

From Peak to Trough

The scientist and natural philosopher John Tyndall was known to the public through his lectures and newspaper debates. But, say **Miguel DeArce** and **Norman MacMillan**, one of Tyndall's most famous public speeches, his Belfast Address of 1874, plagiarised the thinking of others.

John Tyndall (1820-93) is celebrated today as the Victorian physicist who discovered the greenhouse effect. While studying the effects of solar radiation passing through the atmosphere at high altitudes, he examined the effects of water vapour and carbon dioxide in preventing heat from dissipating. His studies took him to the Swiss Alps, where he encountered a world of beauty far removed from his native Ireland or his workplace in London, and where he derived profound inspiration for his work. He is also known in medicine, along with Louis Pasteur (1822-95), for having opposed the idea of spontaneous generation as an explanation for outbursts of epidemic disease, proposing instead the microbial theory of contagion and with it recommending radical public hygiene measures, such as the provision of clean running water for human use, methods for the preservation of foodstuffs and sterile surgery.

A *Vanity Fair* cartoon of 1872, showing John Tyndall giving a lecture.

Tyndall made many friends in the scientific community but he also thrived on controversy political, scientific and religious. He was notorious for his directness and lack of tact. He was the main protagonist in a number of protracted scientific debates, such as that in the 1870s concerning spontaneous generation: were microbes made from basic components in places where infection was occurring – spontaneous generation – or did these phenomena occur only if pre-existing microbes found their way to them? These debates were partly conducted in public in the pages of *The Times* (which could sell 60,000 copies a day) and served to spread his reputation. From the 1850s he was an examiner in the Royal School of Mines, alongside Thomas Huxley (1825–95). In this position and at other British institutions he helped shape the teaching of scientific subjects in Britain for decades. He was often invited to advise parliamentary committees on scientific conundrums, such as the use of gas or oil in lighthouses, accidental explosions, the lighting of public places and how best to repair Big Ben.

Physics en plein air.

But there was more to Tyndall than straight physics or microbiology. The search for a unifying theory of nature has long fascinated philosophers and scientists alike. In the mid-19th century such a theory was considered to be within the grasp of science. Some scientists viewed philosophical materialism as necessarily underpinning any scientific theory. Tyndall's discipline was described as 'natural philosophy', the predecessor of modern physics, and it is as a philosopher of nature that we should consider his work.

Natural philosophy attempted to understand and explain phenomena such as light, heat, colour and sound and how the senses experienced them. Tyndall was also interested in the concept of beauty. He first visited the Alps around 1850 and returned to Switzerland for 34 consecutive summers to study and develop his thinking, a sort of physics *en plein air*.

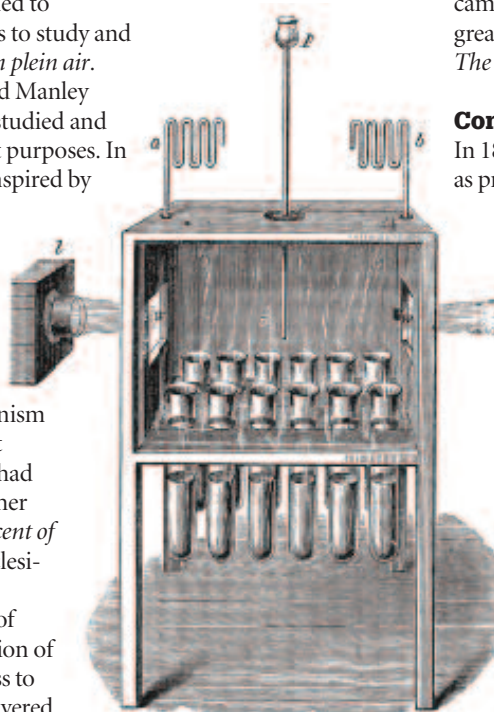
Writers including Leo Tolstoy, Gerard Manley Hopkins and George Bernard Shaw all studied and made use of Tyndall's work for different purposes. In painting, too, the Impressionists were inspired by his contributions to the new theories of light. For his part Tyndall read authors such as Longfellow, Wordsworth and Goethe (in German), among others. He also read Charles Darwin (1809–82), who became a friend in the 1870s, and made a vigorous effort to extend Darwinism into physics and history, something that delighted the venerable naturalist, who had stopped short of doing so himself in either *The Origin of Species* (1859) or *The Descent of Man* (1871) for fear of upsetting the ecclesiastical establishment.

