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Evolution by Natural Selection and Ethics:

What in evolution has ethical implications?

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Front cover: Soursob (Oxalis pes-caprae L.), as seen in mediterranean Australia, was once a 'hopeful monster', since it is in fact a sterile pentaploid, unable to set seed. Despite this, it is an extraordinarily successful coloniser, producing a carpet of yellow in Spring over hundreds of thousands of hectares. The pollen-collecting bee, also alien to Australia, is wasting the plant's time, since it cannot pollinate other plants of the one giant clone.

Photo: Oliver Mayo

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What in evolution has ethical implications?

‘“Magna est veritas et prævalebit!” Truth is great, certainly, but, considering her greatness, it is curious what a long time she is apt to take about prevailing.’ T. H. Huxley

1 Introduction

The writing of this book was inspired or at least initiated by the reading of a short book by Ferdinand Brunetière. Writing in 1894, Brunetière considered the arguments of the previous half-century about the direction of human evolution. He noted that biologists such as T. H. Huxley had established that progress was not a necessary consequence of change occasioned by natural selection, and that, indeed, regression was possible. In Brunetière's eyes, this vindicated the biblical account of the Fall of Man and the doctrine of Original Sin. (A translation of the remarkable work of Brunetière is set out in the Appendix.)

Progress to Brunetière was only moral or spiritual progress; material advance e.g. scientific progress is irrelevant to the argument he made. Yet increased brain size, above some unknown minimum, has probably been necessary for the evolution of a moral sense, as for other 'higher' attributes. We do not know whether other animals possess such a sense. We see them behave as if they possess shame, as we understand it. Two hundred years ago, Jean Paul's character Dr Katzenberger could ask 'Where is the absolute tie between spiritual shame and the valves in the veins which dam up the blood in the cheeks?' (Paul 1809, p. 77) This was to ask 'How?' 'Why?' was much harder. Darwin first assessed 'What?' Blushing was indeed widespread as a mark of human shame, amongst other emotions. He noted that it had been so recognised for thousands of years e.g. in the Talmud (Old Testament). He speculated that it arose from self-attention which interfered with local blood circulation. How it happens is now understood (e.g. Mellander *et al*., 1982).

Darwin had been dead for two decades when Brunetière wrote his book, but he could well have chosen Huxley as his main source of current evolutionary thinking not just because his work was up to date but because Huxley recognised that evolution by natural selection was not progressive. Darwin, on the other hand, appears always to have held the view, expressed near the end of the Origin of Species (1859, p. 489), that 'all corporeal and mental endowment will tend to progress towards perfection' by means of natural selection. This is not the case, as will be discussed, though any particular adaptation that remains beneficial to an organism will slowly be refined and improved by this means.

It was clear to Brunetière that Man has fallen (e.g. Brunetière par. 5, quoting Calvin 'Original sin is a corruption and hereditary perversity of our nature'). It is not so clear to all believers. Barnes (1924, p. 162–3) wrote: '…the wider teleology, which assumes that in the whole evolutionary process there is purposive action directed to a definite end, is left intact by biological inquiry. We cannot deny that in the evolutionary development of life upon the earth there has been progress, culminating in man; and, by progress, we mean the successive appearance of powers and qualities which we unanimously accept as valuable. We cannot interpret such progress without assuming that it is due to an intelligent Will. It is true that at every stage progress has been largely by environment, and that the whole scheme by which human personality has been evolved seems ultimately dependant on certain properties of inorganic matter.'

De Duve (2009a, 2009b) trod the same path as Brunetière, but informed by his own prodigious contribution to human genetics and understanding of evolutionary biology, and reached much the same conclusions as Brunetière. He went

on to formulate a set of 'options for the future' which he viewed as moral imperatives, but still they were informed by revelation.

