Back to Article page

London Review of Books

Why Pigs Don't Have Wings

Jerry Fodor

Die Meistersinger is, by Wagner's standards, quite a cheerful opera. The action turns on comedy's staple, the marriage plot: get the hero and the heroine safely and truly wed with at least a presumption of happiness ever after. There are cross-currents and undercurrents that make *Meistersinger*'s libretto subtle in ways that the librettos of operas usually aren't. But for once Nietzsche is nowhere in sight and nobody dies; the territory is closer to T*he Barber of Seville* than to *The Ring*. Yet, in the first scene of Act 3, the avuncular Hans Sachs, whose benevolent interventions smooth the lovers' course, delivers an aria of bitter reflection on the human condition. It comes as rather a shock:

> Madness, Madness!
> Madness everywhere.
> Wherever I look . . . .
> People torment and flay each other
> In useless, foolish anger
> Till they draw blood.
> Driven to flight,
> They think they are hunting.
> They don't hear their own cry of pain . . . .
> When he digs into his own flesh,
> Each thinks he is giving himself pleasure.

So 'what got into Sachs?' is a well-known crux for Wagner fans, and one the opera doesn't resolve. (By Scene 2 of Act 3 Sachs is back on the job, arranging for Walther to get his Eva and vice versa.) Sachs isn't, of course, the first to wonder why we are so prone to making ourselves miserable, and the question continues to be pertinent. We have just seen the last of a terrible century with, quite possibly, worse to come. Why is it so hard for us to be good? Why is it so hard for us to be happy?

One thing, at least, has been pretty widely agreed: we can't expect much help from science. Science is about facts, not norms; it might tell us how we are, but it couldn't tell us what is

wrong with how we are. There couldn't be a science of the human condition. Thus the received view ever since Hume taught that *ought* doesn't come from *is*. Of late, however, this Humean axiom has come under attack, and a new consensus appears to be emerging: Sachs was right to be worried; we are all a little crazy, and for reasons that Darwin's theory of evolution is alleged to reveal. What's wrong with us is that the kind of mind we have wasn't evolved to cope with the kind of world that we live in. Our kind of mind was selected to solve the sorts of problems that confronted our hunter-gatherer forebears thirty thousand years or so ago; problems that arise for small populations trying to make a living and to reproduce in an ecology of scarce resources. But, arguably, that kind of mind doesn't work very well in third millennium Lower Manhattan, where there's population to spare and a Starbucks on every block, but survival depends on dodging the traffic, finding a reliable investment broker and not having more children than you can afford to send to university. It's not that our problems are harder than our ancestors' were; by what measure, after all? It's rather that the mental equipment we've inherited from them isn't appropriate to what we're trying to do with it. No wonder it's driving us nuts.

This picture – that our minds were formed by processes of evolutionary adaptation, and that the environment they are adapted to isn't the one that we now inhabit – has had, of late, an extraordinarily favourable press. Darwinism has always been good copy because it has seemed closer to our core than most other branches of science: botany, say, or astronomy or hydrodynamics. But if this new line of thought is anywhere near right, it is closer than we had realised. What used to rile Darwin's critics most was his account of the phylogeny of our species. They didn't like our being just one branch among many in the evolutionary tree; and they liked still less having baboons among their family relations. The story of the consequent fracas is legendary, but that argument is over now. Except, perhaps, in remote backwaters of the American Midwest, the Darwinian account of our species' history is common ground in all civilised discussions, and so it should be. The evidence really is overwhelming.

But Darwin's theory of evolution has two parts. One is its familiar historical account of our phylogeny; the other is the theory of natural selection, which purports to characterise the mechanism not just of the formation of species, but of all evolutionary changes in the innate properties of organisms. According to selection theory, a creature's 'phenotype' – the inventory of its heritable traits, including, notably, its heritable mental traits – is an adaptation to the demands of its ecological situation. Adaptation is a name for the process by which environmental variables select among the creatures in a population the ones whose heritable properties are most fit for survival and reproduction. So environmental selection for fitness is (perhaps plus or minus a bit) the process par excellence that prunes the evolutionary tree.