In 1853 Tyndall was made Professor of Natural Philosophy at the Royal Institution of Great Britain (RI), which gave him access to the public through frequent lectures delivered

John Tyndall around the time of his Belfast lecture.



Illustration from one of Tyndall's books showing a chamber constructed as an experiment to disprove spontaneous generation.



to live audiences. It also brought him into contact with Michael Faraday (1791–1867), with whom he developed a close father-son relationship in spite of their scientific and religious differences. On Faraday's death Tyndall succeeded his mentor as superintendent of the Institution, publishing *Faraday as a Discoverer* in 1868.

Tyndall travelled to Switzerland, alone with a few books, to draw inspiration from the landscape and simultaneously from the process of introspection, trying to chart the path of the scientific mind to arrive at new theories. He could see that in a descending scale of size, moving from the visible to the molecular and invisible, the mind had to take a leap beyond the sensual into an imagined, sub-microscopic world, where the known laws of physics kept working and new laws came into operation. Such was the substance of a greatly acclaimed lecture Tyndall delivered in 1858 on *The Scientific Role of the Imagination*.

Controversial election

In 1873, at a meeting in Bradford, Tyndall was elected as president of the British Association for the

Advancement of Science (BAAS) for 1874, when the association would meet in Belfast. Founded in 1831 the BAAS aimed to rectify what many saw as the decline of science in England, to professionalise the discipline and create a network of scientists. Accordingly it elected a new president each year and held its annual meetings in a different regional centre in the British Isles. Tyndall was due to deliver his inaugural address in Belfast on August 19th, 1874. Although its reception has been widely studied, little attention has been paid to the composition of the lecture and its published version.

Tyndall's election to the presidency at the Bradford meeting of the BAAS was controversial. The chemist Thomas Andrews (1813–85), a local man, had been unanimously pro-

posed for the role the year before. But Tyndall was manoeuvred into the position through the efforts of his friends, Joseph Hooker and William Spottiswoode, members, with Tyndall, Huxley and Herbert Spencer, of the 'X Club', an informal group of nine influential scientists. Their focus was to gain influence for an emerging professional scientific establishment, speeding up the process of transformation from the hands of wealthy amateurs and country parsons into a competitive body of professionals, ambitious for newly created university careers and official research funds. Anything that shook the grip of the Church on the universities was also welcome by the X-Clubbers. A speech by the outspoken Tyndall in the religiously divided city of Belfast was calculated to publicise their cause.

However, the controversy surrounding Tyndall's election to the BAAS presidency had less to do with his religious views than with his abrupt manner, perceived rudeness and concerns about his doubtful ethics, including allegations of having plagiarised a well-known, recently deceased Scottish geologist, James David Forbes (1809-68), on the nature of glaciers and how they move as a river of ice down the mountains. During the Bradford meeting, the journal *Nature* had published a letter by Tyndall rudely dismissing both Forbes and his biographers (who had just produced Forbes' biography) and who were very much present at Bradford. One of them Peter G. Tait (1831-1901) had already argued bitterly with Tyndall in a dispute over who had established the mechanical equivalent of heat.

Tyndall had already expounded theories about materialism as the only proper method for the natural sciences and natural philosophy at two previous BAAS meetings, in Norwich and Glasgow, and these had been received without much hostility, even from clergy

of different hues. He could not entertain the agency of 'spirits' in the physical world and, like his mentor Faraday, he scorned séances, mediums and the paraphernalia of spiritualism popular at the time.

