Darwin and the search for an evolutionary mechanism

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Darwin's theory of natural selection needs to be placed in the context of the history of intellectual thought preceeding and contemporary with Darwin. The ideas of Lamarck, Hutton, Adam Smith and Malthus all influenced Darwin's thinking, yet it was political and social theories of the day that did more to shape the concept of progression in human development. Natural selection merely became the mechanism.

The purpose of this article is to place Darwin's theory of natural selection within a number of contexts. One is within the context of his own time in order to understand better why he produced that particular theory. That in turn contributes to understanding subsequent developments in biology, and in social and political thinking. An interesting perspective emerges from placing the theory in context. Some of the basic problems we confront today were already present at the beginning, although expressed in different terms. That makes more intriguing not just the development of the theory, but also its popular triumph.

Another thing that emerges is that the popular understanding of the relationship of animal and human evolution is wrong. It is commonly assumed that Darwin developed the idea of animal evolution and that then led to speculation about human evolution. On the contrary, speculation about the history and development of man was taken over to produce a biological theory. Another misconception is that the acceptance of evolution led to the exclusion of God as a real factor in the operation of the world. That may be somewhat true as far as popular thought is concerned, but in the elite circles in which evolutionary theory was developed, the disregarding of an active God came first and evolution was a consequence.

A concept of progression prior to Darwin

Partly for shock value and partly because it has particular relevance to Australia, where I live, I begin by quoting from two Australian newspapers. Notice the dates carefully, for these come from before the publication of *The Origin of Species* in 1859. The *Geelong Advertiser* of May 2, 1846, in support of the claim that *'the present generation of Aborigines is the last that will have existence'*, writes:

> *'the perpetuation of the race of Aborigines is not to be desired. That they are an inferior race of human beings it is vain to deny (the probable extinction of the race from natural causes is a proof of this); and it is no more desirable that any inferior race should be perpetuated, than that the transmission of a hereditary disease ... should be encouraged.'* [1]

A second example appears in a letter to the *South Australian Register*, August 28, 1850. The writer was arguing against sorrow at what was happening to Aborigines and he drew an analogy:

> *It would be a very decided waste of sorrow to regret that the mosses and lichens and other forms of primitive vegetation should have been supplanted by forest trees.'*[2]

Neither of these quotations employ the magical term 'natural selection', but they reveal a concept of progression in which inferior forms, both non-human and human, are fated to die out as superior forms take over. The point of these illustrations is not to argue that Australia was 'ahead' of the rest of the world, but rather that such ideas were commonplace before Darwin's theory was published. For Australians looking back at our history, they have a particular poignancy, but they force us all to confront the question of what was innovative about Darwin.

There is another significant respect in which a crucial aspect of Darwin's thought was anticipated. It has been argued quite plausibly that Darwin encountered the idea of natural selection in a writer named Edward Blyth.[3] However, Blyth saw natural selection as an anti-evolutionary mechanism. If one assumes that the normal type of the species is adapted to its environment, then any departure from that type will be less fit and will be selected against. Thus with Blyth, natural selection is a homeostatic mechanism to prevent change. Blyth was not the only one to use this argument.[4] Yet Darwin never explicitly addressed the possibility that natural selection could thwart evolution and he presented natural selection as a developmental mechanism.

Darwin claimed[5] that the idea of natural selection came to him from reading Malthus, *An Essay on the Principle of Population.*[6] However, Darwin's history of his ideas has served to perplex historians of science who now have access to his notebooks. To take the most obvious problem: several days before Darwin read Malthus he wrote:

> *All this agrees well with my view of those forms slightly favoured getting the upper hand and forming species.'*[7]

Once again the magic words 'natural selection' do not appear, but the struggle for existence with the stronger winning is very clear.