It seemed worthwhile to try to evaluate, at least qualitatively, what the post-Brunetière century's research on evolution, especially human evolution might permit us to conclude about the interaction of evolution and ethics, in the absence of revelation. I note views to the contrary, e.g. Coyne (2009, p. 245):

> How can you derive meaning, purpose or ethics from evolution? You can't. Evolution is simply a theory about the process and patterns of life's diversification, not a grand philosophical scheme about the meaning of life. It can't tell us what to do, or how we should behave. And this is the big problem for many believers, who want to find in the story of our origins a reason for our existence, and a sense of how to behave.
>
> Most of us *do* need meaning, purpose and moral guidance in our lives. How do we find them if we accept that evolution is the real story of our lives? That question is outside the domain of science. But evolution can still shed light on whether our morality is constrained by our genetics. If our bodies are the product of evolution, what about our behaviour? Do we carry the psychological baggage of our millions of years on the African savannah? If so, how far can we overcome it?

Some of Coyne's assertions will be addressed in the following pages. As noted above, Brunetière wrote 'science enquires only into the "how" of things, never into the "why"', but this is a 'disastrous error' (pars. 29–30 in Brunetière below).

Coyne's statement that 'Evolution is simply a theory' is curious and warrants brief discussion. Among other things, evolution is an interpretation of observed diversity, of changes in diversity over measured time, of appearances in and disappearances from the fossil record of life forms. Up to a point, it is no more a theory than is a tabulation of the monarchs of France with their dates. Evolution by natural selection is a theory. Evolution by divine creation is a theory. For Brunetière, revelation as set out in the Old Testament of the Bible was not a theory in the same way, since it could not be falsified, only confirmed, or accepted as correct if science disagreed with it. (Some revelations have been falsified, but generally have thereafter been re3interpreted by their adherents.)

I should also say what I am not trying to do. Fain (2008) asks 'Can we prove the law of evolution?' He does not state what 'the' law of evolution is; he appears to accept 'the fact of evolution'. Mayr (1991) said that there were several 'laws of evolution', one of which is that evolution occurs; an interbreeding group of organisms, or species, changes its attributes over time. Extinction is another 'law of evolution': it is the norm, according to the fossil record. Natural selection occurs; we see it in action in our short lifetime. This too is a 'law'. (As Darwin, 1859, p. 469, wrote '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.')

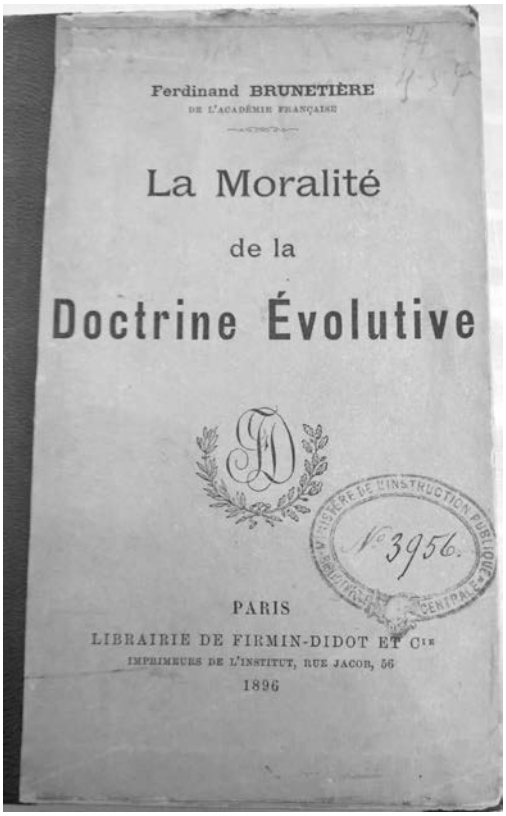
Fain's conclusion, following standard Popperian thinking, is that we cannot prove a law; we can only disprove it. Popper, as cited by Fain, accepts the 'laws' of heredity (Mendel's 'laws') and of natural selection (Darwin's 'law', though he did not call it that). Popper further says that the fact of evolution cannot be disproved, because it is one of a kind, the historical record, written in the rocks and the biosphere. There is confusion here; because evolution is inseparably dependent on chance and necessity, prediction is very difficult, there cannot be biological equivalents to the laws of physics: under certain circumstances, certain consequences must always follow. In biology, everything, including the 'laws of evolution' just mentioned, is probabilistic. This is hardly surprising; biology is not

physics; psychology is not rocket science; it is much more complicated than that.

