Field studies: novels as Darwinian niches, poetry for physicists and mathematicians

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> I agree [. . .] that 'everything is Darwinism'. But especially a ship.
> Gerard Manley Hopkins.[1]

The obvious observation to be made about the long nineteenth century is that it does go on a bit. It allows the Victorians to be more easily appreciated not simply as the successors to Romanticism, but also as the continuation and partial fulfilment of the Enlightenment, a perspective that is especially germane when considering the place of science in their culture. The emergent modern idea of science, as it gradually extricates itself from its old synonym philosophy during the eighteenth and early nineteenth centuries, is reflected in the new form of the novel. Establishing itself as the pseudo-empirical study of representative middle and lower-class individuals, whom it subjects to various, often testing, stimuli, the novel approaches human life in ways that give it an affinity to natural history. As the descriptive natural history papers produced by the Royal Society during the early decades of the eighteenth century, which are mocked in the Laputa episode of Jonathan Swift's *Gulliver's Travels*, gave way to more analytic concerns with the histories of living things over time – their inner functions and taxonomy – novels and autobiographies similarly offered ontogenic and increasingly psychological studies of human beings and their relations to one another. Much as such natural histories included anecdotes about the behaviour of individual animals alongside physical descriptions and illustrations by which specimens could be identified, contemporaneous novels presented case studies of their subjects that were often subsumed under broader conceptions of generic being, a human nature. Parallel to the proto-anthropological study of the 'natural history of mankind' that Swift satirises throughout his book, the British Enlightenment novel seeks out and celebrates the diversity of human life.

Selected and preserved within its prose medium, the principal, often eponymous, character of early novels resembles the holotype or type specimen in natural history, a specimen that is adopted with a degree of arbitrariness (for no individual is in itself typical) and preserved in a public collection as the name-bearing form of the taxon to which future identifications are referred. A species is spoken of in the life sciences as being authored by the person who first describes it from the specimen they nominate as the holotype, a task that in the case of Homo Sapiens has been dispersed and progressive,

as we are type-less, one of the few species that has not been allocated a name-bearing specimen. Indeed, that the principal character of early novels is singled out as one amongst many apt examples, as a syntype rather than the holotype, draws it closer to the descriptions that natural history and its successors in zoology and biology restlessly make of our species. Suggestively paralleling natural history in the broad empirical and illustrative approaches it took to understanding its phenomena, the new genre of the novel readied itself for its more scientifically informed and self-conscious Victorian practitioners such as George Eliot, who famously declares in 1876 that her 'writing is simply a set of experiments'.[2]

Insofar as it establishes itself as an exercise in the natural history of human character and behaviour, usually focused upon social and material relations, the novel can be seen as an adjunct to Enlightenment naturalism, which was finally shaped and sanctified by Darwin's principle of natural selection. It is accordingly not surprising that during the Victorian period the genre, which often took the form of the *bildungsroman*, readily assimilated developmentalist doctrines, and in many instances greeted Darwinism with a curiosity and tolerant consideration that contrasts dramatically with the responses it received from such canonical poets of the time as Alfred Tennyson and Matthew Arnold, whose forms and ideologies, drawing more directly upon Romanticism, sustain a Wordsworthian suspicion of positivist science. In his early poem 'The Tables Turned' William Wordsworth famously describes the vivisecting 'meddling intellect' of such science that 'Mis-shapes the beauteous forms of things,' while in 'The Excursion' he allows that science could be admitted to the realm of poetry and the imagination, but only in a chastened form and on a strictly temporary, probationary and subordinate basis, as 'a precious visitant', 'a support / Not treacherous, to the mind's *excursive* power'.[3]

While studies in nineteenth-century science and literature have flourished over the past quarter century, since the advent of Gillian Beer's *Darwin's Plots* in 1983, the field remains in some important respects lop-sided. It has long had a preponderant concern with geology and biology over the other sciences, while its disciplinary origin and abiding affiliation with English literature has understandably led it to privilege the perspectives of its literary figures. While Beer is the main culprit responsible for the current prevalence of studies in Darwinism and Victorian prose she evades conviction on this charge with a series of audacious and convincing alibis in *Open Fields: Science in Cultural Encounter* (1996), the second and third sections of which include important discussions of poetry and

physics through readings of poems by Gerard Manley Hopkins, the physicist James Clerk Maxwell and the mathematician James Joseph Sylvester, amongst others.[4] Much of my own work has been in these further fields that Gillian Beer has also opened. A study of Hopkins' use of energy physics I published in 1997, and another I completed in 2009 on poetry by Victorian scientists, have allowed me to reflect upon the categories of science and literature as they were shaped over the course of the nineteenth century, as well as the subsequent formation of the field of study that is devoted to exploring their relations to one another.[5]

