovery would increase his veneration for the Divine Author of such wonders…[53]

[52] Swainson, *Preliminary Discourse*, 152-295.
[53] Swainson, *Preliminary Discourse*, 93-94.

Together with many natural theologians before him, he likened nature to a book, open for man's perusal, the study of which not only provided comfort from the 'stirring excitations of the troubled world', but stimulated the development of the powers of reason and, finally, as conferring habits of mind and study which would improve 'the ordinary business of life'.[54]

Alone amongst the quinarians, Swainson already had a considerable record as an advocate of popular, general scientific works as a means of moral and intellectual improvement. However, like Herschel, he strongly believed that the efforts of 'general readers' should be directed by authority. He first advanced these views long before his conversion to quinarianism, in the somewhat unusual forum of his first illustrated folio, *Zoological Illustrations*, the first series of which was published between 1820 and 1823. In his preface, he noted that the work had two principal objects. First, the diffusion of general observations which 'while they might further the ends of science, would also be interesting to the general reader'. The second, to which we will return shortly, was to set before the reader up-to-date images of nature which, unlike many natural history works of the period, did not merely reproduce or adapt previously-published illustrations. [55]

Given the audience to which this work was aimed, Swainson was here limiting his remarks to the wealthy. Although Swainson had slashed the cost of producing *Zoological Illustrations* through his adoption of lithography for the production of the plates – in fact, the first natural history work in which lithography was employed – it was still a prestige work, beyond the means of the middle-class audience commonly viewed by historians as the principle

[54] Swainson, *Preliminary Discourse*, 93, 96.
[55] W. Swainson, *Zoological Illustrations, or Original Figures and Descriptions of New, rare, or Interesting Animals, selected chiefly from the classes of Ornithology, Entomology, and Conchology, and arranged on the principles of Cuvier and other Modern Zoologists* (London: Baldwin, Cradock, and Joy, 1820-1). First Series**,** iii.

audience for improving works. Noting the rapid advance of science in the preceding decade, particularly in the overlapping fields of zoology and geology, which had increasingly turned from its traditional emphasis on mineralogy to the much more exciting field of palaeontology, he nevertheless questioned whether science, ‘in the end’, would not be better advanced had more scientific works been aimed to general readers.[56]

He returned to the theme a decade later when he re-issued an amended version of *Zoological Illustrations*, complete with new plates, additional species, and a much more pronounced adherence to ‘natural system’ - although, significantly, he expressed reservations about quinarianism which suggest that he became a zealous convert later than commonly assumed by historians. Published as he worked on his *Natural History* for Lardner, it contains many points of overlap, echoing Herschel’s vision of a mass of natural history workers feeding their observations to experts of enlightened understanding, but was directed at a very different audience than that of the *Cyclopaedia*:

> The power of embracing comprehensive views, and of detecting diversified relations, must be confined to a few, because such objects require the greatest exertion of a superior mind, yet they must ever be mainly dependant on the labours of another class of naturalists: those who analyse the properties of species, and separate with critical judgement, and nice discrimination, resemblances from affinities. But for these valuable coadjutors our acquaintance with nature would be altogether speculative: they supply, in short, by analysis, that basis upon which all

[56] Swainson, *Zoological Illustrations*, iii-iv. Richard Yeo interprets this passage in the opposite light, but it seems inconceivable that, even given Swainson’s notoriously perverse temper, he would have cautioned against diffusion of science whilst writing a popular textbook on zoology. See Yeo, ‘Science and Intellectual Authority’, 15.

> true knowledge of nature must repose. Natural combinations can never be fully detected, without an acquaintance with their component parts.[57]

Swainson saw these paths as convergent, ‘advancing the knowledge of their favourite science by different modes of study’, and assigns priority to neither one nor the other; ‘as both must be trodden, it seems unnecessary to discuss which road is the most honourable’.[58] However, it is clear, from an analysis of this work at least, to which category of naturalist he assigned himself. Whilst praising the modest labours of collectors and field naturalists, he made evident his expertise in ornithology and conchology and a great parade of his close acquaintance, either personal or through knowledge of their work, with the great authorities of the preceding century, citing Vigors, Selby, Gilbert White (1720-1793), François Levaillant (1753-1824), Alexander Wilson (1766-1813), Felix de Azara (1746-1821), and numerous others.[59] By setting himself in this distinguished, if heterogeneous roll of European zoologists, Swainson attempted to firmly stamp his authority upon the higher study of natural history.

When viewed in the context of natural history at this period, in addition to the wider political and social turmoil within which it was conducted, Swainson’s determination to place himself in a tradition can be seen to have been motivated by other reasons than simple vanity. The sheer volume of information which inundated naturalists in the first decades of the nineteenth century, making classification a topic of such burning importance and which led to fierce debates over inductive and deductive methodologies, also blurred long-established boundaries of where authority lay and made the codification of knowledge a vital priority. This

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[57] W. Swainson, *Zoological Illustrations, or Original Figures and Descriptions of New, rare, or Interesting Animals, selected chiefly from the classes of Ornithology, Entomology, and Conchology, and arranged on the principles of Cuvier and other Modern Zoologists* (London: Baldwin, Cradock, and Joy, 1829-33). Second Series, v.
[58] Swainson, *Zoological Illustrations*, second series, vi.
[59] Swainson, *Zoological Illustrations*, second series, vii.

was a particularly acute concern for those, like the 'Philosophical Naturalists', who advocated radical departures from long-established scientific methodologies. Vigors, as we have seen in previous chapters, called upon a narrowly-chauvinistic reading of British philosophers, particularly Locke, and inductivism to confer upon his zoological work the requisite authority for it to be taken seriously by scientific peers. Swainson, who did not share Vigors' aggressive, if strategic anti-Gallicism, also made much of his credentials as an inductive naturalist, and as late as 1833 drew attention to the 'evil' which resulted where 'synthesis has completely set aside analysis, and where the rigged and laborious path of patient investigation, has been deserted for the flowery walks of Speculation and Hypothesis'.[60] It could almost have come from the pen of Herschel or Brougham, expressing as it did that the true authority of the scientist came from patient accumulation of facts. It also reiterated the concept of the scientific hierarchy – and, by analogy, the hierarchical ordering of nature and society, with each unit in its designated place.

Swainson also placed great emphasis on the educational power of illustration in his works for Lardner. Illustration was one of the most attractive features of the *Cyclopaedia* and intended by Lardner and Longman to be one of its principle selling points. As Sheets-Pyenson notes, publishers were adept at following public demand and even shaping public taste, and particularly shrewd printers, such as John Van Voorst and Lovell Reeve, recognised the appeal of illustrated natural history works at a time when many in Britain were experiencing a rapidly changing, increasingly urban world and in which the popularity of zoological gardens and menageries was rocketing.[61] The same advances in print technology that had made possible the

[60] Swainson, *Zoological Illustrations*, second series, vi-vii.
[61] S. Sheets-Pyenson, 'War and Peace in Natural History Publishing: The Naturalist's Library, 1833-1843, *Isis*, 72, 1 (Mar., 1981), 52.

production and dissemination of the SDUK's publications applied also to improvements in cheap, relatively high-quality illustration. Later in the 1830s, the success of *The Naturalist's Library*, with Jardine as editor, depended greatly upon the ability of its publisher, W. H. Lizars (1788-1859), to issue lavishly illustrated books with hand-coloured steel-engravings at only six shillings a volume.[62] In common with Lardner, Lizars exploited advances in steam-powered printing machinery, which by the 1830s had revolutionised newspaper production, and brought them to the service of book publishing. The vast increase in printing speed, and reduction in costs, allowed Lizars and Jardine to expend more money on high-quality illustration relative to the quantity of text than any of their competitors. This was greatly appreciated by reviewers; when the first volume, *Hummingbirds*, appeared in 1833, the *Sunday Times* praised the 'exquisitely finished' plates, noting the 'the delicacy with which every, the slightest, variety of colour in the feather of the living bird is delineated', whilst the *Atlas* believed that the 'brilliant' illustrations were 'an *ad captandum* argument for cultivation of natural science'.[63]

Pictures played an important role in promoting scientific knowledge in the early nineteenth century, but the ways in which words and images constituted knowledge, and the role of pleasure in encouraging more people to take up natural history as an edifying pursuit, provoked much heated debate. Although the majority of reviews of *The Naturalist's Library* were positive, particularly whilst the novelty of hand-coloured illustrations in cheap volumes was still fresh, there were some who viewed illustrations as an unnecessary allurement which could even damage the progress of science. These debates have been studied by Anne Secord, whose insights, although based upon specific reference to botanical works, are equally applicable to the practices and purposes of zoological illustration.[64] As Brougham, Herschel

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[62] Sheets-Pyenson, 'War and Peace in Natural History Publishing', 61.
[63] [Anon.], 'The Naturalist's Library', *Sunday Times*, 31 March 1833; [Anon.], 'Naturalist's Library', *Atlas*, 31 March 1833, 197.
[64] A. Secord, 'Botany on a Plate: Pleasure and the Power of Pictures in Promoting Early Nineteenth-Century Scientific Knowledge, *Isis*, 93, 1 (March 2002), 28-57.

and Swainson all stressed, pleasure was at the heart of their campaigns to promote the study of science, but it had to be the right sort of pleasure, that which ‘purifies and refines the passions, and helps our reason to assuage their violence’.[65] They accordingly had a cautious attitude towards illustration, believing it to be just as effective in the ‘low gratification of the senses’ as honing the powers of reason.[66] Evident here is a resurgence of eighteenth-century moral and religious concerns about sensual forms of recreation, which Barbara Stafford deems to have been sufficiently prohibitive that imagery ‘became morally and intellectually discredited as constitutive of knowledge’ and were afterwards regarded solely as entertainment.[67]

There may have also been narrow, sectarian factors behind the suspicion of imagery, particularly in the highly-charged religious atmosphere of the 1820s and 1830s. Thomas Dick’s rabid anti-Catholicism is a reminder of one of the other ways in which religion and science were linked at this time. For Dick, Catholicism was a pernicious threat to the progress of human knowledge and the restrictions that had recently been lifted from Catholics in Britain potentially disastrous in its effects:

> That the establishment of the popish religion in any state has a tendency to impede the progress of knowledge, it would be almost needless to illustrate… mummeries… the grovelling and superstitious notions which it has engendered, the ignorance which prevails among the population of all those countries over which its influence extends… it is a system founded on the darkness and imbecility of the human intellect… and where reason has lost its ascendency in the minds of men.

[65] H. Brougham, *The Objects, Advantages, and Pleasures of Science* (London: SDUK, 1827), 1.
[66] Secord, ‘Botany on a Plate’, 31.
[67] B. Stafford, ‘Author’s Response’, *Metascience*, 6 (1994), 24-30.

Stafford, in *Artful Science*, argues that this evangelical and Presbyterian distaste for Catholic images and 'superstition' may have predisposed some, particularly non-conformists, to set relatively greater emphasis on words as vectors of knowledge.[68] Her thesis is supported by Adrian Johns, who sees in the 'obsession' of eighteenth-century Protestants with the eradication of 'false images' the seeds of a lasting struggle over proper ways of communicating natural knowledge.[69] However, this line of argument can be pushed too far, not least because, as Secord notes, evangelical groups such as the Religious Tracts Society used images liberally in their own publications.[70]Whilst the expostulations of a vocal body of nineteenth-century scientific opinion give partial credence to Stafford's claims, the weight of evidence suggests that for the majority of naturalists illustration was very much intended for instruction, and if they gave their readers pleasure then so much the better for the progress of science.

As an observational science, zoology relied heavily on pictures. However, the above discussion, and that in chapter two, demonstrates that there was a pronounced dichotomy in the way that naturalists regarded the utility of images and their correct format, based upon their intended audience. Museum-based men of science, operating within the closed sphere of scientific institutions, used them in conjunction with specimens and written descriptions as means of codifying species definitions, classificatory systems, and communicating discoveries to their peers. By contrast, as Herschel noted, men of science were concerned to attract new recruits to science with specific reference to an inductive methodological framework. The proper aim of introductory books was to enlarge the community of amateur producers of

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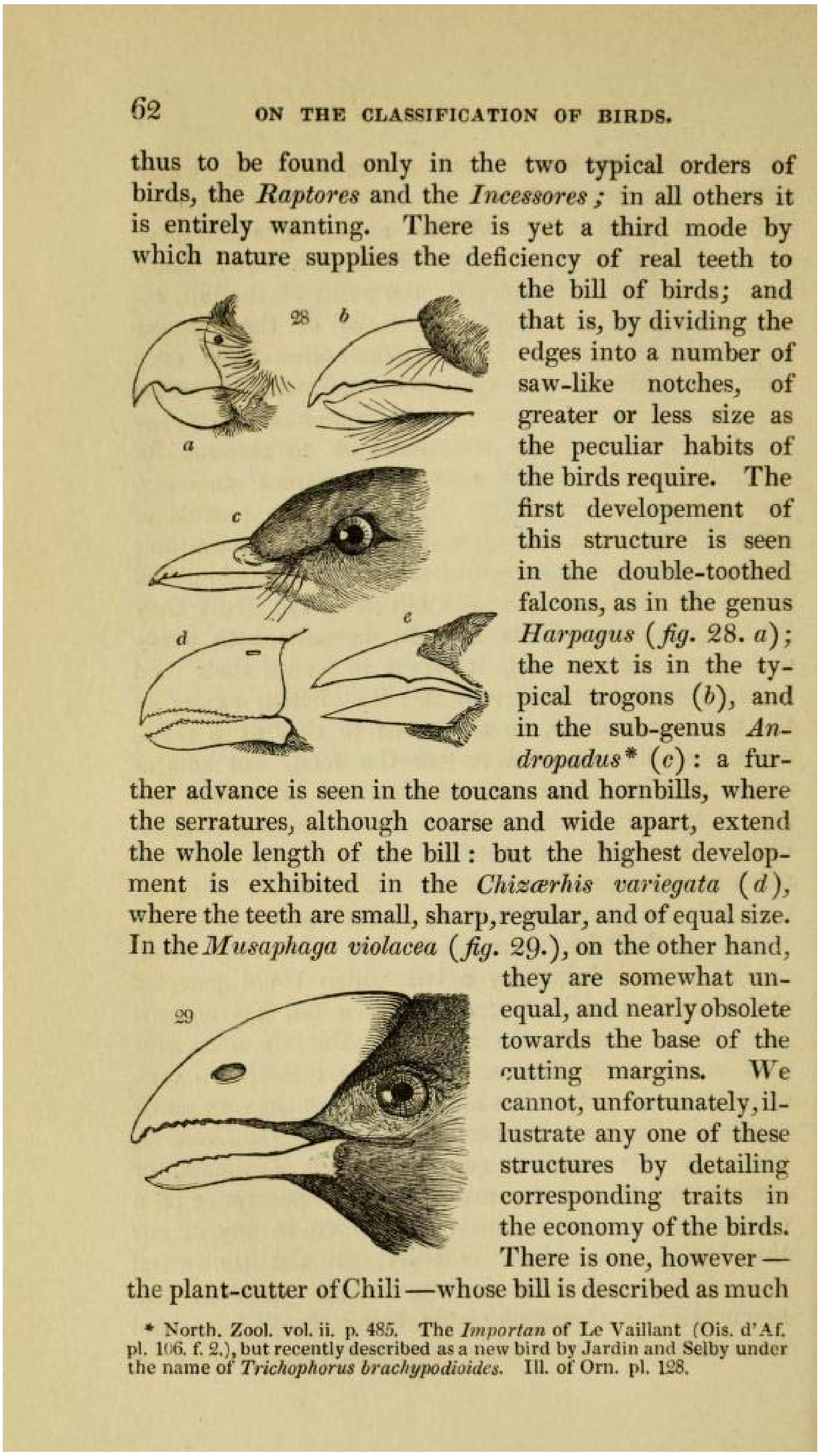
[68] B. Stafford, *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education* (Cambridge, MA: MIT Press, 1994).
[69] A. Johns, 'Barbara Maria Stafford, *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education*', *British Journal for the History of Science*, 29, 3 (Sep., 1996), 368.
[70] Secord, 'Botany on a Plate', 55, n. 70.

reliable scientific knowledge, which could then be analysed and synthesised by men like Herschel.

