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Classification was a key practice of the natural history sciences in the early 19th century, but leading taxonomists disagreed over basic matters, such as how many species the British flora contained. In this arena, the impact of Charles Darwin's ideas was surprisingly limited. For taxonomists like Darwin's friend, Joseph Dalton Hooker, the priority was to establish a reputation as a philosophical naturalist, and to do so Hooker embarked on a survey of global vegetation patterns. He believed that taxonomic "splitters" hindered his ambition to create natural laws for botany (and hence establish it as a prestigious science) by generating a multitude of redundant synonyms for every plant variety. Despite the fact that Darwin's ideas apparently promised a justification for splitting, they also offered a philosophical justification for Hooker's taxonomic practice, and so he enthusiastically championed his friend.

The claim is often made that Darwin changed the world in part because *On the Origin of Species* shattered people's religious faith and ushered in a period of turmoil. There are many reasons to be skeptical about this interpretation, not least that many of *Origin*'s readers regarded it as neither creating nor exacerbating a "war" between science and religion (*1*–*3*). Yet even if reports of religious war are exaggerated, surely there can be no doubt about Darwin's revolutionary impact on science? However, for some of his most important scientific allies, Darwin's ideas promised a robust justification for conducting scientific business as usual, and I want to argue that Darwin's "revolution" was actually profoundly conservative (*4*–*6*).

The impact of Darwinism on Victorian science is clearly reflected in the career of his closest friend, the botanist Joseph Dalton Hooker (Fig. 1). Hooker was the son of William Jackson Hooker, Regius Professor of Botany at Glasgow University. This prestigious-sounding title could not conceal the fact that the botany professor earned a modest living by teaching those whom Joseph Hooker referred to as "that lowest of all classes of students, the medical" [quoted in (*7*)]. Medicine was regarded as a lowly trade, in which cures were rare and scientific understanding of disease even rarer, and, because the few paid positions for botanists involved teaching trainee medical men, botany's scientific standing suffered from the association. Moreover, medical botany was typical of the uses of 19th-century botany, which were mainly practical or commercial; such useful sciences were frequently considered to be of lower status than elite studies, such as mathematics and physics.

A Naval Botanist

Hooker began his career with a long ocean voyage, spending 4 years exploring the Antarctic aboard HMS *Erebus*, which was mapping Earth's magnetic field (Fig. 2). This was a common path for putative men of science to take, and of course Darwin's scientific life had also begun aboard a ship. Darwin had traveled in style as a gentleman companion to the *Beagle*'s captain, whereas Hooker was a badly paid junior naval surgeon whose father, unlike Darwin's, did not have a fortune to bequeath him. During the voyage, William Hooker became director of the Royal Botanic Gardens at Kew, which helped him add to the network of influential friends who helped him secure his son half-pay from the Admiralty while he wrote up the results of his expedition. Yet despite this assistance, Joseph Hooker spent over a decade searching for a scientific position that was both better remunerated and more prestigious than teaching medical students.

As the ship sailed homeward, Hooker analyzed his future prospects in a letter to his father, noting that "I am not independent, and must not be too proud; if I cannot be a naturalist with a fortune, I must not be too vain to take honourable compensation for my trouble" [quoted in (*7*)]. Clearly being "a naturalist with a fortune" would have been preferable to accepting money. His statement reflects the fact that, for much of the 19th century, the ideal man of science was someone like Sir Joseph Banks, an independently wealthy gentleman who put his money and expertise at the nation's service and accepted no financial reward, his wealth being a guarantee of his disinterestedness (i.e., having no financial stake allowed him to pursue truth without thought of personal gain). Victorian men of science like Hooker struggled to retain some of the status associated with the old gentlemanly ideal while nevertheless demanding that their merits be recognized and properly rewarded. One result of this tension was that for the emerging class of professional scientists the highest accolade was to be described not as a professional, but as a "philosophical" naturalist. In this context, "philosophical" was a word with many complex meanings, starting with its derivation from the term "natural philosophy," which encompassed

Fig. 1. Joseph Hooker at his desk, microscope in hand. From the original by T. B. Wirgman (published 17 July 1886 in *The Graphic*, p. 64), held at Kew. [Copyright, The Board of Trustees of the Royal Botanic Gardens, Kew]

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Fig. 2. The *Erebus* and *Terror* at Kerguelen's Land. [Reprinted from (*23*)]

branches of science that sought to understand and explain the causes of natural phenomena. By contrast, natural history was merely descriptive: cataloging and naming, but not explaining. Natural philosophy was the forerunner of the elite sciences, especially physics, which provided the model for those naturalists who wished and worked to raise their disciplines to comparable status.