More often than not, both halves of the Darwinian synthesis are uttered in the same

breath; but it's important to see that the phylogeny could be true even if the adaptationism isn't. In principle at least, it could turn out that there are indeed baboons in our family tree, but that natural selection isn't how they got there. It's the adaptationism rather than the phylogeny that the Darwinist account of what ails us depends on. Our problem is said to be that the kind of mind we have is an anachronism; it was selected for by an ecology that no longer exists. Accordingly, if the theory of natural selection turned out not to be true, that would cut the ground from under the Darwinist diagnosis of our malaise. If phenotypes aren't selected at all, then there is, in particular, nothing that they are selected for. That applies to psychological phenotypes inter alia.

In fact, an appreciable number of perfectly reasonable biologists are coming to think that the theory of natural selection can no longer be taken for granted. This is, so far, mostly straws in the wind; but it's not out of the question that a scientific revolution – no less than a major revision of evolutionary theory – is in the offing. Unlike the story about our minds being anachronistic adaptations, this new twist doesn't seem to have been widely noticed outside professional circles. The ironic upshot is that at a time when the theory of natural selection has become an article of pop culture, it is faced with what may be the most serious challenge it has had so far. Darwinists have been known to say that adaptationism is the best idea that anybody has ever had. It would be a good joke if the best idea that anybody has ever had turned out not to be true. A lot of the history of science consists of the world playing that sort of joke on our most cherished theories.

Two kinds of consideration now threaten to displace natural selection from its position at the centre of evolutionary theory; one is more or less conceptual, the other is more or less empirical.

The conceptual issue. There is, arguably, an equivocation at the heart of selection theory; and slippage along the consequent faultline threatens to bring down the whole structure. Here's the problem: you can read adaptationism as saying that environments select creatures for their fitness; or you can read it as saying that environments select traits for their fitness. It looks like the theory must be read both ways if it's to do the work that it's intended to: on the one hand, forces of selection must act on individual creatures since it is individual creatures that live, struggle, reproduce and die. On the other hand, forces of selection must act on traits since it is phenotypes – bundles of heritable traits – whose evolution selection theory purports to explain. It isn't obvious, however, that the theory of selection can sustain both readings at once. Perhaps the consensus view among Darwinists is that phenotypes evolve because fit individuals are selected for the traits that make them fit. This way of putting it avoids the ambiguity, but whether it's viable depends on whether adaptationism is able to provide the required notion of 'selection for'; and it seems, on reflection, that maybe it can't. Hence the current perplexity.

History might reasonably credit Stephen J. Gould and Richard Lewontin as the first to

notice that something may be seriously wrong in this part of the wood. Their 1979 paper, 'The Spandrels of S. Marco and The Panglossian Paradigm: A Critique of the Adaptationist Programme', ignited an argument about the foundations of selection theory that still shows no signs of quieting. A spandrel is one of those more-or-less triangular spaces that you find at the junctures of the arches that hold up a dome. They are often highly decorated; painters competed in devising designs to fit them. Indeed (and this is Gould and Lewontin's main point), casual inspection might suggest that the spandrels are there because they provide the opportunity for decoration; that, an adaptationist might say, is what spandrels were selected for. But actually, according to Gould and Lewontin, that gets things backwards. In fact, spandrels are a by-product of an arch-and-dome architecture; decide on the latter and you get the former for better or worse. Arches were selected for holding up domes; spandrels just came along for the ride.