The illustration in the *Cyclopaedia*, which began to appear several years before Lizars and Jardine embarked on *The Naturalist's Library*, were comparatively modest. Although Lardner trumpeted illustration as one of his series' principle attractions, a good proportion of the volumes included no or very few illustrations: neither Herschel nor Swainson's preliminary discourses, for example, contained anything but densely-packed letterpress. However, those of Swainson's works which dealt with specific departments of natural history, such as *On the Natural History and Classification of Birds* (1836), were generously illustrated.[71] Although of a high artistic standard, being executed by Swainson himself, these were generally of a more technical character than the illustrations in the *Naturalist's Library*, reflecting their more 'scientific' content which relied far less on that easy, anecdotal tone which characterised Lizars and Jardine's volumes (*figs* 19 and 210).

[71] Swainson, *Classification of Birds*,



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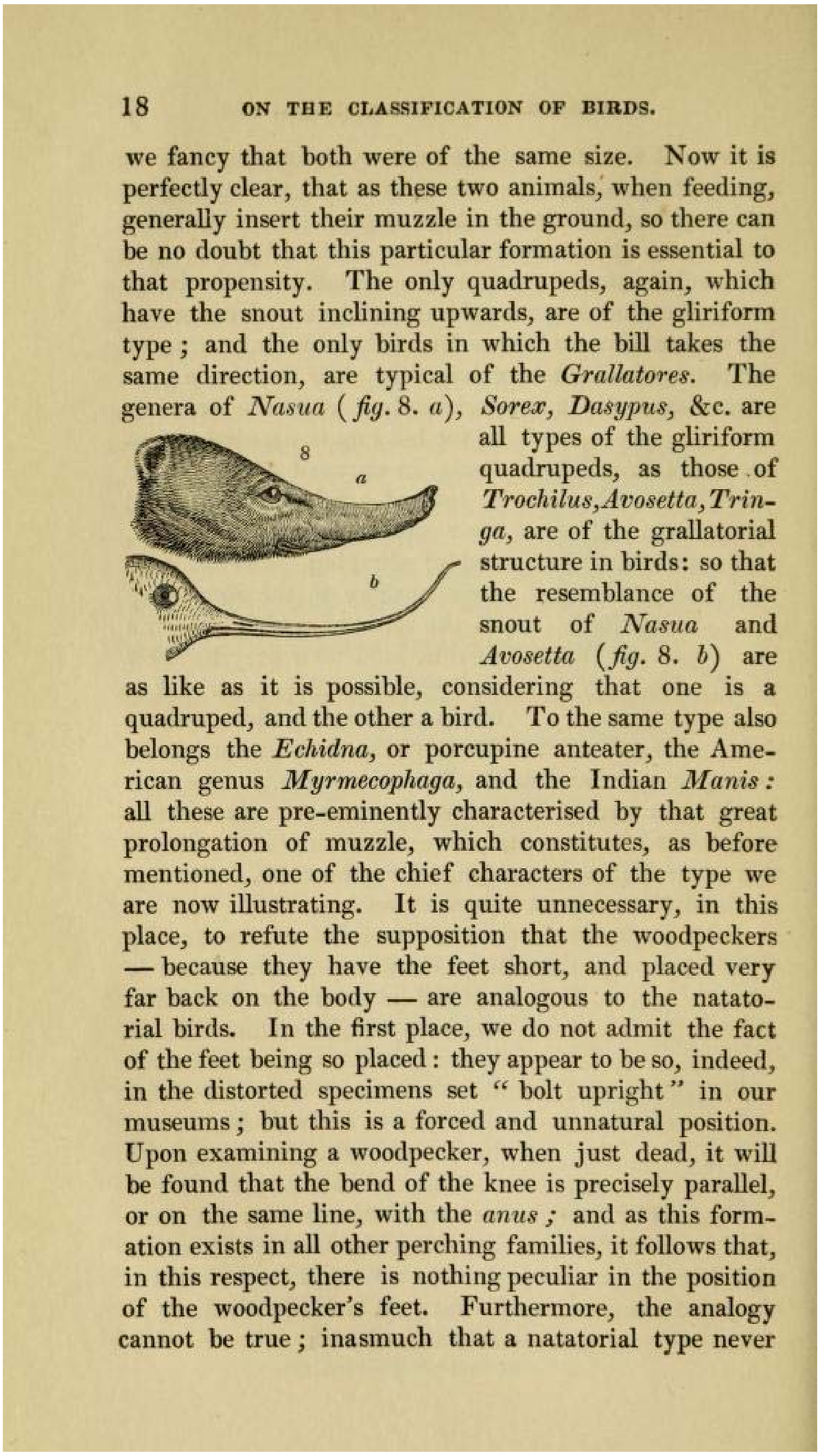
thus to be found only in the two typical orders of birds, the *Raptores* and the *Incessores ;* in all others it is entirely wanting. There is yet a third mode by which nature supplies the deficiency of real teeth to the bill of birds; and that is, by dividing the edges into a number of saw-like notches, of greater or less size as the peculiar habits of the birds require. The first developement of this structure is seen in the double-toothed falcons, as in the genus *Harpagus* (*fig.* 28. *a*); the next is in the typical trogons (*b*), and in the sub-genus *Andropadus** (*c*) : a further advance is seen in the toucans and hornbills, where the serratures, although coarse and wide apart, extend the whole length of the bill : but the highest development is exhibited in the *Chizærhis variegata* (*d*), where the teeth are small, sharp, regular, and of equal size. In the *Musaphaga violacea* (*fig.* 29.), on the other hand, they are somewhat unequal, and nearly obsolete towards the base of the cutting margins. We cannot, unfortunately, illustrate any one of these structures by detailing corresponding traits in the economy of the birds. There is one, however — the plant-cutter of Chili — whose bill is described as much

* North. Zool. vol. ii. p. 485. The *Importan* of Le Vaillant (Ois. d'Af. pl. 106. f. 2.), but recently described as a new bird by Jardin and Selby under the name of *Trichophorus brachypodioides*. Ill. of Orn. pl. 128.

Figure 21. W. Swainson, illustrations depicting variations in beak structure of different genera of birds, in W. Swainson, *On the Natural History and Classification of Birds* (London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836), 62.



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we fancy that both were of the same size. Now it is perfectly clear, that as these two animals, when feeding, generally insert their muzzle in the ground, so there can be no doubt that this particular formation is essential to that propensity. The only quadrupeds, again, which have the snout inclining upwards, are of the gliriform type; and the only birds in which the bill takes the same direction, are typical of the *Grallatores*. The genera of *Nasua* (*fig.* 8. *a*), *Sorex, Dasypus,* &c. are all types of the gliriform quadrupeds, as those of *Trochilus, Avosetta, Tringa,* are of the grallatorial structure in birds: so that the resemblance of the snout of *Nasua* and *Avosetta* (*fig.* 8. *b*) are as like as it is possible, considering that one is a quadruped, and the other a bird. To the same type also belongs the *Echidna*, or porcupine anteater, the American genus *Myrmecophaga*, and the Indian *Manis*: all these are pre-eminently characterised by that great prolongation of muzzle, which constitutes, as before mentioned, one of the chief characters of the type we are now illustrating. It is quite unnecessary, in this place, to refute the supposition that the woodpeckers — because they have the feet short, and placed very far back on the body — are analogous to the natatorial birds. In the first place, we do not admit the fact of the feet being so placed: they appear to be so, indeed, in the distorted specimens set "bolt upright" in our museums; but this is a forced and unnatural position. Upon examining a woodpecker, when just dead, it will be found that the bend of the knee is precisely parallel, or on the same line, with the *anus*; and as this formation exists in all other perching families, it follows that, in this respect, there is nothing peculiar in the position of the woodpecker's feet. Furthermore, the analogy cannot be true; inasmuch that a natatorial type never

Figure 22. W. Swainson, illustrations depicting analogy between an aardvark's nose and avocet's beak, in W. Swainson, *On the Natural History and Classification of Birds* (London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836), 18.

When we consider his earlier comments on the importance of illustration, it should not surprise us that Swainson chose to illustrate his *Cyclopaedia* works himself. As he noted in 1821,

> [T]he publication of distorted figures coped from old authors, by accustoming the public eye to original designs and correct representations of natural objects… [F]or it is only by the publication of original matter, that a check can be given to the increasing number of compilations and multiplied copies of "ill-shaped" figures, by which error is perpetuated, and science retarded.[72]

By the time he came to write and illustrate his volumes for Lardner, the science which Swainson zealously sought to advance through the deployment of well-shaped figures was overwhelmingly quinarian in tone. Beyond stressing, conventionally enough, the benefits of natural history as a socially useful activity, and its ability to 'improve and regulate the moral feelings', Swainson devoted much space in both *Preliminary Discourse* and *Natural History of Birds* to detailed overviews of quinarianism. These extended beyond explications of its theoretical principles to the reasoning behind the selection of characters upon which quinarian classification was based, and directions to amateur naturalists about how to identify them. In the *Preliminary Discourse*, noting that naturalists cannot 'universally' employ any organ or external characteristic to furnish generic characters in either artificial or natural systems because of the lack of a common standard, he argued:

[72] Swainson, *Zoological Illustrations*, First Series, iii.

> When the naturalist… has before him a generic group, whose affinities, more or less, appear to be circular, he is next to seek for those characteristics which are most prevalent in all the forms or species which compose it. It is a matter of perfect indifference, what organ, or what set of organs, furnish these characters, provided they are more comprehensive than the others, and are of such a nature as is to be readily detected. His great object, in fact, is to point out how the group before him is distinguished from all the others; and if he can do this effectually, it matters not by what means the object is to be accomplished. He is not, however, to expect that he can so far isolate a natural group, as that there shall be exceptions to the characters he assigns it; or that each of the individuals composing it shall possess those characteristics in the same degree. This would imply the existence of absolute divisions in nature, - which all experience is opposed to, - but would be directly at variance with what has been just said on the chain of continuity of gradation; for where there is gradation in structure, there must be gradation in character.[73]

The bald revelation here of the arbitrary fashion by which naturalists selected classificatory characters, which Vigors, in response to Strickland's attacks, would rather wearily admit at the Glasgow BAAS meeting in 1840, is striking enough.[74] However, this lengthy passage is crucial to understanding Swainson's attempt to take quinarianism to the people. It is, in effect, a set of instructions to amateur naturalists on how to tailor their observations to ensure that their work can be put to use in quinarian ornithology.

[73] Swainson, *Preliminary Discourse*, 239.
[74] See M. P. Winsor, 'Considering Affinity', for this unusual episode, shortly before Vigors' death.

In contrast to the complexity of the system itself, the methodology which Swainson recommended to his audience of amateur naturalists is simple, relying not on technically-difficult examinations of internal anatomy, but on the consideration of easily-observed, 'simple and obvious' external characteristics. In an age where naturalists increasingly followed Cuvier and employed the insights gained by comparative anatomy, this focus on external anatomy was 'in direct contradiction to the usual mode of proceeding pursued by modern naturalists', as Swainson acknowledged.[75] However, pointing to the 'present state' of natural history, in which the sheer volume of new information necessitated the streamlining of classification, lest zoologists be overwhelmed, he argued that simplicity was a virtue, particularly when it came to recruiting new naturalists.

> The science [professors] would teach, and which they of course desire that others should learn, can only be rendered inviting to mankind in general, by being divested of all verbose technicality and minute investigation, not absolutely essential… Simplicity, perspicuity, and brevity should be the characteristics of all systematic distinctions…[76]

What Charles Waterton, who had memorably and roundly abused Swainson for threatening to drive away nine-tenths of budding ornithologists with his 'circles within circles', would have made of this is easy to imagine. Nonetheless, his focus on external characters, whatever the metaphysical complexities underpinning quinarianism, was at least easy to understand, and

[75] Swainson, *Preliminary Discourse*, 247.
[76] Swainson, *Preliminary Discourse*, 247.

accorded well with existing trends in popular natural history, ranking almost as a form of collecting in itself.

However, there was a caveat. Whilst all characters of a species' external anatomy had their value, it would, Swainson argued, clearly be absurd for an amateur naturalist to try to classify birds by referring to *every* minute point of difference and similarity, although 'in a monograph, or complete account, every one of [a species'] characters should of course be described'.[77] Therefore, he recommended that particular attention be paid by his readers to two, or perhaps three *primary* characters displayed by a species which were sufficiently definitive upon which to classify it. What these primary characters are, he argued, is of little importance and did not, given the variety of forms, have to be uniformly applicable to all birds. They should be chosen '*only* as are necessary to the determination of the group, or object, in question'. He gives as an example the hornbill's distinctive casque.[78]

[77] Swainson, *Preliminary Discourse*, 236-249.
[78] Swainson, *Preliminary Discourse*, 248.

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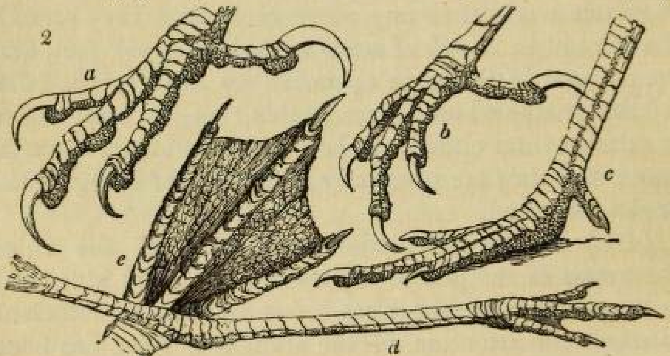
probable that the three last — which constitute the aberrant group of the class — are only of the rank of *tribes ;* equivalent to the *Fissirostres, Scansores,* &c. hereafter noticed. As the circularity of these three groups, taken collectively, has not yet been made out, we shall therefore, for the present, consider them as holding the rank of *orders.* The typical circle is seen in the order INSESSORES, and the subtypical in that of the RAPTORES. Groups, truly natural, may be defined by more than one set of characters ; hence it is, that, independent of every other, the primary divisions of this class may be shortly and beautifully discriminated by their feet. In these members we have three striking modifications of structure (*fig.* 2.). In the RAPTORES, or birds of prey

2



the feet (*a*) are raptorial ; that is, adapted for seizing and destroying other animals ; the claws are consequently sharp, much hooked, and retractile, and they may be employed both offensively and defensively. In the second, or pre-eminent type — the INSESSORES — the feet are constructed more especially for grasping or perching (*b*) ; the claws are comparatively small, less curved, and are not retractile ; while the hind toe, as in the last, is placed upon the same level as the fore toes. In the third, or aberrant division, composed of the fowls (*c*), the waders (*d*), and the swimmers (*e*), none of the above characters are found. The hind toe, when it exists, is always *elevated above the plane of the others,* and the fore toes are more or less connected by a membrane. The

Figure 23. W. Swainson, illustration depicting 'types' of foot structure by which birds were to be classified under the quinarian system, in W. Swainson, *On the Natural History and Classification of Birds* (London: London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836), 12.

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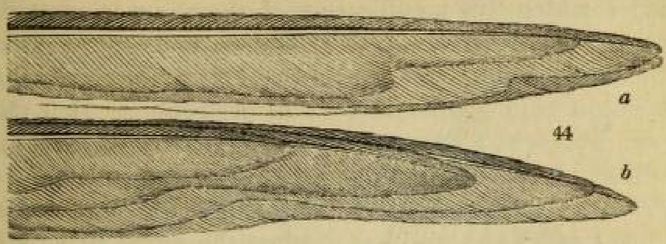
to be less powerful than that of the typical falcons; for their three first quills are gradually shortened, whereas



the "noble" race has the first quill feather nearly as long as any of the others. In the owls, the situation of the notch varies; for in some it is near the end, in others, towards the middle of the quills. This structure, the precise use of which it is difficult to explain, although universal among the rapacious birds, is only extended, out of their circle, to the typical tyrant shrikes; and which represent the *Raptores* in their own particular family group. A modification of this sinuous margin of the *inner*, is frequently found on that of the *outer*, web, not only in the rapacious birds, but in many others. It is particularly strong in the genus *Aster;* for the sparrow-hawk has the terminal half of the outer web of the primaries only half as broad as the remaining portion; but in *Falco Sparverius**, and the genuine falcons, the second quill only has a slight *external* emargination towards the middle. Many of the parrots, crows, and other birds have the exterior much broader at the base than it is towards the tip, but then the change in the breadth is gradual, and in no instance that we are acquainted with, is it sufficiently sudden to be termed *emarginate*.