Characteristically Tyndall was not subtle at making distinctions between the barely concealed fraud of spiritualism and the more sober and reflective references to the spiritual world of Christianity. Unlike Faraday, he dismissed prayer, miracles and organised religion in the same stroke as he failed to measure their material effects. Some of the audience attending Tyndall's Belfast address clapped, others booed and some left the room in disgust.

The chance for an Irishman to speak against organised religion in Belfast was seized by Huxley and the X Club who nominated Tyndall for the task. But from his large extant correspondence, it is clear that Tyndall did not like the idea of delivering his presidential address in that city probably because of its reputation as a bastion of Church influence. As the date grew closer, his reluctance grew stronger, hardening against his potential audience. His intention became to shock rather than to enlighten them.

In the past, fellow natural philosophers, such as James Forbes, P.G. Tait, William Thomson and James Clerk Maxwell, had spoken brilliantly from the BAAS podium, summarising the year's progress in their field. These four men were also exceptional mathematicians, able to develop their theories in mathematical language. By contrast Faraday and Tyndall were great experimentalists but had considerably less facility for mathematics. Forbes, Tait, Thomson and Maxwell all came from aristocratic families and had Scottish roots while Tyndall was an Irishman who through immense effort had climbed to the top of the London scientific elite. Maxwell and Thomson were committed to their religious views and saw no incompatibility – rather

An 1865 *Punch* caricature of the BAAS annual meeting, which took place in Birmingham. Tyndall is shown at the top, to the right of Huxley and Owen, lancing the geologist (Joseph) Beete Jukes with a poker (in a dispute over coal). Fellow scientists Babbage, Murchison, Lyell, Scrope and Brewster are also shown.



they saw synergy – between a unified theory of nature and faith in the creator, a fact that they expressed from time to time in their public addresses. Tyndall observed this and was perhaps irked by it, as if they were abusing their scientific reputation publicly to support religion. Tyndall decided to use the opportunity in Belfast to undermine it.

Classical atomism

Departing from the traditional lecture content and motivated perhaps by a competitive desire to outshine his predecessors, Tyndall ventured into a field new to him on August 19th, 1874. His 20,000 words delivered a mixture of science, history and religion that, fuelled by considerable publicity in the press, reached the confines of the world where British science in general, and Tyndall in particular, were held in high regard.

In the first half of his speech Tyndall sketched an overview of the history of materialism going back to the early Classics, Democritus, Lucretius and Epicurus. For the Classics, atoms were postulated, and had some human-like features, likes and dislikes. For the current generation of scientists, atoms were just units of matter, belonging to a limited number of classes, had physical properties like mass and structure and combined according to the laws of chemistry.

This was new for Tyndall, because although he had spoken of materialism before, he had never mentioned the Classic atomists and had not linked their atomism to the emerging 19th-century notion of atomism. As sources he mentioned mainly the German philosopher Frederick Albert Lange (1828–75) and his *History of Materialism* (1866) and John William Draper and his *History of the Intellectual Development of Europe* (1864).

The second half summarised current British contributions to scientific materialism, interpreting Darwin's and Huxley's views on evolution and Herbert Spencer's on psychology, as a continuation of such materialist view of man. However, he refused openly to endorse these doctrines and appeared rather moved by the romanticism of his dear friend Thomas Carlyle (1795–1881). In Tyndall's materialism, matter had some of the characteristics of the divinity. Tyndall took offence at a presentation of matter as inanimate or a mere brute force.

Scholars still dispute the precise nature of Tyndall's materialism and whether his Belfast address was a testament to scientific materialism or pantheism. What is beyond doubt is that he intended his address to unhinge traditional Christian belief, whether Protestant or Catholic, and this he successfully

John Tyndall lectures on electromagnetism at the Royal Institution in 1870, cover engraving from the *Illustrated London News*.





achieved. For months and even years after Belfast, pulpits and press thundered against Tyndall.

