

The scientists and Darwin's *The Origin of Species* in nineteenth century Australia. A re-evaluation

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Abstract

The arrival in Sydney of a copy of the first edition of *The Origin of Species* early in March 1860, purchased and annotated in pencil by a botanically aspiring colonist, William Woolls, yielded a significant insight into the reception of Darwin's theory of evolution at a remote outpost of the scientific world. A Christian "creationist," Woolls, rejected the theory, and his pencilled objections and questioning marked an attitude that would predominate among Australian naturalists for almost four decades. British institutional approaches coloured the development of colonial science. The personal and research influence of the great British palæontologist, Sir Richard Owen, and his concept of a "final cause" held prevailing sway, and it was not until the mid to late 1880s that a new breed of trained pro-Darwinian scientists from the United Kingdom percolated the teaching posts in the three Australian universities and promoted a paradigm shift in Australian biological science. Darwin's long consideration of the platypus (first sighted in 1836 on his visit to the Cox's River, New South Wales) as a key aberrant species in the evolutionary chain, finds relevance in this re-evaluation. Evolutionary ideas won widening acceptance at the Royal Society of New South Wales following the creation and award of the Clarke Medal in the late '80s as the first scientific award in Australia.

The Origin arrives in the Colonies

In December 2009 the National Library of Australia acquired a copy of the first edition of Charles Darwin's *The Origin of Species*, the earliest to reach the Australian colonies. Published by John Murray, London, in a small edition of 1,250 copies on 24 November 1859, it arrived in Sydney by ship on 10 March 1860 and a week later it was proudly inscribed by one of its first purchasers — "Parramatta N.S.W. William Woolls March 17 / 60". Defined in library terms as an "association copy,"¹ its singularity was marked by the pencilled annotations made by its owner across some one hundred of its pages denoting the earliest known commentary offered in Australia on a work that was destined

to transform scientific thinking and promote a new understanding of the biological world. Titled fully *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, Darwin's book would both confound and challenge opinion in the Australian colonies across the next four decades.

Fertilized by his *Beagle* journal (Darwin 1839) from his four years as a travelling naturalist and his subsequent experiments and research, *The Origin* was stocked with new biological data drawn from sources across the globe, its wide compass offering a detailed proposal for the progressive development of species and a positivist biological framework for man's understanding of the natural world. It was launched into an audience already exposed to Lamarck's theory of the evolution of species through the process

¹ NLA.cat-vn4591931

* Ann Moyal died on 21 July 2019, aged 93.

of adaptive change and the amateurish, but popular, *Vestiges of the Natural History of Creation* published anonymously by Richard Chambers² (Chambers, 1844) advancing a theory of progressive evolution instituted by a Creator working down the ages to produce an unending series of adaptive change. Yet centrally it was Archdeacon Paley's book, *Natural Theology* (Paley³ 1802–70) with its thirty-odd editions, set as a standard text at Oxford and Cambridge universities, that had the most sustained influence on public opinion: "There cannot be design without a designer; contrivance without a contriver; order without choice...subserviency and relation to a purpose, without that which could intend a purpose; means suitable to an end...without the end ever having been contemplated, or the means accommodated to it. Arrangement, disposition of parts, subserviency of means to an end...imply the presence of intelligence and mind" (Paley, 1833, p.259). "I could almost," Darwin himself once remarked, "formerly have said it by heart"⁴ (Darwin, 1859b).

For Australia itself Darwin had early followed the published journeys of the Australian explorers, Thomas Mitchell and Alan Cunningham, was acquainted with the work of the renowned British botanist Robert Brown in Australia, (Moyal, 2017) and, during his own visit to New South Wales — recalling that "wonderful" animal (Darwin, 1836), the platypus, seen in the Cox's River — had jotted in his Journal on 19 January 1836, "An unbeliever in everything beyond his own reason might exclaim,

'Surely two distinct Creators must have been [at] work'"⁵ (Darwin, 1836a). Now in early 1860, an eager Australian reader approached Darwin's book and, addressing it with his pencil, provided a rare historical record of the impact of this seminal work on the mind of an aspiring colonial botanist.

William Woolls' commentary

William Woolls (1814–1893) was born at Winchester, England, the last of nineteen children. His family enjoyed close association with the Established Church and, while he received no formal education, he was tutored by several Anglican clergymen, including his godfather, a master at Westminster College, and his own older brother, the Rev. Charles Woolls at Pembroke College, Oxford, both of whom contributed to his education in literature, classics, theology and verse. Orphaned at 16 and lacking prospects in Britain, he was advised to emigrate to Australia and arrived in Sydney in April 1832 carrying a passport to colonial society with a letter from Viscount Goderich to Governor Bourke. In Sydney Bishop Broughton, impressed by the young man's skill as something of a literateur, appointed him as an assistant master to the Rev. Forrest, the first headmaster of The King's School, Parramatta. Woolls quickly published his epic poem *The Voyage: A Moral Poem* (1832), contributing other poems to the *Sydney Gazette* and *The Colonist*, and in 1841 opened his own school, Mr Woolls Academy, at Parramatta, where he educated the sons of colonists for some twenty-four years. He took an early interest in church matters, became secretary of the Parramatta Bible, Tract and Religious Book Society in 1842, and in 1844 published *A*

² Richard Chambers (b 1802–d 1871)

³ William Paley (1743–1805)

⁴ <https://www.darwinproject.ac.uk/letter/DCP-LETT-2532.xml>

⁵ <http://darwinbeagle.blogspot.com/2011/01/19th-january-1836.html>

Short Account of the Character and Labours of the Rev. Samuel Marsden, followed by *A Tract for the Times: addressed to the laity of New South Wales* in 1849. He was also influenced in these early years by the Rev. James Walker, a later headmaster at The King's School, who fostered his interest in botany. Collecting plants around Parramatta between 1845 and 1856, he began to hone his understanding of the principles of systematic botany,⁶ develop an interest in “the natural system” of Jussieu⁷ (adopted by Brown in his *Prodromus Florae Novae Hollandiae et Insulae Van-Diemen*) and the works of William and Joseph Hooker, and to publish material in the *Sydney Morning Herald* on the derivation of scientific names, the promotion of local plants, and information on species of the Parramatta region. He would publish his second paper, “A glance at the Botany of the North Shore, Sydney” in 1861.⁸

William Woolls comes to *The Origin of Species* with botany on his mind. He proves an attentive and confident reader. He embraces the book's four leading chapters ‘Variation Under Domestication’, ‘Variation Under Nature’, ‘Struggle for Existence’, ‘Natural Selection’, and enters the discussion on natural selection in Chapter 5, ‘Laws of Variation’. There, Darwin, having declared after several allusions to environment and the direct action of the conditions of life that

induce “variability; and natural selection will then accumulate all profitable variations,”⁹ Woolls notes, “All the examples [of environmental condition] “seem to prove to me the premise [of their influence]...all the author's deduction to deny it” (Darwin 1859, pp. 133–4). At Darwin's assertion that “Natural selection, it should never be forgotten, can act on each part of each being, solely through and for its advantage,”¹⁰ Woolls asks, “By what process is a part to develop by itself?” and writes, “God determines” (Darwin 1859, p. 149). With Darwin's criticism of “the logic of attributing accommodations in domestic situations of each species having been independently created” rather than “to the *vera causa* of community of descent,”¹¹ Woolls scribbles, “Why not?” (Darwin 1859, p. 159).