Some background from British history

To unravel the various strands which contribute to a more complex origin of the theory than Darwin's reconstruction reveals, we have to go back into the history of British thought. British thought in the eighteenth and nineteenth centuries had viewed Isaac Newton as a paragon of scientific thinking.[8] His laws of motion were seen as the model to which scientific explanations should conform. Those laws had found a common explanation for phenomena as diverse as the motion of the planets and the fall of an apple. The view of the universe which was understood as resulting was a universe which was seen to run smoothly, of itself, without needing any tinkering or intervention from without.

In turn, this was built into the theological system we call Deism. According to that theory, God at the beginning established the laws and from that point everything went on without any need of intervention. Indeed, the proof of the perfection of the system, and hence of God's planning, was that God did not need to intervene. The corollary of that is that an evangelical[9] belief in an active deity is a disparagement of God; it implies his laws are not perfect.

The leaven of this sort of thinking worked through cultured society in Britain. It was particularly manifested in Nonconformity in England (that is, groups such as Unitarians and Quakers), and in the 'Moderate' party in the Church of Scotland.

A number of people set out to do for other branches of science what they saw Newton as having done for mechanics and optics. That means they needed to establish laws which would operate perfectly without divine intervention; that could be seen as operating mechanistically; that is, with no factor which could not be pictured as operating in impersonal, mechanical and physical terms.

There is a further aspect to the required model, which might not be obvious just from a knowledge of Newton's laws. The discovered laws had to produce a gradual and constant operation. The Newtonian Universe was seen as a clockwork mechanism which never needed rewinding but went on uniformly and at a constant rate.[10] Hence the processes described had to operate uniformly, if the theory was to be seen as worthy to be ranked with Newton's.

Lamarck, Hutton and Adam Smith

There was a widely accepted model of evolution which Darwin and his circle strongly opposed: the theory of Lamarck. It posed problems because it was French and tainted by association with France of the Revolution. However, there was a more basic reason for rejection. Lamarckianism is generally described today as the inheritance of acquired characteristics, but that leaves out a crucial aspect of the original theory, which was the will of the organism. In the familiar example, the giraffe grows a long neck because it wills to stretch its neck to reach the higher leaves. Will is not a factor which can be pictured mechanically; hence such a theory was not acceptable to Darwin's circle.

For our purposes, these ideas had had a particular impact in Scotland, in what is often called the Scottish Enlightenment of the second part of the eighteenth century. The name that may be familiar from this circle is that of the geologist, James Hutton. His geology is an outworking of this search for processes which go on uniformly and gradually without divine intervention.

The Scottish Enlightenment also included attempts to understand the operation of human society according to Newtonian or Deist principles. We who are heirs of several hundred years of this thinking can easily overlook the obstacles that had to be overcome in constructing a Newtonian theory of society. A history of the development of human society had to be conceived without reference to the Bible, because the Bible tells a history in which God is active. This was well before the discoveries which were used to argue a universal Stone Age for humanity, and before the decipherment of ancient scripts such as hieroglyphics and cuneiform. Thus there was very little material from which to construct the early history of mankind. Another hurdle to be overcome was that no encouragement must be given to those who argued from the sinfulness of mankind, as manifested in society, to the necessity for divine intervention. That is, sin had to be made in some sense a positive force.

The man who attempted this monumental task, and made a very significant impact upon subsequent speculation, was Adam Smith. He tackled the problem of a history of society by what was called philosophical or conjectural history.[11] That is, he took the modes of human existence known at the time and arranged them in what seemed a logical order.[12] He started with tribal hunting societies of North America as his first stage, and pastoral nomads such as Tartars and Arabs as the second. The third stage was agrarian or farming societies, and finally commercial societies such as Britain of his own day. In analysing each stage he placed the emphasis on the forms of property in each stage, and claimed that there was a correlation between the nature of the property and the forms of government possible in that state of society.[13]

Smith's interest in this conjectural history was to construct a history of how human societies develop. It was not a deliberate purpose to create a hierarchy of societies with some viewed as better than others, but it is not hard to imagine how a supposedly historical order of the development of societies was understood as a statement that those which had reached 'later' stages were superior societies.

