DARWIN'S METAPHOR AND THE PHILOSOPHY OF SCIENCE

by Robert M. Young

I begin, rather as a clergyman would, with a text - a paragraph which Darwin added to the third edition of *On the Origin of Species*, published in 1861. I have come to believe that the issues raised by this passage are fundamental to the philosophy of science. Here is the text: 'Several writers have misapprehended or objected to the term Natural Selection. Some have even imagined that natural selection induces variability, whereas it implies only the preservation of such variations as arise and are beneficial to the being under its conditions of life. No one objects to agriculturists speaking of the potent effects of man's selection; and in this case the individual differences given by nature, which man for some object selects, must of necessity first occur. Others have objected that the term selection implies conscious choice in the animals which become modified; and it has even been urged that, as plants have no volition, natural selection is not applicable to them! In the literal sense of the word, no doubt, natural selection is a false term; but who ever objected to chemists speaking of the elective affinities of the various elements? - and yet an acid cannot strictly be said to elect the base with which it in preference combines. It has been said that I speak of natural selection as an active power or Deity; but who objects to an author speaking of the attraction of gravity as ruling the movements of the planets? Every one knows what is meant and is implied by such metaphorical expressions; and they are almost necessary for brevity. So again it is difficult to avoid personifying the word Nature; but I mean by Nature, only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us. With a little familiarity such superficial objections will be forgotten' (Darwin, 1895, pp. 58-9).

Before analysing this passage I want to make some points about Darwin's writing habits. He was very meticulous in revising his masterpiece. In fact, each successive edition contained more revisions than the previous one. The person who counted them, Morse Peckham, said, 'Of the 3,878 sentences in the first edition, nearly 3,000 , about 75 per cent, were rewritten from one to five times each. Over 1,500 sentences were added, and of the original sentences plus these, nearly 325 were dropped. Of the original and added sentences there are nearly 7,500 variants of all kinds. In terms of net added sentences, the sixth edition is nearly a third as long as the first' (Peckham, 1959, p. 9). Of the total revisions, 7 per cent appeared in the second edition, 14 per cent in the third, 21 per cent in the fourth, 29 per cent in the fifth and the sixth had even more. (pp. 20-24).

So we have here a man who is very, very careful about what he says. He responds to specific papers and to letters from his friends and critics. For example, the sixth edition has so many revisions, because St. George Jackson Mivart had said a lot of things that really upset Darwin, and he answered them with great care and precision. I tell you this because we are going to analyse some of his sentences very carefully, and I want you to know that the care he took justifies the closest scrutiny of the text.

Turning now to the analysis of the text, let's get the easy things out of the way. First, Darwin says he is not talking about the causes of variability; he's not talking about why species change, why they are modified. He is only talking about the ones that get preserved. Second, he is not a Lamarckian; he is not talking about animals or plants striving in any way. Third, and of interest to us, he plunges into the philosophy of science, and we will be staying with him there for the rest of this essay .

What about 'natrural selection', what I have called 'Darwin's metaphor' (Young,1985a)? He says it is not a literal term. It is literally false. Then he says, rightly in my view, that chemists use such terms - 'elective affinity' is the example he gives, and that physicists speak of the 'attraction of gravity' ruling the movements of the planets. 'Every one knows what is meant and is implied by such metaphorical expressions', he says, and 'they are almost necessary for brevity'. The metaphorical basis of his style is central to my argument, so we will return to this topic below. The next - and closely related - issue is his habit of writing about Nature as if it is a conscious agent, i.e., anthropomorphically. 'So again it is difficult to avoid personifying the word Nature; but I mean by Nature, only the aggregate action and product of many natural laws, and by laws [I only mean] the sequence of events as ascertained by us. With a little familiarity such superficial objections will be forgotten.' I don't think they are superficial, and they certainly did not get forgotten. They plagued him for the rest of his life. I think that they are the legacy of unresolved problems from the scientific revolution of the sixteenth and seventeenth centuries, problems which A. N. Whitehead called 'the achilles heel of the whole system' (Whitehead, 1985, p. 71).

What's going on here? Darwin had earlier written to his great mentor and hero, the geologist, Charles Lyell, to say that he felt in good company, since Leibniz had objected to the law of gravity and claimed that it was opposed to natural religion, because Newton could not show what gravity *is*. If it's okay for gravity to rule the planets, why can't natural selection rule the history of life? Well, I'd say this makes me wonder about elective affinity and gravity rather than about natural selection, and I'll explain below that the concept of force seems to me to be in the same bag. I want you to notice some of the ways that Darwin wrote about nature and about his putative mechanism - natural selection. But first, let's ask why it is important.