“Our ignorance of the laws of variation”, Darwin sets down, “is profound. Not in one case out of a hundred can we pretend to assign any reason why this or that part differs, more or less, from the same part in the parents. But whenever we have the means of instituting a comparison, the same laws appear to have acted in producing the lesser differences between varieties of the same species, and the greater differences between species of the same genus¹²... Whatever the cause may be of each slight difference in the offspring from the parents...it is the steady accumulation, through natural selection, of such differences, when beneficial to the indi-

⁶ His paper, Remarks on the botany of Parramatta, was read at the Linnean Society, London, communicated by Dr. Ferdinand Müller, on December 15, 1859. See *J. Linnean Soc. Zoology*, v. 5, p. iii, 1861. <https://www.biodiversitylibrary.org/item/35035#page/11/mode/1up>

⁷ A. L. de Jussieu (1748–1836)

⁸ Read at the Linnean Society, London, on February 21, 1861. See *J. Linnean Soc. Zoology*, v. 6, p. v, 1862. <https://www.biodiversitylibrary.org/item/39615#page/223/mode/1up>

⁹ <http://darwin-online.org.uk/content/frameset?pageseq=152&itemID=F373&viewtype=side>

¹⁰ <http://darwin-online.org.uk/content/frameset?pageseq=167&itemID=F376&viewtype=side>

¹¹ <http://darwin-online.org.uk/content/frameset?pageseq=177&itemID=F373&viewtype=side>

¹² <http://darwin-online.org.uk/content/frameset?pageseq=185&itemID=F373&viewtype=side>

vidual, that gives rise to all the more important modifications of structure by which the innumerable beings on the face of this earth are enabled to struggle with each other, and the best adapted to survive”¹³ (Darwin 1859, p. 167, 170). “*Structures!*” writes Woolls, “There can be no structural change of ‘like begetting like’” (Darwin 1859, pp. 170).

When Darwin reflects directly upon the question of squirrels and how they “work” and notes that “it does not follow ... that the structure of each squirrel is the best that it is possible to conceive under all natural conditions,”¹⁴ Woolls again scribbles in the margin, “Does this not call into question the Creator’s wisdom?” (Darwin 1859, p. 180). Darwin, earlier, has argued that it was improbable that shared characters of three related species were the result of three separate acts of creation, and not of common descent, Woolls asks, “Why not?” (Darwin 1859, p. 159). Against Darwin’s judgment on “one general law leading to the advancement of all organic beings, namely, multiply, vary, let the strongest live and the weakest die,”¹⁵ Woolls questions, “Who gave this law?” (Darwin 1859, p. 244). And when, turning to “disuse” in nature, Darwin suggests that the wingless condition of beetles in Madeira is a possible case due to the action of natural selection, these beetles having “the best chance of surviving from not being blown out to sea,”¹⁶ Woolls sets

down: “Ingenious dismissal of their Creator’s intention” (Darwin 1859, p. 136).

Woolls’ credulity is increasingly exercised in other natural history fields when Darwin, addressing ‘Organs of Extreme Perfection’ on the structure and graduated diversity in the evolution of the eye (Darwin 1859, p.187), and the difficulty of explaining electric organs in fish, Woolls notes, “separate creation” at margin points (Darwin 1859, p.193) and, faced with the question of parasitic bees pollinating bees of another kind, he observes, “surely this is a design by the Maker” (Darwin 1859, p. 218 & p.250). The imperfection of the geological record offers further challenge. Here Darwin’s comment, “We have no right to expect to find in our geological formations, an infinite number of those fine transitional forms, which on my theory assuredly have connected all the past and present species of the same group into one long branching chain of life”¹⁷ [where] “all the species of the same genus have descended from some one species”¹⁸ (Darwin 1859, p. 301, p. 341), elicits Woolls’ heavy underlining, as does the author’s assertion that “The extinction of old forms is the almost inevitable consequence of the production of new forms”¹⁹ (Darwin 1859, p.343). Throughout the chapter ‘On the Imperfection of the Geological Record’, Woolls’ attention and interest is evident; his exclamation marks and underscoring, a strong show of his questioning and dissent.

On “Classification” he is directly engaged. At Darwin’s remark that, “it has often been

¹³ <http://darwin-online.org.uk/content/frameset?page seq=185&itemID=F373&viewtype=side>

¹⁴ <http://darwin-online.org.uk/content/frameset?page seq=198&itemID=F373&viewtype=side>

¹⁵ <http://darwin-online.org.uk/content/frameset?page seq=262&itemID=F373&viewtype=side>

¹⁶ <http://darwin-online.org.uk/content/frameset?page seq=154&itemID=F373&viewtype=side>

¹⁷ <http://darwin-online.org.uk/content/frameset?page seq=319&itemID=F373&viewtype=side>

¹⁸ <http://darwin-online.org.uk/content/frameset?page seq=359&itemID=F373&viewtype=side>

¹⁹ <http://darwin-online.org.uk/content/frameset?page seq=361&itemID=F373&viewtype=side>

asserted, but the assertion is quite incapable of proof, that the amount of variation under nature is a strictly limited quality.”²⁰ “Why if man can by patience select variations most useful to himself, should nature fail in selecting?...I can see no limit to this power in slowly and beautifully adapting each form to the most complex relations of life. The theory of natural selection even if we looked no further than this, seems to me to be in itself probable”²¹ (Darwin 1859, pp. 468 & 469). Woolls firmly lines the margins of the text adding a large question mark. When, ultimately, Darwin offers his conclusive dismissal of “the doctrine of final causes” as espoused by Professor Owen, “Nothing can be more hopeless than to attempt to explain this similarity of pattern in members of the same class, by utility or by the doctrine of final causes,”²² Woolls is there, expressing his objection with his underlining and large question mark (Darwin 1859, p. 435). Moving towards his conclusions, Darwin writes, “I have attempted to show that it is the widely ranging, the much diffused and common, that is the dominant species belonging to the larger genera, which vary most. The varieties, or incipient species, thus produced, ultimately become converted, as I believe, into new and distinct species”²³ (Darwin 1859, p. 411). Once more Woolls leaves his signifying question mark.

Yet despite his questions and rebuttals, Darwin’s richly argued treatise undoubtedly

claimed Woolls’ close attention: he read the volume to the end. His pencilled comments are at times obscured by time or smudged by the book’s two subsequent owners.²⁴ His participation is sporadic, yet his continuity and sense of commitment is clear. Darwin may set down in his final pages that “all true classification is genealogical; that community of descent is the common bond which naturalists have been unconsciously seeking, and not some unknown plan of creation”²⁵ (Darwin 1859, p. 420), Woolls remains cautious and intense. However, when Darwin, concluding, acknowledges outlooks “directly opposite to mine” and looks with confidence to the future “to young and rising naturalists, who will be able to view both sides of the question with impartiality,”²⁶ Woolls leaves a final cryptic comment, “No doubt” (Darwin 1859, p. 482).