Looking back to his youth in the 1820s, William Rowan Hamilton writes to his friend and fellow astronomer, mathematician and poet John Herschel in 1847 that 'it would really seem to have been at one time a toss-up, whether I should turn out a rhymer or an analyst [i.e., mathematician]'.[6] His close friend Wordsworth, whom he had met in 1827 when he was twenty-two and the romantic poet fifty-seven, pushed him to choose between the two, although not, it should be added, in favour of poetry. Wordsworth was able to make a living from poetry, and throughout his discussions of Hamilton's verses he stresses the need for what is effectively a professional commitment to the art, which he assumes that 'the path of Science' similarly requires. Wordsworth came to Ireland to stay with Hamilton and his sisters in August 1829, during which time the two conducted a series of impassioned discussions about the relations of poetry and science. The main consequence of this visit was that Wordsworth's host abandoned his poetic ambitions (Graves, 312-13; 314-15). Indeed he formally renounced them in verse form. In 'To Poetry', which dates from October 1829, Hamilton refers nostalgically to an original pre-lapsarian unity of poetry and science, the 'joint abode' of the 'Spirit of Beauty' and her 'sister Truth,' but must advise the former that 'my life be now / Bound to thy sister Truth by solemn vow' (Graves, 317).

Hamilton's friendship with Wordsworth, and the parity he gave to his practices of poetry and science in the 1820s, are telling of, and indeed emblematic for, an historical moment of transition in British culture, in which poetry, beginning its gradual decline in power and prestige with the waning of romanticism, meets with ascendant science. Wordsworth represents a confident romantic ideology that sees poetry and the poet to have a unique access to truth, and with it great cultural and social authority. This was an epistemological efficacy that as the century progressed would largely come to be monopolised by professional science and its practitioner, the scientist, a term coined in

1833 by the Cambridge polymath, and friend of Hamilton's and Herschel's, William Whewell, in reply to Samuel Taylor Coleridge's criticism of the term philosopher as 'too wide and too lofty' for contemporary needs.[7] As Whewell's coinage serves to highlight, Hamilton's choice of science over poetry came on the eve of the decade in which British science strove forthrightly to become professional, primarily through the efforts of the British Association for the Advancement of Science (BAAS), which was established in 1831 at a meeting at York called by the Scots natural philosopher Sir David Brewster.

While Brewster's observation of a 'scientific and literary' decline in Britain informed his push for a new scientific association, and while, as Morrell and Thackray note, British provincial scientific societies in the 1830s treated literature as integral to their concerns with moral and natural philosophy, the BAAS chose not to include it amongst its disciplinary sections.[8] This exclusion at the very inception of modern British professional science mirrors the opposition between literature and science that Wordsworth also makes, which similarly became institutional with the growth of his reputation amongst the Victorians as the greatest and definitive romantic poet,[9] and the consequent consolidation of his thought within a British romantic ideology that shaped the emergent discipline of English literature, first as it was taught in working men's institutes, then in schools, and from the early twentieth-century in universities. The adoption of a basically Wordsworthian and Coleridgean romantic ideology by English literature was also facilitated by the BAAS's blanket rejection of metaphysics, despite Hamilton's advocacy of it at the early meetings, as 'merely ideal'[10] Taking Newtonian physics as its model, the BAAS's new professional science repudiated romantic science and its harmonious, indeed integral, relations with metaphysics and poetry. In the early 1850s the young James Clerk Maxwell, having completed a degree at Edinburgh University that had strong elements of both physical science and metaphysics, was frustrated to find that his subsequent Mathematical Tripos studies at Cambridge, a pillar of the new professional science, offered little scope for metaphysical inquiry. Well read in the romantics, Maxwell accordingly turned to writing poetry as the private medium in which he developed the epistemological grounds for his scientific practice and, through a critique of the Tripos and the Cambridge system, his intellectual ethics. I have argued in my study of Victorian scientist-poets that poetry's defining formal and semantic concerns with parallelism and analogy provide the focus for the development of Maxwell's scientific methodology in the