We are not talking here about an occasional bit of florid language but about his consistent representation of the concept - natural selection - which binds life to the conditions of existence, binds humanity to the rest of life and underpins the historicity of life and mind and society. Indeed, if, with Whitehead, we take the concept of organism to be a more fruitful basic unit for metaphysics than matter, force or particle, Darwin's theory could be seen as the basic, deepest idea in all of science and all of society.

The issue is, therefore, to say the least, important. It has also been - I'd say until recently - a much controverted matter. That is, although Darwin says again and again that the analogy between the selection of breeders and farmers and pigeon fanciers was the basis for his analogy to what nature does - *natural* selection - some historians of biology have claimed that his was not the true path. I think that a paper by L. T. Evans on 'Darwin's Use of the Analogy Between Artificial and Natural Selection' (1984) makes a convincing case for the role of this analogy in the period leading up to Darwin's crucial reading of Malthus - just as Darwin says in his autobiography: 'In October 1838, that is, fifteen months after I had begun my systematic inquiry, I happened to read for amusement Malthus on *Population*, and being well prepared to appreciate the struggle for existence which everywhere goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of a new species. Here, then, I had at last got a theory by which to work; but I was so anxious to avoid prejudice, that I determined not for some time to write even the briefest sketch of it' (Darwin, 1958, p. 120).

Now, if it isn't obvious, the reason I'm labouring this point is that the phrase 'natural selection' and the ways that he wrote about it are absolutely full of voluntaristic, anthropomorphic, *dirty* words as far as the official rules of science are concerned. One of the cardinal rules of modern science is to avoid explaining things in terms which draw on human intentions and to eschew evaluative language. The abandonment of

explanation in terms which draw on analogies to human intentions and which explain in terms of values and purposes (teleology) is supposed to set modern science off against earlier forms of explanation of the phenomena of the natural world.

My strategy is to force us to see that there is no escaping the fact that this kind of thinking lies at the heart of Darwin's ideas and then to generalise this point to other kinds of science and then, in my concluding section, to draw on the writings of some thinkers who believe that this is a good way of thinking about science altogether.

Darwin stressed this point again in a letter he wrote to his friend, Joseph Hooker. He said in 1844, 'I have read heaps of agricultural and horticultural books and have never ceased collecting facts. At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable'

(Darwin, 1887, Vol. 2, p. 23).

He goes on to say, 'I believe all these absurd views arise from no one having, as far as I know, approached the subject on the side of variation under domestication, and having studied all that is known about domestication' (Darwin, 1887, Vol. 2, pp. 29-30).

We know that in the case of domestic breeders there is a conscious selecting agent. Darwin also says elsewhere, '...all my notions about how species changed derive from long-continued study of the works of agriculturalists and horticulturalists'. After the merest semi-colon, he continues, writing of nature as a selecting agent: 'and I believe I see my way pretty clearly on the means used by nature to change her species and *adapt* them to the wondrous and exquisitely beautiful contingencies to which every living being is exposed....' (Ibid.)

This analogy between human breeders and nature is of crucial significance, since Alfred Russel Wallace, the co-author of the theory of natural selection, *denied,* in their joint paper of 1858 the very paper in which their theory was announced to the world that *any* inferences could be drawn about conditions under nature from the study of artificial selection. He says, 'We see then, that no inferences as to the permanence of varieties in a state of nature can be deduced from the observation of those occurring among domestic animals' (Wallace, 1891, p. 31). Indeed, Wallace later regretted in print Darwin's use of such expressions. In a paper that was otherwise defending what he was deferentially content to refer to as 'Darwinism', Wallace included a section entitled 'Mr. Darwin's Metaphors Liable to Misconception' (p. 144).

But be all that as it may, I want you to notice the ways Darwin wrote about natural selection, a term which Evans tells us Darwin began employing after he read a treatise by a man named Youatt on 'Cattle, their Breeds, Management and Diseases' in March of 1840 (Evans, p. 122). Another key concept which has the same overtones is that of 'picking', which he used before then and for which, to a considerable extent, 'selection' was substituted (p. 123).

Evans argues that the study of works of this kind was crucial for preparing Darwin for the insight that occurred on reading Malthus in 1838. After this event, or this extended process, Darwin wrote, for example, 'It is a beautiful part of my theory, that domesticated races of organisms are made by precisely the same means as species - but latter far more perfectly and infinitely slower' (Darwin, 1987, p. 416; Evans, p. 125). In another place he writes about greyhounds, race horses and pigeons and then speculates 'Has nature any process analogous if so she can produce great ends' (Darwin, 1987, p. 430; Evans,p. 126). 'But how [he is here rehearsing how he is going to spell out his theory] - Make the difficulty apparent by cross-questioning. - even if placed on Isld - if &c &c - Then give my theory. - excellently true theory' (Ibid.).