William Woolls’ pencilled response to the 1859 *The Origin of Species* has produced a significant artefact (Moyal, 2018). The author is revealed both as a Christian who views the natural world through the Paleyan concept “thro Nature up to Nature’s God” and as a creationist and a separate creationist. On the matter of the progressive evolution of species, he emerges as a fastidious rejecter and unwilling recruit. His historical relevance, however, is clear. With his rare and detailed reading of Darwin’s landmark book, he appears as a pertinent signifier of what became a prevailing Antipodean reaction and attitude to one of the most influential scientific concepts in the history of human thought.

²⁰ <http://darwin-online.org.uk/content/frameset?page=seq=486&itemID=F373&viewtype=side>

²¹ <http://darwin-online.org.uk/content/frameset?page=seq=487&itemID=F373&viewtype=side>

²² <http://darwin-online.org.uk/content/frameset?page=seq=453&itemID=F373&viewtype=side>

²³ <http://darwin-online.org.uk/content/frameset?page=seq=429&itemID=F373&viewtype=side>

²⁴ Bookplates denote H. S. Mort and Robert L. Usinger

²⁵ <http://darwin-online.org.uk/content/frameset?page=seq=438&itemID=F373&viewtype=side>

²⁶ <http://darwin-online.org.uk/content/frameset?page=seq=500&itemID=F373&viewtype=side>

William Woolls would go on to develop a vigorous commitment to Australian botany and to become an influential educator and public spokesman on the country's flora. In 1868 he founded the Cumberland Mutual Improvement Society and, throughout the '60s and '70s, gave numerous lectures and despatched frequent letters to the *Sydney Morning Herald* informing the community of plants and his own wide-flung field explorations in New South Wales. His *A Contribution to the Flora of Australia* (1867) was a compendium of miscellaneous notes, data and short papers relating to the Parramatta district, the North Shore, the botany of the Berrima district and Mittagong, Kurrajong, Tomah, Ash Island, Darling and the Castlereagh district; his *Lectures on the Vegetable Kingdom with special reference to the flora of Australia* (1879) yielded another dense collection of papers to carry forward his botanical mission. His *Plants indigenous in the Neighbourhood of Sydney, arranged according to the System of Baron F. von Mueller*, (1880) was followed by his introduction and occasional notes to Mueller's *The Plants of New South Wales* (1885), which was praised as an important "floristic" work.

Woolls' early forays into public communication brought him into contact with Ferdinand von Mueller (1825–1896), the Government Botanist of Victoria, to whom he sent specimens and one thousand letters across his career.²⁷ It was a connection that brought him frequent attributions in Mueller's published work and carried Woolls to the attention of the British botanists, George Bentham and Joseph Hooker. Hooker noticed him early in his *Flora Tasmaniae* (1859) as "a zealous Australian botanist,"

while Bentham, employed on preparing the multi-volume *Flora Australiensis* at Kew, acknowledged Woolls' large contribution of specimens and information in 500 mentions in his collective work. He was elected a Fellow of the Linnean Society of London in 1865 on the recommendation of Mueller and the two British botanists. Woolls, however, never became a botanical systematist; he published no description of new species, deferring to the taxonomic decisions of the professionals and adhering in his work on species to Mueller's cortical system. His most important paper "The Progress of Botanical Discovery in Australia" given initially as a Lecture to the Cumberland Mutual Improvement Society on 13 July 1869,²⁸ was included together with *A Contribution to the Flora of Australia* in his submission (on Mueller's urging) to the University of Göttingen, which won him a Ph.D. from the university in 1871.²⁹

William Woolls' position on evolution, however, held firm. Reviewing the third volume of Mueller's *Fragmenta Phytographiae Australiae* in the *Sydney Morning Herald* of 7 July 1863, he wrote, "I have no faith in Dr Darwin's origin of species, nor in the process of hybridization by which some would attempt to clear away part of the difficulties, yet I am sensible that in certain species the amount of variation is astonishing."³⁰ The fundamental questions of variation and distribution remained at the core of his puzzle.

²⁸ *Sydney Morning Herald*, 15 July 1865, p. 5. See <https://trove.nla.gov.au/newspaper/article/13185201>

²⁹ Gilbert, 1985; *ADB*, 1976, Moyal, 2003, 2, p.903). "The Progress of Botanical Discovery in Australia" was published in *Lectures on the Vegetable Kingdom* (1879, pp. 25–60).

³⁰ W. Woolls, "Dr Mueller's *Fragmenta*," a letter to the *Sydney Morning Herald*, 7 July 1863. <https://trove.nla.gov.au/newspaper/article/13081158>

²⁷ Mueller had communicated Woolls' 1859 paper to the Linnean Society, London.

But as he told members of the Cumberland Mutual Improvement Society, “the Great Architect of the Universe created nothing in vain.” If Man “had not discovered a plant’s especial purpose in the economy of nature,” he argued, it was due to his current state of ignorance, and not, “to any other cause” (*A Contribution*, p. 138, quo. Gilbert, p. 60). Nonetheless, Woolls took a persistently forward view: “Our knowledge...is simply progressive,” he maintained, “the more we know, the more remains to be known.” “[In] the study of the Creator’s works, there is no finality.”³¹ For Woolls, science and the scientist had a sacred duty “to replace ignorance with enlightenment and to reveal God’s plan to Man.”

Aware of his own “amateur” status, the scribbling colonist remained essentially a botanical missionary eager to share knowledge of Australian plants and to draw the public into citizen botanical science (Gilbert, p. 84). In this his influence proved far stretching. As his scholarly biographer, Lionel Gilbert, writes, for some fifty years members of the Cumberland Mutual Improvement Society, Horticultural and Agricultural Societies, the Young Men’s Friendly Society, and the great company of newspaper readers, together with the boys he taught in various schools, were “treated to a seemingly never-ending feast of lessons, addresses, articles, papers and book reviews” (Gilbert p. 63). “The boys learnt most of their botany’ from Woolls.” In 1873 Dr Woolls was ordained priest in the Anglican Church and appointed incumbent at St Peter’s Church, Richmond. He is commemorated in the genus *Woollisia* (Epacridaceæ) and the names of six species.

William Sharp Macleay

In 1839 two naturalists arrived whose work in England had placed them in the mainstream of scientific ideas and whose emigration to the Colony gave particular impetus to colonial science. William Sharp Macleay (1792–1865), a Cambridge graduate who had studied under Cuvier in Paris and associated with Lamarck and Geoffroy Saint Hilaire, had already played a prominent part in the debate on the classification of species with his treatise *Horæ Entomologicae* in which he espoused the Quinary or Circular system of classification founded on affinity and analogy. “One plan,” he wrote there, “extends throughout the universe, and this plan is founded on the principle of a series of affinities returning into themselves, and forming as it were circles” (Macleay 1819, p. 459). A Fellow of the Royal Society of London, Macleay gathered a considerable following in Britain. T. H. Huxley,³² reading the *Horæ* on his return from service on *HMS Rattlesnake* in Australian waters, wrote to him in 1851, “I am every day becoming more and more certain that you were on the right track thirty years ago in your view of the order and symmetry to be traced to the true natural system” (8 November, 1851, Huxley, p. 100). Macleay’s own belief was that the true “natural system” was the very “plan of Creation itself, the work of an all-wise, all-powerful Deity” (Fletcher, quo p. 594). As a senior scientist in Australia he was averse to embracing Darwin’s evolutionary conclusions. With access to *The Origin* early in 1860, he set down his position in a letter to his friend Robert Lowe in London. “The naturalist finds himself,” he wrote in May, “on the horns of a dilemma. For, either from

³¹ *Sydney Morning Herald*, 15 July 1865, op. cit.

