

SIR JOSEPH DALTON HOOKER

F. O. BOWER

[In a memorial oration delivered at the University of Glasgow, June 25, 1912, Professor BOWER spoke of Sir JOSEPH D. HOOKER as a traveler, a geographer, a geologist, a morphologist, an administrator, a scientific systematist, and a philosophical biologist. There is danger that HOOKER's great contributions to taxonomy will overshadow, for the biologists of a later generation, his important relation to the development of evolutionary theory. With the permission of Professor BOWER, therefore, that part of his oration dealing with HOOKER as a philosophical botanist is here reproduced.—EDITOR.]

I hope I have not wearied you with these brief sketches of four of the great systematic works of Sir JOSEPH HOOKER. I have gone somewhat more into detail than is quite justified in a public speech. But this has been done with a definite end in view. It was to show you how fully he was imbued with the old systematic methods; how he advanced, improved, and extended them, and was in his time their chief exponent. His father had held a similar position in the generation before him. But the elder HOOKER, true to his generation, treated his species as fixed and immutable. He did not generalize from them. His end was attained by their accurate recognition, delineation, description, and classification. The younger HOOKER, while in this work he was not a whit behind the best of his predecessors, saw further than they. He was not satisfied with the mere record of species as they were. He sought to penetrate the mystery of the origin of species. In fact, he was not merely a scientific systematist in the older sense. He was a philosophical biologist in the new and nascent sense of the middle period of the nineteenth century. He was an almost life-long friend of CHARLES DARWIN. He was the first confidant of his species theory, and, excepting WALLACE, its first whole-hearted adherent. But he was also DARWIN's constant and welcome adviser and critic. Well indeed was it for the successful launch of evolutionary theory that old-fashioned systematists took it in hand. Both DARWIN and HOOKER had wide and detailed knowledge of species as the starting-point of their induction.

Before we trace the part which HOOKER himself played in the drama of evolutionary theory, it will be well to glance at his personal relations with DARWIN himself. It has been seen how he read the proof-sheets of the *Voyage of the Beagle* while still in his last year of medical study. But before he started for the Antarctic he was introduced to its author. It was in Trafalgar Square, and the interview was brief but cordial. On returning from the Antarctic, correspondence was opened in 1843. In January 1844 HOOKER received the memorable letter confiding to him the germ of the theory of descent. DARWIN wrote thus: "At last gleams of light have come, and I am almost convinced that species are not (it is like confessing a murder) immutable: I think I have found (here's presumption!) the simple way by which species become exquisitely adapted to various ends." This was probably the first communication by DARWIN of his species theory to any scientific colleague.

The correspondence thus happily initiated between DARWIN and HOOKER is preserved in the *Life and letters of Charles Darwin*, and in the two volumes of *Letters* subsequently published. They show, on the one hand, the rapid growth of a deep friendship between these two potent minds, which ended only beside the grave of DARWIN in Westminster Abbey. But what is more important is that these letters reveal, in a way that none of the published work of either could have done, the steps in the growth of the great generalization. We read of the doubts of one or the other; the gradual accumulation of material facts; the criticisms and amendments in face of new evidence; and the slow progress from tentative hypothesis to assured belief. We ourselves have grown up since the clash of opinion for and against the mutability of species died down. It is hard for us to understand the strength of the feelings aroused, the bitterness of the attack by the opponents of the theory, and the fortitude demanded from its adherents. It is best to obtain evidence on such matters at first hand, and this is what is supplied by the correspondence between DARWIN and HOOKER.

How complete the understanding between the friends soon became is shown by the provisions made by DARWIN for the publication of his manuscripts in case of sudden death. He wrote in August 1854 the definite direction "HOOKER by far the best man

to edit my species volume," and this notwithstanding that he writes to him as a "stern and awful judge and sceptic." But again, in a letter a few months later, he says to him "I forgot at the moment that you are the one living soul from whom I have constantly received sympathy." I have already said that HOOKER was not only DARWIN'S first confidant, but also the first to accept his theory of mutability of species. But even he did not fully assent to it till after its first publication. The latter point comes out clearly from the letters. In January 1859, six months after the reading of their joint communications to the Linnaean Society, DARWIN writes to WALLACE "You ask about LYELL'S frame of mind. I think he is somewhat staggered, but does not give in. . . . I think he will end by being perverted. Dr. HOOKER has become almost as heterodox as you or I, and I look at HOOKER as by far the most capable judge in Europe." In September 1859 DARWIN writes to W. D. FOX "LYELL has read about half of the volume in clean sheets. . . . He is wavering so much about the immutability of species that I expect he will come round. HOOKER has come round, and will publish his belief soon." In the following month, writing to HOOKER, DARWIN says: "I have spoken of you here as a convert made by me: but I know well how much larger the share has been of your own self-thought." A letter to WALLACE of November 1859 bears this postscript: "I think that I told you before that HOOKER is a complete convert. If I can convert HUXLEY I shall be content." And lastly, in a letter to W. B. CARPENTER, of the same month, DARWIN says: "As yet I know only one believer, but I look at him as of the greatest authority, viz. HOOKER." These quotations clearly show that, while LYELL wavered, and HUXLEY had not yet come in, HOOKER was a complete adherent in 1859 to the doctrine of the mutability of species. Excepting WALLACE, he was the first, in fact, of the great group that stood round DARWIN, as he was the last of them to survive.