1850s, which through the audacious models elaborated in 'On Physical Lines of Force' (1862) yields the momentous discovery of the electromagnetic theory of light.[11]

Like science, Victorian and twentieth-century academic philosophy, outside of British Idealism, demonstrated no proprietorial interest in romantic metaphysics, which accordingly found refuge, indeed a Trojan horse, in English Literature, where it has continued the Wordsworthian battle with positivist, utilitarian and materialist science. Emerging from within this discipline, science and literature studies were accordingly bequeathed this institutional bias. Tending to favour canonical Victorian poets such as Tennyson, Arnold and Robert Browning who critique science, and usually overlooking their lack of scientific credentials, the field conversely ignored the reciprocal case of those scientists who wrote poetry, for whose often amateur versifying some leniency could be similarly extended. While writing bad verse may, as Wordsworth suggests to Hamilton, be an occupational hazard for nineteenth-century scientist-poets, so too are incomplete understandings of science for their peers amongst the canonical poets (not to mention non-scientists, such as myself, trying to write about them both). The careful demarcation of professional literary figures from professional scientists was a foundational assumption of the dedicated field of literature and science studies, another factor that has worked against the recognition of the hybrid form of the scientist-poet and tended to relegate scientists to the historical 'background' or 'milieu', where they furnish ideological contexts, or indeed to the role of *agent provocateurs*. The scientists' function in such studies often seems to be to spur and inflect the production of canonical works of literature, like the irritant matter that the oyster forms into a pearl. For much of its history, science and literature studies appear to have been predicated upon a rather proprietorial and anachronistic 'Two Cultures' model of interdisciplinarity, in which neighbours chat over fences that clearly mark out their respective territories, so that all such talk accordingly serves to further reify such disciplines, rather than reveal them as originally interfused and in process.

Early influential readings of Tennyson and certain other canonical poets appear to have established a default identification of Victorian science with geological and biological developmentalism, and a godless materialism and positivism that directly affronts the romantic idealist values and faiths of William Blake, Wordsworth and Coleridge. This neat antithesis between ideologies of science and literature is happily complicated by physics, with the energy concept and field theory, like the hypothesis of biological evolution, coming of age in the 1850s and early 1860s. The great romantic

premise of a transcendent ontological unity, Coleridge's 'one life within us and abroad',[12] belongs also to romantic science, which provided the prepossession for the energy concept. A paradigmatic instance of simultaneous discovery,[13] like the natural selection mechanism in biology, energy describes an indestructible quantity, conceived as the power to do work, that is translatable into such forms as heat, light, sound, chemical activity, magnetism and electricity. By establishing the profound unity and dynamism of the known universe, from the processes of plant photosynthesis and animal digestion to light from astronomical bodies telling of their chemical composition, the energy concept offered many Victorians an assurance of an original First Principle that was more radical and hence metaphysically satisfying than the Anglican natural theology that Tennyson and his peers found affronted by various evolutionary doctrines. As the epigraph to this paper indicates, a further canonical Victorian poet, Hopkins, found little threat in Darwinism, as in a letter to his friend Robert Bridges he happily acknowledges its ubiquitous applications, whilst naming the most apt of these as maritime engineering.[14] Opposed to forms of positivism, developmentalism and materialism that he saw it to encourage, Hopkins was not otherwise concerned by Darwinism, as energy physics furnished him, like many contemporary physicists, with the means of sustaining a monistic Christian cosmology and metaphysic, which crystallises through his 1868 reading of Parmenides in his doctrine of inscape, instress and stress.[15]