In 1833, the *Edinburgh Review* noted that a field like botany had traditionally been undervalued and that its position appeared to be gradually changing, thanks to the appearance of "the philosophical botanist, who invents new principles of classification, who studies the structure and organs of plants, who develops the laws of their geographical distribution, and who investigates their uses in relation to diet, medicine, and the arts" (*8*). The reviewer's comments were typical of discussions within the botanical community at the time and provided an implicit definition of what it meant to be philosophical for men like Hooker who were working to develop "new principles of classification," study the "structure and organs of plants" (plant anatomy and physiology), and, above all, develop the laws governing plants' "geographical distribution."

The Laws of Botany

For a botanist like Hooker, there were two main attractions to understanding the complex patterns of vegetation. First, imposing laws on botany would elevate it from the merely descriptive. Second, unraveling the mysteries of plant distribution had a more practical, economic benefit at a time when much of the wealth of Britain's empire rested on plants: from the timber and hemp from which her navy was built to the indigo, spices, opium, tea, cotton, and thousands of other plant-based products that the ships carried (Fig. 3). Understanding the laws that shaped vegetation allowed valuable new plants to be discovered and allowed existing crops to be successfully transplanted to British colonies, where they could be cultivated profitably. A grateful nation might reasonably be expected to reward the science that had added to the empire's wealth. Hence, unsurprisingly, Hooker described the "great problems of distribution and variation" as "prominent branches of inquiry with every philosophical naturalist" (*9*).

However, before the philosophical naturalist could pursue the study of distribution, classifications needed to be resolved. Hooker was convinced that many of the plants named as species were merely varieties, which had been elevated to specific status by those he called splitters. Abolishing names that he considered invalid would simplify the maintenance of Kew's rapidly expanding collection of dried plant specimens (herbarium), where every species name required a separate specimen on a separate sheet. More importantly, the key tool Hooker and his colleagues used to analyze distribution was known as botanical arithmetic, the calculation of the precise ratio of species to genera at each locality that they hoped would give numerical precision to previously vague statements about different regions being rich or poor in species. Such calculations could not be done until every botanist agreed on common definitions of species and genus and classified according to common principles.

Hooker's desire to grasp the laws of plant distribution helps to explain his hostility to the inexperienced colonial botanists, of whom he wrote that, whenever they found a plant they could not name, "it rarely enters into his head to hesitate before proposing a new species." The result was the creation of duplicate names, synonyms, which he described as "the greatest obstacle to the progress of systematic botany" (*10*).

A Colonial Naturalist

Among the most avid namers of new species was William Colenso (Fig. 4), a missionary naturalist in New Zealand who collected plants for Hooker over many years. On the one hand, Hooker valued his correspondent's work so highly that he dedicated his flora of New Zealand to Colenso and a fellow colonial naturalist (*11*). On the other hand, Hooker was adamant that Colenso should not attempt to name his adopted country's plants himself but cede that right to metropolitan experts like himself. Hooker concluded his New Zealand flora with a lengthy essay on the principles of botany, in which he addressed those like Colenso whom he knew would disagree with some of his classifications. He wrote that, "the New Zealand student will at first find it difficult to agree with me in many cases, as for example on so protean a Fern as

Fig. 3. Economic botany. A sample of rubber collected by Hooker during his Indian travels. [Copyright, The Board of the Trustees of the Royal Botanic Gardens, Kew]

Lomaria procera, whose varieties (to an inexperienced eye) are more dissimilar than are other species of the same genus" (*12*). This might almost have been addressed to Colenso personally, because he was a specialist on ferns and repeatedly attempted to name them; his unpublished botanical notebooks list more than a dozen specific names for the plant that Hooker called *Lomaria procera* (now *Blechnum procera*). Colenso believed his detailed, first-hand knowledge of New Zealand's plants gave him a greater expertise than Hooker, who had spent only 3 months in the country. However, Hooker was equally convinced that the herbarium gave him the final word because he was able to compare New Zealand's plants with examples from around the world. If this were done, Hooker argued, it became clear that the apparently distinct New Zealand forms could be placed within an unbroken sequence of similar forms, and so, Hooker firmly asserted, the plant "ranks according to my philosophy as a variety and not as a species" [quoted in (*7*); see also (*13*)].

The fact that varieties that were distinct in some locations disappeared in others was, in Hooker's view, proof that "no deduction drawn from local observations on widely distributed plants can be considered conclusive." He added that

> To the amateur these questions are perhaps of very trifling importance, but they are of great moment to the naturalist who regards accurately-defined floras as the means of investigating the great phenomena of vegetation (*12*, p. xiv).

From Hooker's perspective, the potential for confusion created by the "splitters" was a major obstacle to his wider project to raise the status of botany by globally mapping vegetation types, hence the need to persuade the colonials to toe the imperial line.