(82.) Rounded wings are always short; and there is so little difference, either in point of length or shape, between the last six or seven primaries and the secondaries, that the difference of the two series can hardly be distinguished. The tertials, also, are nearly of the same dimensions; so that when the wing is fully expanded,

* North. Zool. vol. ii. pl. 24.

Figure 24. W. Swainson, illustration depicting primary wing feather structure and relative lengths, by which birds were to be classified under the quinarian system, in W. Swainson, *On the Natural History and Classification of Birds* (London: London: Longman, Rees, Orme, Brown, Green & Longman *et al*, 1836), 89.

All of this, as Swainson went on to acknowledge, might seem a little *ad hoc*, and his explanation of the process of induction by which these essential characters were to be chosen is verbose and inadequate.[79] However, for those of his readers less well-versed in ornithology and the minutiae of classification he recommended taking into account three general features which would guide them 'to sound and logical deductions': 'the form or general contour [body shape], the organs by which food is taken, and to those of locomotion'.[80]

In *The Natural History and Classification of Birds,* this was taken further, with the figures themselves intended to be read in conjunction with the text, highlighting these three main points of comparison. Simple but beautifully executed, they encourage the reader to compare beak structures in different species; the different ways in which feet were adapted for the bird's particular environment and methods of gathering food (*fig.* 21); or the comparative structures of wings, with particular emphasis on the relative lengths of primary and secondary flight feathers (*fig.* 22). With all of this guidance to hand, readers could then take their first steps to becoming the knowledgeable data-gatherers who Herschel, and almost every other prominent man of science of the era, believed were essential to the revival of scientific standards in Britain.

III.

Although the reputation of quinarianism as a viable, or even credible, scientific theory was on the wane by the early 1840s, and circular systems had been publically renounced by many naturalists at the 1843 meeting of the BAAS, it enjoyed one final blaze of notoriety. In

[79] Swainson, *Preliminary Discourse*, 251.
[80] Swainson, *Preliminary Discourse*, 251.

1844, the London publisher, John Churchill, published *Vestiges of the Natural History of Creation*, sparking one of the most intense public scientific debates of the nineteenth century.[81] Written by Robert Chambers, whose authorship remained a closely-guarded secret until after his death, *Vestiges* grew from the same fertile soil as had Lardner's *Cyclopaedia*, Jardine's *Library*, and Herschel's *Preliminary Discourse*. It drew upon a wide range of contemporary scientific developments, from geology to embryology, and proposed that natural laws not only governed and directed the development of life forms, but also the origins of life itself – or, that the universe had not been created in a single act by God, and that species evolved over time. Priced at 7s 6d, slightly more expensive than Lardner's volumes – a cheap 'people's edition', heavily abridged and priced at 2s 6d, only came out in 1847 – *Vestiges* looked to the same, middle-class audience as the *Cabinet Cyclopaedia*, but rapidly became a vivid point of discussion at all levels of society.[82]

As James Secord notes in his introductory essay to a modern re-issue of *Vestiges*, Chambers' main strategy was a simple one: to make creation itself the subject of a natural history.[83] Denounced in many quarters, most notably in a slashing review by the Cambridge geologist, Adam Sedgwick, as a farrago of 'rank, unbending, and degrading materialism' that threatened to corrupt 'the glorious maidens and matrons' of England, its appeal to the reading public was immediate and persistent, with the furious controversy only serving to boost sales.[84] Some prominent men of science, headed by Whewell, denied that a natural history of creation

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[81] Outstanding accounts of this are given by M. J. S. Hodge, 'The Universal Gestation of Nature: Chambers' "Vestiges" and "Explanations"', *Journal of the History of Biology*, 5 (1972), 127-151; J. A. Secord, *Victorian Sensation: the extraordinary publication, reception, and secret authorship of 'Vestiges of the natural history of creation'* (Chicago, IL: University of Chicago Press, 2000); R. Yeo, 'Science and Intellectual Authority in Mid-Nineteenth Century Britain: Robert Chambers and 'Vestiges of the Natural History of Creation'', *Victorian Studies*, 28 (1984), 5-31.
[82] S. M. Cooney, *Publishers for the people: W. & R. Chambers, the early years, 1832–1850*, PhD. diss., Ohio State University, 1970; Secord, *Victorian Sensation*, chapters 1 and 2.
[83] J. A. Secord, 'Introduction', in R. Chambers, *Vestiges of the Natural History of Creation and other Evolutionary Writings* (Chicago, IL: University of Chicago Press, 1994), xiv.
[84] A. Sedgwick, 'Natural History of Creation', *Edinburgh Review*, 82 (1845), 3; Secord, *Victorian Sensation* – see appendix 1 for sales figures, comparative with those of the *Origin of Species*.

could even be written, as *legitimate* science had nothing to do with first causes, only the examination of secondary laws.[85]

However, the ferocity of the attacks levelled at the book can be misleading, as a large proportion of reviewers noted that the volume could serve as a tolerable introduction to the sciences as they then stood, notwithstanding the many, curious mistakes that reflected Chambers' broad, but not particularly deep knowledge of the subjects about which he wrote. Indeed, much of the ground that he covered had been thoroughly gone over by dozens of other introductory works of the period, not least by the authors of Lardner's *Cabinet Cyclopaedia*.[86] As Richard Yeo points out, when the religious implications of the book were discussed by reviewers and leading men of science, it was frequently observed that its natural theology echoed the same, bland emphasis on the moral and social benefits of natural knowledge as did works by Whewell, Sedgwick, Herschel and others – what David Brewster called 'the holy alliance' of science and natural theology.[87] Nor was there anything particularly original about Chambers' scientific discussions. Although the profoundly orthodox *Athenaeum* attempted to link the book with alchemy and 'other kindred humbugs', Chambers based much of the work upon developments in mainstream science, such as Richard Owen's advances in comparative anatomy and the analysis of fossils.[88] Owen was, in fact, generally favourable to the book, it coming at a time when he himself was covertly wrestling with evolutionary ideas.[89] The problem, as Darwin noted to the botanist, Joseph Hooker, lay in Chambers' conclusions.[90] By associating the 'safe' science of the 1830s and early 1840s with materialist ideas about

[85] R. Yeo, *Defining Science: William Whewell, Natural Knowledge, and Public Debate in Early Victorian Britain* (Cambridge: Cambridge University Press, 1993).
[86] [Secord], *Vestiges*, xv.
[87] Yeo, 'Science and Intellectual Authority', 11; D. Brewster, 'Vestiges of the Natural History of Creation', *North British Review*, 3 (1845), 471.
[88] Chambers, *Vestiges*, 99-103.
[89] Desmond, *Archetypes and Ancestors*, 31-33.
[90] C. Darwin to J. D. Hooker, 7 Jan 1845, *Correspondence*, **3**, 107.

evolution, however, and in a 'popular' work akin to general treatises such as those in the *Cyclopaedia*, Chambers threatened the whole rationale behind British science.[91]

Chambers devoted considerable space in the first edition of *Vestiges* to a consideration of the 'Macleay System of Animated Nature', some forty pages in a book of four hundred.[92] Directing the attention of his readers to the 'labours' of Macleay, Vigors and Swainson, Chambers offered a concise and admirably lucid overview of the tenets of quinarianism, drawing particularly upon Vigors' ornithological work and Swainson's development.[93] He then proceeded to hitch the system to his own transmutationist position, arguing that it provided '*powerful additional proof of the hypothesis of organic progress by virtue of law* [original emphasis]';

> It establishes the unity of animated nature and the definite character of its entire constitution. It enables us to see how, under the flowing robes of nature, where all looks arbitrary and accidental, there is an artificiality of the most rigid kind. The nature, we now perceive, sinks into and merges in the Higher Artificial.[94]

However, whilst agreeing with Swainson that all organic nature is bound together in a system of affinity and analogy, Chambers is not uncritical of quinarianism, taking Swainson severely to task on points of classification, particularly on man's relation to apes, which Swainson categorically denied. Chambers regarded this stance as just cause to doubt Swainson's judgement, and posited instead a quinary arrangement which placed man as the

[91] Yeo, 'Science and Intellectual Authority', 11.
[92] Chambers, *Vestiges*, 236-276.
[93] Chambers, *Vestiges*, 238-250.
[94] Chambers, *Vestiges*, 251.

typical tribe of the ‘cheirotheria’ order (apes, monkeys, lemurs), drawing lines of affinity (in true quinarian style) with the two adjoining circles, ‘*Simidae’* (apes) on the one hand and *Cebidae* (New World monkeys), the ‘lowest’ form, on the other.[95]

Having previously expounded on Lamarckian evolution and concluded that species are subject and change in response to the workings of secondary laws of nature, Chambers’ appropriation of quinarian classification to reduce man to the same status as the rest of creation, and subject to the same laws, was profoundly ironic. Macleay had no truck with notions of transmutation and its materialist implications, and consistently deprecated Lamarck’s theory.[96] In his youth, Chambers had adhered to a similar cosmology, underlining the stability of the natural, political and moral world, which Secord locates in ‘the nostalgic politics’ of Scott’s *Waverley* novels.[97]

Chambers’ enthusiasm for circular systems would, however, be of short duration. Several high-profile naturalists, Darwin among them, singled out Chambers’ grasp of zoology for particular opprobrium: ‘his geology strikes me as bad,’ Darwin griped to Hooker, ‘& his geology far worse’.[98] By the time the third edition appeared in February 1845, only five months after the first, the chapter on ‘Animated Nature’ had been drastically revised. As Secord notes, however, in choosing to deploy the quinarian system Chambers had been unlucky, rather than either ‘silly or old-fashioned’, and his hasty backsliding ensured that of the twenty-four thousand copies of *Vestiges*, in eleven editions, printed between October 1844 and December 1860, only 1750 contained this lengthy discussion of quinarian classification.[99]

[95] Chambers, *Vestiges*, 265-268.
[96] For example, Macleay, *Horae*, **I.**, 299, 330-336.
[97] Secord, *Victorian Sensation*, 83; Chambers, ‘Vindication of the World and of Providence’, in *Vestiges*, 200-203.
[98] C. Darwin to J. D. Hooker, 7 Jan 1845.
[99] [Secord], Chambers, *Vestiges*, xv.

By this point, 'popularization' bore rather less positive connotations, and to some leading men of science the public were as ill-informed as they had ever been, making a mockery of the great educationalist designs of the SDUK *et al*. Indeed, in a review of the tenth edition of *Vestiges* in 1854 – albeit the most expensive edition of them all, at a considerable 12s 6d – T. H. Huxley (1825-1895) bemoaned the 'increasing ignorance of the public mind as to the methods of science and the criterion of truth': a comment which reveals not only how Huxley perceived science to be striding ahead, but also something about his conception of a new, 'professional' science in which works like the *Vestiges* had no place.[100] 'We look for original research,' Huxley thundered on, 'and we find what might be picked up by reading "Chambers' Journal" or the "Penny Magazine".[101] In this, he echoed a theme picked out by a sceptical, Whig reviewer of Herschel's *Preliminary Discourse* twenty years previously, who had argued that the progress of science would be better advanced if men like Herschel stuck to original, abstract research rather than composing popular texts.[102] The wheel, it seems, was moving full circle.

The publication of the *Vestiges* and Chambers' deployment of 'safe' science to dangerously materialist ends, reveals some of the problems inherent in the drive for popularisation, and in popular science itself, during the 1830s and 1840s. It brought to the fore issues of authorship and authority; who was entitled to write about science; the reliability of their sources; and, finally, brought into focus the ability of a general readership to understand the complexities and implications of contemporary scientific research. One of the accusations levelled against Swainson, even in the 1830s, was that no one individual was qualified to write about the whole of the natural sciences, the boundaries of which had expanded enormously

[100] T. H. Huxley, 'Vestiges of the Natural History of Creation', *British & Foreign Medico-Chirurgical Review* 13 (1854), 425
[101] Huxley, 'Vestiges of the Natural History of Creation', 438.
[102] T. Galloway, 'Sir John Herschel's Astronomy', *Edinburgh Review*, **58** (1833), 165.

since the beginning of the nineteenth century, a limitation echoed by the historian of science, David Knight.[103]

However, as introductory texts to science, whatever their utilitarian moral and social reasoning about the merits of natural history as a beneficial activity, Swainson's works and those like them did have a wider impact – and not only in Britain. The example of the *Vestiges*, soon translated into a myriad of European languages and published in the United States, is ample demonstration of the rapidity with which books published in Britain could find their way onto foreign bookshelves.

[103] Knight., 'Swainson: naturalist, author and illustrator', 288-290

Chapter 6

Imperial Nature: Quinarianism's Colonial Afterlife

The story of quinarianism's final years is one of the few uncontentious aspects of its curious history. With minor variations, it goes like this. By 1840, its three principal advocates removed from the scene, quinary theory had entered into a period of steep, terminal decline. In October of that year, Vigors, depressed by his marginalisation from the Zoological Society and the eclipse of his political fortunes, and crushed by family troubles, suddenly died at the early age of 55. It was whispered by Selby, who knew him well, that he had committed suicide, because 'of the distress the conduct of some of his sons had occasioned him, but which he could only expect from the manner in which they were brought up'.[1] Macleay emigrated to Australia in 1837, followed by Swainson in 1841. His relations with London's scientific community permanently embittered, Swainson eventually settled in New Zealand to live out the rest of his life on an isolated farm.[2] Though their theories continued to attract occasional, eccentric adherents, the efforts of Hugh Strickland, who had made it his goal to banish forever the 'metaphysical' from taxonomy, had triumphed. This was underlined by the publication in 1844 of the 'Strickland Rules', which finally established a standard framework of nomenclature and classification that was entirely inimical to quinarian principles.[3]

[1] Selby to Jardine, 19 Dec., 1840.
[2] Brockie, 'Decline and Fall', 92-93.
[3] H. E. Strickland, 'Rules for Zoological Nomenclature', *Annals and Magazine of Natural History*, 1 (1837b), 173-176; and 'On the true Method of discovering the Natural System in Zoology and Botany', *The Annals and Magazine of Natural History*, 6 (1841), 184-194.

This narrative of decline is broadly true. However, although unceremoniously swept aside in Britain, quinarianism was not quite forgotten. Throughout the 1840s, it continued to be used by a small number of well-regarded naturalists, almost all of them working on Britain's colonial peripheries. The foremost was Gould, already a pillar of London's scientific institutions and who, in 1838, sailed to Australia on an ambitious collecting expedition, with the aim of publishing the first authoritative monograph on Australia's endemic birds. The resultant folio, *Birds of Australia*, duly appeared in regular parts between 1840 and 1848, running to seven huge volumes that were arranged according to Vigors' quinarian system.[4] By the time the final part was published, quinarianism was a bad memory in the minds of many of Gould's peers, yet the work was received with universal acclaim. This, in itself, is remarkable, and calls into question the established narrative of quinarianism's final decline.[5] What applied to British scientific culture, it seems, did not necessarily apply also to that in Britain's colonies.