The second factor which a social theory which denied divine intervention had to deal with was the dynamics of society, and in particular the reality of human sinfulness. Smith's solution was ingenious and has become famous

and influential. He argued that selfishness was a beneficial force in society. The desire of men for greater profit drives the manufacturer to produce cheaper, and the seller to sell cheaper. This of course applies only when there is no external interference with freedom of trade. The antagonism to outside interference fits with the Deist insistence that no outside divine intervention is needed in the running of the Universe: it will run by itself. Thus the selfishness which produces competition is a positive force and promotes the public interest.[14] In discussing this positive effect, Smith uses a figure which has been variously interpreted. He speaks of the user of capital as being 'led by an invisible hand'.[14] Was he using no more than a metaphor, or are we to see this as a reference to divine providence? For our purposes we do not need to resolve that question. What it does reveal is how a process in which God plays no formally acknowledged role is yet described as acting like a beneficent divine providence.[15]

Smith lived as the Industrial Revolution was gathering pace. (James Watt, the inventor of the steam engine, was part of his circle.) Smith observed a tendency towards craft and skill specialisation in early industrial plants, and increased productivity and greater profit as a result.[16] He saw this 'division of labour' as the major cause of the increased productivity of labour.

The studies of Adam Smith and his circle, commonly called 'political economy', became part of the thought of nineteenth century literate society. Some of the great controversies of the century, for example, the debate over free trade, grew out of the issues raised by the political economists.

Malthus' influence

It was also part of intellectual parlance in another way, in that it established a methodology for considering social questions. Another person who put the methodology into effect was Thomas Malthus. He was a clergyman who was troubled by the Utopian arguments that emerged from the atmosphere of the French Revolution; that is, hopes that the world was becoming better and that misery would be eventually replaced by perfect happiness. Malthus argued that population tends to increase geometrically, so that it doubles every so many years. However, food supply increases much more slowly, arithmetically at best. Hence, population growth tends to exceed food supply, and the hoped-for Utopia of mankind can never be reached. The practical application which Malthus drew is that pressure should be placed on people, especially upon poorer people, to delay marriage until they could afford to support a family. Further, welfare for the poor should be discouraged as it encouraged them to have bigger families.

The presuppositions of Malthus are very well illustrated by his discussion of the objection that we have a duty of concern for, and generosity to, the poor. He argues that it is a fact of observation that the passion of self-love is far stronger than the passion of benevolence. Hence this priority must be a law of the Author of nature, and it should guide our thinking.[17] Notice that the presupposition which excludes divine intervention must exclude the possibility of a radical change in human nature consequent upon the Fall. As a result, whatever now prevails in human nature must be a law implanted by God.

Malthus also became part of intellectual discourse. Whether people agreed with his plan of action or not, there was general agreement that the tendency of population to outstrip the food supply was a law of nature.

The standard understanding of the theory of natural selection is that it was discovered independently by two different people, with Malthus being the stimulus for both. The one who tends to be forgotten is Alfred Wallace,[18] a man without pedigree or formal position who earned his living by collecting and selling zoological specimens. His version is that, laid low by malaria in what is today eastern Indonesia, he was thinking through the question of evolution. Malthus came to mind and the idea of natural selection dawned upon him. Upon recovery, he wrote up his theory and sent the paper to Darwin.

Darwin's version is that he happened to read Malthus for recreation and it suggested to him the idea of natural selection or survival of the fittest. However, he did not publish the theory until concerned that the credit would go to Wallace. Then Darwin's powerful friends in the English scientific establishment rallied to support his claim to precedence.

What in Malthus suggested the idea of the survival of the fittest? It is very hard to see anything that would suggest that! Yet it seems to have had the same impact upon two different people. Even if it was the stimulus only to Wallace, and Darwin's version is suspicious, concerned as he was to claim priority, there is no reason to doubt Wallace. Both say that the reality of scarcity of provision, which follows from Malthus' law of population, suggested to them that individuals of a species must be in struggle and competition for resources. Out of that competition will come the survival of the fittest.