³² Thomas Henry Huxley (1825–1895).

the facts, he must believe in a special creation of organised species, which creation has been progressive and is now in full operation, or he must adopt some such view as that of Darwin, viz. that the primordial material cell of life has been constantly sprouting forth of itself by 'natural selection' into all the various forms of animals and vegetables. . . . The theory is almost a materialistic one, nay, even so far atheistic that, if it allows a deity at all, He had been ever since the institution of the primordial type of life fast asleep. I am myself so far a Pantheist that I see God in everything; but then I believe in his special Providence, and that He is the constant and active sole Creator and all-wise Administrator of the Universe"³³ (Patchett, p. 207, Moyal 1986, p. 145). Nevertheless he allowed that "Charles Darwin is an old friend of mine and I feel grateful to him for his work." His own opinion, however, remained unaltered. Three years later when Huxley's exposition of Darwin's theory was in current debate in Britain, he confided to his friend the Rev. W. B. Clarke, "I am utterly opposed to Darwin's, or rather Lamarck's theory, and no one had done greater harm to Genesis than Darwin, Huxley and Lyell."³⁴

Macleay and Clarke's friendship had drawn them into early discussion of the relationship between science and theology, Macleay writing to his clerical friend in July 1842 to give his view on the Mosaic chronology and the possible relationship of the seven days of creation to an understanding of the geological epochs which Clarke was early examining in New South Wales

(Letter 4 July 1842, Moyal, 2003, 1, pp. 115-9). Clarke had also delved deeply into the subject lecturing as a young parish priest in Dorset on the relationship between the Mosaic chronology and geological science and arguing for a clear distinction between the claims of the Scriptures and science (Moyal, 2003, 1, p. 52). While at Cambridge he had combined his degree in divinity with training in geology under the foundation Woodwardian Professor of Geology, the Rev. Adam Sedgwick. Increasingly, Clarke was influenced by Lyell's writings on uniformitarianism and the vast changes these works suggested on the passage of forms over infinite eras of geological time (Lyell, *Principles*). Launching his Australian fieldwork in the early 1840s, he envisaged making the country "a new earth for geology."

William Branwhite Clarke

The Rev. William Branwhite Clarke (1798–1878) was an avowed admirer of Darwin's *Voyage of the Beagle* which, as he wrote to Sedgwick, had given him great pleasure and which he judged "a truly philosophical work" (Letter to Adam Sedgwick 13 August 1840, Moyal, 2003, 1, p. 80). He was also familiar with Darwin's other writings including his work on coral reefs and his *Geological Observations on the Volcanic Islands Visited during the Voyage of H.M.S. Beagle* (1844), but, engaged in his busy parish at St Thomas's Church, St. Leonards, his public role as a government geological surveyor in the 1850s, and his wide fieldwork and reportage on gold and mineral resources, he communicated for the first time with Darwin on *The Origin* in August 1861. His tone was positive. Although the first page of Clarke's August letter is missing from the Charles Darwin Correspondence in Cambridge (Moyal, 2003, 1, pp. 551–2), he cordially noted the

³³ <http://darwin-online.org.uk/content/frameset?page=seq=8&itemID=A350&viewtype=side>

³⁴ Mozley, 1967, p. 422, Letter 27 June 1863, Moyal, 2003, p. 621). The remainder of this letter, held originally at ML MSS 139/42, pp. 421–4, is missing.

author's treatise, had read the book in full and, alluding to Darwin's remark (Darwin 1859, p. 373) of "direct evidence of glacial action in the south-eastern corner of Australia,"³⁵ observed that it came from one of his own reports to government from Eden, N.S.W. Clarke accordingly enclosed "a minute slice of the surface" of the granite evidencing glacial "polish" and "a stereoscopic view of the locality" which led Darwin to include information on Clarke's discovery of glacial action in New South Wales in the third edition of *The Origin* in 1869. Darwin's swift response to Clarke's letter is dated 25 October 1861;³⁶ "I thank you cordially," he wrote, "for your very kind expressions towards me & for your letter which has deeply interested me. Your name has of course been familiar to me for years." "There are great difficulties," he continued, "in believing in a mundane cooler period; but it would throw a flood of light on Geographical distribution. ... No subject interests me more than the Glacial period." He also added his congratulations on Clarke's "new discoveries of Secondary fossils in N. S. Wales," noting, "I have for some time thought that the geology of distant countries would help in the progress of the Science more than anything else; and in this, you have been an earnest worker. Most cordially do I wish you success" (Letter 25 October 1861, Moyal, 2003, 1, pp. 560–61). Concluding, he sought Clarke's assistance in a "little" biological experiment on bees. "You have attended to so many branches of Nat. History," he urged, "that I daresay you are a Botanist" and invited Clarke "to cover up any species of the Goodeniaceæ under a

net so as to prevent any other bees or insects visiting it, & observe whether it sets seeds as well as an unprotected plant." Throwing his biological net wide, Darwin was securing another assistant in the face of Ferdinand von Mueller's declining to aid him in this.

Clarke and Darwin's relationship was set in their first exchange. Clarke wrote to Darwin four times between August 1861 and September 1862 seeking his help for guidance to a British palæontologist for his Carboniferous fossils, informing on the behaviour of local bees, and subsequently transferring the Goodeniaceæ experiment to the Director of the Botanical Gardens in Sydney to subject it to more "rigid trial" (Moyal, 2003, 1, Letters, pp. 574–5; 576; 587–8; 599). Darwin rewarded Clarke with a copy of his *The Fertilization of Orchids* (1862) and, notably in 1876, became one of three sponsors for Clarke's election to the Fellowship of the Royal Society of London. Within the context of their collegial links and commitment to his Christian faith, Clarke, as the most strategically placed savant in New South Wales, took the opportunity to give a rare public expression of open-mindedness to *The Origin of Species* in his Inaugural Address as Vice-President of the newly formed Royal Society of New South Wales in 1866. Warning the members against nervousness on the fate of the Scriptures and urging that we "should wait for further evidence and a wider range of experiment," he declared: "We must strive to discern clearly, understand fully and report faithfully, ... adjure hasty theory and unsupported conjectures; where we are in doubt, not to be positive; to give our brother observer the same measure of credit we take to ourselves; not striving for mastery, but leaving time for the formation of the judgment which will inevitably be given, whether

³⁵ http://darwin-online.org.uk/content/frameset?page_seq=391&itemID=F373&viewtype=side

³⁶ <https://www.darwinproject.ac.uk/letter/DCP-LETT-3298.xml>

for or against it, by those who come after us.” In this, he noted, Australia’s continent, afforded “much to excite man’s curiosity and intellect” (Clarke, 1867).