Another expatriate British naturalist to use the theory was Gould's contemporary, Brian Hodgson, for twenty years a British diplomat in Nepal. Hodgson has only recently been 'rediscovered' by scholars, by virtue of his prominence in the establishment of Anglo-Nepalese diplomatic relations, and the full extent of his achievements, particularly in zoology, is still to be fully understood.[6] These were considerable. Little-explored by Europeans and governed by an elite latently hostile to Britain following its defeat in the Anglo-Nepalese War (1814-1816), Nepal was virgin territory for zoologists and Hodgson was the first to attempt a systematic

[4] J. Gould, *Birds of Australia* (London: J. Gould, 1848).
[5] J. Pemble, 'Forgetting and Remembering Britain's Gurkha War', *Asian Affairs*, 40, 3 (2009), 361-376; J. Pemble, *Britain's Gorkha War: The Invasion of Nepal, 1814-1816* (London: Frontline Books, 2008).
[6] W. W. Hunter, *Life of Brian Houghton Hodgson* (London: John Murray, 1896) was the only biography until the publication of C. Allen, *The Prisoner of Kathmandu: Brian Houghton Hodgson in Nepal, 1820-43* (London: Haus Publishing Ltd., 2015). Both of these are 'broad-brush' treatments, though Hunter's book is still useful. Waterhouse (ed.), *Origins of Himalayan Studies*, is a wide-ranging edition of collected essays which shed light on some of the lesser-known aspects of Hodgson's life and research interests. Hodgson's zoological work is analysed in M. Cocker, C. Inskipp, *A Himalayan Naturalist: The Life and Work of Brian Houghton Hodgson* (Oxford: Oxford University Press, 1988); and D. Waterhouse, 'Biographical Sketch', in Waterhouse (ed.), *Origins of Himalayan Studies*, 5-10; A. Datta, C. Inskipp, 'Zoology…amuses me mutch', in Waterhouse (ed.), *Origins of Himalayan Studies*, 134-153.

study of its wildlife. Between 1820 and 1843 Hodgson discovered and described a vast number of animals, many of which were new to European science. From the mid-1830s, he conducted his research with clear reference to the quinarian system. Sacked from his post in 1843 and exiled to Darjeeling, he continued his studies until finally returning to Britain and self-imposed obscurity in 1859. These drew the admiration of his fellow colonial ornithologists, Allan Hume (1829-1912) and Edward Blyth.[7]

Hodgson's zoological articles, in which he notes his adherence to 'the natural system', can tell the historian important things about naturalists' involvement in colonial scientific culture, and the means by which their research was disseminated to a wider audience. What they do not reveal is how Hodgson applied quinarian theory to his collecting activities, if at all; what variant of quinarianism he adhered to; or how Hodgson, isolated in Kathmandu since 1820, came to hear about quinarianism in the first place. These are important questions, not only for how we interpret Hodgson's work today, but also for how we consider the status of colonial naturalists in relation to their metropolitan, London counterparts. However, as well as collecting specimens, Hodgson commissioned thousands of watercolour paintings of Himalayan animals. Unpublished, with the greater number in the collections of the Zoological Society of London, these paintings constitute one of the most notable practical applications of quinarianism, demonstrating clearly how the fundamental principles which underpinned the system determined the form of zoological illustration.[8] Intended by Hodgson as working drawings for a series of folios that would surpass Gould's own, the paintings are syntheses in

[7] J. E. Gray, G. R. Gray, *Catalogue of Specimens and Drawings of Mammalia and Birds of Nepal and Thibet presented by B. H. Hodgson to the British Museum* (London: British Museum, 1846). Further accessions are recorded in J. E. Gray, *Catalogue of Specimens and Drawings of Mammalia and Birds of Nepal and Thibet presented by B. H. Hodgson, Esq., to the British Museum, Second Edition* (London: British Museum, 1863). A complete list of Hodgson's zoological articles can be found in Waterhouse (ed), *Origins of Himalayan Studies*, 255-262.

[8] Hodgson Zoological Collections, ZSL.

which European scientific and aesthetic conventions are combined with the artistic traditions of Himalayan culture.

As ‘imagetexts’ intended to act as repositories of species information, shaped by direct reference to quinarian principles, and with the goal of establishing Gould’s and Hodgson’s scientific authority, Gould’s *Birds of Australia* and Hodgson’s paintings are amongst the last major quinarian artefacts.[9] In the final section of this study, they are analysed with reference to the peculiar circumstances of their creation, scientific and otherwise, from which three principal conclusions are drawn.

First, and most fundamentally, it is argued that their existence poses a challenge to the established narrative of quinarianism’s final years, and that the theory was still used as a framework for major bodies of zoological research well beyond the point identified by the majority of historians. Second, that both naturalists deployed quinarianism in support of their attempts to buttress their authority as zoologists. It is argued that Gould’s position in 1838 was far less secure than his biographers have previously thought, as a result of the internal ZSL reforms that dethroned Vigors. With his professional status in jeopardy, Gould’s Australian expedition and the folio it inspired was a means to establish, decisively, his reputation as a scientific authority and enable him to operate as an independent man of science. Hodgson nursed similar scientific ambitions, with dreams of being recognised as the principal authority on Himalayan fauna. However, unlike Gould, Hodgson was largely self-taught and, through his reading of a variety of texts, adopted Swainson’s quinarian variant rather than Vigors’. It is argued that this ostensibly-small distinction had dire consequences for the reception of Hodgson’s work.

[9] Datta, *Gould in Australia*; Cocker, Inskipp, *A Himalayan Naturalist*, 33; Waterhouse (ed.), *Origins of Himalayan Studies*, 150.

Finally, it is demonstrated that quinarianism's presence on the colonial peripheries, in this case Australia and Nepal, challenges established models of colonial science that stress the unidirectional nature of knowledge dissemination in the early-nineteenth century British empire, and its 'civilising mission'.[10] The images, analysed in conjunction with their associated texts and with reference to other primary sources from the period, including Gould's and Hodgson's correspondence, and Swainson's popular quinarian treatises, indicate that the reality was more complex. It was a reciprocal culture in which theories such as quinarianism were spread to the colonies by a variety of mediums, and fed back into London's scientific culture in journal articles and images, undergoing considerable modification in the process.

I.

In 1838, John Gould resigned his post at the Zoological Society of London. Shortly afterwards, he packed up his bags and family and sailed for Australia. Appointed a Corresponding Member for the duration of the expedition, he joined a growing number of naturalists, British and foreign, who were commissioned to collect specimens, live and dead, for the society's museum and menagerie.[11] Unlike Macleay and Swainson, he would return to London two years later, laden with a collection of bird and mammal skins, and drawings of Australian fauna the likes of which had never been seen in Europe. These he used as the basis

[10] The key works which stress this interpretation are Basalla, 'The Spread of Western Science', 611-622; and L. Pyenson, 'Why Science May Serve Political Ends: Cultural Imperialism and the Mission to Civilize', *Berichte zur Wissenschaftsgeschichte*, 13 (1990), 69-81, both of which have had an enduring impact. Other works which adopt this stance include D. Kumar, 'Patterns of Colonial Science in India', *Indian Journal of History of Science*, 15, 1 (May 1980), 105-113; L. Schiebinger, 'Forum Introduction: The European Colonial Science Complex', *Isis*, 96, 1 (Mar., 2005), 52-55; P. Petitjean (ed.), *Colonial Sciences: Researchers and Institution* (Paris: Orstom Editions, 1996).
[11] January 31 1838, Minutes of Council, **V.**, 258. ZSL. Gould was appointed a Corresponding Member for the duration of the trip.

for the most scientifically important of all his major works, and also the most beautiful; the *Birds of Australia*, illustrated by Elizabeth Gould, Edward Lear, and Henry Richter. By December 1840, the first part of the folio was published.[12] It was completed, in seven volumes, in 1848.[13] This was followed by a supplementary volume in 1869, in which Gould detailed around forty species of bird discovered in the intervening twenty years.[14] It ranks amongst the greatest of his works, rivalled only by the similarly-scaled, and scientifically-important *Monograph of the Trochilidae,* completed in 1861.[15]

Gould's journey to Australia was one of the last great zoological expeditions conducted in the spirit of the 'age of exploration'. Ann Datta has studied the journey itself, and the genesis of the subsequent folio, in her definitive account, *John Gould in Australia*.[16] The remit of Datta's study does not encompass the aims and structure of the folio itself, and its images solely on aesthetic grounds. The folio's purpose and its impact on Gould's fellow naturalists, the nature of its illustrations and the information they were intended to convey, remain poorly-studied.

Before turning to the folio itself, it is important to ask what factors drove Gould to embark on his Australian work. Following his lead, Gould's biographers are united in ascribing his decision to scientific curiosity and the desire for commercial gain. Uncharacteristically, in volume one of the *Birds of Australia*, he obliquely alludes to these mixed, but not mutually exclusive motivations:

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[12] December 2 1840, Minutes of Council, **V.**, 281. ZSL.
[13] J. Gould, *Birds of Australia* (London: J. Gould, 1840-48). See Sauer, *The Bird Man: A Chronology*, for the publication schedule of this work.
[14] J. Gould, *Supplement to the Birds of Australia* (London: J. Gould, 1869).
[15] J. Gould, *A Monograph of the Trochilidae, or Family of Humming-Birds* (London: J. Gould, 1849-1861).
[16] A. Datta, *John Gould in Australia* (Melbourne: Melbourne University Press, 1997).

> Having in the summer of 1837 brought my work on the "Birds of Europe" to a successful termination, I was naturally desirous of turning my attention to the Ornithology of some other region; and a variety of concurring circumstances induced me to select that of Australia, the Birds of which, though invested with the highest degree of interest, had been almost entirely neglected.[17]

There was a fundamental truth in this. By virtue of its distance from Britain, lingering reputation as a glorified prison colony, and harsh climate, Australia and its wildlife remained largely unknown to naturalists.[18] This did not signify a lack of scientific interest. Appointed to James Cook's expedition to the south Pacific, Joseph Banks' visit to Australia in the late 1760s and subsequent publication of the first major, illustrated collection of Australian flora made the continent the focus of considerable scientific attention.[19] With zoology overshadowed into the 1800s by Banks' utilitarian focus on botanical acclimatisation, collections of Australian zoological specimens in Britain were rare and extremely sought after.

Before Gould's expedition, much of what was known about Australian animals was a by-product of botanical investigation. George Caley (1770-1829), one of Banks' botanical collectors, performed an inestimable service to metropolitan zoologists by amassing a collection of some 700 bird skins in New South Wales between 1800 and 1810, estimating in a letter to his fellow botanist, Robert Brown (1773-1858), that they represented around 150 distinct species.[20] In 1815 these specimens were purchased by the Linnean Society of London, where they were later named, described and catalogued according to quinarian principles by

[17] Gould, *Birds of Australia*, **I.**, 'Preface', v.
[18] C. Finney, *Paradise Revealed: Natural History in Nineteenth-Century Australia* (Melbourne: Museum of Victoria, 1993).
[19] See B. Adams, *The Flowering of the Pacific: Being an Account of Joseph Banks' Travels in the South Seas and the Story of his Florilegium* (London: British Museum (Natural History), 1986).
[20] Caley to Brown, April 1813, *Brown Papers*, M1193 MS32440, 3-4.

Vigors and Horsfield.[21] Whilst giving Caley his due credit, they noted, with some incredulity, that he had named and grouped them 'without any predilection for system, and in consonance merely with what appeared to him to be their natural affinities, of which he formed his judgement by actual observation of their manners'.[22]

Isabella Tree has speculated that one of the reasons for Gould's seemingly precipitate choice was that Swainson was considering embarking on a similar work, the news of which forced Gould's hand.[23] This seems unlikely, as Swainson was at this point tied to his contract with Lardner, not completed until 1840. Gould himself noted that he had already started work on an Australian avifauna, presumably on the basis of the ZSL's and Linnean collections, he claimed to have 'soon found, from the paucity of information extant on the subject, that it could not be executed in a manner that would be satisfactory to my own mind or commensurate with the exigencies of science'.[24] Indeed, several parts of this abortive work had been produced, if not published, before Gould realised his error, but not before Audubon had caught wind of it. 'Gould is publishing the Birds of *Australia* from stuffed Skins', he sniffed to John Bachman, who by now was the focus for the American's regular snipes at his British rival.[25] Gould felt the inadequacy of this approach and he decided to personally investigate.[26]

However, as so often in early nineteenth-century science, scientific and patriotic considerations were inextricably linked to the personal. Under pressure from the ordinary fellowship of the society, in February 1836 the council appointed a committee to investigate the running of the Bruton Street museum and supervise the transition to larger premises in John

[21] N. A. Vigors, T. Horsfield, 'A Description of the Australian Birds in the Collection of the Linnean Society; with an Attempt at Arranging them According to their Natural Affinities', *Transactions of the Linnean Society of London*, 15, 1 (1827), 170-332.
[22] Vigors and Horsfield, 'Description of Australian Birds', 202
[23] Tree, *Bird Man*, 59.
[24] Gould, *Birds of Australia*, **I.**,
[25] Tree, *Bird Man*, 83.
[26] Gould, *Birds of Australia*, v-vi.

Hunter's old house on Leicester Square. The remit extended to the committee, which included Barlow, Broderip, Horsfield, Owen, Sabine, Vigors, and Yarrell, boded ill for the old guard of the museum hierarchy, particularly Vigors, who had recently been removed from the crucial publications committee on a motion precipitated by the fellows. Particularly disquieting was the committee's power to 'direct the arrangement of the specimens in the Museum by the officers belonging to that department, and further to make suggestions to the Council on all matters connected with the arrangement and completion of the collection of specimens as they may deem expedient'.[27] Although Vigors had by this time relinquished control of the museum, William Martin, the Superintendent at Bruton Street, had continued his policies, and the committee's orders to wrest control of the collections a clear indication of dissatisfaction with quinarian classification on the part of the council. Hitherto Vigors' sole preserve, latterly with the assistance of Gould, this could not have signalled his marginalisation within the ZSL more clearly.

Gould's own position in the Museum quickly came under close scrutiny. From February 1833, he had received an annual salary of £100 as the curator of the society's ornithological department, a promotion pushed through by Vigors in one of his last acts as Secretary.[28] There is intriguing circumstantial evidence that, when the council advertised for staff for the new museum, signalling its lack of confidence in Martin by not simply appointing him to the Superintendent post, Gould put himself forward for one of the new positions. The Museum Committee minutes of April 16 1836 record that Sabine read a letter (now lost) from Gould to the Council, although its contents were not stipulated. However, as Martin, who was in attendance, tendered his services as assistant curator at the same meeting, it may reasonably assumed that Gould's letter was on a similar theme. However, if this was the case, the minutes

[27] Minutes of the Museum Committee, appointed by the Council Feb 3 1836, ZSL.
[28] Minutes of Council, February 27 1833. **II**. ZSL.

of the next meeting, on April 20, indicate that he had horribly overestimated the strength of his position. Called before the committee, Gould was read a lengthy new job description, including the following crucial articles:

> He is to complete up to a given period stuffing the due proportion of the annual 400 Bird skins and to receive his present salary up that date, which date shall be settled by the Committee. His future assistance to be given to the Ornithological Collection, principally as to noting what is deficient and to the arrangement of specimens, but to be in no shape independent of the Curator in any part of his relations to the Museum except as to his time.
>
> He must report to the Council on deficiencies before taking any steps towards making them good.
>
> If purchases are made by him, or under his direction, they must be charged for, the separate price of each, and not in the mass. All exchanges to be negotiated and made by the Secretary and Council and not by him. Power may be given to him to expend a certain sum in purchases of specimens exactly on the same conditions and subject to similar control, as rule the Head Keepers power to purchase living animals, according to Minute of Council dated Nov. 18 1835.
>
> If he desires to publish from the Collection he must previously obtain a written permission from the Secretary which is to be reported to the Council.

> He is not to affix any names of his own making to specimens except such as have been legitimately recognised by publication and adopted as good, and then only with notice and on permission to be given.[29]

Gould agreed to these terms, which were ratified by the Council later that day, followed by a pay cut of £50 a week later.[30]

Datta has interpreted this episode, which is overlooked completely by Tree and Lambourne, as evidence simply that Gould wished to cut down his commitments and devote more time to his publishing career, probably already with an eye to his Australian expedition.[31] However, if Gould's own remarks in the *Birds of Australia* be taken at face value, he did not fully commit to the journey until the following year, and indeed saw no reason to undertake it until his attempt to create an Australian fauna by his usual methods had proven lamentably inadequate. Although evidence from his correspondence is lacking – indeed, the extended controversy at the ZSL during 1835 and 1836 is not mentioned at all – when considered in the rapidly shifting political and scientific context of the mid-1830s, the highly restrictive terms imposed on Gould, who had hitherto enjoyed unlimited freedom within the remit of his position, and his swingeing pay cut, suggest strongly that he was closely identified with the old, unreformed Museum administration, and suffered accordingly. He was also now listed merely as 'Ornithologist', instead of 'Superintendent of the Ornithological Department'.[32]

With this in mind, Gould's decision to publish on Australian birds must be considered in a different light. The notion that he embarked on the journey solely in order to make a

[29] Minutes of the Museum Committee, April 20 1836.
[30] April 20 1836, April 27 1837. Minutes of Council, **IV**. ZSL.
[31] Datta, *Gould in Australia*, 58-62.
[32] Minutes of Council, Feb 27 1836. ZSL.

commercial killing, as advanced by Tree, is implausible: given the relatively stable potential market for his expensive folios, it would have made little sense for him, essentially a museum man, to have taken such a huge gamble with both his finances and his life (and that of his wife).[33] However, his decision does make sense if we consider it as part of a wider strategy not only to recover ground lost in the political upheaval in London's scientific institutions during the mid-1830s, but to free himself from institutional ties and establish himself as an *independent* man of science. If he could return from Australia laden with new species, publish both folio and articles, and sell the collection, his professional status would be transformed, and he could join the higher ranks of naturalist-explorers, with the increased personal authority that went with it.