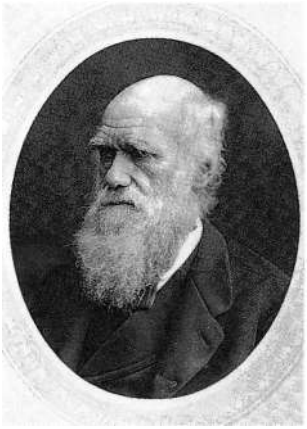
There is interesting evidence[19] that Wallace was pondering the question of the origin of human races, an issue which had concerned him for many years and which confronted him in eastern Indonesia where the Malay and Papuan races met. He was also observant of scarcity of food, and consequent sickness, in some areas he visited. Those observations may have brought Malthus to mind, but, as mentioned earlier, Malthus does not provide the idea of the survival of the fittest as an outcome of the struggle for food.

With Darwin we have even more of a puzzle, because we have more evidence in his notebooks on his thoughts about the transmutation of species. They record what he read and the impact it had on him. The clear statement of his *Autobiography* concerning the impact of Malthus is not reinforced by clear evidence in his notebooks.

The interpretation which is most charitable to Darwin, and which seems best to fit the evidence, is that Malthus shifted Darwin's focus in a significant way. Previously, under the impact of the fossil evidence, he was more concerned with the problem of extinction and hence tended to see nature as a conflict of species against species. Malthus, by drawing his attention to one species — man — facing inadequate food supply, made him think more of competition within the species.

Even if that is the case, the fact of competition does not itself imply improvement and change rather than extinction and death. Indeed, the logic of Malthus was that unless the birth-rate was artificially lowered, there would be more mortality. I would suggest that for both Darwin and Wallace, the ascription of a positive role to competition came from the same source: the role of competition in political economy.[20]

Darwin and his theory



My point earlier about Darwin having met natural selection first as a homeostatic mechanism now takes on an additional significance. Darwin does not explicitly confront the question of when natural selection will be a developmental force and when it will be a homeostatic one. That failure makes sense if he was depending upon a corpus of thought in which the positive effect of competition was one of the basic elements. It could therefore be that Smith's view of competition was so permeating that Darwin was not conscious of the source of this crucial part of his theory.

While such an interpretation does not charge Darwin with deliberately passing over in silence an important objection to his theory, the situation may not have been that simple. If selection is to lead to 'progress', what form will that progress take? Darwin's understanding seems to be that it would lie in the development of specialist lifestyles. In more modern jargon we would say that it would lead to more specialised forms adapted for particular ecological niches. Darwin credited the idea of specialised forms to a French biologist, Milne-Edwards,[21] but Milne-Edwards said that he derived the idea from political economy. That is to be expected, because it is another version of Adam Smith's doctrine that craft and skill specialisation maximises profit. That has created a further question: why can the Frenchman acknowledge the source of the idea in political economy but Darwin makes no mention of the ultimate source of the idea? One suggestion is that Darwin was reluctant because acknowledging that such ideas came from outside of biology would undermine Darwin's claim that his theory was purely from the observed facts of science.[22] The suggestion raises the intriguing but ultimately unanswerable question: were there other elements of his theory which he himself would have known came from political economy but to acknowledge that would have been to weaken the theory? It is an interesting possibility

If Darwin was in many ways indebted to the political economists, why was this fact not brought out in the subsequent controversy? The answer to that question is probably related to the popular success of Darwinism. Many people had accepted the views of political economy, and with many they were so familiar as to sound like common sense truths. Hence their convincing power when presented in biological dress.