The story of the joint communication of DARWIN and of WALLACE to the Linnaean Society "On the tendency of species to form varieties, and on the perpetuation of varieties and species by natural means of selection" will be fresh in the minds of you all, for the fiftieth anniversary of the event was lately celebrated

in London. It was Sir CHARLES LYELL and Sir JOSEPH HOOKER who jointly, and with the author's permission, communicated the two papers to the society, together with the evidence of the priority of DARWIN in the inquiry. Nothing could then have been more apposite than the personal history which Sir JOSEPH gave at the DARWIN-WALLACE celebration, held by the Linnaean Society in 1908. He then told, at first hand, the exact circumstances under which the joint papers were produced. Nor could the expressions used by the President when thanking Sir JOSEPH, and presenting to him the DARWIN-WALLACE Medal, have been improved. He said: "The incalculable benefit that your constant friendship, advice, and alliance were to Mr. DARWIN himself, is summed up in his own words, used in 1864: 'You have represented for many years the whole great public to me.'" The President then added: "Of all men living it is to you more than to any other that the great generalization of DARWIN and WALLACE owes its triumph."

Having thus sketched the intimate relations which subsisted between HOOKER and DARWIN, it remains to appraise his own positive contributions to philosophical biology. He himself, in his address as President of the British Association at Norwich in 1868, gives an insight into his early attitude in the inquiry into biological questions. "Having myself," he says, "been a student of moral philosophy in a northern university, I entered on my scientific career full of hopes that metaphysics would prove a useful mentor, if not a guide in science. I soon found, however, that it availed me nothing, and I long ago arrived at the conclusion so well put by AGASSIZ, when he says 'We trust that the time is not distant when it will be universally understood that the battle of the evidences will have to be fought on the field of physical science, and not on that of the metaphysical.'" This was the difficult lesson of the period when evolution was born. HOOKER learned the lesson early. He cleared his mental outlook from all preconceptions, and worked down to the bed-rock of objective fact. Thus he was free to use his vast and detailed knowledge in advancing, along the lines of induction alone, toward sound generalizations. These had their very close relation to questions of the mutability of species. The subject was approached by him through the study

of geographical distribution, in which, as we have seen, he had at an early age become the leading authority.

The fame of Sir JOSEPH HOOKER as a philosophical biologist rests upon a masterly series of essays and addresses. The chief of these were the introductory essay to the *Flora Tasmaniae*, dealing with the antarctic flora as a whole; the essay on the distribution of arctic plants, published in 1862; the discourse on insular floras in 1866; The Presidential address to the British Association at Norwich in 1868; his address at York, in 1881, on geographical distribution; and finally, the essay on the vegetation of India, published in 1904. None of these were mere inspirations of the moment. They were the outcome of arduous journeys to observe and collect, and subsequently of careful analysis of the specimens and of the facts. The dates of publication bear this out. The essay on the antarctic flora appeared about twenty years after the completion of the voyage. The essay on the vegetation of India was not published till more than half a century after HOOKER first set foot in India. It is upon such foundations that HOOKER'S reputation as a great constructive thinker is securely based.

The first-named of these essays will probably be estimated as the most notable of them all in the history of science. It was completed in November 1859, barely a year after the joint communications of DARWIN and WALLACE to the Linnaean Society, and before the *Origin of species* had appeared. It was to this essay that DARWIN referred when he wrote that "HOOKER has come round; and will publish his belief soon." But this publication of his belief was not merely an echo of assent to DARWIN'S own opinions. It was a reasoned statement, advanced upon the basis of his "own self-thought," and his own wide systematic and geographical experience. From these sources he drew for himself support for the "hypothesis that species are derivative and mutable." He points out how the natural history of Australia seemed specially suited to test such a theory, on account of the comparative uniformity of the physical features being accompanied by a great variety in its flora, and the peculiarity of both its fauna and flora as compared with other countries. After the test had been made, on the basis of the study of some 8,000 species, their characters, their spread,

and their relations to those of other lands, he concludes decisively in favor of mutability and a doctrine of progression.