That this strategy paid off handsomely is clear from Gould's subsequent career – and, on his return to England, by his relatively rapid election to the Royal Society.[34] Indeed, soon after his death, the British journal *Science* reckoned that the Australian expedition was 'unsurpassed in its effects in the annals of ornithology… a distinct scientific achievement'.[35] However, having set the *Birds of Australia* in the context of Gould's revived fortunes, we must now turn our attention to the folio itself. In format and layout it is a carbon copy of the *Birds of Europe*, the multi-volume work which had immediately preceded it, comprising a total of seven volumes in which an index and lengthy introduction, where Gould gave a general scientific survey of the continent, are followed by synopses of the primary genera depicted in the following figures and descriptions.[36]

[33] Tree, *Bird Man*, 58.
[34] [Anon.], 'January 19, 1843, *Proceedings of the Royal Society*, 4, 56 (1843), 435.
[35] 'Gould's Ornithological Works', *Science*, 13, 328 (May 17, 1889), 387-388.
[36] Gould, *Birds of Australia*, **I.,** 'Introduction, i-ci.

Figure 25. J. Gould and H. C. Richter, *Ptilornorhynchus holosericeus*, in J. Gould, *Birds of Australia* (London: J. Gould, 1840-48), **IV.**, TAB X. ZSL [Courtesy of James Godwin].

The volumes are ordered upon Vigors' quinarian division of orders, beginning with Raptores (birds of prey), and proceeding through Grallatores, Natatores, Rasores, and finally Insessores which, on account of the greater number of species, occupy three whole volumes. The figures themselves are 'elephant-folio' size, which Gould had by now adopted as standard and to which he would adhere for the rest of his career, and depict one species per plate. However, in contrast to his earlier works, they often depict several individuals, male and female, in an approximation of the habitat in which Gould observed and collected them (*fig.* 23) The accompanying descriptions give details of habitat, behaviour (where observed), range, and detailed accounts of appearance and general morphology.

The latter may seem curiously redundant when the plates themselves are so wonderfully detailed. However, the description and the image were intended to be 'read' in conjunction – whether Gould's readers were so scrupulous is another matter – with the image, particularly in a work such as this which described so many new species, serving as a proxy for a type specimen. Indeed many of the illustrations were based upon one specimen. This entailed an altogether 'looser' concept of type specimens than they are understood by modern zoologists, as was pointed out in the 1950s by the then curator of Gould's Australian ornithology collections, Rodolphe de Schauensee, in Philadelphia's Academy of Natural Sciences. De Schauensee noted that Gould did not designate individual specimens as holotypes, but rather based his descriptions, including in the *Birds of Australia*, upon a specimen or pair of specimens which were only afterwards selected to serve as name-bearing types (syntypes).[37]

This may be better understood by looking closely at a representative example. The Little Australian Eagle (*Aquila morphnoides*), now known simply as the Little Eagle, is the second species depicted in volume one of the *Birds of Australia* (*fig*. 24). The smallest raptor

[37] R. M. de Schauensee, 'On Some Avian Types, Principally Gould's, in the Collection of the Academy', *Proceedings of the Academy of Natural Sciences of Philadelphia*, 109 (1957), 125.

indigenous to the continent, it was then poorly-known and Gould was the first European ornithologist to describe it.[38] Accordingly, this was the first publication in which it had been figured and, as no specimens of the species existed in any European collection, Gould's illustration would have been the only source of information about its general appearance. Of it, Gould wrote the following:

> *'Aquila Morphnoides, Gould in Proc. of Zool. Soc., Part VIII, p. 161.*
>
> I shall perhaps better convey an idea of the rarity of this small but true species of Aquila, by stating that the specimen from which the accompanying drawing was made, and which forms part of my own collection, is the only one I have ever seen either living or dead. It is the second species of the genus known to inhabit Australia, and it is singular that while the Wedge-tailed Eagle is so common, the present species should be so rare, or, perhaps, so restricted in its range of habitat. This Eagle is as clearly an analogue of the Aquila pennata of Europe, as the Wedge-tailed Eagle is of the Golden…
>
> The part of Australia where I shot the specimen above alluded to, was Yarrundi on the River Hunter, on a portion of Mr. Coxon's estate near Tooloogan. I was led to the discovery of the bird by finding its nest containing a single egg, upon which it had been sitting for some time….
>
> Face, crown of the head and throat blackish brown, tinged with rufous, giving it a striated appearance, bounded in front above the nostrils with whitish; feathers at

[38] J. Gould, '*Aquila Morphnoides*', *Proceedings of the Zoological Society* (1841), 161.

the back of the head, which are lengthened into a short occipital crest, back of the head, back, and sides of the neck, all under the surface, thighs and under tail-coverts rufous, all but the thighs and under tail-coverts with a stripe of black down the centre of each feather; back, rump and wings brown, the centre of each wing lighter; primaries brownish black, becoming darker at the tip, and barred throughout with greyish buff, which is conspicuous on the under surface, but scarcely perceptible on the upper, except at the base of the inner webs; under surface of the wing mottled with reddish brown and black; tail mottled greyish brown, crossed by seven or eight distinct bars of blackish brown, the tips being lighter; cere and bill lead-colour, passing into black at the tip; eye reddish hazel, surrounded by a narrow blackish brown eyelash; feet and toes very light lead-colour.

The figure is about three-fourths of the natural size.

Figure 26 J. Gould and H. C. Richter, *Aquila Morphnoides,* in J. Gould, *Birds of Australia* (London: J. Gould, 1840-48), **I.**, TAB. II. National Library of Australia.

Figure 27. J. Gould and H. C. Richter, *Aquila Morphnoides*, in J. Gould, *Birds of Australia* (London: J. Gould, 1840-48), **I.**, TAB. II. ZSL. [Courtesy of James Godwin.]

There are several very good reasons why Gould took such pains with his descriptions. The first was the nature of the lithographs themselves which, whilst eliminating the need to employ engravers who often had no understanding of the subjects they were called upon to depict, had still to be hand-coloured. Despite Gould's production of detailed pattern plates, the standard of colouring could vary widely from one folio to another. This can be seen clearly when we compare the first figure of the Little Eagle, taken from the National Library of Australia's copy (*fig.* 24) with the second, taken from the archives of the Zoological Society of London (*fig.* 25). Whilst the illustrations gave a vivid and immediate impression of the species - its general outline, classificatory characteristics (including clear delineations of beak and feet, the primary characteristics) and habitat -, the accompanying description, immune to the whims of untrained colourists, gave fixity and permanence, and was aimed particularly at the taxonomists amongst Gould's subscribers.

Gould himself was well aware of the potential for misidentification which could result from an over-reliance upon illustration alone. In his description of the 'black-tailed parakeet' (*Polyteris melanura*), now renamed the Regent parrot, he notes that the species was first illustrated by Edward Lear in his *Monograph of the Psittacidae* (1831). Lear, no ornithologist, had mistakenly believed the male and the female of this bird to be separate species, so marked was their sexual dimorphism, 'the rich jonquil yellow of the male giving place to dull yellowish green in the opposite sex', and had depicted them as such (*fig.* 26).[39] Vigors, for whom the illustrations and their accompanying texts were his sole point of reference, took them at face value and characterised the female as a distinct species. Gould, who had observed the species in its natural habitat, was the first to realise that Lear's two species were, in fact, one and the

[39] J. Gould, *Birds of Australia*, **V.**, 16, (*Polyteris melanura*).

Figure 28. E. Lear, *Palaeornis melanura*, in E. Lear, *Monograph of the Psittacidae* (London: E. Lear, 1832), TAB. XXVIII.

Figure 29. J. Gould and H. C. Richter, *Polytelis melanura*, in J. Gould, *Birds of Australia* (London: J. Gould, 1840-1848), **V.**, XXVI. ZSL.

same, and depicted the male and female together in the same illustration to underline the point (*fig.* 27).

Gould's continued adherence to Vigors' classificatory principles is evident throughout the work. In the 'Introduction' he noted:

> The "Birds of Europe" were arranged according to the views of the late Mr. Vigors; and in the "Birds of Australia" the arrangement is mainly the same, with some modification of my own which appeared to me necessary.[40]

His description of the lyre-bird (*Menura superba*), a species which had long fascinated European ornithologists on account of its remarkable lyre-shaped tail plumes, abilities as a mimic and uncertain classificatory status, contains an extended discussion of the species' place within 'the natural system'. Here, Gould's emphasis on first-hand observation accorded his description a unique authority. Upon a 'minute observation of the bird in a state of nature', he declared himself of the opinion that it is not to be classified, 'as very generally considered', with the 'Gallinaciae' (a now-defunct classification which encompassed gallinules and jacanas), but rather with various orders of American passerines (perching birds), such as the huet-huet (*Pteroptochos castanaeaus*) of South America. 'Like them, it possesses the bristles at the base of the bill, the same unusual mass of loose, flowing, hair-like feathers on the back and rump, the same extraordinary power of running… Many intervening genera will,' he added, 'doubtless yet be discovered to complete the series of affinities'.[41] As well as displaying Gould's continued focus on external physical characteristics, which was by this point

[40] J. Gould, *Birds of Australia,* **I.**, 'Introduction'.
[41] Gould, *Birds of Australia,* **II.**, 14, *Menura superba*.

something of an anachronistic approach even amongst British naturalists, given the increasing influence of comparative anatomy upon the study of zoology, the reference to the gaps in 'the series of affinities' is a clear reference to the circular chain of affinities which was one of the chief characteristics of the quinarian system.

II.

The nature of the 'modifications' to quinarian theory which appeared necessary to Gould upon being confronted by the extraordinary variety of bird life in Australia is an excellent illustration of Mark Harrison's thesis that, once transplanted into a 'colonial' context, scientific theories could undergo considerable change.[42] As this was the last of Gould's folios to be arranged according to quinarian principles, his subsequent decision to abandon direct reference to the system partly stemmed from his difficulties in making his observations correspond with quinarianism's rigid circular series of affinities and analogies.

Brian Houghton Hodgson experienced quinarianism, and applied its tenets, in a different way. Unlike Gould, who received his scientific training in London, Hodgson was an enthusiastic amateur naturalist and collector who, isolated in Kathmandu, picked the theory up from texts sent to him from Britain and Calcutta.[43] Hodgson ranks as one of the exemplars of a small group of colonial naturalists, including Edward Blyth and Samuel Tickell (1811-1875), who contributed greatly to the progress of zoological knowledge in the nineteenth century,

[42] M. Harrison, 'Science and the British Empire', *Isis*, 96, 1 (Mar., 2005), 56-63.
[43] Waterhouse, (ed.), *Origins of Himalayan Studies*, particularly 134-205 in which his zoological work is assessed. See also D. Lowther, 'Preliminary Analysis of the Hodgson Collection at the Zoological Society of London', *Archives of Natural History*, 43, 1 (2016), 1-5; and Hunter, *Brian Houghton Hodgson*, 302-309.

primarily through collecting, and whose contributions today are little-recognised.[44] Joseph Hooker, who stayed with Hodgson in the 1840s, wrote to Darwin in 1848 that 'Hodgson was so complete a Himalayan Naturalist' that he had abandoned his own zoological researches.[45] During his twenty-four years in Nepal, and a following fifteen years in the mountains above Darjeeling and Simla in India, Hodgson amassed an astonishing collection of zoological specimens, the majority now lost or uncatalogued, from which he published around one hundred and forty zoological papers in Calcutta and London, many of which described species new to science.[46] In February 1844, the *Journal of the Asiatic Society of Bengal* published a list of 94 articles submitted to its editor by Hodgson since 1828.[47] 1837 was a particularly notable year, in which he published three articles that described new species and genera.[48]

Hodgson's prolific career as an author of original articles highlights his good fortune in being stationed in a country little-explored by European naturalists. Only three European naturalists had previously been allowed into the country by the Nepalese government: Major-General William Kirkpatrick (1756-1812) in 1793; the botanist Francis Buchanan Hamilton (1762-1829) in 1802 and 1803; and Major-General Thomas Hardwicke (1756-1835) in 1810.[49]

[44] Tickell, in particular, has faded from history, despite the extraordinary paintings he created of Indian birds, now held by the NHM in The Tickell Drawing Collection. See also, A. Walden, 'Notes on the late Colonel Tickell's manuscript Work entitled "Illustrations of Indian Ornithology", *The Ibis*, 7, 23 (Jul., 1876), 336-357.
[45] J. Hooker to C. Darwin, 13 October 1848. Letter 1203. Darwin Correspondence Database, http://www.darwinproject.ac.uk/entry-1203
[46] A. Datta and C. Inskipp, 'Zoology… amuses me much', in Waterhouse (ed.), *Origins of Himalayan Studies*, 136. A sense of the scale of his collecting efforts, and his generosity in donating his collections, can be gained from G. R. Gray, *List of the Specimens of Mammalia in the Collection of the British Museum* (London: George Woodfall and Son, 1843), and *List of the Specimens of Birds in the Collection of the British Museum* (London: George Woodfall and Son, 1844).
[47] [Anon.], 'Proceedings of the Asiatic Society', *Journal of the Asiatic Society of Bengal*, 13, 146 (1844), xiv-xv.
[48] B. H. Hodgson, 'On Three New Genera or Sub-genera of Long-legged Thrushes with Descriptions of their Species', *Journal of the Asiatic Society of Bengal*, 6 (1837a), 101-104; 'Description of Three New Species of Woodpecker', *Journal of the Asiatic Society of Bengal*, 6 (1837b), 104-109; 'New Species of Scolopacidae, Indian Snipes', *Journal of the Asiatic Society of Bengal*, 6 (1837c), 489-492.
[49] W. J. Kirkpatrick, *Account of the Kingdom of Nepal* (London: W. Miller, 1811), 130-135; F. B. Hamilton, *Account of the Kingdom of Nepal* (Edinburgh: W. H. Lizars, 1819); T. Hardwicke, 'Description of a New Genus of the Class Mammalia (Ailurus fulgens, Cuv.) from the Himalaya Chain of Hills Between Nepaul and the Snowy Mountains', *Transactions of the Linnean Society of London*, 15 (1827), 161-165, and 'Description of Two New Birds (Lophophorus Wallichii and Phasianus Gardneri) from Nepaul', *Transactions of the Linnean*

However, none of these short expeditions were anything as productive as Hodgson's two-decades of zoological investigation. James Prinsep, the Asiatic Society of Bengal's Secretary, acknowledged the scientific and commercial value of Hodgson's articles in a letter sent to Kathmandu in 1838. 'I trust you will speedily send me more zoological papers as well as duplicates of those the printer has mislaid,' Prinsep wrote, 'for Professor Royle writes to me from London that your papers are held to constitute the principal value of my journal among the folks at home'.[50]

Hodgson was clearly far from being unknown to his metropolitan peers, despite his distance from London's scientific institutions, and his good repute indicates that historians' reluctance to acknowledge him as anything other than a collector is misguided. There is much evidence, in his correspondence and that exchanged between his fellow naturalists, and in his journal articles that Hodgson keenly engaged with issues of classification, and that his ideas were closely derived from Swainson's. Often, his thoughts were muddled and, by the 1840s, there is evidence that his continued adherence to quinarianism damaged his chances of getting published. Despite this, quinarianism provided the crucial framework within which Hodgson conducted his ornithological work, and his active application of quinarian principles can be seen most clearly in the two thousand watercolours, depicting Himalayan birds and mammals, that he commissioned from Nepalese artists during his time in Kathmandu.

These paintings were accorded a high place by his contemporaries: the 'pope of Indian science', Allan Hume, declared that they constituted 'materials for a life-history of many hundred species such as I believe no one ornithologist has ever previously garnered'.[51] Exactly when Hodgson started commissioning the images, the bulk of which he presented to the

Society of London, 15 (1827), 166-169. See also C. Bayly, *Empire and Information: Intelligence Gathering and Social Communication in India, 1780-1870* (Cambridge: Cambridge University Press, 1996), 101-104.
[50] J. Prinsep to B. H. Hodgson, 1838 [day and month unknown]. RAS.
[51] W. W. Hunter, *Life of Brian Houghton Hodgson* (London: John Murray, 1896), 304-305.