However, somebody who did not see the ideas of the political economists as self-evident could see the problem. That man was Karl Marx. While applauding the naturalism and materialism of *The Origin of Species*, Marx was critical of its dependence on the reading of English political and social structures into biological realms.[23]

Darwin's thought, as he responded to the criticisms after the publication of *The Origin of Species*, has generally been seen in terms of his lack of an adequate theory of inheritance. That is, Darwin was pre-Mendel and did not understand genetics. Hence he had no way to answer the objection by Fleeming Jenkins that his postulated slightly favoured and fitter individual would be forced to mate with others less endowed, and hence the advantage would not be passed on entire to the next generation.[24-26] Yet Darwin did have an answer, which consisted in the belief that favourable variations arise constantly and hence will persevere while selection removes the others.[27]

If the line of argument pursued here is correct, there may be a much more basic problem; whether consciously realised by Darwin or not. Selection is not necessarily a developmental force. Therefore a directional impulse had to be imported into the process. That is, a mechanism was needed to make sure the right variants appeared, in sufficient quantity and in the right order. That in turn led to the problem of limits to variation. Most of his critics were willing to concede a limited role to selection but believed the stock of variations was not unlimited.

Darwin therefore shifted emphasis to stress ways in which the environment could provide the needed variation. That is, he talked of a direct action of the environment on the developing organism, or the effect of use or disuse of particular parts of the organism.[28] This has often been lamented by later Darwinians as a concession to Lamarck. However, there was a significant deviation from Lamarck; there is no place here for the role of the organism's 'will' or desire. Darwin was looking for something to complement natural selection, but he wanted it to be something which could be visualised as a mechanical factor congruous with a Newtonian Universe.

In this case, the directional or positive component to accompany his not-necessarily-developmental selection is being smuggled in from the environment itself. By direct action, or by the effect of use and disuse, the environment is conforming the organism to itself and thus giving evolution a direction. What does not seem to have been picked up in the debate is that this mechanism can work only on the assumption that the organism is not already adapted to its environment. If the organism is already adapted, the mechanism, like all other environmental influences, must be homeostatic.

Another way to illustrate Darwin's dilemma is to take the argument from animal and plant breeding. It is built into Darwin's theory to such an extent that 'natural' selection is understandable only from its contrast with artificial selection. Yet domestication formed part of the anti-evolutionary argument, in that domesticated varieties which go wild again tend to revert to the original type.[29] If they revert to original type, domestication has not induced substantial changes. Hence Wallace, in the essay which spurred Darwin into print, repudiated any analogy between natural and artificial selection.[30] An action of the environment on the organism to produce selectable and inheritable variation would solve a number of problems for Darwin. It gave him a positive direction to evolution, producing variations which fitted the environment and a source of new variations in new environments, thus overcoming the objection that variability would be exhausted in time.

One of the puzzles about Darwin is that he did not make more appeal to isolation as a mechanism to aid natural selection. In an isolated small population, the problems of blending inheritance may be minimised. More recent Neo-Darwinian versions of evolution rely heavily upon isolation (allopatric speciation). Darwin was aware from the Galapagos of the potential effects of isolation; yet it plays a relatively minor role in his thinking. It has been suggested that he veered away from the possibility because of the difficulty of a mechanism of isolation with marine organisms.[31] Another suggested consideration is that wide ranging species seemed to him to offer more variability and hence more scope for selection to work.[32] It may be that since, whether he was conscious of it or not, his main image was coming from contemporary or near contemporary Britain, he was not induced to think of small isolated populations. The phenomenon of a changing mercantile and industrial scene with extinction of old ways and emergence of new specialties out of free competition was Britain-wide, and becoming Europe and North America-wide. It did not require isolation to happen. Why then should its biological analogy?

Thus Darwin bequeathed to biology and to thought generally an image of selection acting positively to change organisms into greater specialisations. The problem is that selection is not inherently directional. Just as Darwin did not directly face this problem, neither has modern biology. Most commonly, direction has been smuggled in, in the form of graduated environmental change. For example, Dobzhansky cites an experiment whereby, through gradually increasing the doses of penicillin, one may select for bacteria with penicillin resistance.[33] The direction is provided by the experimenter's gradual increase in penicillin concentration. Certainly natural environments will show that convenient graduation on occasion, but is environmental change, especially when in theory we deny divine guidance, always going to be so obliging? The fact of extinction answers the question; indeed, postulated theories of evolution often have the problem that it is not clear why the mechanism proposed will lead to evolution and not extinction.