In geological and palaeontological matters, however, from his own exposure to the giant marsupial *Diprotodon* found in the Wellington Caves and *Dromornis* in Queensland, on which he corresponded with Richard Owen, Clarke announced in a letter to the *Sydney Morning Herald* on 11 June 1869³⁷ that he could not subscribe to the doctrine “that recent animals are *the offspring of the older forms*. I believe that species as such were made by the Creator, and that they are not the result of accidental conditions, but however related are independent of their predecessors.” In this field of knowledge he aligned himself as a separate creationist.

Most of Clarke’s colleagues held to similarly cautious views. While Charles Lyell’s³⁸ uniformitarianism and his later *Geological Evidences of the Antiquity of Man* (1863) had exposed men’s minds to both the vast spanning reaches of geological time and man’s possible antiquity, the Government Inspector of Coalfields in New South Wales, William Keene,³⁹ proudly proclaimed his distrust of both theories. “Better evidences ... are needful,” he wrote tartly to the *Sydney Morning Herald* in 1863,⁴⁰ “before geologists can pretend to set aside the prevailing

belief in the Jewish chronology” (Keene, 1863). At the same time, one of the most visible of Sydney’s men of science, Dr John Smith,⁴¹ foundation Professor of Chemistry and Experimental Physics at the University of Sydney destined to become a prominent public analyst, educator and legislator, while ready to concede that there might have been a race of pre-Adamite men, concluded “that these had been entirely destroyed to give place to the present race of which we now had record” (Smith, 1863).⁴²

Charles Moore

On the institutional front, the Government Botanist and Director of the Gardens in Sydney, Charles Moore (1820–1905), trained at Kew and serving as director in Sydney from 1848 to 1896, carefully labelled plants for his herbarium showing the Natural order, scientific name and authority and country of origin; exchanged specimens of plants and seeds, corresponded widely, and served as an established representative of science in the Sydney community. Yet, as a rare recipient of a presentation copy of Darwin’s book,⁴³ he avoided public discussion of the evolutionary principle, issuing ‘A Catalogue of Plants in the Government Botanic Gardens, Sydney’ 1895 which, without introduction, listed all plants held providing names, family and country of origin “to facilitate exchanges with all those interested in Botany and Horticulture.” Moore published *A Census and the Plants of New South*

³⁷ “Extinct Species,” a letter to the *Sydney Morning Herald* from W. B. White, p. 2. <https://trove.nla.gov.au/newspaper/article/13187620>

³⁸ Charles Lyell (1797–1875).

³⁹ William Keene (1798–1872), <http://adb.anu.edu.au/biography/keene-william-3931>

⁴⁰ Letter to the *Sydney Morning Herald*, after a meeting of the Sydney Philosophical Society, 19 November 1863, p. 8. <https://trove.nla.gov.au/newspaper/article/13094245>

⁴¹ John Smith (1821–1885), <http://adb.anu.edu.au/biography/smith-john-4608>

⁴² Cooper (2018) argues that Smith was trying to reconcile his faith with the scientific data.

⁴³ Moore’s presentation copy of *The Origin* is held by the Daniel Solander Gallery, Botanic Gardens of New South Wales

Wales (1884) and *A Handbook of the Flora of New South Wales* (1893) (*ADB*, 1974, 5). As Finney notes, men such as Moore at the Australian Museum were “users of classification schemes rather than devisers of them.”

Ferdinand von Mueller

The most eminent and resolute anti-Darwinian in the Colonies, however, was the doyen of Victoria's scientific community, the Government Botanist and subsequent Director of the Royal Botanic Gardens Victoria, Dr Ferdinand von Mueller (1825–1896). Born in Schleswig-Holstein, a Ph.D. scholar from the University of Kiel who emigrated to Adelaide in 1847 and began his botanical investigations in South Australia, was appointed Government Botanist of Victoria in Melbourne in 1853, and, extended his knowledge of Australian flora by joining A. C. Gregory's North Australian Exploring Expedition as expedition botanist in 1855. He became a prominent and authoritative figure in the colony, the most honoured of Australia's nineteenth century scientists, the “von” being bestowed on him by the King of Württemberg in 1869 and the hereditary title of Baron from the same source two years later. An intense collector and researcher, Mueller developed a network of willing workers who contributed specimens to his herbarium and built a large international and local set of correspondents. Raised as a strict Lutheran and adhering to the faith all his days, he might privately acknowledge that Darwin's early writings had influenced him as a young man and given plan and direction to his life (*Kynaston*, p. 175). But with the arrival of *The Origin* he fiercely resisted the theory of evolution and clung tenaciously to his belief that species were fixed and immutable. As he wrote to Richard Owen in August 1861, “during less than 22 years of observations of

the forms of vegetable life in free nature, I had during travels extending in Europe and Australia over nearly 30,000 miles, never cause to entertain any doubt, that we are surrounded by species clearly defined by nature, all perfect in their organization, all destined to fulfil by unalterable laws those designs for which the power of our creating god called them into existence” (24 August 1861, *Regardsfully Yours*, 2, p. 113).

Mueller, rather strangely in light of his wide excursions in Australia, chose to set down his own views on species in a small book on an isolated group of islands east of New Zealand, the Chatham Islands. There he wrote of “the wonderful adaptability of species to sometimes singularly different circumstances” but added that “analytical dissections in his museum and the field of hundreds of thousands of plants” had “convinced him of the great truth, that the Supreme power to which the universe owes its existence, called purposefully forth those wonderful and specifically ever unalterable structures of symmetry and perfection... from the morn of creation to the end of this epoch” (Mueller 1864, p. 8).

As the Australian authority, Mueller hoped to be invited to prepare the proposed official flora of Australia; but the prize went to the eminent George Bentham (1800–1884) at Kew upon whom he at once pressed his firm belief: “I cannot help to differ from you in the sentiments, which you so decidedly express in reference to the non-fixity of species,” he wrote in 1862. “I think I had in Australia, where physical conditions are more widely different within limited space than perhaps in most parts of the globe, an opportunity to study the laws of variation of species more carefully in the field & under the most varied circumstances, than

any other, or at least than most Botanists. And the result of investigations has *invariably been, wherever I had a fair opportunity of completing observation that species are permanent & unalterable.*” “I think you will forgive me,” he added, “if I boldly uphold the great principle, on which the formation of species rests... but I consider it a duty which I owe to science, that I should not withhold my views on this important question which agitates now the naturalists of the day” (24 September 1862, *Regardsfully Yours*, 2, pp. 167–168). As Bentham was in the van of British botanists in accepting the impressive weight of Darwin's evidence, Mueller's entrenched adherence to the fixity of species proved a complication in their collaboration on *Flora Australiensis*, 1863–1878. For his part replying by letter on 26 October 1862, Bentham advised Mueller, “Whatever may be one's opinion of the speculative part of his work, it is very certain that the numerous facts he has observed must cause naturalists to consider their previous opinions” (Willis, p.74, Mozley, 1967, pp. 422). Mueller, however, determined to keep ahead of Bentham by publishing his description of new taxa in fascicles of his *Fragmenta phytographia australiæ*. In the event Bentham and Mueller were able to collaborate, Bentham noting in the text of his seven volumes of the *Flora* where Mueller disagreed (*Regardsfully Yours*, 2, pp. 24–26).