Darwin wrote a pencil sketch of his ideas in 1842, and in 1844 wrote out a more extended one (Darwin and Wallace, 1958). He was anxious lest he die before going public and left instructions for the publication of the theory if he did. Even though he was so concerned about his mortality, he did not

actually publish the theory for another fifteen years and then only in a summary version.

Ten years after writing the 1844 essay he got down to his big book, which was never published in his lifetime, called *Natural Selection* (Darwin, 1975). The first two chapters were on variation under domestication - two hundred pages, which he finished by October 1856. He then wrote the part on natural selection, which he finished at the end of March of 1857. By the middle of June of 1858, he was well along when he received a letter out of the blue in which Wallace's concepts were the same as his own chapter headings - an extraordinary independent discovery of evolution by means of natural selection. He was absolutely appalled by this coincidence, even though Charles Lyell had warned him that Wallace was on his heels, thereby catalysing Darwin's finally getting down to writing what was intended to be his *magnum opus*. Darwin wrote to Lyell: 'I never saw a more striking coincidence; if Wallace had my MS sketch written out in 1842, he could not have made a better short abstract! Even his terms now stand as heads to my chapters' (Darwin, 1887, Vol. 2, p. 116).

What actually turned out to be Darwin's biggest book - and the one he wrote even before turning to the *Descent of Man*, i.e., even before applying evolution to man - was *The Variation of Animals and Plants Under Domestication:* two volumes, 300,000 words, published in 1868. He published no other section of *Natural Selection*. Evans concludes from this: 'Darwin's recognition of the power of selection in changing organisms was almost entirely due to what he learned of plant and animal breeding. Simple as this may seem now, it involved a bold and brilliant step, namely comprehending that he could use the facts and insights of breeding to understand species in nature. Sir Walter Raleigh and others had previously made this assumption, but the belief had grown during subsequent centuries that domesticated varieties were quite unlike wild species, being much more variable as a result of better nutrition and care and liable to revert in its absence' (Evans, p. 133).

I now want to give a sense of his language, first from the big book - Chapter 6, on natural selection, which refers frequently to domesticated animals. On the first page he says, 'If we reflect on the infinitely numerous & odd variations in all parts of the structure of those few animals & plants, on which man may be said to have experimentised by domestication...' (Darwin, 1975, p. 214; Evans, p. 137). He illustrates these with a wealth of examples and then turns to nature. Note the verbs, adverbs and adjectives. He says, 'See how differently Nature acts!. . . She cares not for mere external appearance; she may be said to scrutinise with a severe eye, every, nerve, vessel & muscle; every habit, instinct, shade of constitution, - the whole machinery of the organisation. There will be here no caprice, no favouring: the good will be preserved and the bad rigidly destroyed. . . Nature will not commence with some half-monstrous & useless form. . . Nature is prodigal of time & can act on thousands of thousands generations: she is prodigal of the forms of life.... Can we wonder then, that nature's productions bear the stamp of a far higher perfection than man's product by artificial selection' (Darwin, 1975, pp. 224-5; Evans, p. 137).

In the introduction to the *Origin*, he says, 'At the commencement of my observations it seemed to me probable that a careful study of domesticated animals and cultivated plants would offer the best chance of making out this obscure problem. Nor have I been disappointed; in this and in all other perplexing cases I have invariably found that our knowledge, imperfect though it be, of variation under domestication, afforded the best and safest clue. I may venture to express my conviction of the high value of such studies, although they have been very commonly neglected by naturalists' (Darwin, 1967, p. 4).

In the sketch of 1842 he writes (much of this language gets carried over to the 1844 sketch and to the *Origin)*: 'But if every part of a plant or animal was to vary..., and if a being infinitely more sagacious...' (Darwin and Wallace,1958, p. 44). So we start out with the being man, the selector, the breeder, the horticulturalist, the pigeon fancier, and now he says, 'if a being infinitely nore sagacious than man (not an omniscient creator) during thousands and thousands of years were to select all the variations which tended towards certain ends ([or were to produce causes which tended to the same end]), for instance, if he foresaw a canine animal would be better off, owing to the country producing more hares, if he were longer legged and keener sight - greyhound produced [Darwin is writing cryptic notes]... Who, seeing how plants vary in garden, what blind foolish man has done in a few years, will deny an all-seeing being

in thousands of years could effect (if the Creator chose to do so), either by his own direct foresight or by intermediate means' (pp. 45-6).