Mendel, genetics and political philosophies

As mentioned earlier, Darwin's problem is commonly seen as lack of an adequate genetics, with the consequence that Mendelian genetics has solved the problems which Darwin could not solve: it explained the mechanism of inheritance and it overcame the problem of blending inheritance. However, the fundamental problem of homeostatic versus developmental selection is unchanged. That most mutations are deleterious is an affirmation of homeostatic selection.

Indeed Mendelianism (not Mendel himself), by making genes relatively fixed and the only mechanism of inheritance, created problems for some evolutionists. A consequence of the materialism which Darwin espoused was that man's moral and mental character is as much dependent upon his genes as his body is. Once one eliminates, as remnants of Lamarckianism, this positive influence of the environment, then moral and mental capacity must be controlled by genetic inheritance. That is, there must be inheritable criminal dispositions,[34] and races with genetically inferior mental capacity. No amount of education can change that.

Of course, this is anathema to every Utopian scheme for improving the lot of the human race. Hence Mendelianism tends to be rejected by Left Wing philosophies. On the other hand, the implication that 'superior' groups or races are superior because of an inherited and indelible genetic capacity is attractive to those already in positions of power. Hence it is supported by Right Wing movements.

As mentioned earlier, Marx perceptively criticised the Darwinian mechanism of evolution as reflecting British social and political theory. In a sense, Mendel makes things

worse, because Mendelianism says that the position of classes in society reflects innate genetic constitutions. Hence Marxist 'science' in Russia rejected Mendelianism and opted for Lamarckianism, which is more attractive in saying that environment, and responses to the environment, may induce changes which can be passed on to the progeny, and thus produce relatively rapid and permanent changes in the nature of man. This in turn resulted in serious attempts in Soviet biology, led by Lysenko, to vindicate Lamarck.[35]

While the Soviets were consistent materialists in bringing together their social and their biological theory and thus were in the spirit of Darwin, in the West the two have not consistently been held together. It is common for Left Wing governments in the West to believe that all human social and moral problems can be solved by changing environments, whereas Right Wing governments tend to see criminality as inherent and to see no solution but to lock up more of them. I would suggest that blaming either the criminal's environment or his genes is wrong, in that each is a determinism removing responsibility.

This question leads naturally to that of race. Are there genetically determined differences between races in terms of moral characteristics and IQ? Materialism leaves us caught between ascribing all to genes or all to environmental influences.

Progression in human development

Previously I mentioned Adam Smith's order of lifestyles: hunter-gatherer, pastoral nomad, farmer, commercial society. With Adam Smith, these are an order of historical progression. We observe further, that very simplistically put, black-skinned people seem to be found among the hunters, swarthy people (Tartars and Arabs) among the pastoral nomads, and Europeans in the third and fourth categories. Naturally the question arises: why have some people gone all the way through the historical progression whilst others remain at the first stage? The natural answer is because they are inferior. When they are seen to lose out in competition/ conflict with European settlers, that is further proof of their inferiority.

Note that I did not say all this reasoning came from Smith. I am speaking of what people, not surprisingly, did with it. Note also that this creation of a human hierarchy existed before Darwin, as the Australian examples, with which I began, show. Nevertheless, Darwin had effectively taken over the thought of the political economists and linked the development of animals and man. Does it not follow that if the evolution of amoeba to man is fact, then the development of primitive man to civilised man must be fact also? The triumph of the theory of human evolution happened in close conjunction with the development of a theory of human prehistory in which stone tools found in Europe were taken as proof that the 'Stone Age' seen in some contemporary cultures once prevailed in Europe.

Further, such ideas had a use. Adam Smith had tied these stages to property and government. If hunter-gatherers have no property in land, then the land of such people could be appropriated for other uses without the moral question of stealing arising. If nomads cannot form proper governments, and Arabs were seen very simplistically as nomads, then European powers were justified in taking over Arab lands to help people incapable of ruling themselves.