Tyndall knew that his verbal address would be widely reported in the press and in academic journals. He was therefore in a rush to have a copy ready for the printers. His flaws, as we see below, cannot be attributed to the verbal aspect of the address. On other occasions when Tyndall had had to prepare public speeches without having any new results from his own research, he had withdrawn to the remote Bel Alp hotel alone. In 1874 the hotel, near the town of Brig at the northern edge of the alpine chain where it meets the Bernese alps, could only be reached on horseback or on foot and this limited the number of books he could take with him. That year he had arrived in early June, with about two months to prepare his address. Drafts should be sent to the printers (Taylor and Francis of London) in good time to allow for proofs to be read carefully and a final draft printed before the meeting. By that time Tyndall might have had some idea of the direction his speech would take, since we know that in January he had been in touch with Lange enquiring about the revised edition of *History of Materialism* that the German was preparing. But unforeseeable circumstances intervened that prevented Tyndall from concentrating on the Belfast address as he and Huxley intended.

Glacier table at Chamonix in 1842, from the Scottish physicist and glaciologist James David Forbes' *Travels Through the Alps*.

Ulster Hall in Belfast, by the Victorian photographer Robert French.



Unexpected distractions

Exiting a mountain pool after a swim shortly after his arrival, Tyndall cut his instep on the rocks and the wound became infected. He was feverish for several days and could neither sleep nor exercise. Following this episode he had a toothache which caused similar suffering. This meant that his writing time was reduced and he had made little headway by late June. During his Alpine sojourn he received about 30 letters, some of them concerning his public image, written by respected colleagues such as Tait and Agassiz, which called for his immediate and considered response. A few days before he had begun his summer vacation, *The Contemporary Review* had published another of Tyndall's vicious reviews, this time about Chanone Rendu, a priest who also wrote critically on the movement of glaciers and who was in agreement with Forbes' defenders, who were also Rendu's friends, had letters in the journal *Nature* strongly attacking Tyndall, to the point that, unusually, and following Huxley's advice, he saw the need to write a public apology.

Tyndall was unpopular with many of his colleagues, he was sick and he was wasting time having to defend himself from public attack. He was isolated and had very few books. Days later he received a letter from George Gabriel Stokes (1819-1903), editor of one of the journals of the Royal Society, telling him

that a paper he had recently submitted had been rejected. Correspondence about the details for the rejection flowed between the two. By July 22nd Huxley complained of not having seen a draft of the address. On August 8th, Tyndall was still in Bel Alp, reviewing the printer's proofs of the final third of the address. He had written to Spencer requesting some fresh details about the behaviour of a newly hatched chicken, which Spencer kindly provided and which eventually found their way into the printed address as a footnote.

By August 11th Tyndall was back in London. He had asked Spencer to go over the proofs one last time but Spencer, writing from Ardtornish in the Marvern Peninsula in Scotland, wrote that the post there was delivered and collected only three days a week, adding: 'I have not got the proofs from Taylor and Francis yet, and now I cannot till Thursday at 1 o'clock. I cannot send it away until Friday morning and it will not be delivered till Monday in London.' The date Spencer referred to was August 17th.

Allegations

For all its explosive power, Tyndall clearly found writing the address difficult. He had no need to follow others to produce brilliant ideas, but on this occasion it appears that he had painted himself into a corner so tight that the only option by which he could meet the August 19th deadline was to copy. It seems certain that he took many of his ideas and straight – though translated – passages of text from Lange and colleagues, including his friends Darwin, Huxley, Spencer and the self-styled historian John Draper. Our findings in this respect follow three contemporary allegations of plagiarism by Thomas Davidson (1874), Michael O'Ferrall (1874) and J. Barry (1877), philosophers and theologians who knew the German cultural scene well. More recent references to 'heavy borrowing' have also been made by the historian Ruth Barton.

Lange was clearly Tyndall's major source of inspiration for the Belfast address and his plagiarism was quite subtle. He did sometimes mention sources, but not always revealing where or to what extent he had used them. For instance, at the beginning of the paper Tyndall refers to Lange's book *The History of Materialism*; 'to the letter and the spirit of which I owe so much'. But he omitted to highlight just how much of his text was a direct translation of this work.