In 1857, he wrote to a friend (and reproduced the letter as part of his case for priority over Wallace) of 'a being who did not judge by mere external appearances... I think it can be shown that there is such an unerring power at work in *Natural Selection* (the title of my book), which selects exclusively for the good of each organic being' (Darwin & Wallace, 1958, pp. 264-5). Here we have the cumulative power of natural selection. Indeed, we have the words in the title of this book. How's this for a scientific treatise in a tradition of scientific explanation which is supposed to have banished teleology from science: *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life?* Those terms: selection, preservation, favoured, struggle, indeed 'life' itself, sit uneasily when considered in the light of the reductionist programme in modern philosophy of science.

In fact, Darwin says in the chapter on 'The Struggle for Existence': 'We have seen that man by selection can certainly produce great results, and can adapt organic beings to his own uses, through the accumulation of slight but useful variations, given to him by the hand of Nature. But Natural Selection... is a power incessantly ready for action, and is as immeasurably superior to man's feeble efforts, as the works of Nature are to those of Art' (Darwin, 1967, p. 61).

In the chapter on 'Natural Selection' he again writes quite comfortably in this vein: 'Can the principle of selection, which we have seen is so potent in the hands of man, apply in nature? I think we shall see that it can act most effectually' (p. 80). 'As man can produce and certainly has produced a great result by his methodical and unconscious means of selection, what may not nature effect?' (p. 83). He goes on (this is my favourite passage): 'It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life' (p. 84).

Here we have a cascade of anthropomorphic descriptions of nature. He is showering the reader with examples of what the critics of Victorian poetry call 'the pathetic fallacy' (Miles, 1965), attributing human emotions and intentions to nature: 'acting', 'nature's power of selection', 'skills', 'powers', 'visual power', 'a power intently watching', 'natural selection will pick out with unerring skill'.

He is at it again in the 'Recapitulation and Conclusion' (I shall emphasise the 'offending' phrases): 'There is no obvious reason why the principles which have *acted* so efficiently under domestication should not have *acted* under nature.... If then we have under nature variability and *a powerful agent always ready to act and select*, why should we doubt that variations in any way useful to beings, under their excessively complex relations of life, would be *preserved,* accumulated, and inherited? Why, if man can by patience select variations most useful to himself, should nature fail in *selecting variations useful*, under changing conditions of life, *to her living products?* What limit can be put to *this power, acting during long ages and rigidly scrutinising* the whole constitution, structure, and habits of each creature, - *favouring the good and rejecting the bad*? I can see no limit to *this power, in slowly and beautifully adapting* each form to the most complex relations of life. The theory of natural selection, even if we looked no further then this, seems to me to be in itself probable' (Darwin, 1967, pp. 467, 469).

Wallace couldn't stand it. He wrote to Darwin and said:'I have been so repeatedly struck by the utter inability of numbers of intelligent persons to see clearly, or at all, the self-acting and necessary effects of Natural Selection, that I am led to conclude that the term itself, and your mode of illustrating it, however clear and beautiful to many of us, are yet not the best adapted to impress it on the general naturalist public' (Darwin & Seward, 1903, p. 267). He gives examples of writers who had badly misunderstood Darwin. One of them 'considers your weak point to be that you do not see that "thought and direction are essential to the action of Natural Selection." The same objection has been made a score of times by your chief opponents, and I have heard it as often stated myself in conversation. Now, I think this arises almost entirely from your choice of the term "Natural Selection" and so constantly comparing it in its effects to

Man's Selection, and also your so frequently personifying nature as "selecting", as "preferring", as "seeking only the good of the species," etc., etc. To the few this is a clear as daylight, and beautifully suggestive, but to many it is evidently a stumbling-block' (pp. 267-8). He adds that 'people will not understand that all such phrases are metaphors,' (p. 269) and suggests that Darwin should instead use 'the survival of the fittest' - which seemed to Wallace no different (p. 268). It was only after Darwin didn't pay a blind bit of attention that Wallace wrote 'Mr. Darwin's Metaphors Liable to Misconception'.

Darwin replied, 'I formerly thought, probably in an exaggerated degree, that it was a great advantage to bring into connection natural and artificial selection; this indeed led me to use a term in common, and I still think it some advantage' (pp. 270-71). He said he had just completed a new edition of the *Origin* which was already at the press and concluded with a bit of a tease about Wallace's preferred phrase: 'The term Natural Selection has now been so largely used abroad and at home that I doubt whether it could be given up, and with all its faults I should be sorry to see the attempt made. Whether it will be rejected must now depend "on the survival of the fittest." As in time the term must grow intelligible the objections to its use will grow weaker and weaker' (p. 271).

What Darwin said here adumbrates Richard Rorty's (1989, chs 1-2) theory of the literalization of metaphors - one way of describing the history of science. Scientific ideas begin life as metaphors, retaining richness and ambiguity as the theory develops. As it leads to more and more settled findings, the life and range of possibilities slowly fade from it, leaving only literal truths and less and less research to be done. People become so familiar with it that they cease to experience it as a metaphor. I'll return to this theory in my conclusion.