How highly this essay was esteemed by his contemporaries is shown by the expressions of *LYELL* and of *DARWIN*. The former writes "I have just finished the reading of your splendid essay on the origin of species, as illustrated by your wide botanical experience, and think it goes far to raise the variety-making hypothesis to the rank of a theory, as accounting for the manner in which new species enter the world." *DARWIN* wrote "I have finished your essay. To my judgment it is by far the grandest and most interesting essay on subjects of the nature discussed I have ever read."

But besides its historical interest in relation to the species question, the essay contained what was, up to its time, the most scientific treatment of a large area from the point of view of the plant-geographer. He found that the antarctic, like the arctic flora, is very uniform round the globe. The same species in many cases occur on every island, though thousands of miles of ocean may intervene. Many of these species reappear on the mountains of Southern Chile, Australia, Tasmania, and New Zealand. The southern temperate floras, on the other hand, of South America, South Africa, Australia, and New Zealand, differ more among themselves than do the floras of Europe, Northern Asia, and North America. To explain these facts he suggested the probable former existence, during a warmer period than the present, of a center of creation of new species in the Southern Ocean, in the form of either a continent or an archipelago, from which the antarctic flora radiated. This hypothesis has since been held open to doubt. But the fact that it was suggested shows the broad view which he was prepared to take of the problem before him. His method was essentially that which is now styled "ecological." Many hold this to be a new phase of botanical inquiry, introduced by Professor *WARMING* in 1895. No one will deny the value of the increased precision which he then brought into such studies. But in point of fact it was ecology on the grand scale that Sir *JOSEPH HOOKER* practiced in the Antarctic in 1840. Moreover, it was pursued, not in regions of old civilization, but in lands where nature held her sway untouched by the hand of man.

This essay on the flora of the Antarctic was the prototype of

the great series. Sir JOSEPH examined the arctic flora from similar points of view. He explained the circumpolar uniformity which it shows, and the prevalence of Scandinavian types, together with the peculiarly limited nature of the flora of the southward peninsular of Greenland. He extended his inquiries to oceanic islands. He pointed out that the conditions which dictated circumpolar distribution are absent from them, but that other conditions exist in them which account for the strange features which their vegetation shows. He extended the application of such methods to the Himalaya and to Central Asia. He joined with ASA GRAY in like inquiries in North America. The latter had already given a scientific explanation of the surprising fact that the plants of the eastern states resemble more nearly those of China than do those of the Pacific slope. In resolving these and other problems, it was not only the vegetation itself that was studied. The changes of climate in geological time, and of the earth's crust as demonstrated by geologists, formed part of the basis on which he worked. For it is facts such as these which have determined the migration of floras. And migration, as well as mutability of species, entered into most of his speculations. The essays of this magnificent series are like pictures painted with a full brush. The boldness and mastery which they show sprang from long discipline and wide experience.

Finally, the chief results of the phytogeographical work of himself and of others were summed up in the great address on "Geographical distribution" at York. The Jubilee of the British Association was held there in 1881. It had been decided that each section should be presided over by a past President of the Association, and he had occupied that position at Norwich in 1868. Accordingly at York, HOOKER was appointed President of the Geographical Section, and he chose as the subject of his address "The geographical distribution of organic beings." To him it illustrated "the interdependence of those sciences which the geographer should study." It is not enough merely to observe the topography of organisms, but their hypsometrical distribution must also be noted. Further, the changes of area and of altitude in exposed land surfaces of which geology gives evidence, are

essential features in the problem, together with the changes of climate, such as have determined the advance and retrocession of glacial conditions. Having noted these factors, he continued thus: "With the establishment of the doctrine of orderly evolution of species under known laws, I close this list of those recognized principles of the science of geographical distribution, which must guide all who enter upon its pursuit. As HUMBOLDT was its founder, and FORBES its reformer, so we must regard DARWIN as its latest and greatest lawgiver." Now, after thirty years, may we not add to these words of his, that HOOKER was himself its greatest exponent?

You will have felt how tenuous is the line of limitation, if line indeed there be, between morphological reality and morphological abstraction; between the unit observed, and the summation of such units into a progression; between the static and the dynamic study of living things. It was this line that was crossed by DARWIN; and, as I have shown, HOOKER was the first of his friends to follow. To the general public he was perhaps the least known of the great triumvirate of Glasgow. The results he achieved do not touch everyday life so nearly as those of KELVIN or of LISTER. This is perhaps natural, for while he was the leading botanist of his time, he was, before all, a philosopher. In him we see the foremost student of the broader aspects of plant life at the time when evolutionary belief was nascent. His influence at that stirring period, though quiet, was far-reaching and deep. His work was both critical and constructive. His wide knowledge, his keen insight, his fearless judgment were invaluable in advancing that intellectual revolution which found its pivot in the mutability of species. The share he took in promoting it was second only to that of his life-long friend, CHARLES DARWIN.

UNIVERSITY OF GLASGOW