Poetry written by Victorian scientists not only offers unique insights into the metaphysical premises that underpin their creative scientific practice and the larger cultures of Victorian science, but conversely also furnishes progressive and playful perspectives on prosody and poetic form. So, for instance, during the 1830s and 1840s Whewell and his friend Herschel argued for the use of classical quantitative meters in English poetry, and demonstrated them in both their original poetry and translations of contemporary German poetry. The traditional seal of integrity and authenticity for the student of literature, the condition of being 'no good at maths', is well respected by the simple arithmetic of our system of prosody. Critiquing established metrics as a crude instrument that is ill suited to gauging the subtle musical effects of poetic form, James Joseph Sylvester offers a prosody based upon the continental calculus in his book *The Laws of Verse* (1870). This accordingly allows the appreciation of infinite gradations of sound, a principle of continuity that Sylvester sees to parallel and indeed instance the mathematics that he and Arthur Cayley, and their continental non-Euclidean peers, were

engaged in at the time. Much of his poetry from the 1870s is based upon a single rhyme, one of which, 'To Rosalind', extends to 500 lines, each of which closes with a rhyme on the final syllable of its addressee's name. Rosalind is represented by a set of invariants and other formal properties and relations of persistent pulchritude that the remorseless rhyme scheme generates; 'Sum of worth in woman-kind! / Whose dear praises I could grind, /...' (ll. 120-1, *Fliegende Blätter*, 11).[16]

The coinages that Sylvester devised for both the new mathematics he shared with Cayley and his own prosody converge in his work, as terms from poetry are applied to mathematics and vice-versa, with some such as the 'catalecticant' and 'syzygy' making the return trip from prosody and back again, collecting decisive semantic inflections from avant-garde mathematics on the way. Sylvester illustrates this new prosody with his idiosyncratic poetry, the remorseless rhymes of which he justifies as illustrating his great mathematical principle of Continuity, which at the time also preoccupied the physicist Peter Guthrie Tait and Sylvester's colleague at Johns Hopkins University during the late 1870s and early 1880s, Charles Sanders Peirce, who develops it in his philosophical pragmatism.

The common idiom that Sylvester develops for his new mathematics and prosody, and the various mathematical principles and conceits that inform his poetry, demonstrate his conception of both poetry and mathematics as games and his experience of them as play, an understanding that he shares with his fellow mathematician Lewis Carroll. Principles of mathematics and prosody converge in Carroll's word games from the 1870s, one of which, 'Syzygies' he develops directly from Sylvester's mathematics. Indeed, it is the opportunity for play that impels many of the poems by Victorian scientists, especially for those who gathered during the annual meetings of the BAAS for the Red Lions club dinners, where various forms of pastiche, lampoon, and doggerel would be read out. The geologist and paleontologist Edward Forbes founded the original Red Lions club during the 1839 Birmingham meeting of the BAAS, when he and other young naturalists in the Natural History section abandoned the daily formal dinners in favour of cheap meals of beef and beer 'enlivened by joke and song' at a local tavern, The Red Lion.[17] The records for the early membership show that the BAAS was dominated by Anglican clergy, which was by far the largest group, the next being medical doctors, then aristocrats, followed closely by academics, with smaller numbers of members of parliament and other government officers and the like (Morrell and Thackray, 110). While Forbes and his Red

Lions tend to be presented as having a merely marginal and anecdotal interest in the history of the BAAS, with their leonine rituals of roaring and coattails-wagging, they nonetheless represented the future of the Association as a professional society that would value research merit over Anglican and aristocratic privilege, and indeed, like their choice of food and drink, the genres of verse and song they chose for their recitals offer a direct affront to the 'High' culture of such establishment elements. Play for the Red Lions was accordingly apt to take tribal forms of attacking scientific opponents in verse, most prominently during the 1870s in the battles between John Tyndall's 'Metropolitan' and Maxwell's 'North British' factions of physicists. The louche nature of some of this poetry, principally by the North Britons, served to galvanise the masculinist culture of the new professional science. Other, more personal, verses, however, lament the exclusion of women from science, often imaging the two as twin, and sometimes interchangeable, private passions. This is most poignantly instanced by a series of sonnets that Sylvester addressed to female singers during the late 1880s, when he was the Savilian Professor of Geometry at Oxford. They include such titles as 'To a Young Lady with a Contralto Voice', 'On a Recital at an "Orgie" in New College', and 'To a Young Lady about to sing at a Sunday Evening Concert in Balliol College'.