This use of theories of human development to denigrate some races cannot be seen as a planned consequence on Darwin's part, because Darwin cannot justly be called a racist: for example, his opposition to slavery is well known. Rather, Darwin was part of an attempt to develop a history of the world in which God, except maybe at the very beginning, could be ignored. Attempts to remove God from the picture always have consequences that the planners cannot foresee.

The problem of differences between races was increased rather than diminished by advances in biology. For Mendelianism was taken to imply that all racial differences have a genetic basis. If one race is inferior to another, and the basis of the difference is genetic, there is no way to correct the deficiency.

In this century the debate has taken two very different directions. A study of IQ tests of men inducted into the US army in World War I showed much lower average scores for Blacks. Here was what could be interpreted as evidence of a genetic inferiority.[36,37] Liberal opinion in response argued that the differences represented differences in educational opportunity. Out of such issues came the nature/nurture controversy. Are people's mental abilities and personalities more shaped by the genetic inheritance with which they enter the world, or by what they experience in the world? After much heat and little light it came to be generally — but not universally — recognised that there was no scientific way in which the question could be answered, because to answer it we would have to do barbaric things to children, such as separating them from personal adult influences and watching how they developed in isolation.

Nevertheless, extremists on both sides continued to insist that although proof was inherently impossible, they were right and everybody else was wrong. One representative of that point of view is mainline Feminism. This 'knows' that male and female bodies are genetically determined ('sex'), but that any tendency to traditional male or female roles and feelings is totally due to environmental influences ('gender') and can have nothing to do with inborn propensities. This is in turn an example of a tendency mentioned previously: Left Wing movements that want radical changes in society have to be Lamarckian in stressing the relatively easily changed environmental factors as the crucial ones.

It follows that Right Wing movements tend to be Mendelian: the vices of a race are inherent in their genetic constitution.[38] Hence, in one respect, the ideology of Hitler's final solution was orthodox biology; it refused to divorce man's moral nature from his physical nature. If the biology of the physical nature must be Mendelian, then so must the

biology of the moral and mental nature. Hence the 'dangerous character' of Jewry has a genetic base.[39] The inference is obvious: since genetic defects cannot be remedied, the bearer must be sterilised or even killed.

Conclusion

One moral that comes from the study of intellectual history is the extreme difficulty of separating scientific questions from political, moral and social questions. It is frequently argued that the scientific question of whether man's body evolved can be quite divorced from the ethical and religious questions which face us. I would suggest that the study of the history of evolutionary theory reveals that position as nonsense. Political theories contributed to the shaping of biological thought, and in turn biological theories had great influence upon social and political thinking. Certainly people are not always consistent in bringing all areas of their thought into agreement, but the tendency is for one aspect of our thinking to influence another. The seeing of human society in a certain way by the Scottish Enlightenment led to a seeing of animal life in a certain way. Once the distinction between man and animals was blurred, then people were forced into either the Mendelian or the Lamarckian camp; Feminism or the Final Solution; defend homosexuality or sentence Aborigines to inevitable slaughter. Yet each of these theories and approaches was applied as a form of determinism, denying human responsibility for our actions and our condition. That is the consequence of trying to develop an understanding of the world in which God is deliberately excluded.