Disagreement as Evidence

Hooker, therefore, was a "lumper," one who defines species broadly, submerging many minor varieties under a single name, whereas a splitter does the opposite, naming the varieties as subspecies or even full species. From Darwin's perspective, each had their uses, as he told Hooker in 1857, "it is good to have hair-splitters and lumpers" (*14*). Hooker would undoubtedly have demurred, but for Darwin the disagreements between lumpers and splitters were evidence for evolution. He referred in *Origin* to those genera that were so hard to classify that "hardly two naturalists can agree which forms to rank as species and which as varieties," giving as instances *Rubus* (brambles) and *Hieracium* (hawkweeds). These plants were notoriously difficult to name and classify, and experts clashed regularly over how many species there were in each group (*15*). For Darwin, these "polymorphous" genera were evidence of evolution in progress because they were precisely what his theory would predict: If every species had been created in its modern form, their boundaries should be clearly defined; but, if each species evolved from another, there ought to be cases where the random variations that characterized all living things had yet to be sifted by natural selection or where extinction had not yet created the gaps that allowed species to be clearly discerned and named. Darwin therefore argued that "a well-marked variety may be justly called an incipient species," [p. 57 of (*19*)] and thus all those varieties of hawkweed or bramble were species in the making. From Hooker's perspective, the thought of species being constantly formed was a nightmare. There were, he argued, already far too many so-called species in existence, most of them named by provincial and colonial splitters.

Fig. 4. The Reverend William Colenso in old age. [Copyright, The Board of Trustees of the Royal Botanic Gardens, Kew]

Although a well-connected metropolitan expert like Hooker might be assumed to be able to impose his views on a colonial naturalist like Colenso, the prevailing disagreements between British taxonomists undermined his authority. Between 1858 and 1862 three major British floras appeared, all of which used what was supposedly the same taxonomic system. Yet an anonymous reviewer noted that each came to wildly different conclusions as to how many plant species there were in Britain. The reviewer noted that "While Mr. Babington's Manual (Ed[ition]. iv) contains 1708, Messrs. Hooker and Arnott have but 1571, and Mr. Bentham 1285"; in other words, Bentham's contained only three-quarters of the number of species found in Babington's book (*16*). How could botany be considered a mature science if leading botanists could not agree on the simple issue of how many species there were in a well-botanized locality like Britain? Colenso was well aware of these disputes, telling Hooker that

> To the question,—*What constitutes a really distinct genus*, or *species*? ***I*** cannot give a satisfactory answer. I know not of any certain rule; and I find the first Botanists of the day opposing one another in their speculations; while not a few are laboriously undoing what their predecessors or compeers have toiled to rear (*17*).

Given these disputes, Colenso could see no reason not to enter the fray himself, especially as he knew the living plants of his country better than anyone who relied entirely on dried specimens.

Supporting Darwin

Hooker was the first man of science to publicly endorse Darwin's theory. Within a few weeks of *Origin*'s first publication, Hooker published his essay "On the flora of Australia," in which he announced his support for "the ingenious and original reasonings and theories by Mr. Darwin and Mr. Wallace" (*9*). One year earlier, after Darwin's and Alfred Russel Wallace's papers had first been read at the Linnean Society of London, Hooker had written to the American botanist Asa Gray that he was "most thankful"

> that *I* can now use Darwin's doctrines – hitherto they have been kept secrets I was bound in honor to know, to keep, to discuss with him in private – but never to allude to in public, & I had always in my writings to discuss the subjects of creation, variation &c &c as if I had never heard of Natural Selection – which I have all along known [quoted in (*18*, pp. 32–33)].

Hooker's pleasure at being able to make use of Darwin's ideas suggest excitement that a long-standing problem was being solved, a new era in natural history was being inaugurated. However, this was only partly true. Darwin had claimed in *Origin* that "When the views entertained in this volume on the origin of species, or when analogous views are generally admitted, we can dimly foresee that there will be a considerable revolution in natural history," and yet he went on to say that despite his revolution, "systematists will be able to pursue their labors as at present" (*19*). Hooker understood this argument very well (not least because it had been shaped by the discussions he and Darwin had had over the previous 15 years). In his essay, Hooker argued that "the descriptive naturalist who believes all species to be derivative and mutable [the evolutionist], only differs in practice from him who asserts the contrary, in expecting that the posterity of the organisms he describes as species may, at some indefinitely distant period of time, require redescription." For all practical purposes, there was no difference between post- and pre-Darwinian taxonomy: "the believer in species being lineally related forms must employ the same methods of investigation and follow the same principles

that guide the believer in their being actual creations" (*9*).