Zoological Society of London in 1874, is unclear.[52] Very few of the paintings are dated. Equally, it is not certain *why* he began to collect the paintings, although by the middle of the 1830s he had determined to use them as the basis for his own illustrated folio on Nepalese birds, getting so far as to print a prospectus for the work in the *Journal of the Asiatic Society of Bengal*.[53]

When Hodgson began to amass his paintings is less important than how and why he chose to do so. How the paintings were created tells the historian a great deal about how scientific knowledge and scientific conventions were disseminated in the early-nineteenth century. Mildred Archer, still the authority on 'Company Art' fifty years after she began publishing on the subject, noted that British artists rarely went to India to do such humble work as natural history drawings. This left naturalists like Hodgson and Hardwicke heavily dependent upon the services of communities of artists living in northern India's administrative centres, Calcutta, Dehli and Patna.[54] For Hodgson, at an even further remove in Kathmandu, the problem was compounded, and he was to find his best artists, including Raj Man Singh (1797-1865), in the Newar *chitrakar* caste of religious painters in the Kathmandu Valley.[55] Operating in a culture which privileged entirely different aesthetic conventions to those current in Europe, he had to ensure that the paintings he commissioned would be accepted by British naturalists. In common with Raffles and Hardwicke, Hodgson therefore trained his artists to *see* zoological specimens like their European counterparts. The process, and the materials

[52] P. L. Sclater to B. H. Hodgson, 12th August 1874. Hodgson Papers, ZFAK. ZSL. For this donation, Hodgson was admitted as Fellow of the ZSL.
[53] [Anon.], 'Proposal to Publish, by Subscription, an Illustrated Work on the Zoology of Nipál', *Journal of the Asiatic Society of Bengal*, 4 (1835), 356-357.
[54] M. Archer, *Natural History Drawings in the India Office Library* (London: HMSO, 1962); *Company Drawings in the India Office Library* (London: HMSO, 1972).
[55] See J. P. Losty, 'The Architectural Monuments of Buddhism: Hodgson and the Buddhist architecture of the Kathmandu Valley', in Waterhouse (ed.), *Origins of Himalayan Studies*, 82-83; H. Raj, I. J. Joshi, *The First Nepali Pioneer Artist Raj Man Singh Chitrakar* (Kathmandu: Nepal Studies: Past & Present, 2005).

which Hodgson used for reference, is outlined in a crucial letter sent to the Vice-President of the RAS, Sir Alexander Johnston, in 1835.

> The existing results of my research consist of a series of drawings (the birds all of natural size) executed by two native artists, carefully trained to the strict observance and delineation of the significant parts… [M]y drawings amount to several hundreds; and almost every subject has been again and again corrected, from fresh specimens, with a view to the mature aspect of the species, in respect to colour and figure. Sexual differences, as well as those caused by nonage, have been fixed and portrayed when it seemed advisable; and various characteristic parts, external and internal, have been separately delineated. In regard to the latter, when given separately, or combined with the general form, the use of the camera has been resorted to, to insure rigid accuracy; and, when it has not been employed, the draughtsmen have been perpetually recalled to the careful exhibition of characters by my supervision. Whilst abundance of fresh specimens have been thus employed by my painters, I have myself continued to draw from the same source notes of the structure of stomachs and intestines; of habits in regard to food, as indicated by the contents of stomachs; and of other habits, of manner, location, and economy, derived either from observation or report.[56]

This delineation of his zoological practice reveals, first, that Hodgson exerted a degree of supervision which closely parallels Gould's own working methods. He differed from Gould in

[56] B. H. Hodgson to A. Johnston, 20 June 1835. RAS.

his use of ‘the camera’ to ensure the accuracy of his images. This was more likely the *camera lucida*, a simple optical device that had come into widespread use around 1810, rather than the more bulky *camera obscura*. For Hodgson, the *camera* would also have speeded up the process of production and decreased the amount of waste: several of the paintings in the ZSL Hodgson collections are on re-used paper, with paintings Hodgson judged inadequate scored through on the reverse. Though likely exhausting for his artists, Hodgson’s demanding course of instruction worked, and by 1836 he was sufficiently confident of their merit to send small batches to Calcutta to illustrate his articles. ‘[A]re they not wondrous work for a Nipalese?’ he crowed to Prinsep. ‘I have some more executing which I dare any artist in Europe to excel and they are rigidly correct in their minutest detail’.[57]

The letter also tells us how Hodgson interpreted the specimens from which his artists took drawings. His reference to internal anatomy demonstrates that unlike most of his metropolitan counterparts, who were confined to studying skins and stuffed specimens, Hodgson took additional pains to study live and recently-killed animals where possible. Hume made admiring reference to this in his 1895 appraisal of Hodgson’s paintings, noting that the ‘admirable large-scale pictures’ of birds were ‘continually accompanied by exact, life-size, pencil drawings of the bills, nasal orifices, legs, feet, and claws (the scutellation of the tarsi and toes being reproduced with photographic accuracy and minuteness) and of the feathers in crests, wings and tails’.[58] This can be seen in the majority of the ornithological paintings in the

[57] B. H. Hodgson to J. Prinsep, 15 April 1836. RAS.
[58] Hunter, *Brian Houghton Hodgson*, 305.

Figure 30. Raj Man Singh, *Buceros bicornis*, in B. H. Hodgson, *Birds of India*, **II.**, 40. ZSL. [Courtesy of James Godwin.]

ZSL collection, of which the figure of the Giant Indian Hornbill (*Buceros bicornis*) is a particularly notable example (*fig.* 28).

Under Hodgson's direction, Singh and the other artists continually referred to a set of anatomical characteristics, both external and internal, which rarely varied. Hodgson's concern that the beak, feet, and primary wing feathers always be drawn, whatever the species, indicates that they were of importance to his attempts to order species according to a classificatory system. Hodgson's access to contemporary scientific sources was limited, but it is known that his library included two of Gould's early folios, the *Century of Birds* and *Birds of Europe*, to both of which Hodgson subscribed and which he had dispatched to Kathmandu.[59] The impact of these works on Hodgson's own researches can be gauged by the visual similarity between some of the paintings in his collection and those by Gould's artists, and by Hodgson's handwritten references to Gould's work and classifications. The most notable instance of this is Singh's depiction of the Bengal Eagle Owl (*Bubo bengalensis*), which bears Hodgson's note 'See Gould Eur. Birds Part 22a Bubo Ascalaphus, Bubo bengalensis?' (*fig.* 29).[60] It is likely, however, that Hodgson turned to Gould's work primarily for aesthetic inspiration rather than to check details of classification, for he had a relatively low opinion of Vigors' descriptions of Himalayan birds and regarded Gould's classifications in the *Birds of Europe*, based on skins, as 'miserably trivial'.[61] Indeed, in an 1837 article he gave vent to his frustrations that more naturalists like Gould did not observe species in a state of nature, and railed that 'the face of our land is darkened with skin-hunters, deputed by learned Societies to incumber [sic] science with ill-ascertained species'.[62]

[59] J. Gould, *Century of Birds*, 'List of Subscribers'; *Birds of Europe*, 'List of Subscribers'.
[60] R. M. Singh, *Bubo bengalensis*, B. H. Hodgson, *Birds of India,* **I.**, 138.
[61] Tree, *Bird Man,* ; B. H. Hodgson, to A. Johnston, 10 March 1837, GP.
[62] B. H. Hodgson, 'New Species of Scolopacidae, Indian Snipes', *Journal of the Asiatic Society of Bengal,* 6 (1837), 489-492, 490.

Figure 31. Raj Man Singh, *Bubo bengalensis*, B. H. Hodgson, *Birds of India*, **I.**, 138. ZSL. [Courtesy of James Godwin.]

He clarified this argument in a letter to his fellow Orientalist and Buddhist scholar Eugene Bernouf (1801-1852):

> The phenomena of life are not to be reached by our skins; and the species and classification deduced in Europe from such materials are the bane and disgrace of science. True, we local researchers feel lamentably the want of Museum and Library, but learned Societies at home, if they really sought to advance knowledge in this dept., would lend us these aids, and encourage and support our investigations, instead of striving to anticipate us by crude deductions from insufficient materials – insufficient, I repeat and necessarily so.[63]

This is highly-redolent of Swainson's strictures against the Zoological Society and his advice to naturalists on best classificatory practice in the *Preliminary Discourse*. None of Hodgson's biographers, or scholars of his zoological work, have made clear his adherence to quinarian systematics. Datta and Inskipp remark only that he used 'an older system' than that used by Strickland, Blyth and others around 1840, but the evidence that he was committed to Swainson's quinarian variant is overwhelming.[64] The similarities between Hodgson's approach to collecting and classification and that advocated by Swainson are telling. Swainson differed from his fellow quinarians in seeking to base his system on a more secure basis than that provided by affinities and analogies between external characteristics alone. Like Hodgson, he argued that previous methods of designating the characters (parts of the body) upon which naturalists described species were based on arbitrary decisions on the part of the systematist.

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[63] B. H. Hodgson to E. Burnouf, 1 May 1837. RAS
[64] Waterhouse (ed.), *Origins of Himalayan Studies*, 144.

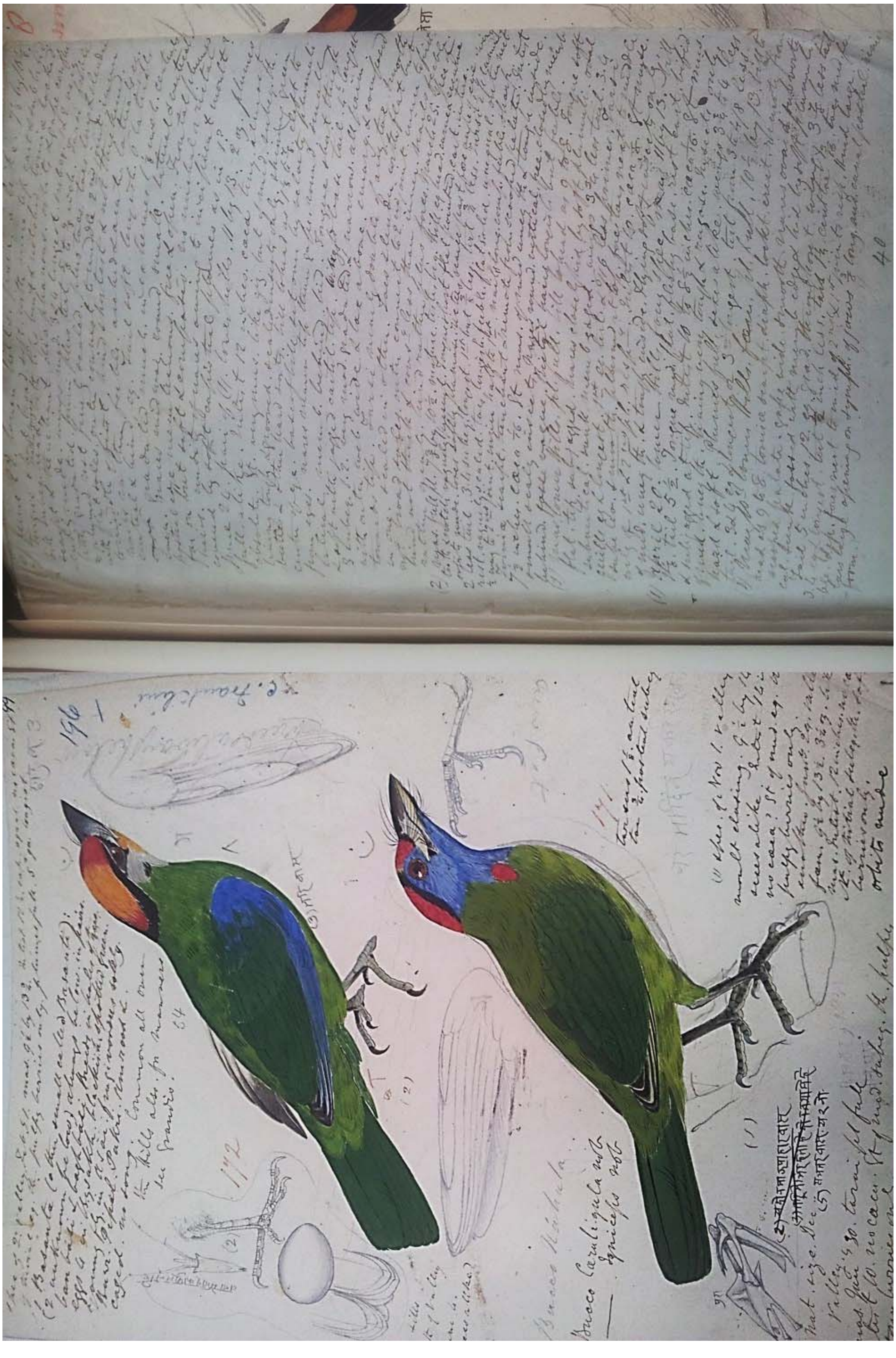

Figure 32. Raj Man Singh, *Megalaima asiatica*, B. H. Hodgson, *Birds of India*, **II.**, 99.

[Courtesy of James Godwin, ZSL.]

Linnaeus' system of classifying birds, for example, had focused *only* upon the forms of the beak and feet, 'totally disregarding the formation of their wings, - which is one the chief characteristics of birds, - and entirely overlooking their manners, habits, and food'.[65] Though he acknowledged that the degree of variation in birds meant that naturalists could not 'universally' employ any single organ to furnish generic characters in avian classification, as such processes do not rest upon any common standard, Swainson directed the naturalist to search for the most 'comprehensive' characters. By this he meant those which serve to determine 'how the group before him is distinguished from all the others'. In searching for these characters, Swainson advocated taking into account:

> Every circumstance that is known regarding the economy and structure of the objects; and from all these make a selection of such as are most constant, universal, and obvious. It will almost always be found, that a peculiarity of internal organisation is accompanied by a corresponding difference in external structure, and that both of these are adapted for that particular mode of life which the animal pursues. As there is a constant harmony between the conformation of an animal and its peculiar economy, we should study the former with a constant reference to the latter.[66]

As the ZSL paintings demonstrate, Hodgson followed this advice to the letter. In the detail annotations on the reverse of the great majority of the sheets, he noted measurements, details of the location and habitat in which the specimens were found and collected, diet and

[65] Swainson, *Preliminary Discourse,* 236.
[66] Swainson, *Preliminary Discourse*, 236-237.

behaviour (*fig.* 30). In addition, as he noted in his letter to Johnstone, he instructed his artists to pay close attention to features of internal anatomy, including the structure of the keel and breastbone and the tongue. He also required that they draw anatomical and morphological features in a particular way. This can be seen most clearly in the drawings of wings. The curious position in which the wing is drawn, folded as if at the side of the body, omits any detail of the secondary and tertial feathers and narrowly concentrates attention upon the ten primary feathers. This is of little aid to identification, but does directly reflect Swainson's injunction to consider the relative lengths of the first and second primaries when determining the genus in which a species should be placed – a characteristic peculiar to his variant of quinarian classification.[67]

Swainson also repeatedly drew attention to the beak as a primary classificatory feature. Although he noted this in the *Preliminary Discourse*, he made the most sustained explanation for this focus, and its importance in quinarian classification, in *Birds of Western Africa*, one of his volumes for Jardine's *Naturalist's Library* written in 1837.[68] In a discussion of the Crimson nut-cracker (*Pyrenestes sanguineus*), a small finch with a powerful bill for breaking open tough seedpods, Swainson cited the species as the 'typical form' of its genus on the basis of its bill structure. He accompanied this discussion with a diagram to demonstrate the chain of affinities between the five main genera of the finch family (Fringillidae) (*fig.* 31).

In this diagram, figure 1 shows the head of *Pyrenestes sanguineus*. Figure 2 shows *a* typical *Coccobus* finch, designated by Swainson as the 'sub-typical' form of the genus (not so 'perfect' as *P. sanguineus*) owing to a notch at the end of its beak, visible in the illustration.

[67] Swainson, *Classification of Birds*, 205-374, in which Swainson discusses these principles in detail.
[68] W. Swainson, *Birds of Western Africa* (London: Highley, 1837).