Fain states that 'the prevalent opinion is that … natural selection explains all evolution on earth, and that from the moment life was created … we can predict the development of life on earth' (Fain, p. 435). Leaving aside the question of who holds this prevalent opinion (I have never met anyone who does), we see that Fain illustrates the confusion perfectly: we are getting better at explaining what has happened, but this does not mean that we can predict what will happen. To give a simple example, from 1897 onwards it was recorded that insects were evolving resistance to insecticides, and such evolution has happened repeatedly (Forgash 1984). How it would occur in any particular case could not be predicted. In experimental production of insecticide resistance, it has usually arisen through selection of small inherited changes, classically Darwinian, whereas investigation of the genetical basis of insecticide resistance in wild populations has shown that a major gene mutation has been increased greatly in frequency in the resistant populations. Modifiers of deleterious pleiotropic effects of the gene may be selected for over time, but the critical point will have been the selection of a rare mutant of a major gene. The same appears to have happened in human populations living in human populations living near the Atacama Desert in Chile, who have evolved tolerance to high levels of arsenic in the water supply (Apata *et al*., 2017).

Fain states further that 'we cannot discover … a theory of evolution' (p. 437). It is my contention that we (starting with Darwin) have discovered such a theory, the theory of evolution by natural selection. Fain does not address this theory, indeed gives no evidence that he has read, for example, *The Origin of Species* (Darwin 1859), *The Genetical Theory of Natural Selection* (Fisher 1999) or even *The Ant and the Peacock* (Cronin 1992), and does not appear to accept well-established basic biology, such as the biparental production of offspring by humans ('A complete living organism develops from semen' p. 431).

The reason for Fain's refusal to address evolution by natural selection as investigated by thousands over 150 years is that he opposes his 'theocentric' worldview to a particular 'atheistic-materialistic or secular one' (p. 428). To Brunetière, 'what is *natural*' is precisely 'what is not *human*' (Brunetière below par. 8). I have devoted so much space to this view because I want to make it clear that this disjunction is irrelevant to my goal, which is to see whether evolution (as seen, mostly brought about by natural selection) guides us or perhaps forces us to particular ethical positions.



'Brunetière's book'

Natural selection is a remarkable agent, metaphorically speaking: it appears to be working towards a goal, as Darwin (1859, p. 186) pointed out 'To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different

amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.' However, as has often been explained, the goal is only there in hindsight; small differences in 'perfection' exist, within and between species. In consequence, for natural selection the end justifies the means because there is no end, in the sense of purpose; the means used by natural selection varies according to the raw material at hand: in many respects, the octopus's eye has a better *Bauplan* than our own, for example.

Working for the benefit of the individual organism, natural selection's focus is on the short term, whatever the perfection wrought over time. Scarpino *et al*. (2016) give a fine contemporary example. If workers stay home during an influenza epidemic, often at the behest of their superiors, the epidemic can spread faster than if the afflicted workers stayed at work. While the conclusion is only provisional, it is probably an example that illustrates how local, short-term adaptive behaviour can produced medium-term negative effects. The imperfection of the human organism is likely to have arisen from selection for short-term adaptation that locks evolution into a path that is adaptive but not optimal because of the starting point. As Brunetière wrote: 'we are the present term of an infinite series of animal ancestors' (Brunetière par. 4 below), taking 'infinite' metaphorically, as did Brunetière, who accepted a first cause.

De Duve (2009a p. 163) made the short-term focus of natural selection a key component of our 'genetical original sin', as he saw it. Humans in particular have, in his view, evolved to make excellent short-term judgements that ignore the long-term consequences of chosen actions. This problem will be seen to be implicit in many of the behaviours discussed below, and of course is evident in almost every aspect of reproduction in particular.