Frederick McCoy

At the University of Melbourne, the occupants of the foundation chairs of science were equally uncompromising in their attitudes to evolutionary ideas. There the inaugural Professor of Natural Science, Frederick McCoy (1817–1899), a dedicated Anglican, while holding no degree, was a palæontologist with several works of systematic refer-

ence behind him and a close colleague of the anti-Darwinian Professor of Geology, Adam Sedgwick, at Cambridge. A forceful and dogmatic figure, McCoy rapidly gained eminence in Melbourne, convinced from his palæontological and zoological findings in Victoria that species were immutable and that Australian mammals were the subjects of separate creation. He went so far as to oblige his undergraduate students to take a strong stand against Darwinian theory, declined to have a copy of *The Origin* in the Museum's library, and prevented student exploration of other evolutionary scholarship (Finney, p. 99, Frame, p. 102). In two published lectures, *The Order and Plan of Creation*, delivered in 1869 and 1870 shortly after the publication of T. H. Huxley's 1869 essay *On The Physical Basis of Life*, McCoy severely castigated Huxley proclaiming, “There was no authority, either in Scripture or science, for belief in the gradual transmutation from one species to another, or passage from a low creation into a higher one” (Frame, p.102, Finney, p. 107). Rather, he too saw the living world as “a part of one great, complete, universal and perfect plan whose separate parts were brought into existence at His own different times, following laws some part of which we may dimly perceive.”

Eager for visual proof to encourage rejection of the idea about a relationship between man and ape, McCoy imported a stuffed gorilla for exhibition in Melbourne's National Museum of Natural History and Geology in 1865 informing the public, “It is well for the inhabitants of a country so remote ... from the chance of seeing actual specimens of the greatest and most man-like of the anthropomorphic apes, to see how infinitely remote the creature is from humanity, and how monstrously the writers

have exaggerated the points of resemblance” (Finney, p. 107). McCoy also became a notable exploiter of the taxidermist's art, his own zoological collection, the largest in the country, displaying animals, he claimed, “from six centres of creation” expressly aimed to counter Darwin's evolutionary argument (Moyal, 1986, p. 94, 100-101).

George Halford and J. E. Tenison-Woods

Melbourne's Foundation Professor of Anatomy, Physiology and Pathology, George Britton Halford (1824–1910), a nominee of Richard Owen's for the colonial post, also weighed in with a public lecture series briskly titled, *Not like Man, Bimanous and Biped, nor yet Quadrumanous*, to rebut Huxley's man and monkey theme, a position stoutly supported by the *Australian Medical Journal*.⁴⁴ There were other serious-minded contributors. The respected Jesuit, Rev. Julian Edmund Tenison-Woods (1832–1889), blending his pastoral and rural duties with his palæontological studies in several colonies, presented his record of geological fieldwork to an audience of the Royal Society of Tasmania to undermine the Darwinian perspective. “My researches in Australian tertiary geology,” he recorded in 1876, “have now extended over twenty years, and during that time, as I have helped somewhat to create its literature, I may say, probably without arrogance, that I have as good an opportunity of becoming acquainted with its palæontology as any one...in all my examinations of our fossil and living fauna, I have carefully sought for any reasonable evidence in favour of evolution or clue to its mode of operation, and have found none — none whatever. I must add that Australian

geology, whether reluctantly or not, must admit that she can urge nothing in favour of that theory being true, the true explanation as we find it” (Tenison-Woods, 1876, p.78).

At root, however, McCoy's and Halford's respective appointments to the new University of Melbourne, and John Smith's earlier posting in Sydney, were illustrative of the official commitment of the two senior colonies to the British structure of science and to the entrenchment of a vision of the scientific enterprise as “a creationist vision,” (Butcher, 1988, pp. 140–141). A sense of the British scientific structures was further underpinned by the Philosophical and Royal Societies rising in the separate colonies and endorsed by the colonial governors, who lent their patronage and influence as the societies' Presidents. Vice-regal figures enjoyed high prestige among the scientific community, and alert to their Imperial status, aired their anti-Darwinian view in public and private. Victoria's Governor, Sir Henry Barkly (1815–1898), an active President of the Victorian Royal Society and himself a student of geology and natural history, early urged members to refute by every scholarly means a theory “so pernicious to the very existence of Christianity” (Barkly, 1865, pp. xxvi). In New South Wales, the eminent Governor-General of the Colonies, Sir William Denison (1804–1871), a supporter of science in general, wrote privately to his sister that, although he had not actually read *The Origin*, he took his lead from the curator of the Australian Museum, Simon Pittard (1821–1861), who considered that “natural selection was contrary to natural processes” (Frame, p. 99). In South Australia, the highly active Richard Hanson (1805–1876), serving successively as lawyer, premier and Chief Justice of South Australia, became governor

⁴⁴ *Australian Medical Journal* 1863–68; Finney, p. 102

from 1872–3. As an articulate Christian and a jurist he had given a series of closely argued papers before the Adelaide Philosophical Society in the early 1860s in which he espoused the view that the Bible “was God’s great instrument for the education of the world...if read with the spirit of enquiry instead of infallible authority.” Hanson, a positivist in his thinking, came to uphold the view that “theology must respond to Darwinian insights or risk becoming irrelevant” (Frame, p.95, *ADB*, 1972, 4).

While attitudes to Darwinian theories were largely confined to leading figures in science, the reaction of two of Darwin’s close associates from *Beagle* days reflected a view popularly held by many colonists. Phillip Gidley King, a midshipman on the *Beagle* now settled in New South Wales who retained a long friendship with Darwin, wrote to his old friend, “Your work the *Origin of Species* has a prominent place in my library & was read with much interest. I think you are thought by many to be right who will hardly allow it. I feel in the small scope of my expression that there is much truth in yr deductions, but the question is where do they lead us to — or what is their limit?” (19 September, 1862, Nicholas, quo p. 200; Finney, p.104),⁴⁵ while another one-time shipmate writing from Sydney, the artist Conrad Martens, playfully covered his ground. “Your ‘book of the season’ as the reviewers have it, I must own I have not yet read [he wrote] altho Mr Clarke offered to lend it me, I am afraid of your eloquence, and I *don’t* want to think that I have an origin in common with toads and tadpoles” (*ibid.*).