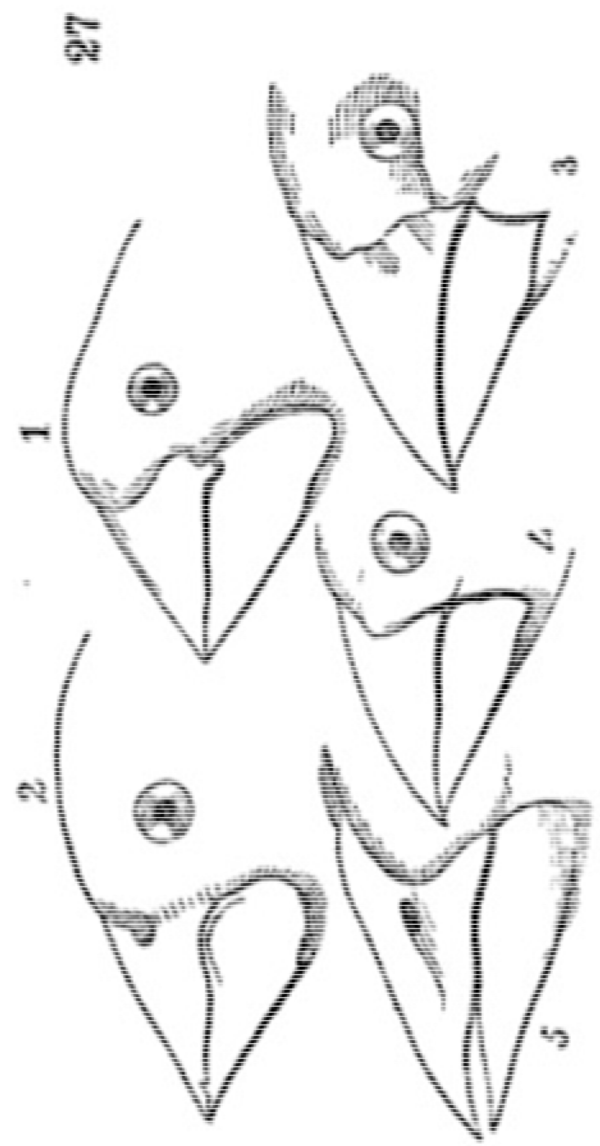

Figure 33. W. Swainson, diagram showing affinities between the members of genus *Pyrenestes*. W. Swainson, *Birds of West Africa* (London: Highley, 1837), 156.

Figures 3 (genus *Coccothraustes*), 4 (genus *Spermophaga*), and 5 (genus *Dertroides*) show the 'aberrant' forms in the sub-family which, when depicted thus, demonstrate the chain of affinities between beak structures. 'We have chosen to illustrate this progression by the form of the bill only, because this organ is the most obvious to the generality of students, and will admit of more accurate delineation; but this chain of connexion is equally apparent in the variation of wings and feet. We have thus presumptive evidence of a circular group'.[69]

To determine if this circular sub-family classification was 'natural', or, 'whether it will bear the test of comparison with the orders of birds and the tribes of the *Insessores*', Swainson then compared the features of these five genera with those of other genera in the sub-family Coccothraustinae.[70] 'The usual mode we have always adopted for this purpose is to place the genera in a column which corresponds to those which contain the groups represented:

SUB-FAMILY COCCOTHRAUSTINÆ.

	1. Typical.	
Pyrenestes -	The most perfectly conic bills. - -	*Conirostres.*
	2. Sub-typical.	
Coccoborus -	Bill notched at the tip. - - - -	*Dentirostres.*
	3. Aberrant.	
Coccothraustes -	Wings long, tail forked, feet very short.	*Fissirostres.*
Spermophaga -	Bill most lengthened - - -	*Tenuirostres.*
Dertroides -	Wings short, feet large, very strong, upper mandible curved above -	*Scansores.*

Figure 34. Swainson's tabular depiction of analogies between members of the sub-family Coccothraustinae. W. Swainson, *Birds of West Africa*, 158.

[69] Swainson, *Birds of Western Africa*, 157.
[70] Note: Coccothraustinae is a now-defunct sub-family. The majority of the finches in this grouping have been regrouped as Carduelinae. *Coccothraustes* is now considered a genus containing only one species, the Hawfinch (*Coccothraustes coccothraustes*).

Each of the columns in this table represents a circle. Swainson explained:

> *Pyrenestes* passes into *Dertroides*, just as the tribe of *Conirostres* passes into that of *Scansores*. Thus we find that the chief distinctions of each of the tribes of the perchers turns out to be the same as those of the group of Finches before us; that is, they possess the same characters *in addition* to others which constitute them finches. It is only upon these principles, in fact, that we can account for the glossy plumage, for instance, of the haw-finches; their very short feet, - their broad, though conic bills, - their pointed wings, - their forked tail, - and their migratory habits; all which, as every one knows, are also the characteristics of the swallow family, and of all *Fissirostral* birds… Numerous other analogies might be here pointed out, strengthening the accuracy of the above arrangement; but it is quite needless to proceed further. The clue being now given, the experienced ornithologist will be at no loss in following it up; while the student will thus have an example he can comprehend, of that *systematic order of variation* in all animals which the discoveries of every year more and more demonstrate as the fundamental principle of the great plan of creation.[71]

By means of this process of comparison, Swainson identified a regular quinarian grouping.

It is not clear from Hodgson's surviving correspondence whether or not he shared Swainson's certainty as to whether quinarian classification demonstrated the great plan of creation. John Whelpton has noted that, brought up in the Church of England, Hodgson was a

[71] Swainson, *Birds of Western Africa*, 157-158.

theist but one who consistently refused to discuss his religious beliefs.[72] He also did not share Swainson's political sympathies, being vaguely Whiggish in early life and later a passionate, Gladstonian Liberal, much to the disgust of his Tory neighbours.[73] The reasons why he selected Swainson's theory for use in classifying the birds of Nepal and the Himalayas is therefore unclear, particularly at a time when it was coming increasing fire from hostile naturalists in Britain. As a reviewer of Swainson's *Birds of West Africa* wearily noted in 1837,

> 'Through the entire range of human investigation into the laws of nature, we shall probably not succeed in meeting with so singular an anomaly as the opposite opinions entertained upon those views of natural arrangement first made public by MacLeay, and subsequently sustained by the observations of other naturalists… If some competent naturalist would give a general summary of all that has been urged in support of the quinary system, and all that has been and can be brought to bear against it, limiting the evidence on either side, as much as possible, to matters of fact, many there are who would gladly avail themselves of the information which might thus be afforded; and, in the present posture of affairs, such a volume would be no insignificant contribution to science.' [74]

By 1845, when he was still using Swainson's principles to investigate birds in his Darjeeling exile, Hodgson lagged far behind mainstream scientific opinion in Britain. In a letter

[72] Whelpton, J., 'Hodgson, Brian Houghton (1801?–1894)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004;
[73] Waterhouse, *Origins of Himalayan Studies*, 15-16.
[74] [Anon.], 'Reviews. *Naturalist's Library. Ornithology. Vol.* VII. *Birds of Western Africa*. By W. Swainson', *Annals and Magazine of Natural History*, 1 (1837), 328-329.

to Strickland, Edward Blyth underlined Hodgson's peculiar status as a naturalist who provided invaluable information but whose judgement could no longer be trusted.

> Of the new species which I am now describing, Hodgson has furnished a good many, which I have had all this time to hand: he was, and is terribly eager to have them all published, no matter how crudely; being fond of the credit of making discoveries of this kind, and leaving to others the labours of reducing and determining his species, of which I have done in an immense number of instances, quashing his new species altogether. But there is a very considerably residuum of new species which still remain to be publicly made known, and these I am now describing out of hand.[75]

Crucially, Blyth's position in Calcutta, with his easy access to the scientific journals to which the Asiatic Society subscribed, meant that he was more aware than Hodgson of the developments in classification that had taken place in London in the early 1840s and had sided early on with Strickland and the reformers against Macleay, Vigors, and Swainson. Hodgson had previously clashed with Blyth, who was the Curator of the Asiatic Society's Calcutta museum, on the issue of credit for discovering species, laying a foundation of mutual distrust between the two men.[76] Blyth's systematic 'quashing' of his new species names, on the basis

[75] E. Blyth to H. Strickland, [undated] 1845. RAS.
[76] For this episode, see E. Blyth, 'Appendix to the report for December Meeting, 1842', *Journal of the Asiatic Society of Bengal*, 13 (1844), 361-395. Also, C. B. Jones, 'Edward Blyth, Charles Darwin, and the Animal Trade in Nineteenth-Century India and Britain', *Journal of the History of Biology*, 30 (1997), 145-178.

that they were unsupported by sufficient evidence, therefore rankled deeply with Hodgson, particularly given his careful amassing of detailed paintings.

The paintings, too, fared poorly, but it was Gould rather than Blyth with whom Hodgson crossed swords. By the mid-1830s, Hodgson viewed his collection as the basis for a folio on Himalayan birds that would rival or surpass Gould's *Century of Birds* and which would constitute a major contribution to zoological knowledge. Hodgson's initial attempt to publish alone was a failure, partly because he lacked Gould's willingness to drum up subscriptions, as his correspondence attests. 'By my soul', he exclaimed to Prinsep, 'it is a d____d bore to be compelled to fawn and entreat for subscribers as if one was the obliged instead of the obliging party, when one undertakes to labour with pains and cost for the love of science'.[77] Hodgson asked Prinsep to solicit subscriptions from the members of the Asiatic Society, for two years later Prinsep recorded that Hodgson had not gained 'the usual patronage of the Government to his elaborate and costly publication'.[78] This also amounted to nothing.

In 1837 he wrote to Gould to suggest a collaboration. It is unlikely that the two men had ever met, but Hodgson's choice of potential collaborator was clearly guided by Gould's growing reputation as both an ornithologist and a publisher, as well as by the apparent expectation that, having made his name with a book on Himalayan birds, Gould would welcome the opportunity to publish a much-expanded and updated version. Hodgson envisaged that he would provide the paintings, and that Gould would be content to provide the publishing expertise, and perhaps the classification and species descriptions, based on Hodgson's detailed notes.

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[77] B. H. Hodgson to J. Prinsep, 1836. India Office Library, British Library.
[78] 'Proceedings of the Asiatic Society', *Journal of the Asiatic Society of Bengal*, 7, 2 (July, 1838), 668.

Hodgson's letter to Gould has not survived, but Gould received his approach as he was pre-occupied with the preparations for his Australian expedition. He responded through Hodgson's father, setting out a list of demands that seem calculated to ensure that the project would never go any further. He agreed to write the bulk of the letterpress, leaving details of behaviour and habitat with Hodgson, but demanded sole responsibility for producing the illustrations. Gould was 'perfectly convinced… that no work executed from the drawings of Indian artists would sell', and stipulated that his own artists, meaning Elizabeth Gould and Edward Lear, would be responsible for every stage of the illustration process.[79] Hodgson rejected these terms and in 1839 approached Swainson himself. This got as far as the production of a joint contract, but no further, and no further evidence survives of their negotiations.[80] The final great quinarian folio remained nothing more than a pipe-dream.

III.

Superficially, Hodgson's exposure to, and later adoption of quinarian classification appears to be a textbook example of Basalla's and Coggon's unidirectional model of scientific dissemination, from the metropolitan 'centre' to the colonial margins, which still dominates our understanding of colonial intellectual life.[81] His reading of Gould's two early folios, both of which were explicitly arranged according to Vigors' system, and exposure to Swainson's system in the popular works for Lardner and Jardine, would have made him aware of circular theory if he had not already learnt of it from correspondents and journal articles. To Hodgson,

[79] J. Gould to B. H. Hodgson, Senior, 6 March 1837. GP.
[80] A copy of this contract exists in the NHM collections, though the original has been lost. GP.
[81] Basalla, 'The Spread of Western Science', 611-622; Coggon, 'Quinarianism after Darwin's "Origin"', 5-42. See also L. Pyenson, 'Why Science May Serve Political Ends: Cultural Imperialism and the Mission to Civilize', *Berichte zur Wissenschaftgeschichte*, 13 (1990), 69-81.

as to other British naturalists marooned in remote colonial outposts, such as William Hincks in Toronto, Strickland's 'death blow' to quinarianism in 1841 was not quite so final as to their counterparts working within the framework of London's institutions, as his clash with Blyth makes clear.[82] Indeed, Hodgson only appears to have engaged with quinarianism in the mid-1830s, some two or three years after Swainson's conversion around 1832-1833 and the appearance of the latter's first book for Lardner in 1834. This 'lag' in the dissemination of theory was partly a result of the physical distance from London at which he worked, but also because of his distance from the colonial intellectual circles of Calcutta. Blyth, also far-removed from the deliberations of the Linnean and Zoological societies, was spared this by being situated in one of British India's most learned societies, with its close links both to London's intellectual circles.

However, Hodgson did publish articles on Nepalese and, later, Indian animals that were closely influenced by the quinarian system and which were known in Britain thanks to the publication of annual collected editions of the *Journal of the Asiatic Society of Great Britain and Ireland* by the London publisher, John Parker (1792-1870), in which proceedings and reports from learned societies around the world were registered.[83] These were sufficiently well-received in Calcutta to prompt the Asiatic Society, before Hodgson sailed into temporary exile in Britain in 1844, to order 'some first-rate artist' to sculpt a bust of Hodgson to be placed in the Society's reading room.[84] However, they had less impact in Britain. Unlike Gould, who continued publishing in scientific journals to the end of his life, Hodgson published no zoological work after his final return to Britain in 1859, and even his later work, though cited

[82] Coggon, 'Quinarianism after Darwin's "Origin"', 5-42.
[83] For example, 'Proceedings of the Meetings of the Royal Asiatic Society', in J. Prinsep (ed.) *Journal of the Royal Asiatic Society of Great Britain and Ireland, Volume the Third* (London: J. Parker, 1836), i-lxxiii.
[84] [Anon.], 'Proceedings' (1844), xv.

by subsequent naturalists for evidence of precedence, was wholly out of step with the scientific mainstream after 1845.

It is the collection of zoological illustrations which demonstrate that a far more complex process of knowledge dissemination was at work. Raj Man Singh, Hodgson's principal artist from the mid-1830s to 1859, introduced into Nepalese art the European aesthetic conventions he learnt under Hodgson and from the latter's collection of European illustrated zoological works. For this, Singh is now increasingly considered the 'founder' of modern Nepalese art.[85] Had Hodgson's dream of using Singh's watercolours succeeded, the history of Himalayan zoology would have been very different, codified in illustrations shaped by quinarian principles and a hybrid aesthetic that married East and West. Only a very few of Hodgson's illustrations were ever seen by the wider British scientific community, simple monochrome engravings of the *Jharal*, or Nepalese wild goat (*fig.* 33), and an impressive lithograph of the Steppe eagle (*Aquila nipalensis*) (*fig.* 34), which accompanied articles published in 1833.[86] The limiting factors stemmed from the difficulty in finding skilled engravers and lithographers: unlike Gould, Hodgson's artists remained untrained in reprographic techniques. At a time when Gould established and increased his authority as a naturalist through the mobilising of zoological imagery, this set Hodgson was set at a crucial disadvantage, acting to further curb his ambitions to become the great authority on Himalayan zoology.

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[85] H. Raj, I. J. Joshi, *The First Nepali Pioneer Artist Raj Man Singh Chitrakar* (Kathmandu: Nepal Studies: Past & Present, 2005).
[86] B. H. Hodgson, 'On the Ratwa Deer of Nepal', *Asiatic Researches*, 18, 2 (1833d), 139-146; 'The Wild Goat, and the Wild Sheep, of Nepal', *Asiatic Researches*, 18, 2 (1833c), 129-138.