Reading Lange's English translation and Tyndall's lecture today one is struck by the close similarity between the two. For example, the summaries on Democritus, Lucretius, Protagoras, Giordano Bruno or Descartes that appear in both are nearly verbatim for lengthy passages, but Tyndall uses neither quota-

tion marks nor italics to reference Lange.

In 1874 Lange was trying to complete the third German edition of his magnum opus, *The History of Materialism*, to show that philosophical materialism was problematic. In it, he went back to the Classic atomists, indicating that their materialism was subversive of the gods and that for this reason it was often suppressed. The attention then shifted to Plato and Aristotle, whose philosophy was, Lange said, basically word-games that facilitated religion. The first half of Tyndall's address follows Lange very closely. Clearly Tyndall was translating from the German, 'boiling down' (his words) the text and inserting it into his own narrative. The fact that Lange's work had not yet been translated (it was published in English in 1877)

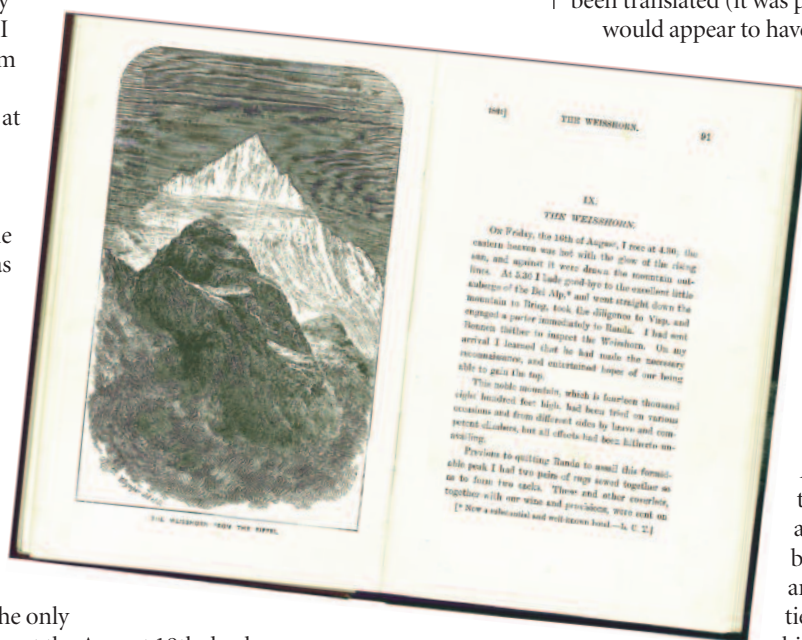
would appear to have presented a singular opportunity to pass the plagiarism unnoticed. Tyndall could safely assume that most of his Belfast audience could not read German, much less the work of a modest German philosopher.

John William Draper (1811–82) was Professor of Chemistry and Physiology at the University of New York, writing his *History of the Intellectual Development of Europe* in 1862 (second edition 1864), an influential book at the time in some quarters but today widely discredited among historians for the liberties he took with the methods of historical research. Paraphrasing James Moore, Draper was at lib-

erty to write a religious tract, but he was at fault for calling it 'history', and for pretending impartiality. He was guided in his views by a powerful anti-Roman bias and this, perhaps more than any other attribute, was what attracted Tyndall to his work. Probably the two men met in New York, where Tyndall had lectured while on an American tour in 1872–73. The name of Draper is mentioned in the address, but the reference, flanked by inverted commas spanning 26 words, goes on for nearly 500 words.

Historic plagiarism

Darwin is the author most quoted in Tyndall's address (22 times). This, however, does not preclude plagiarism elsewhere. At a point in the second half of the address, Tyndall copied verbatim 450 words from the preface of the 4th edition of *The Origin*, but only used quotation marks to encompass a passage of 18 words and, for those only, credit is given to Darwin, the implication being that the other 430 words were not Darwin's. Darwin's knowledge of natural history was so vast that he often fell into prolixity. Huxley was the earliest of Darwin's popularisers, partly because his use of language could be lively and accessible. Tyndall chose to copy from Huxley rather than Darwin in certain pas-



Pages from Tyndall's book *Hours of Exercise in the Alps*.