I should also say that I shall for the most part not deal with the evolution of behaviours shared widely in the animal kingdom, though I shall use comparison of behaviours where appropriate. Take, for example, courage. Watching rainbow lorikeets feeding on gum-blossom in an 80 kph wind before a big storm, one sees intuitively where courage comes from: the need to continue a life-sustaining activity in the face of a hostile environment. The birds communicate incessantly as they feed and move about, but there is no need to suppose that they are doing it to keep their spirits up; it is their normal conduct sustained in difficult circumstances. The behaviour has evolved and is basic instinct in action. What needs more explanation at the level with which I am concerned is not a basic instinct itself but the ability to overcome it, Gehlen's 'relief' perhaps (e.g. Delitz, 2011, Chapter 4).

In drawing information from and making comparisons with other species, I therefore do not say that the behaviour in the non-human species is the same, rather that the outcomes are conformable with the human behaviour that has a particular label. An example should make this clear. Darwin (1871/1901, pp. 868–9) wrote

> 'the musical faculties, which are not wholly deficient in any race, are capable of prompt and high development, for Hottentots and Negroes have become excellent musicians, although in their native countries they rarely practise anything that we should consider music. Schweinfurth, however, was pleased with some of the simple melodies which he heard in the interior of Africa. But there is nothing anomalous in the musical faculties lying dormant in man: some species of birds which never naturally sing, can without much difficulty be taught to do so; thus a house-sparrow has learnt the song of a linnet. As these two species are closely allied, and belong to the order of Insessores, which includes nearly all the singing-birds in the world, it is possible that a progenitor of the sparrow may have been a songster. It is more remarkable that parrots, belonging to a group distinct from the Insessores, and having differently constructed vocal organs, can

> be taught not only to speak, but to pipe or whistle tunes invented by man, so that they must have some musical capacity. Nevertheless it would be very rash to assume that parrots are descended from some ancient form which was a songster.'

There is no suggestion in this passage that the acquired song of a parrot is serving the same function as song in humans, rather that the different brain and vocal apparatus of a parrot have produced sounds comparable with human song.

In discussing response to natural selection, I shall have frequent recourse to the concept of heritability, that is, the proportion of observed phenotypic variation that is genetically determined i.e. the ratio of genetical variance (V_A or V_G) to total variance in the trait (V_P), variance being a measure of the amount of variation. This can be broad, in including all genetical variation in the denominator, or narrow, in including only additive genetical variation. Additive genetical variation is the variation always exposed to natural selection, partly determining the rate of change under natural selection (from the 'fundamental theorem of natural selection', Fisher 1999). Heritability, as a ratio, does not indicate how much change can be achieved by selection; that depends on V_A, as Fisher (1951) reminded its users. As a tool in human genetics, heritability has many detractors, and is being rendered irrelevant in human genetics by genomics, but it has been very widely used, so estimates for many human behavioural traits are available, and the studies are in most cases remarkably consistent (Polderman *et al*., 2015).

If we consider a trait fundamental to many others, such as memory, its high heritability (0.4–0.8) is made up of many components, closely linked genetically. Blokland *et al*. (2011) have examined the architecture of the inheritance of memory, by considering activation of specific regions of the brain. The patterns are complex, and highlight the fact that selection on any trait will bring about correlated responses in other traits. The effect of natural selection for improved memory would be very complex at the level of brain function; correlated response will in general be a limitation on progress under selection and hence to the use of V_A or h^2 to assess possible recent selection or likely future selection. Nevertheless, one must begin somewhere; for an account of the expected effects on evolutionary change of genetic correlation, see Blows and Hoffmann (2005).

Across all traits examined in twin studies over half a century, Polderman *et al*. found that heritability averages about 0.5, and for two-thirds of traits studied, resemblance between twins in a pair is accounted for by a simple additive model. It might be thought, therefore that mention of heritability is nugatory, since for almost all human traits, variation exists that could bring about substantial change in the trait by natural selection. However, it is still worth noting, because newer methods will allow interpretation in different ways, particularly through detection and estimation of recent selective change.