Darwin did not accept the advice. Was he merely speaking loosely? Is he alone? I'll take the argument in two directions. First, I will confirm your worst fears and then I'll try to give a more mundane version of my point. By 'confirm your worst fears', I mean that you might think I will plunge headlong into animism, panpsychism or some other semi-mystical philosophy of science. Well, in a way I want to say that this was an utterly respectable point of view in the mid-nineteenth century. The father of the modern philosophy of science, William Whewell, who coined the terms 'physicist', 'anode', `cathode', and many more, *did* see the matter in just these terms. He wrote - not sloppily and not crazily - that we have to think of concepts such as 'cause', 'matter', 'force', all key terms in science, as analogous to human intentions. Indeed, he says of the concept of force, 'The original meaning of the Greek word was *muscle* or *tendon*.. Its first application as an abstract term is accordingly to muscular force... The property by which bodies affect each other's motions was naturally likened to that energy which we exert upon them with similar effect... Thus man's general notion of force was probably first suggested by his muscular exertions,' and we always have this comparison implicit when we use the concept of force (Whewell, 1840, Vol. 1, p. 178). He concludes that the concept of force 'arises with our consciousness of our own muscular exertions' (p.179). He goes on to say the same thing of solidity and our concept of matter: we derive the concept of matter by extension of the concept of force through our own efforts. He says 'conceptions of Force, Matter, Solidity, and Inertness' and indeed the touch sense or proprioception are also learned from our muscular frame, and it 'is the main instrument of our perceptions of space' (pp. 180-84).

His is a position in a large debate in the nineteenth century among phenomenalists, idealists, realists and positivists, in which the questions 'What do we mean by these terms?' and 'To what do we refer them?' were carefully considered. Whewell was saying that we mean something that is based finally on human intentions, human experiences - that our conceptions of nature are inextricably connected to our concepts of human purposiveness. The official story is that Whewell lost this fight; the philosophpy of science on the whole turned itself away from this point of view. Even so, it was a perfectly respectable position to hold in the period when Darwin was writing and, as I have argued elsewhere, has always been just beneath the surface in the biological sciences (Young, 1989).

The second example I'll give is Alfred Russel Wallace himself. Some people write dismissively of Wallace that he became a spiritualist and mystic, but in the perspective that he took forward in his philosophy of nature, of matter and mind, were perfectly reputable positions at the time, and it's only

people who don't do their historical homework who don't understand that.

In 1870, he wrote a famous paper in the Darwin literature, 'The Limits of Natural Selection as Applied to Man', in which he departs from Darwin's utterly consistent application of natural selection as applied to man and argues that we cannot deploy naturalistic explanations in every sphere. It is not that aspect of of Wallace's thinking to which I want to draw attention. What I want to emphasise is a set of concepts about matter, mind and force in which he ends up saying with Whewell that all force has to be considered analogous to will-force. He argues that the concept of human will lies behind the physicists' concept of force and that we can't escape this connection when we write and think about nature. That doesn't make physical force into human will, but it says we cannot escape the relationship to human intention and human imagination.

To put it in the terms of the point I'm trying to make in the whole paper: we can't finally divest ourselves completely of the humanocentric and metaphorical overtones of these concepts, even in the basic issues of physics itself. Natural selection doesn't thereby become a deviant form of physics but something which leads us to scrutinise, concepts such as gravity, matter and force again. And if you look at the last section of Wallace's essay on 'The Limits of Natural Selection as Applied to Man', you'll see him making this argument at some length: 'If, therefore, we have traced one force, however minute, to an origin in our own WILL, while we have no knowledge of any other primary cause of force, it does not seem an improbable conclusion that all force may be will-force' (Wallace, 1891, p. 212).

As I've said, there was a heated debate in nineteenth century philosophy of science around these issues. One of my former students, Roger Smith, wrote a very interesting dissertation on it and is likely to return to the topic (Smith, 1970, 1972, 1973). It was a profound debate in the sense that its participants tried to talk about how we relate to reality by getting off the subject-object-mirror theory that is traditional in empiricist epistemology and on to a theory of knowledge in which our humanity and our active relationship with the world lead to our understanding. What Whewell and Wallace held was that learning is not passive but is the consequence of what we do. Therefore, proprioception rather than perception becomes the model for learning. (I have elsewhere developed other aspects of this way of thinking: Young, 1990.)