⁴⁵ <https://www.darwinproject.ac.uk/letter/?docid=letters/DCP-LETT-3727.xml;query=&brand=default>

Gerard Krefft and Robert Fitzgerald

It was not, then, until the 1870s, more than a decade after *The Origin of Species* reached Australia, that direct expressions of support for Darwin’s ideas on progressive development were publicly heard in the colonies. At the Australian Museum in Sydney, Gerard Krefft (1830–1881), Simon Pittard’s successor as curator, was an active zoologist with a serious interest in fossils. Emigrating to the Victorian goldfields in 1852, the German-born Krefft had been a member of Blandowski’s expedition to the Murray River, had worked on its collections in Melbourne’s National Museum, and, appointed assistant curator at the Australian Museum in 1860, became its Curator in 1866. With his zoological studies, *The Snakes of Australia* (1869) and *The Mammals of Australia* (1871), and his part in the retrieval of the fossils of the Wellington Caves, Krefft was a sophisticated Australian researcher who gained international reputation. He claimed to have been converted to Darwinism by reading *The Origin*, but his public commitment to the evolutionary principle first appeared in the 1870s, when he communicated his views on Darwin’s works and theory through a column in the *Sydney Mail*.⁴⁶

Krefft corresponded with international scientists, became a critic of the dominant Richard Owen, and exchanged letters and data with Charles Darwin. “I have long respected your able and indefatigable labours in the cause of Natural Science,” Darwin wrote to him on 17 July 1872. “Your conclusion also agrees with Prof. Flower and others. It is lamentable that Prof. Owen shd. shew so little consideration for the judgment of other

⁴⁶ See also his papers presented at the Philosophical Society of New South Wales at <https://royalsoc.org.au/council-members-section/91-phi;soc1856-65#1862>

naturalists, and shd. adhere in so bigoted a manner to whatever he said"⁴⁷ Creative and nonconformist, Krefft was disdainful of the Museum Trustees' concentration on collecting and classifying natural history specimens and acquiring pieces for their personal cabinets but he fell foul of the Trustees on the grounds of his public commitment to evolution. As Butcher records, Krefft "was a theoretically sophisticated naturalist whose contribution to the zoological literature of Australia was substantial and of lasting value." He won an international reputation beyond Australia; his letters to Darwin reveal him as a colleague and fellow scientist rather than a colonial informant. He was brought down by the entrenched, personal interests of the Museum Trustees and was forcibly expelled from office in 1874⁴⁸ because, as he told Darwin, of his "rejection of the God of Moses as the Creator;" his livelihood destroyed (Letter to Darwin, 15 May 1872, quo Finney p. 113). Corresponding later with a colleague, Richard Lydekker, Krefft perceptively observed, "here in Australia you must follow the footprints of those ancient gentlemen who still follow Cuvier."⁴⁹

The second conspicuous figure to emerge in favour of Darwin in New South Wales was the colony's deputy-surveyor, the botanist Robert D. Fitzgerald (1830–1892), who raised orchids. Trained as an engineer in Ireland, he emigrated to New South Wales in

1856 and joined the Department of Land where he rose to become deputy surveyor-general in 1873. His initial spur to prepare a multi-part work, *Australian Orchids* (1882), came from Darwin's book on *The Fertilization of Orchids* and, working critically from his personal investigations outside the institutions, Fitzgerald became, as Butcher notes, one of the first Australians "to turn to Darwinism both as an alternative to orthodox religious doctrine and as a potential source of inspiration in interpreting the natural productions of the continent" (quo Frame, p. 94). Fitzgerald sent the separate finely illustrated parts of his work from 1875–82 to Darwin, who absorbed many of the Australian's observations in the second edition of his orchid fertilization work. It proved a fertile two-way interchange. Writing to Fitzgerald in July 1875, Darwin was moved to express astonishment "that such a work could have been prepared in Sydney".⁵⁰ While Fitzgerald had some reservations about Darwin's theory that the structure of orchids was "a design for cross-fertilization" and advanced his observations on pollination and the self-fertilization of many Australian orchids, he saw Darwin as "the greatest naturalist of the age" and used his research results both to challenge Darwin's concept of a fertilizing "design" and to give his support to the progressive development of species, "happy," as he put it, to add "a single stone to the very great pile constructed by the boldest speculator of the age." The two men's correspondence again marked a collaborative exchange of equals. With Darwin's permission, Fitzgerald dedicated his completed seven-part *Australian Orchids* to Darwin's memory in 1882 (Mozley, p. 429; Frame, p. 94).

⁴⁷ Letter 17 July 1872, quo Finney, p. 111, p. 171 fn 99; Butcher, 1988, pp. 146–7. <https://www.darwinproject.ac.uk/letter/?docId=letters/DCP-LETT-8416.xml>

⁴⁸ The Trustees' forceful treatment of Gerard Krefft prompted the swift resignation of the two naturalist trustees, the Rev. W. B. Clarke and Dr. George Bennett (1804–1893).

⁴⁹ Letter to Darwin, 15 May 1872 and Richard Lydekker, 8 December 1880, quo Butcher, 1988, p. 146–147, *ADB*, 1974, 4.

⁵⁰ Mitchell Library Ref. No. A2546, quo Butcher 1988, p. 157. Fn.33, p. 152–3

The presence of Gerard Krefft and Robert Fitzgerald marked a changing disposition in the sociology of colonial science that suggested an emerging shift away from the creationists to the tenets of scientific naturalism. But Krefft's allusion to Cuvier had pertinence. For fifty years from the 1830s, the commanding presence of Professor Richard Owen (1804–1892), Britain's leading comparative anatomist and palæontologist and Superintendent of the Natural History Department of the British Museum, had loomed significantly over Australian zoology and palæontology, where his vast output of papers and monographs on extinct and living fauna defined the expanding outlines of knowledge. Macleay, Clarke, McCoy, Tenison-Woods, Mueller, and Krefft were his correspondents or local investigators, despatching specimens and data for his research. Owen published his composite *Researches on the Fossil Remains of the Extinct Mammals of Australia* (1877). Much influenced originally by Cuvier, Owen had begun his career as a separate creationist but saw himself increasingly as “a successive and continuous creationist” who considered that, while each species had been created only once in time and space, its diffusion was the result of its own law of reproduction influenced by external circumstances. While his theory was short on the evolution of adaptive mechanisms, Owen was an ardent anti-Darwinian who saw a unity of plan in the animal kingdom attributable to a beneficent Sovereign and “the irrefragable evidence of ‘Creative foresight’ and ‘Final Cause’” (Mozley Moyal 1975, p. 47). Both Richard Owen's scientific reconstructions and philosophical ideas had a strong currency in the colonies.

Thus in 1876 as President of the newly formed Linnean Society of New South

Wales, the eminent Sir William Macleay⁵¹ could affirm in his Inaugural Address that all evolutionary theories since Lamarck “could be dismissed with the Scottish version of ‘Not Proven’” (Macleay, 1877, p. 96), while the renowned independent astronomer at Windsor, John Tebbutt (1834–1916), was wont to repeat his 1878 lecture on “The Testimony which Australia Furnishes to the Attributes of the Creator” (Bhathal, 1993, p. 35).

And there too in 1879 is the Rev. William Woolls, addressing a public audience on “Variation of Species in Relation to the Variations of Language”⁵² partly in response to Darwin (1874), and insisting; “Those, who are content to receive the Bible as a revelation from heaven, reject the absurd notion of fortuitous combination and gradual development” (*Lectures on the Vegetable Kingdom*, p. 126). “Is it not sufficient [he asked] for us to know that, for three or four thousand years, species have undergone no visible change? And does not that simple fact tend to show that they were the result of some creative act, not the result of gradual development?” (p. 129).

Yet emergent change was in the air. In the colonial press Charles Darwin's death in 1882 ushered in cautious public praise. “Even if [his theory] were conclusively disproved tomorrow,” said *The Age*,⁵³ “it will still retain an important place in the history of thought,”

⁵¹ William John Macleay (1820–1891) was a cousin of William Sharp Macleay (1792–1865).

