DISCUSSION

DARWIN AND WHEWELL

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IN a recent article, Michael Ruse describes some important respects in which Charles Darwin's work was influenced by William Whewell.[1] However, the influence of Whewell on Darwin was even greater than Ruse suggests. I shall show this by presenting new evidence that Darwin had read Whewell's *Philosophy of the Inductive Sciences* and then arguing that Darwin was strongly influenced by Whewell's views on consilience of inductions and true causes.

No direct evidence has been found that Darwin owned or read Whewell's *Philosophy of the Inductive Sciences*. This is surprising, since Darwin admired Whewell's *History of the Inductive Sciences*, and after reading J. F. W. Herschel's review of the *History* and *Philosophy* he wrote in a notebook: '*I must study* Whewell on Philosophy of Science.'[2] But indirect evidence that Darwin read Whewell's *Philosophy* is to be found in Darwin's *The Variation of Animals and Plants Under Domestication*, published in 1868. Late in the book, Darwin introduces his controversial theory of pangenesis. He puts it forward as a provisional hypothesis, one that brings together a multitude of facts and may thus be serviceable until a better hypothesis is advanced. Darwin defends this procedure by quoting Whewell: 'As Whewell, the historian of the inductive sciences remarks: — "Hypotheses may often be of service to science, when they involve a certain portion of incompleteness, and even of error."'[3] Except for the spelling of 'errour', the capitalization of 'hypotheses', and the absence of italics, this is the exact wording of the maxim as stated by Whewell in the second volume of *The Philosophy of the Inductive Sciences*.[4]

Of course, Darwin may have quoted the maxim from some source other than Whewell's *Philosophy*. One possible source is Whewell's own *History*, but although that work contains the ideas expressed in the maxim,[5] I have not

[1] Michael Ruse, 'Darwin's Debt to Philosophy: An Examination of the Influence of the Philosophical Ideas of John F. W. Herschel and William Whewell on the Development of Charles Darwin's Theory of Evolution' *Studies in the History and Philosophy of Science*, 6 (1975), 159-181.

[2] Quoted by Ruse in *ibid.*, 166.

[3] Charles Darwin, *The Variation of Animals and Plants Under Domestication* (London: John Murray, 1868), Vol. 2, p. 357.

[4] William Whewell, *The Philosophy of the Inductive Sciences*, facsimile of the 2nd edn, London, 1847, (New York: Johnson Reprint Corporation, 1967), Vol. 2, p. 60.

[5] Whewell, *The History of the Inductive Sciences* facsimile of the 3rd edn, London, 1857, (London: Frank Cass, 1967), p. 140).

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found in it a statement of the maxim as such. Whewell's characterization of the division between the *History* and the *Philosophy* implies that the statement of such maxims be reserved for the latter work.[6] Another likely source for Darwin of Whewell's maxim is Herschel's review of Whewell's books. Herschel commends Whewell for emphasizing the value of imcomplete hypotheses, but he does not actually quote the maxim.[7] Hence the most probable source of Darwin's quotation from Whewell is the original one: Whewell's *Philosophy*.

That Darwin quoted Whewell in 1868 would be of interest even if it did not show that he had read Whewell's *Philosophy*. Darwin's references to methodologists were infrequent, and it is significant that he would refer to Whewell long after he knew him personally and read his *History*.

The conclusion that Darwin read Whewell's *Philosophy* is reinforced by noticing Darwin's use of Whewell's important notion of the consilience of inductions. Whewell says that 'the evidence in favour of our induction is of a much higher and more forcible character when it enables us to explain and determine cases of a *kind different* from those which were contemplated in the formation of our hypothesis.'[8] According to Whewell, 'the cases in which inductions from classes of facts altogether different have thus *jumped together* belong to the best established theories which the history of science contains.'[9] A theory achieves a consilience of inductions by explaining a number of different classes of facts, some of which were not contemplated in the formation of the hypothesis. I shall now present two striking passages where Darwin, without using the term 'consilience of inductions', recommends consilience as the criterion for judging his theory of evolution.

The first is from the same source as Darwin's quotation from Whewell — *The Variation of Animals and Plants Under Domestication*. Darwin states:

> In scientific investigation it is permitted to invent any hypothesis, and if it explains various large and independent classes of facts it rises to the rank of a well-grounded theory. The undulations of the ether and even its existence are hypothetical, yet every one now admits the undulatory theory of light. The principle of natural selection may be looked at as a mere hypothesis, but rendered in some degree probable by what we positively know of the variability of organic beings in a state of nature, — by what we positively know of the struggle for existence, and the consequent almost inevitable preservation of favourable variation, — and from the analogical formation of domestic races. Now this hypothesis may be tested, — and this seems to me to be the only fair and legitimate manner of considering the whole question, — by trying whether it explains several large and independent classes of facts; such as the geological succession of organic beings, their distribution in past and present times, and their mutual affinities and homologies. If the principle of natural selection does explain these and other large bodies of facts, it ought to be

[6] *Ibid.*, Vol. 1, pp. 4–5.
[7] J. F. W. Herschel, Review of William Whewell, *History of the Inductive Sciences* and *Philosophy of the Inductive Sciences, Quarterly Review*, 68 (1841), 194.
[8] Whewell, *Philosophy*, Vol. 2, 65.
[9] *Ibid.*, Vol. 2, 65.

> received. On the ordinary view of each species having been independently created, we gain no scientific explanation of any of these facts.[10]

This passage concisely summarizes Darwin's long argument in *The Origin of Species*. Darwin believes that his theory deserves to be accepted because it explains several large and independent classes of facts. In short, it achieves a consilence of inductions.