This line which says that the humanocentric, the anthropomorphic, the evaluative, the subjective cannot be finally be purged from scientific explanation is common parlance in the biological sciences. It's absolutely normal. And it need not be restricted to biology. When Newton applied the concept of *gravitas* to the relations between bodies, he, too, was speaking metaphorically. *Gravitas* did not have the literal meaning we now associate with the mutual attraction between bodies. It was a human attribute. And we still have no idea what gravity is. I remember the first physical science course I ever took. On about the third day I went up to my professor and said 'What is a force?' and he said, 'That is a question which you must not ask. The only answer you will get is that it is the product of mass and acceleration; beyond that we do not speak in science.' He was saying this with irony.

I am saying that Darwin was not alone, and the issue raised by his rhetoric takes us to the heart of the problem of the theory of knowledge in science and more generally. Indeed, the concept of cause, in its original Greek expression, meant 'coming to be' - how things come to be. It wasn't about billiard balls, and it wasn't about action at a distance. There were four kinds of coming to be in Aristotelian explanation: material, efficient, formal and final causes. An explanation required all four elements: that from which - the material element; that which imparted motion or change; the shape or form or type; that for which the purpose or goal. This organic scheme of explanation was carved up and stripped of its anthropomorphic dimensions in favour of a mechanistic scheme of explanation which privileged the notions of matter, motion and number.

Now, I will get to the generalisation and I will give you no more long passages from Darwin. New modes of thinking are expressed figuratively, and there is a whole new philosophy of science and culture which is beginning to take this seriously, to re-orient the understanding of science around that approach. And, of

course, it has implications for whether or not we separate science from the arts, from literature and the rest of culture. The answer is that it is quite silly to make that separation. I wrote a book called *Darwin's Metaphor;* a former colleague of mine, Gillian Beer, has since written a book called *Darwin's Plots,* and so it goes.

The history of science can therefore be seen not as a history of discovery but as a history of metaphor. This is part of a way of thinking in which we see that truth is made and not found. It is made by the use of the rich language of the human imagination drawing on whatever resonances seem appropriate and whatever people find helpful. Indeed, my first philosophy teacher, Richard Rorty, whose ideas I shall outline for the remainder of this essay, gave a series of lectures on this very matter called 'Metaphor' (1986), which he later adapted for his collection of essays, *Contingency, Irony, and Solidarity* (1989). He says that intellectual history should be seen as the history of metaphor (Rorty, 1989, p. 16). The distinction that we make is not between the figurative on the one hand and the literal on the other, but between the familiar and the unfamiliar. Whether or not we consider something metaphorical is a matter of people's cultural experience, because all human expression draws on human experience and has overtones. Literalness is a form of deadness, from the point of view of its theoretical potential and richness. The unfamiliar inspires us to theorise, while the familiar becomes banal and is finally sloughed off like old dead skin.

According to Rorty, the history of metaphor is rather like Darwin's theory of the history of coral reefs. Old metaphors are constantly dying off into literalness and then serving as a platform or a soil for new metaphors (Ibid.). That analogy lets us think of our language, including our scientific language, as something that takes shape contingently rather than as a search for truth 'out there'. As another former colleague, Mary Hesse, says, as a consequence of this situation, 'scientific revolutions become metaphoric redescriptions of nature rather than insight into the intrinsic nature of nature' (Ibid.).

We don't become closer to nature itself or things in themselves, but we represent significant parts of our culture. Indeed, once Kant put a distance between the phenomena and the interpretive action of categories, the concept of metaphor was on its way. It's only a matter of what you choose to call it, once you have postulated that space in knowledge between the thing in itself and its representation. Paradigms, i.e., the Kuhnian concept, are only a scientized form of metaphor and are consequently slightly more acceptable to the scientific community.

There is already a literature on this that I didn't know or didn't know that I knew. There is the work of S.C. Pepper on world hypotheses in which he talks about crude metaphors in culture. He lists them and has a whole schema based on it. There is also Vaihinger's *Philosophy of As-If,* in which he says that 'all knowledge, if it goes beyond simple actual succession and co-existence, can only be *analogical*... metaphors are the main indispensable fictions of all of thought' (Vaihinger, 1935, p. 29). So, to be metaphorical is to be figurative, not literal. To be literal is really to stop things dead. To be figurative is to leave spaces, branch points, something open. A close study of the ways in which Darwin's metaphor of natural selection shows just how fruitfully ambiguous it was (Young, 1985a, ch. 4).

Indeed, if you look at a definition of metaphor, it is 'a figure of speech in which a name or a descriptive term is transferred to some object which in some way is different from, but still analogous to, that to which it is properly applicable' (OED, 1971, Vol. 1, p. 1781). A metaphor opens up a space. It's a space, however, in which the boundary between the aesthetic and the explanatory is completely blurred. That is why it's rich, because of the vagueness. Not just a simile, with the preposition 'like' left out. It is the use of one part of experience to illuminate another. See it this way and say that 'it is this' and see what you can get out of it, instead of 'this is *like* that' (Pepper, 1973, p. 197).