⁵² Presented at the Horticultural Society of N.S.W. on July 3, 1878. Reprinted in the *Sydney Morning Herald*, July 15, 1878, p. 3. <https://trove.nla.gov.au/newspaper/article/13412164>

⁵³ See Trove, at <https://trove.nla.gov.au/newspaper/article/202528339/18355504>

while Melbourne's *The Argus*⁵⁴ agreed that the theory of evolution had brought a revolution to science: "he [Darwin] will be recognised as the originator of the most fruitful idea of the present century and at the same time the most revolutionary." It was quite simply "the most fruitful idea of the present century" (*The Argus*, 22 April 1882, p. 13; Finney, p. 113).

William Caldwell's discovery

Pervasive change would reveal itself in the thrusting new biological sciences. In April 1884, William Hay Caldwell (1859–1941), a young Scottish scientist, trained at Cambridge in embryological studies and reared on the works of Darwin and Huxley, travelled to Australia on a British Balfour Scholarship and arrived at the Burnett River, Queensland, to investigate species reproduction among the monotremes. After several weeks, aided by a large company of Aborigines, he shot a female platypus that had laid one egg and held a second egg at the mouth of the uterus, a hit which confirmed that the platypus was a clear intermediary link between reptiles and mammals. Caldwell's terse cable to the outside world — in this case the British Association for the Advancement of Science meeting in Montreal that year — *monotremes oviparous, ovum meroblastic* (monotremes lay eggs, their large egg yolk is absorbed as food by the developing young) made scientific and telecommunication history and conveyed the knowledge that the platypus was an explicit player in Darwin's ideas on isolation and species diversity.

Caldwell's breakthrough discovery both cancelled out Richard Owen's fifty-year claim of an *ovoviviparous* birth for the plat-

ypus, a view stoutly reinforced by his close associate in New South Wales, collector and naturalist, Dr George Bennett (1804–1893), with his consignment of thousands of platypus specimens to Britain, and Owen's long domination of Australia's biological science. As Caldwell later informed his audience of predominantly separate creationists at the Royal Society of New South Wales (Caldwell, 1884), his results were "facts," not theories; they could not be argued. Thus, recognizing as an evolutionist that each living form had descended "from some differently constructed ancestor," Caldwell became the first in the wake of Darwin to attempt to fit the monotremes into the evolutionary frame (Moyal, 2001, pp.151–157).

Darwin had been laid to rest with honour in Westminster Abbey when this critical scientific news broke, but remembering the curious animal in the Cox's River in New South Wales in 1836, he had written about the *Ornithorynchys* in *The Origin*, where he saw the animal as "aberrant genera" and noted that "The more aberrant any form is, the greater must be the number of connecting forms which on my theory have been exterminated and utterly lost"⁵⁵ (Darwin 1859, p. 429). Speculating on it later in letters to Hooker and Lyell, Darwin held the platypus as a ripple in his mind and returned to it in 1874 in the *Descent of Man*. There he heralded it as "a key exemplar of natural selection" and "as a diversified link" in the organic chain of mammals rising up to man. These "eminently interesting"⁵⁶ Monotremata, he wrote of the two Australian species — the platypus and echidna — "were

⁵⁵ <http://darwin-online.org.uk/content/frameset?page=seq=447&itemID=F373&viewtype=side>

⁵⁶ http://darwin-online.org.uk/converted/published/1874_Descent_F944/1874_Descent_F944.html

⁵⁴ See Trove, at <https://trove.nla.gov.au/newspaper/article/11538553>

structural precursors of the marsupial, placentals and on to man.” And “if any single link in this chain never existed,” he added, man “would not have been exactly what he now is” (Darwin, 1874, pp. 158, 165; Moyal, 2001, p. 114).

New men in the universities.

It was time for the new men in the universities of Australia. Among them at the University of Sydney was Edinburgh-trained J. T. Wilson (1861–1945), appointed in 1887 as a demonstrator in anatomy in the new Medical School, soon to hold a foundation chair, who, introducing the study of physiology and embryology, went on with his two brilliant British assistants, physiologists James P. Hill (1873–1954) and Charles Martin (1866–1955), to apply the theory of natural selection to the study of Australian marsupials and monotremes and to shift the centre of monotreme research to Australia. (Moyal, 2001, Morison, 1997). At the University of Adelaide, the diversely qualified Ralph Tate (1840–1901), geologist, palæontologist, botanist and zoologist was appointed to the first Elder Chair of Natural Science in 1874, bringing rigorous new teaching and research methods to these fields (*ADB*, 1876, 6, Finney, p.113). At Sydney University, Professor William Haswell (1854–1925), a former pupil of T. H. Huxley, appointed demonstrator in comparative anatomy early in the `eighties and rising to fill the foundation Challis Chair of Biology in 1890, characterised the vital transformation that was occurring in scientific education in the colonies.

Addressing the Biology Section of the Australasian Association for the Advancement of Science in 1891, Haswell sketched the upward intellectual thrust. “It is, it need hardly be said, mainly to the influence of

Darwin's writings that a very important change has come over biological research. ... This change has been, in great measure, in the nature of an illumination, and the illuminating influence has been theory, and more especially the theories of descent and modification by natural selection. And this illuminating influence, which has lent tenfold interest to the work of every investigator of animated nature, has also shown to him many new lines of study, in the following of which he is conscious that, while not leaving his particular corner of the field, he is doing work that is of interest to a comparatively wide circle of thinking men” (Haswell, 1891, pp. 173-4). It was a testament to a fundamental change in the institutional structure of science in Australia.

This testament was early expressed in the appointment at the University of Melbourne in the appointment in 1887 of Walter Baldwin Spencer (1860–1929), an evolutionary biologist trained at Owens College, Manchester, as the foundation Professor of Biology. An active and influential figure, Spencer infused new life into the teaching of natural science in Victoria; removed McCoy's outdated tuition, and established a modern laboratory for the new department of biology, that became a major research centre on Australian biota by the century's end (*ADB*, 1990; Mulvaney & Calaby, 1985).

At the old societies of science, there were also regenerating signs of change. At the Royal Society of New South Wales, Australia's first scientific medal was struck in 1878 to honour the research and scientific legacy in the natural sciences of the Rev. W. B. Clarke, who died in 1876. It was awarded in its augural year of 1878 to Richard Owen, to George Bentham in 1879, and to T. H. Huxley in 1880. Charles Darwin was made

an honorary member of the Society in 1879.⁵⁷ Throughout the 1880s the recipients of the Medal — Frederick McCoy in 1881, Ferdinand von Mueller in 1883, and Joseph Hooker in 1885 — reflected the landscape and the history of Australian science.

Conclusion

As the century turned, it fell comprehensively to the universities in the Colonies to inculcate a new generation of students in a wide and diversifying experience of Darwin's intellectual heritage. As historian Tom Frame concludes in his large overview of the extending sweep of *Evolution in the Antipodes*: "The status of evolutionary theory as scientific orthodoxy ... in Australia, had been achieved within four decades."

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