If heritability is very low, this may mean that there is very little genetical variation (V_A or V_G is very small), or that phenotypic variation is great (V_P is very large). If V_G is very low, this may mean that the trait has been under strong selection e.g. melanin in European populations (Zaidi *et al*., 2017). That heritability is high and V_P is substantial for a trait suggests lack of strong recent directional selection and perhaps a lack of an extreme optimum for the trait. These are only suggestions; as pointed out by many, e.g. Mayo *et al*. (1990), even when a trait is strongly associated with fitness, persistent V_A does not mean that there is an intermediate optimum. Single gene differences influence complex traits, and persistent V_A in those traits, as I shall consider in a number of cases, but so many have been elusive, apart from those with major deleterious effects, that they cannot contribute greatly to the argument.

It should be noted that many traits differ between sexes, besides those related to sex per se. Karp *et al*. (2017) analysed hundreds of traits in mice specifically to determine which were influenced by sex and found that over half the traits were indeed influenced by sex. Their

concerns were with potential differential drug response, unexpected because trials were carried out on males only, but the concern is more general than that. In the discussion that follows, I have tried not to draw inferences relevant to sex from such trials. I have also drawn attention in a few of many cases to differences between sexes in the inheritance of traits. The overall arguments should not be influenced by any difference between human sexes.

1.1 The question: What in evolution has ethical implications?

This question has two components. First, can anything in biology have ethical implications; is biology relevant to ethics? Secondly, if the answer to the first question is yes, what evolutionary facts, processes or theories have ethical implications?

The answer to the first question seems to be yes: bringing about a human birth has ethical implications, as discussed below, and so does bringing about a death, or so most societies in recorded history appear to have concluded. Perhaps this conclusion is over-simplified, but it is my starting point.

I also begin by accepting the reality of the 'naturalistic fallacy', as introduced by Hume. It is not universally accepted, so I cover it in a separate section. Brunetière noted that Guyau (1885) had attempted to produce an ethics independent of obligations or duties (or indeed sanctions) but dismissed it in a lengthy footnote, saying 'In France, we love to play with words!' (Brunetière below, par. 1 footnote 2)

Anthropocentrism is a closely related source of error. In this light, Huxley (1894a, p. 48) wrote:

> Suppose, for argument's sake, that all mammals and birds are subjects of pleasure and pain. Then we may be certain that these forms of consciousness were in existence at the beginning of the Mesozoic epoch. From that time forth, pleasure has been distributed without reference to merit, and pain inflicted without reference to demerit, throughout all but a mere fraction of the higher animals. Moreover, the amount and the severity of the pain, no less than the variety and acuteness of the pleasure, have increased with every advance in the scale of evolution. As suffering came into the world, not in consequence of a fall, but of a rise, in the scale of being, so every further rise has brought more suffering. As the evidence stands, it would appear that the sort of brain which characterises the highest mammals and which, so far as we know, is the indispensable condition of the highest sensibility, did not come into existence before the Tertiary epoch. The primordial anthropoid was probably, in this respect, on much the same footing as his pithecoid kin. Like them, he stood upon his 'natural rights,' gratified all his desires to the best of his ability, and was as incapable of either right or wrong doing as they. It would be as absurd as in their case, to regard his pleasures, any more than theirs, as moral rewards, and his pains, any more than theirs, as moral punishments.

At the same time, I accept the idea that some ideas may be inconceivable. As Haldane (1928, p. 286) put it, 'Now, my own suspicion is that the universe is not only queerer than we suppose, but queerer than we can suppose. I have read and heard many attempts at a systematic account of it, from materialism and theosophy to the Christian system or that of Kant, and I have always felt that they were much too simple. I suspect that there are more things in heaven and earth than are dreamed of, or can be dreamed of, in any philosophy. That is the reason why I have no philosophy myself, and must be my excuse for dreaming.' A simple example comes from beautiful work on the representation of space and time in the brain. It appears that the hippocampus, which is basic to memory in humans (Scoville and Milner 1957), contains 'time cells' and 'place cells', so named because of