References

1. Cited in: Harris, J., 1990. *One Blood*, Albatross, Sutherland, pp. 124 ff.
2. Cited in: Harris, Ref. 1, p. 343.
3. Eiseley, L., 1959. Charles Darwin, Edward Blyth and the theory of natural selection. *Proceedings of the American Philosphical Society*, 103:94-158.
4. Depew, D.J. and Weber, B. H., 1995. *Darwinism Evolving*, Massachusetts Institute of Technology, Cambridge, Massachusetts, p. 105.
5. Darwin, C, 1887. Autobiography. *The Life and Letters of Charles Darwin*, F. Darwin (ed.), Vol. I, 2nd edition, John Murray, London, p. 83.
6. A convenient edition which contrasts the various editions of this work was edited by P. James and published by Cambridge University Press in 1989.
7. de Beer, G. (ed.), 1960. *Darwin's Notebooks on Transmutation of Species, Part III, Bulletin of the British Museum (Natural History)*, History Series, 2(4): 149.
8. In this paper I am not focusing on what Newton himself thought. Hence I use 'Newtonian' to mean what people saw as a consequence of Newton's work, rather than what Newton himself might have thought.
9. I use 'evangelical' in the British rather than the American sense.
10. Depew and Weber, Ref. 4, p. 96.
11. Skinner, A.S., 1979. *A System of Social Science*, Clarendon, Oxford, pp. 68ff.
12. Canaan, E. (ed.), 1937. *An Inquiry into the Nature and Causes of the Wealth of Nations*, Random House, New York, pp. 653 ff.
13. This is significant for the treatment of Australian Aborigines: since hunter-gatherer societies were held to lack property and government structures, there was no question of them having a claim to land.
14. Canaan, Ref. 12, p. 423.
15. It is not my intention to explore the significance of Smith for a Christian theory of economics. A Christian theory would need to explore alternative explanations for phenomena and effects which Smith cites as showing the positive consequences of human sinfulness.
16. Canaan, Ref. 12, pp. 3 ff.
17. Malthus, T.R., 1798. *An Essay on the Principle of Population*, vol. II, p. 213.
18. For the role of Wallace see: Brooks, L., 1984. *Just Before the Origin: Alfred Russel Wallace's Theory of Evolution*, Columbia University Press, New York.
19. Brooks, Ref. 18, pp. 174ff.
20. I am not alone in this view: Gould, S. J., 1990. Darwin and Paley meet the invisible hand. *Natural History*, 99(11): 14-16.
21. Schweber, S.S., 1980. Darwin and the political economists: divergence of character. *Journal of the History of Biology*, 13:197.
22. Schweber, Ref. 21, p. 213.
23. Depew and Weber, Ref. 4, p. 82.
24. Moore, J.R., 1979. *The Post-Darwinian Controversies*, Cambridge University Press, Cambridge, p. 130.
25. Depew and Weber, Ref. 4, p. 131.
26. Bowler, P. J., 1984. *Evolution*, University of California, Berkeley, p. 196.
27. Moore, Ref. 24, pp. 130 ff.
28. Moore, Ref. 24, p. 129.
29. Lyell, C, 1840. *Principles of Geology*, 6th edition, Vol. 3, John Murray, London, p. 35.
30. Wallace, A.R., 1859. On the tendency of varieties to depart indefinitely from the original type. *Journal of the Proceedings of the Linnaean Society*, Zoology, 3:61.
31. Schweber, Ref. 21, p. 209.
32. Depew and Weber, Ref. 4, p. 134.
33. Tax, S. (ed.), 1960. Evolution and environment. In: *Evolution after Darwin*, Vol. 1, University of Chicago, Chicago, p. 411.
34. Lombroso, C, 1911. *Crime: Its Causes and Remedies*, William Heinemann, London.
35. Zirkle, C, 1949. *Death of a Science in Russia*, University of Pennsylvania, Philadelphia. While useful in giving the opinions of Russian biologists in translation, this work does not put the debate in a wider context.
36. Fancher, R.E., 1985. *The Intelligence Men: Makers of the IQ Controversy*, W.W. Norton, New York, pp. 117 ff.
37. Gould, S.J., 1981. *The Mismeasure of Man*, Penguin, London,pp. 192 ff.
38. This is not to say that no attempts were made to develop racist theories within a Lamarckian framework. Chamberlain, H. S., 1910. *Foundations of the Nineteenth Century*, Bodley Head, London is one such attempt.
39. Gimther, H.F.K., 1927. *The Racial Elements in European History*, Methuen, London.

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