From the Archive



Nature and Nation: Britain and America in the 19th Century

David Lowenthal explores natural history enthusiasms among Victorian Britons and Americans, and finds an explanation for their differing approaches to conservation.

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sages that in the latter's texts were more obscure. For example, the explanation of naturally occurring variability using the case of pigeons is extensive and scattered through *The Origin*, but Huxley did a simpler job in one of his *Lectures to Working Men* and this was what Tyndall chose to copy, without a direct acknowledgement to Huxley, while talking about Darwin. Spencer also features quite extensively towards the end of the address and although he is quoted specifically on occasion, he is also 'boiled down' with no mention in other lengthy paragraphs.

Today's scientific plagiarism, reaching epidemic proportions, occurs mostly across languages, between English and Chinese. Plagiarism is difficult to establish in any age. Some people claim that it was rampant in 18th and 19th-century science and therefore that it can be judged lightly. Carpenter, Faraday, Forbes, Goethe, Lubbock, Lyell, Wyville-Thomson as well as Tyndall were all accused of incidences in their time. Plagiarism is said to be found relatively more often among RI speeches than among BAAS speeches, because the former were more reliant on verbal communication, while the latter were extensively circulated in print. The cases that are known, however, indicate that often allegations of plagiarism in print mattered greatly to the people involved and to the wider scientific community.

'Historic' allegations, where both plagiarist and plagiarised are dead, are worth examining today because to establish whether or not copying occurred is a matter of good science and good history. To ignore it could lead to missing useful lessons or to

Herbert Spencer as a dog statue about to be muzzled. The caption to this Puck cover of 1883 reads: 'The Society for the Suppression of Blasphemous Literature proposes to get up cases against Professors Huxley and Tyndall, Herbert Spencer, and others who, by their writings have sown widespread unbelief, and in some cases rank atheism.'

accepting flawed knowledge. This is particularly the case with widely circulated texts printed in professional journals. If plagiarism includes copying (even after translation) in such journals without clear attribution, Tyndall's Belfast address was a case in point. General or imprecise attribution could soften the charge to an equally imprecise degree, but when this amounts to more than 25 per cent of the total text, we are conscious of having crossed a boundary.

Much in Tyndall's temperament made him likeable and humane. His frugality, his passion for science and for nature, but above all his lifelong friendships, with Carlyle, Hirst, Huxley, and especially Joseph Hooker, show him to be full of manly tenderness. It was perhaps his young wife's zeal to keep his personal papers private that prevented a timely and substantial 'Life and Letters' being written after his death. Having had no children, this large undertaking remained undone for nearly five decades,

while science moved on. It would be easy to say that Tyndall's Belfast address – the best publicised of his works – fell into oblivion because his religious opponents suppressed it, or that it was an isolated episode, destined to be neglected. In our opinion, it was neglected because mainstream science, needing little justification beyond its own success, became a little embarrassed at the relative intellectual modesty of its proponent and the fireworks of his temperament.

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Further Reading

Ruth Barton, *John Tyndall, Pantheist: A Rereading of the Belfast Address* (Osiris, 2nd Series, Vol. 3, 1987).

William Hodson Brock, Norman D. McMillan and R. Charles Mollan, (editors) *John Tyndall: Essays On a Natural Philosopher* (Royal Dublin Society, 1981).

Miguel DeArce, Norman McMillan, Martin Nevin and Carmel Flahavan, 'What Tyndall read: Provenance, Contents and significance of the Proby Bequest to Carlow Library' *Carloviana: Journal of the Carlow Historical and Archaeological Society*, 60, 2011, p.134–141.

Bernard Lightman, 'On Tyndall's Belfast Address, 1874'; John Tyndall, 'Address delivered before the British Association gathered in Belfast, 1874.' See www.victorian-web.org/science/science_texts/belfast.html



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