A scientific revolution that makes no difference to everyday scientific work seems an odd sort of revolution, yet it was precisely this conservatism that helped make Darwin's version of evolution acceptable to naturalists who had rejected earlier theories.

Evolving Philosophy

Hooker's intense dislike of splitters becomes more understandable in the context of his career and the grand imperial project that made it possible. Yet we are still left wondering why he was the first British man of science to publicly embrace Darwin's theory of evolution, because he must have foreseen that Darwin's claims that varieties were in fact incipient species would be gleefully seized on by the splitters. Colenso, for example, became an ardent Darwinist, and although no record survives of him using Darwin's name to justify giving specific names to varieties, other naturalists certainly did.

If, as Hooker implied, Darwinism required no change to day-to-day scientific practice, why embrace his friend's theory at all? Loyalty was only part of the reason; to fully understand, we need to look again at what Darwin said about classification in *Origin*.

After analyzing the principles of classification, especially the difficult cases like the hawkweeds and brambles, Darwin concluded that

> All the foregoing rules and aids and difficulties in classification are explained, if I do not greatly deceive myself, on the view that the natural system [of classification] is founded on descent with modification; that the characters which naturalists consider as showing true affinity between any two or more species, are those which have been inherited from a common parent, and, in so far, all true classification is genealogical. (*19*, pp. 324–325)

If Darwin was right, classification was much more than mere naming; it was uncovering the history of life on Earth—a history that, when combined with the insights of geology, also explained much about the distribution of plants across the globe. Evolution provided the life sciences with laws, explanations for the patterns that had previously been recorded but not explained. That, for Hooker, was the great attraction of evolutionary ideas; they provided a fully philosophical underpinning for his work, a firm basis from which to tell the splitters he was right and they were wrong. The broadly defined species that Hooker used were, he argued, all the descendents of a common ancestor. He argued that if

> we consider these closely allied varieties and species as derived by variation and natural selection from one parent form at a comparatively modern epoch, we may with advantage, for certain purposes, regard the aggregate distribution of the very closely allied species as that of one plant (*20*, p. 279).

This was lumping with a vengeance, but not on the basis of an idiosyncratic whim; it was justified by Darwin's theories. As he had argued 2 years earlier, Darwin's ideas "should lead us to more philosophical conceptions on these subjects, and stimulate us to seek for such combinations of their characters as may enable us to classify them better, and to trace their origin back to an epoch anterior to that of their present appearance and condition" (*9*).

In *Origin*, Darwin had promised systematists that their "shadowy doubt" about whether or not a particular type was really a species would cease and was confident, having spent 8 years of his life classifying barnacles, that this "will be no slight relief." Instead, they will simply need to assess "whether any form be sufficiently constant and distinct from other forms, to be capable of definition" (*19*). The prospect of objective classifications that would put an end to rancorous disputes between taxonomists, combined with providing natural history with some proper scientific laws, were the major attractions of the Darwinian theory to men like Hooker. Nevertheless, Hooker's concern to bring stability to classification also explains his apparently contradictory statements about the impact of evolution. Not only should pro- and anti-Darwinian botanists "employ the same methods of investigation and follow the same principles," but he went so far as to argue that Darwin's "hypotheses should *not* influence our treatment of species, either as subjects of descriptive science, or as the means of investigating the phenomena of the succession of organic forms in time, or their dispersion and replacement in area" (*9*).

Although reining in the splitters remained an urgent task and despite the advantage it gave to splitters, the philosophical attractions of evolution by natural selection help explain why Hooker became and remained a staunch and loyal defender of Darwin. Hooker embraced the mechanism of natural selection more enthusiastically than many of his contemporaries, speaking out publicly in support of his friend's ideas.

Revolutionary Failure

The terms lumper and splitter are still very much in use among taxonomists and applied, usually pejoratively, to those whose view of the limits of species differs from the writer's own. The fact that they are still in use marks the failure of at least one aspect of the Darwinian revolution: In *Origin*, Darwin had assured his readers that "Our classifications will come to be, as far as they can be so made, genealogies," with the result that "the rules for classifying will no doubt become simpler," once naturalists learned "to discover and trace the many diverging lines of descent in our natural genealogies" (*19*). Darwin's claim has inspired systematists ever since, but despite its near-universal acceptance there is still no comparable agreement as to exactly how to put it into practice (*21*, *22*). Hooker's story suggests that there may never be agreement: What worked for an metropolitan naturalist working at the heart of a great empire could never satisfy a colonial naturalist, eager to record the minute details that years of close study had revealed. Somewhat ironically, the work of many of those Hooker condemned as splitters has since proved of more use to modern evolutionary biologists than his broad species, because the splitters recorded evidence that is now useful for the study of speciation, biodiversity, and climate change. The way we classify is ultimately a product of why we classify.

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