To the second edition of the *Origin* Darwin added the sentence: 'I cannot believe that a false theory would explain, as it seems to me that the theory of evolution does explain, the several large classes of facts above specified.'[11] In the sixth edition of 1878, Darwin replaced this with the following passage which shows definite awareness that he was using an established pattern of argument:

> It can hardly be supposed that a false theory would explain, in so satisfactory a manner as does the theory of natural selection, the several large classes of facts above specified. It has recently been objected that this is an unsafe method of arguing; but it is a method used in judging of the common events of life, and has often been used by the greatest natural philosophers. The undulatory theory of light has thus been arrived at; and the belief in the revolution of the earth on its own axis was until lately supported by hardly any direct evidence.[12].

Again, Darwin emphasizes the explanation of different classes of facts, the achievement of a consilience of inductions. It is also noteworthy that the undulatory theory of light, mentioned in both of the long passages quoted above, was one of Whewell's favourite examples of the consilience of inductions.

Another methodological issue on which Darwin followed Whewell was the controversial issue of true causes, *verae causae*. I believe that Ruse is mistaken in attributing to Darwin a position on true causes akin to that of J. F. W. Herschel.[13] Ruse claims that Darwin's major motive for stressing the analogy between artificial and natural selection was that the analogy enabled him to show, by Herschel's standards, that natural selection is a true cause. As Ruse points out, Herschel maintained that hypotheses must employ only true causes, but allowed that a cause could be judged to be true if it were *analogous* to causes directly perceived.[14]

However, Whewell rejected Herschel's emphasis on analogy, arguing that analogy cannot serve as a guide to true causes, since the restriction of causes to those of such kinds as we know to exist is no restriction at all.[15] It admits for

[10] Darwin, *Variation*, Vol. 1, 8f.

[11] See *The Origin of Species by Charles Darwin, A Variorum Text*, Morse Peckham (ed.) (Philadelphia: University of Pennsylvania Press, 1959), p. 748.

[12] *Ibid.*, p. 784.

[13] Ruse, *op. cit.* note 1, pp. 175–6.

[14] Herschel, *Preliminary Discourse on the Study of Natural Philosophy* (London: Longman, 1830), pp. 149, 197, *Cf.* Condillac, *Oeuvres Philosophiques* (Paris, Presses Universitaires de France, 1947), 1, p. 204; and Dugald Stewart, *Collected Works*, Sir William Hamilton (ed.), (Edinburgh: Thomas Constable, 1854), 3, 305.

[15] Whewell, *Philosophy*, Vol. 2, p. 283.

example the Cartesian hypothesis of vortices, since we are familiar with whirling fluids carrying bodies around in orbit. Whewell concluded that a cause is true if it leads to a consilience of inductions:

> We may, provisorily, assume such hypothetical causes as will account for any given class of natural phenomena; but that when two different classes of facts lead us to the same hypothesis, we may hold it to be a *true cause*.[16]

Darwin shared this anti-Newton, anti-Herschel position on true causes. In 1860, he wrote to J. D. Hooker, following a lecture given by T. H. Huxley to the Royal Institution: 'I must confess that as an exposition of the doctrine the lecture seems to me an entire failure.'[17] Darwin's main complaint against Huxley is:

> He gave no just idea of Natural Selection. I have always looked at the doctrine of Natural Selection as an Hypothesis, which, if it explained several large classes of facts, would deserve to be ranked as a theory deserving acceptance.[18]

Darwin remarks that the difference between him and Huxley is 'that he rates higher than I do the necessity of Natural Selection being shown to be a *vera causa* always in action.'[19] In accord with the doctrine of Whewell, Darwin had no special concern about whether his hypothesis involved a true cause; all that mattered is that it explained several classes of facts and thus achieved a consilience of inductions. Hence Darwin did not need the analogy between natural and artificial selection to show that natural selection is a true cause. The analogy was important to him for other reasons, such as its heuristic value and its contribution, independent of the issue of true causes, to the acceptability of the theory of evolution by means of natural selection.[20]

A strong case thus exists to support my contention that Darwin read Whewell's *Philosophy of the Inductive Sciences*. Certainly, Darwin's methodology was similar to Whewell's on two very important matters, consilience of inductions and true causes. Darwin's debt to Whewell was therefore considerable.[21]

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[16] *Ibid.*, Vol. 2, p. 286. See also Robert E. Butts, 'Whewell On Newton's Rules of Philosophizing', in R. E. Butts and J. W. Davis (eds.), *The Methodological Heritage of Newton*, (Toronto: University of Toronto Press, 1970), 132–149.

[17] Charles Darwin, *More Letters of Charles Darwin*, Frances Darwin and A. C. Seward (eds.), (London: John Murray, 1903), **1**, p. 139.

[18] *Ibid.*, **1**, 139f.

[19] *Ibid.*, **1**, 140.

[20] On the heuristic value of the analogy, see for example Darwin, *On the Origin of Species*, facsimile of 1st edn, (Cambridge, Mass.: Harvard University Press, 1964), p. 4. On the contribution of the analogy to the acceptability of the theory, see for example *ibid.*, p. 17, and Darwin, *The Life and Letters*, reprint of 1888 edition, (New York: Johnson Reprint Corp., 1969) **3**, p. 25. Ruse mentions this contribution in 'Charles Darwin's Theory of Evolution: An Analysis', *Journal of the History of Biology*, **8** (1975), pp. 219–241.

[21] See also W. Faye Cannon, 'The Whewell–Darwin Controversy', *Journal of the Geological Society of London*, **132** (1976), 377–384.