The sub-title to a further sonnet from Sylvester's late series offers a key to understanding the attraction that he felt for the type of the female singer: 'To a Lady on her singing in the Sheldonian Theatre: With side references to Madame Professor Kowalevski of Stockholm'. Sylvester evidently knew the Russian-born mathematician Sofia Kovalevskaya through her research, which she published under the name of Kowalevski. His professional career having suffered from institutional prejudices against his Jewish faith for most of his adult life (his first position at a British university, the Savilian Chair was offered to him in his sixty-ninth year), Sylvester would have appreciated Kovalevskaya's achievement in prevailing over the far greater obstacles that confronted women wishing to become professional research scientists and academics. Sylvester was a social liberal with feminist allegiances, having been for over thirty years a friend and correspondent of Barbara Leigh Smith Bodichon, the great campaigner for women's rights and co-founder of Girton College; indeed, he had proposed marriage to her in 1854. Twenty years later, in 1874, Sofia Kovalevskaya became the first woman to receive a doctorate in Europe, with a thesis that established what has since become known as the Cauchy-Kovalevskaya Theorem, which was published in the following year. She

was appointed *privatdozent* at Stockholm University in 1883 and in the following year 'Professor Extraordinarius' for a five-year term. When, in 1889, Stockholm made her 'Professor Ordinarius', she reputedly became the first woman to be granted a full professorship at a modern European university.

While, as Kovalevskaya's exceptional case highlights, institutional barriers prevented women from studying and practicing professional mathematics, they were, as Sylvester's sonnets acknowledge, permitted to practice music. His Pythagorean construal of the relations between mathematics and music yields a complementarity that recalls Plato's allegory of love as the token broken into two, a sharing of the same soul:

> May not Music be described as the Mathematic of sense, Mathematic as the Music of the reason? The soul of each the same! Thus the musician *feels* Mathematic, the mathematician *thinks* Music, – Music the dream, Mathematic the working life – each to receive its consummation from the other when the human intelligence, elevated to its perfect type, shall shine forth glorified in some future Mozart-Dirichlet or Beethoven-Gauss – a union already not indistinctly foreshadowed in the genius and labors of a Helmholtz![18]

Sylvester awaits the restoration of the Pythagorean androgyne. Corresponding to his hoped-for chimera, 'some future Mozart-Dirichlet or Beethoven-Gauss', the balance between these principles of music and mathematics is represented in his sonnet by the 'Lady . . . singing in the Sheldonian Theatre' and Kovalevskaya. Sylvester also identifies singing with sexual selection. Having presented singing as an expression of moral virtue in the early lines of his 'Sonnet To a Young Lady with a Contralto Voice', he was asked by a reader in *Nature* to justify this principle. He does so, invoking 'Darwinian dialectics', with the example of birdsong: 'It is notorious that birds instinctively, and therefore on the surest ground, infer the worthiness (or goodness according to their ethical code) of their partners from their superiority in song'.[19]

Clearly impressed by her contributions to mathematics, which are mainly in calculus and dynamics, Sylvester pays tribute to Kovalevskaya, along with the unnamed singer, in the sestet of his sonnet. In an early version of the poem published in *Nature*, Kovalevskaya is declared to be the transcendent muse who, encompassing both poetry and science, presides over Nature: 'She the true Muse, fond poets feigned of yore, / Strike Heaven's own lyre, Nature's o'erruling mind'. This original conception of Kovalevskaya as an adept with the instrument that yields the Pythagorean music of the spheres is modified in a later version to 'the lyre Amphion smote', a reference to the son of Zeus and Antiope who fortified Thebes through his musical powers, which caused stones to move

into place as walls and towers. With this analogy Kovalevskaya is seen to charm not only Sylvester, but inspire Nature itself, 'Infuse in Nature's breast Promethean mind', articulate its grand architectonic forms through the 'Music of the reason', her mathematical powers.[20] In his brief prefatory remarks to the published version of the poem, having introduced 'the gifted mathematical lady Professor in the University of Stockholm' as the original muse for 'the following lines', he appears to entertain the hope that they may reach her in Sweden, as he closes by declaring that 'I shall be happy to see [them] appear in the world-wide-diffused columns of NATURE'.[21] The neglected literary work of mathematicians and the physicists, the paradigmatic representatives of modern professional science and its austerely impersonal objectivity, disclose surprising private insights into the culture and psychology of such sciences, in this instance by drawing upon the Darwinian tropes that have preoccupied the field of Victorian literature and science studies. In keeping with his understanding of birdsong and sexual selection, Sylvester is inspired by the songs of various women to himself 'wield the lyre' and pay tribute to them in a series of muted mating calls.