Now these are not wholly new theories. Aristotle wrote, in a cautionary way, about metaphor. By the sixteenth century it was being said that men will sooner discover truth by allegory or metaphor than by other means. A treatise on rhetoric of 1553 says, 'A metaphor is an alteration of a word from the proper and natural meaning to that which is not proper and yet agreeth by some likeness that appeareth to be in it'

(OED, loc. cit.).

If we stop exploring the definitions and ask what it would be like to have non-metaphorical concepts, I find that I've reached the point that I can't imagine what it would be like to strip them of the resonances which make them redolent of human meaning. I simply don't know what it would be like to have a language of that kind, in which people could communicate, in which they could evoke things in other people. It would be simply like one computer speaking to another. We reach a point here where although metaphor assumes that there is something else which isn't metaphorical, it's hard to imagine what it would be like for us to communicate in that way - to have unmediated expressions, unresonant, un-nuanced, closed, settled, finished. It doesn't sound like human consciousness to me.

Rorty argues, in a way that I am in some doubt about, that intellectual progress can be seen as the literalization of selected metaphors. I object to the concept of literalization for the reason I have just given: I can't imagine how it could be a part of communication if it was fully literalized. He says the history of thought is the history of self-creation rather than discovery of truth, that is, the history of metaphor. And Kuhn says that new metaphors make intellectual and moral progress possible.

All of this, of course, would be welcome if we could abandon science as the paradigm mode of discourse to which others are more or less favourably compared. Why should we seek to have human projects underwritten by non-human authority? It seems bizarre. A large historical example is the whole effort to naturalise value systems associated with social Darwinism and functionalist social theory. Social Darwinism attempted to base ethical and economic principles on a highly competitive notion of nature's laws, and functionalist social theory tries to use models drawn from physiology to justify models of society. It's the reigning principle in certain aspects of psychology, anthropology, sociology - the belief that certain models to do with stability, structure, function, adaptation and the concept of the organism, somehow make theories of society more true because they are analogous to biological theory (Young, 1981, 1992).

If we think about metaphors and anthropomorphism in the way I am suggesting, we are forced to conclude that there is no such thing as first philosophy. We shouldn't treat metaphysics as most basic or language as most basic or the philosophy of science as most basic. There are only more or less illuminating and evocative enquiries; there are only things that people find more or less useful in getting on with whatever their projects are.

When I went to university, from Texas, I was a Biblical literalist. I believed in the literal truth of every word in the Bible. It was painful to give that up. I cannot convey to you how painful it was. What beckoned, however, was something that seemed to meet the same needs: philosophy, logic, science - the same kind of search for certainty but without all the guilt. I took home a book in logic as my summer reading after my first year, because I wanted to learn 'how to think'. I still have this book: *Introduction to Logic* by Irving M. Copi (1953). Neatly printed on the flyleaf I find, 'Read Summer 1954'. It starts out by telling one all sorts of fallacies to be avoided if one wants to be rational. I copied them out. There is 'irrelevant conclusion', 'appeal to force', *argumentum ad hominem*, 'argument from ignorance', 'appeal to pity', *argumentum ad populum,* 'appeal to authority', *post hoc ergo propter hoc,* 'complex question', 'equivocation', 'amphibole' (the way oracles speak, e.g., what was said to Oedipus), 'accent' (i.e., fallacies due to stress), 'fallacies of composition'. If one is to learn to avoid bad habits of mind, one must also eschew Bacon's idols: of the tribe (inherent in human nature), the cave (personal prejudices), the market-place (tyranny of words), the theatre (received systems of thought) and the schools (blindly following logician's rules). Having dutifully studied these rules and nostrums, I was sad to discover that I still hadn't learned to think.

When I moved into the history and philosophy of science, there were equally serious warnings, caveats, that we must separate the context of discovery from the context of justification, or testability, or falsifiability. We must police the boundary between fact and values, between science and culture, between science and ideology.

Well, it's a quarter of a century since I was being taught those things, and I want to begin the bit just before my final comment by saying that all I know that is of any use or interest has come from indulging in fallacies - especially the genetic and the pathetic. Everything said about Darwin in this essay and what he said about nature commits the pathetic fallacy. The genetic fallacy is looking into the origins in culture and the motives in people for asking questions in science and for framing criteria for acceptable answers.

Most of what I know about nature is anthropomorphic. Most of what I know about knowledge is metaphoric and ideological and the result of pursuing more and more outlandish articulations under the banner of 'studying over-determination'.