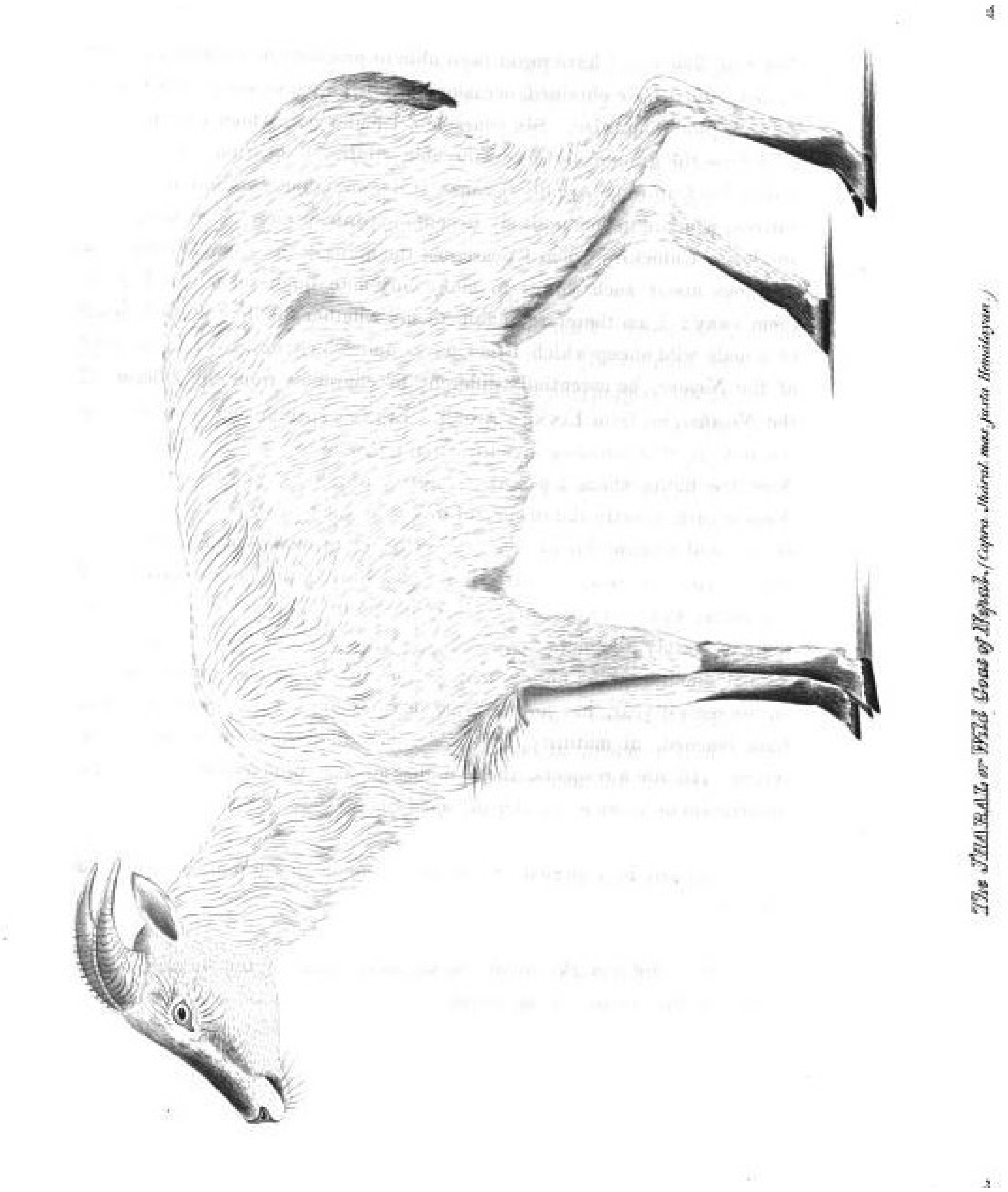

Figure 35. Raj Man Singh, ‘The Jharal, or Wild Goat of Nepal’, in B. H. Hodgson, ‘The Wild Goat, and the Wild Sheep, of Nepal’, *Asiatic Researches*, 18, 2 (1833c), 129-138. Facing page 134.

AQUILA NIPALENSIS

Figure 36. [Unknown artist], ‘Aquila nipalensis’, in B. H. Hodgson, ‘On a Species of Aquila, Circaeetus and Dicrurus’, *Asiatic Researches*, 18, 2 (1833b), 13-26. Facing page 16.

Conclusion

Through the analysis of illustrated scientific works and naturalists' mobilisation of print culture in the 1820s and 1830s, this interdisciplinary study has demonstrated that taxonomy and debates about taxonomic theory in the early-nineteenth century were crucial to the development of a recognisably 'modern' zoology. From the predominantly descriptive, collecting mindset of the Enlightenment to the analytical approach of the mid-Victorians, nowhere was the evolution in methodology more evident than in ornithology, the driving force of zoological development in Britain. Though ultimately a methodological 'dead-end', the application of quinarian systematics in ornithology, and to a lesser extent in mammalogy and ichthyology, helped to create an institutional and intellectual environment in which Darwinism could thrive. Visual representations were key to this process, the interplay between text and image the means by which scientific progress was advanced and disseminated. Their creation, and subsequent deployment, reveals a complex and hitherto-obscured interplay of scientific and 'extra-scientific' factors in zoological debate, and how these reflected deeper, often deeply-entrenched beliefs about nature, and man's relation to it.

Yet very few historians working in the aftermath of the historical 'turns' of the 1960s and 1970s have considered the technical details of early-nineteenth century scientific theory. The inherent complexities, ambiguities and, often, downright absurdities of theories such as quinarianism, which looked both backwards to the classical era and its emphasis on numerical symmetry and forward to the 'philosophical' science of the 1850s, have discouraged scholarly attention. The resurgence of interest in Charles Darwin and the development of his evolutionary thinking prompted an influential body of historians, including Adrian Desmond, Peter Bowler and Dov Ospovat, to look more closely at the normative science of the 1820s and 1830s.[87] However, with the exception of Ospovat, who with Philip Rehbock and Mary Winsor devoted considerable attention to unpicking the tangled threads of natural classification and morphology, their efforts focused on the vast increase in the materials of natural history and its imperial roots, and on the wider political and social transformations which bore down on London's elite scientific circles.[88]

Though this work was of crucial importance in opening up an important 'new' field of research, the neglect of technical details, as expressed in the original writings of early-nineteenth century naturalists, has a similar effect to the rigidly 'internalist' writings of historians like Mayr.[89] In accounting for, and then tracing the application and impact of novel scientific theories, an exclusionary emphasis on either method or intellectual and cultural environment can only result in a partial understanding. By devoting roughly equal space to the technical 'stuff' of early-nineteenth century taxonomic debates and the formative role of its external social and cultural context, including the shifting personal relationships of its key advocates, this study has presented a critical analysis of quinarianism's rise and fall, and demonstrated that, far from being an unproductive curiosity, it was rooted in its time and place and had far-reaching consequences.

This study has been anchored in many sources that have escaped historians' attention, such as Vigors' and Swainson's literary broadsides from the height of their feud in 1831; or that have been overlooked as scientific artefacts, such as Gould's folios. The quinarians flourished in a scientific world that, from 1815, was increasingly reliant on and stimulated by

[87] Desmond, *The Politics of Evolution:* Desmond, Moore, *Darwin;* Bowler, *Evolution*; Ospovat, *Development of Darwin's Theory.*
[88] Rehbock, *Philosophical Naturalists*; Winsor, *Starfish*; 'Non-essentialist methods', 387-400; 'Considering Affinity', 69-75.
[89] Mayr, *The Growth of Biological Thought.*

the expansion of print culture. They all, to varying degrees, participated in it, and their published output is accordingly varied and extensive, from short ‘Notices’ to lengthy articles and books.[90] Though the ‘Notices’ act as a window onto the methods and classificatory systems employed by naturalists in the early decades of the nineteenth century, they tell us rather less than the far longer articles which naturalists of the time produced in abundance. These were showcases of the naturalist’s individual talents, both scientific and rhetorical. It is difficult to think of another period in the history of science in Britain which has been so rich in bitter, personal polemic. As we have seen, one of the factors behind this was nakedly commercial, with magazine and journal editors fanning the flames of personal and national rivalries in order to keep money flowing into the coffers. However, ‘internalist’ factors were also important, not the least of which was that involvement in scientific society was contingent on the individual’s ability to publish.[91]

As might be expected of any group who were determined to establish a ‘new’ scientific theory, the quinarians were polemicists of a high order.[92] Often marked by the ‘mean, quarrelsome spirit’ that so repulsed Darwin, their articles are an essential source of information for the historian. Although there was some twenty years between the publication of Macleay’s *Horae Entomologicae*, the Quinarian Ur-text, and Strickland’s sounding of the death knell in 1844, no other major treatise dedicated to the elucidation of Quinarian principles appeared. The closest approximations were Swainson’s books for Lardner, several of which were devoted to the explication and practical application of his own Quinarian variant.[93] However, as confessedly ‘popular’, or at least ‘middle-brow’ works intended to enlighten middle-class

[90] For example, J. Gould, ‘On the occurrence of a new British Warbler’, *The Zoological Journal*, 5 (1834), 102-103.
[91] Allen, *Books and Naturalists*, 181-232.
[92] For example, Macleay, ‘Dying Struggle of the Dichotomous System’, 431-445; Vigors, ‘Observations’, 395-396.
[93] Knight, ‘High Church Science’, 1-8.

amateurs, they did not carry the same weight with the grandees of metropolitan science as did Macleay's volume, despite reaching a far wider audience. In another of quinarianism's paradoxes, it was Swainson's largely successful efforts to spread the theory that did more to discredit it amongst his peers, and more rapidly, than any amount of artificially-stoked controversy in the pages of the *Magazine of Natural History*.[94]

One of the principal characteristics of many historical studies of scientific culture produced in the past thirty years or so is the extent to which the 'stuff' of scientific theories have been subordinated to analyses of the 'external' context: science as social force. This has been hugely beneficial in many ways, serving to bridge the chasm between history of science and 'proper' history that so troubled Thomas Kuhn in the early 1970s.[95] Externalist history of science has also served to open up facets of scientific development that, in the old narratives, were either banished to the footnotes or overlooked altogether. The Species Debate and the complex social and political environment in which it was conducted, which has provided the constant backdrop to this more focused study, is a prime example. Part of the problem was undoubtedly that the details were so remote from modern experience, and that the debate itself centred on taxonomy which, though fundamental to natural history and biology, could never be described as scintillatingly exciting by even the most partial of historians. With the advent of evolutionary biology in the 1860s, and its subsequent developments into the twentieth century, the concerns of the 'pre-Darwinian' era appeared irrelevant, if not downright misguided.

A corrective to this skewed view can be found in illustrations generated in early-nineteenth century scientific illustration. This study has advanced the premise that zoological

[94] Vigors, 'Controversy', 110-111.
[95] T. S. Kuhn, 'The Relations between History and History of Science', *Daedalus*, 100, 2, The Historian and the World of the Twentieth Century (Spring, 1971), 271-304.

imagery and illustration from this period can tell the historian far more than has previously been acknowledged. That early-nineteenth century science benefitted from the rapid development of print culture, at all levels, has long been recognised. The proliferation of academic journals, which individual scientific societies began to publish from the early 1820s, served to encourage specialism; 'popular', middle-brow periodicals such as the *Magazine of Natural History*; and high-profile publishing enterprises such as Lardner's *Cyclopaedia* that appealed to an expanding audience of lay amateurs, have tended to reinforce the historian's preference for written primary sources over the visual. That much of this same material was accompanied by illustration excited little comment.

Yet the men of science who populate these pages were almost all alive to the possibilities that images opened up for the elaboration and codification of their ideas. John Gould's contributions to this body of primary evidence is of a unique order, in scope and extent, but he was far from being a solitary example. Natural history culture was, to a pronounced extent, visual culture; from Walter Hood Fitch's huge posters that William Hooker used to illustrate his botanical lectures, to museums and the burgeoning zoo movement, it was a science of spectacle. The vast illustrated folios that are so characteristic a feature of this period should not, therefore, be regarded as isolated manifestations.

In focusing on how their illustrations were formulated, constructed, and their meanings determined, historians of both art and science have seldom deviated from the assumption that images are subordinate to their accompanying texts. In recent years, cultural studies scholars have paid close attention to how scientific images 'travel' within and across cultures over time, bearing different ideological messages in different contexts. However, the consequence of this, as Jonathan Smith has perceptively noted, has been a lack of interest in the images' original scientific purpose.[96] Building on the work of Smith, Daston, Mitchell and a small but growing body of research, this study has argued that the function of zoological illustrations largely determined their form and how they were to be 'read' by their audience.[97] Instead of being secondary to the textual descriptions that accompanied them, mere decorations, images served to highlight important classificatory features and familial relationships, elucidating the bewildering chaos of the natural order.[98]

Undoubtedly, there are potential points of rupture. Many of the zoological illustrations from the period are superlatively beautiful and have been reproduced time and again down to the present day. The birds painted by Elizabeth Gould, Edward Lear, John James Audubon and Josef Wolf now most often appear as wall decorations, prized for their intricate designs and vivid coloration. Divorced from their original context, they are simply pictures of birds that have migrated into the broader culture. Their original meanings lost, representation and interpretation become an issue.

The recovery of these images as scientific and historical artefacts comes through tracing the visual and methodological conventions that acted as frameworks for their creation, and by taking into account their character as exercises in compromise. Though working with a novel scientific theory, Gould and his fellow quinarians did not much deviate from the well-established norms that had governed the 'look' of zoological images produced in Britain since the late eighteenth century. There were several reasons for this, some of which related to their scientific function and others to commercial necessity. Broadly speaking, they were as follows: first, to emphasise that Quinarianism was an improvement on that which had come before it, rather than a complete break with the traditions of the past; second, to serve as proxies for type

[96] Smith, *Darwin and Victorian Visual Culture*, 2.
[97] Mitchell, *Picture Theory*, 3-8, 84-90.
[98] Daston, Galison, *Objectivity*, 105-124; Donald, Munro, *Endless Forms*.

specimens and so be useful to museum naturalists; third, in a cut-throat publishing market in which part-publishing was the only viable method of producing lavish illustrated works, to attract as many subscribers as possible by sticking to a ‘safer’ aesthetic.

As Daston and Galison demonstrate, the role of the naturalist and the artist in this process of creation was complex. Aggressively selective in what they did and did not depict, ‘mediated’ images were shaped by the tensions created by disparities between artists’ pictorial *translation* of naturalists’ instructions, and the scientific, commercial and cultural imperatives that shaped those directives. Stories abound of the strains generated in these patron-artist relationships, such as Audubon’s dramatic falling out with the original engraver of *Birds of America*, William Lizars. John Gould was remarkable for his ability to circumvent such difficulties, though the simple fact that his wife was his principal artist during the crucial formative years of his career doubtless simplified matters. Later on, when his reputation was secure, Gould worked profitably with the headstrong German artist, Josef Wolf, and gave him a unique degree of latitude – though Wolf still complained about Gould’s tendency to meddle with minor aesthetic details.[99]

Mediated images of animals, produced to serve a variety of functions simultaneously, were the manifestation of a way of regarding species that was particular to this transitional age. Though iconoclasts like Lamarck blurred the boundaries between species by advancing evolutionary explanations of species generation, the vast majority of naturalists in Britain regarded animals as discrete entities. However, this was not mere biblical literalism nor, as Winsor has convincingly demonstrated, was it classical essentialism. Though widely disseminated, the received view that, prior to the acceptance of evolutionary theory, Platonic essentialism was the standard mode of classification in biological taxonomy has a poor basis

[99] Palmer, *Joseph Wolf*, 71-73.

in historical fact.[100] As Quinarianism's changing fortunes clearly demonstrated, the vast majority of naturalists were far less concerned with the niceties of philosophy than with what their own eyes and experiences told them. Right through the eighteenth century, naturalists held to a wide variety of views about the natural world, but generally preferred taxonomic systems that were practical and allowed them to impose some degree of easy order. These stressed the reality of species and (sometimes) genera, but held higher taxa such as orders and families to be arbitrary constructs of man with no reality in nature. The rapid increase in known species from c.1800 onwards forced a gradual revision of these views; that higher taxa were indeed 'natural' and not 'artificial'. Though they continued to believe in species essentialism, this was essentialism of a far more sophisticated type: a species was not the unchanging, ahistorical entity of classical philosophy, but rather a broad 'natural kind', exhibiting a cluster of properties and variations on a basic type.

The true nature of Quinarianism can only be fully appreciated when we consider the conditions which shaped its formulation and the varied ways in which it was codified and disseminated to a wider audience. A manifestation of a culture in often violent transition, its rejection must not obscure its formative role in the development of science in Britain and the empire. For twenty years, quinarianism was a vibrant, vivifying force, eventually reaching a 'popular' audience beyond the closed realms of London's scientific institutions, and shaped the intellectual development of a generation of naturalists whose work was to define what zoology was and was to become in the 1850s.

[100] Winsor, 'Pre-Darwinian taxonomy', 387.

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