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[1] *The Letters of Gerard Manley Hopkins to Robert Bridges*, ed. Claude Colleer Abbott (London: Oxford University Press, 1935), p. 281.

[2] Letter to Dr. Joseph Frank Payne, 25 January 1876, *Selections from George Eliot's Letters*, ed. Gordon S. Haight (New Haven: Yale University Press, 1985), p. 466. See also Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*, 2nd edn. (Cambridge: Cambridge University Press, 2000), pp. 149-152.

[3] 'The Tables Turned', ll. 26-28, in William Wordsworth: *The Poems*, v. I, ed. John O. Hayden (Harmondsworth: Penguin, 1977), p.357; Bk IV, ll. 1252; Excursion, ll. 1262-63, Wordsworth, 155. See also IV, l. 340.

[4] Gillian Beer, *Open Fields: Science in Cultural Encounter* (Oxford: Oxford University Press, 1996).

[5] Daniel Brown, *Hopkins' Idealism: Philosophy, Physics, Poetry* (Oxford: Clarendon Press, 1997); 'Victorian Poetry and Science', *The Cambridge Companion to Victorian Poetry*, ed. Joseph Bristow (Cambridge: Cambridge University Press, 2000), 137-58. Daniel Brown, *Science and Nonsense: Reading Victorian Scientists through their Poetry* is currently under consideration for publication.

[6] Robert Perceval Graves, *Life of William Rowan Hamilton*, II, (Dublin: Hodges, Figgis, 1885), p. 591.

[7] Cited in William Whewell, 'Mrs Somerville on the Connexion of the Physical Sciences', *Quarterly Review*, II (March-June 1834), p. 59.

[8] Cited in O. J. R. Howarth, *The British Association for the Advancement of Science: A Retrospect 1831-1931* (London: BAAS, 1931), pp. 5-6; Jack Morrell and Arnold Thackray, *Gentlemen of Science: Early Years of the British Association for the Advancement of Science* (Oxford: Oxford University Press, 1981), p. 276.

[9] See Stephen Gill, *Wordsworth and the Victorians* (Oxford: Oxford University Press, 1998).

[10] Cited in Morrell and Thackray, p. 277.

[11] See W.D. Niven, ed., *The Scientific Papers of James Clerk Maxwell* (Cambridge: Cambridge University Press, 1890), I, pp. 489-502.

[12] Coleridge, 'The Aeolian Harp,' ll. pp. 26-27.

[13] See Thomas S. Kuhn, 'Energy Conservation as Simultaneous Discovery' in *Critical Problems in the History of Scienc*e, ed. Marshall Clagett (Madison: University of Wisconsin Press, 1962), pp. 321-56.

[14] He also reassures his mother in a letter from September 1874 that Darwinism does not mean that we are 'descended from any ape or ascidian or maggot or what not but only from the common ancestor of apes, the common ancestor of ascidians, the common ancestor of maggots, and so on: these common ancestors, if lower animals, need not have been repulsive animals'. *Further Letters of Gerard Manley Hopkins*, ed. Claude Colleer Abbott, 2nd edn. (London: Oxford University Press, 1956), p. 128.

[15] See *Hopkins' Idealism*, pp.187-326; Brown, *Gerard Manley Hopkins*, Writers and their Work. (London: Northcote House in association with The British Council, 2004), pp. 36-47.

[16] Sylvester, James Joseph. *Fliegende Blätter: Supplement to The Laws of Verse.* (London: Grant & Co, 1876).

[17] George Wilson and Archibald Geikie, *Memoir of Edward Forbes, F. R. S.* (London: Macmillan, 1861), 247. See Morrell and Thackray, p. 138.

[18] *The Collected Mathematical Papers of James Joseph Sylvester*, ed. Henry F. Baker (Cambridge: Cambridge University Press, 1904-1912), II, pp. 419.

[19] *Nature*, 16 August 1888, p. 371.

[20] Sylvester, 'To a Young Lady with a Contralto Voice', Sylvester papers, St. John's College, Cambridge. Box 1.

[21] *Nature*, 9 December 1886, p. 132.