But this sort of knowledge puts one - as a student of the human and biological sciences - on the defensive. I say this because when I was a graduate student, the paradigm case of knowledge was physics, the model by which all other forms of knowledge would measure themselves. Case studies, readers (I think of Feigl and Broadbeck, Weiner), courses, jobs - all pointed to the project of making all other forms of knowledge accountable to, or at least deferential to, the physico-chemical sciences, while philosophy deferred to scientific knowledge as pre-eminent (I am thinking of Reichenbach and Pap as key texts in that period).

Rorty has a lovely essay on this in the last chapter of his book, *Consequences of Pragmatism*. He says the goals in those days were to get philosophpy out of the humanities and into the sciences. I well remember when, in 1969, I gave a paper called 'Persons, Organisms,...and Primary Qualities', in which I showed how physiology and biology had always broken the rules of explanation - the official paradigm of explanation - of modern science. For example, Descartes says, in his *Discourse on Method,* that we must look to Harvey 'who has broken the ice in this matter' and has shown the way we must treat all the rest of knowledge: the heart is a pump and only the mechanical relations in the body are of significance. Yet Harvey says nothing of the kind, nothing of the kind at all. He was an unrepentant Aristotelian, and yet here is Descartes trying to make him into a mechanistic philosopher.

If we look at the writings of von Haller, the father of modern physiology, his key concepts were 'irritability', 'contractility', 'sensibility' - rather like those of Darwin we've been looking at above. You can tell the whole history of biology and especially of physiology in these terms. A perfectly respectable current concept in physiology is 'inherent rhythmycity' (an attribute of the heart's pacemaker fibres). How are those for reductionist concepts?

When I gave a paper to this effect to the British Society for the Philosophpy of Science it was met with stony silence, as though I'd made a rude noise. I was so shattered that I did not seek to publish the essay, though I mined it many times, until I developed the confidence to offer it to a fetschrift for John Greene (Young, 1989). But now, two decades later, the boot is on the other foot. The positivists, the physicalists, the realists, the demarcationists, and other sons and daughters of that paradigm of explanation of modern science, are in full retreat.

The injunction of Newton: from the phenomena of matter and motion to deduce all the other phenomena (and don't mention all my hermetical writings), is gone. Similarly the claim from Galileo: the *Book of Nature* is written in the language of mathematics. The philosophy of science doesn't really see that model as paradigmatic any more. Instead, we think of science in terms of social relations, in terms of a labour process, and increasingly as a form of culture. And philosophy, far from being a handmaiden of science, so far from being a natural kind of knowledge, is, according to Rorty, just the name of one of the pigeon holes into which humanistic culture is divided for administrative and bibliographic purposes.

Natural selection - Darwin's metaphor - needn't therefore embarrass us now, because it's allowed. It's allowed once again to acknowledge the purposiveness, the final causes, the analogies to human intention, embedded in our concepts of and about nature. We need no longer accept Whitehead's sad comment on the results of the scientific revolution. This would be the consequence, if we really took seriously the prohibition from speaking in metaphorical terms: 'Thus the bodies are perceived as with qualities which in reality do not belong to them, qualities which in fact are purely the offspring of the mind. Thus nature gets credit which should in truth be reserved for ourselves: the rose for its scent: the nightingale for his song:

and the sun for his radiance. The poets are entirely mistaken. They should address their lyrics to themselves, and should turn them into odes of self-congratulation on the excellency of the human mind' (Whitehead, 1985, p. 69). For, on a strict reading of the official model of explanation of mechanist, reductionist science, none of these are the properties of nature. 'Nature is a dull affair, soundless, scentless, colourless; merely the hurrying of material, endlessly, meaninglessly' (Ibid.).

Two concluding thoughts. Once we open our ways of thinking about nature to the richness of the human mind, then we should lower the boundary between our understanding of natural processes in conscious terms and the role of unconscious processes in our relations with the world - a reintegration of inner and outer. There are philosophers and psychoanalysts who have begun to do this, for example, D. W. Winnicott. Wilfred Bion, Harold Searles, Donald Meltzer, Karl Figlio. That project should be integrated with what I have argued here, and I have made some efforts to begin to make the connections (see references), but I don't yet feel up to doing it in the same breath.

Lastly, I want to take stock of some wider issues affected by debates about Darwin and biological theories as they bear on official models of explalnation in the history and philosophy of science. Although there are lots of laggards and holdouts, from where I sit, the good folks have won three victories. First, the Malthus-Darwin link is established and clinches the constitutive role of ideology at the heart of scientific theorising. Second, the metaphorical nature of fundamental concepts in so-called basic sciences - affinity, gravity, natural selection - dissolves the barrier between scientific discourse and other modes of expression. Third, the persistent and fundamental role of anthropomorphic and teleological explanations in basic science shows that the banishment of final causes never happened. Back to the drawing board; back to the Renaissance; bring on a science integrated with broader world views, rich modes of expression and the integration of fact and value: moral science.

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