I assume that Gould and Lewontin got their architectural history right, but it doesn't really matter for the purposes at hand. What matters is that though spandrels survived and flourished, nothing at all follows about what, if anything, they were selected for. To a first approximation, you have spandrels if and only if you have a dome that's supported by arches; the two are, as logicians say, coextensive. Is it, then, that selection for arches explains why there are spandrels? Or is it that selection for spandrels explains why there are arches? It looks, so far, as though the story could go either way; so what tips the balance? Surely it's that domes and arches are designed objects. Somebody actually thought about, and decided on, the architecture of San Marco; and what he had in mind when he did so was that the arches should support the dome, not that they should form spandrels at their junctures. So that settles it: the spandrels weren't selected for anything at all; they're just part of the package. The question, however, is whether the same sort of reasoning can apply to the natural selection of the phenotypic traits of organisms, where there is, by assumption, no architect to do the deciding. If cathedrals weren't designed but grew in the wild, would the right evolutionary story be that they have arches because they were selected for having spandrels? Or would it be that they have spandrels because they were selected for having arches? Or neither? Or both?

It's a commonplace that Darwin constructed the theory of natural selection with an eye to what breeders do when they choose which creatures to encourage to reproduce. This reading of Darwin is by no means idiosyncratic. Darwin 'argues by example, not analogy,' Adam Gopnik wrote in the *New Yorker* in October last year. 'The point of the opening of "The Origin" isn't that something similar happens with domesticated breeds and natural species; the point is that the very same thing happens, albeit unplanned and over a much longer period.' It's true, of course, that breeding, like evolution, can alter phenotypes over time, with consequent effects on phylogenetic relations. But, on the face of it, the mechanisms by which breeding and evolution operate could hardly be more different. How

could a studied decision to breed for one trait or another be 'the very same thing' as the adventitious culling of a population? Gopnik doesn't say.

The present worry is that the explication of natural selection by appeal to selective breeding is seriously misleading, and that it thoroughly misled Darwin. Because breeders have minds, there's a fact of the matter about what traits they breed for; if you want to know, just ask them. Natural selection, by contrast, is mindless; it acts without malice aforethought. That strains the analogy between natural selection and breeding, perhaps to the breaking point. What, then, is the intended interpretation when one speaks of natural selection? The question is wide open as of this writing.

The answers that have been suggested so far have not been convincing. In particular, though there is no end of it in popular accounts of adaptationism, it is a Very Bad Idea to try and save the bacon by indulging in metaphorical anthropomorphisms. It couldn't, for example, be literally true that the traits selected for are the ones Mother Nature has in mind when she does the selecting; nor can it be literally true that they are the traits one's selfish genes have in mind when they undertake to reproduce themselves. There is, after all, no Mother Nature, and genes don't have, or lack, personality defects. Metaphors are fine things; science probably couldn't be done without them. But they are supposed to be the sort of things that can, in a pinch, be cashed. Lacking a serious and literal construal of 'selection for', adaptationism founders on this methodological truism.

There are delicious ironies here. Getting minds in general, and God's mind in particular, out of biological explanations is a main goal of the adaptationist programme. I am, myself, all in favour of that; since I'm pretty sure that neither exists, I see nothing much to choose between God and Mother Nature. Maybe one can, after all, make sense of mindless environmental variables selecting for phenotypic traits. That is, maybe one can get away with claiming that phenotypes are like arches in that both are designed objects. The crucial test is whether one's pet theory can distinguish between selection for trait A and selection for trait B when A and B are coextensive: were polar bears selected for being white or for matching their environment? Search me; and search any kind of adaptationism I've heard of. Nor am I holding my breath till one comes along.

The empirical issue. It wouldn't be unreasonable for a biologist of the Darwinist persuasion to argue like this: 'Bother conceptual issues and bother those who raise them. We can't do without biology and biology can't do without Darwinism. So Darwinism must be true.' Darwinists do often argue this way; and the fear of hyperbole seems not to inhibit them. The biologist Theodosius Dobzhansky said that nothing in biology makes sense without Darwinism, and he is widely paraphrased. The philosopher Daniel Dennett says that 'in a single stroke, the idea of evolution by natural selection unifies the realm of life, meaning and purpose with the realm of space and time, cause and effect, mechanism and

physical law.' (Phew!) Richard Dawkins says, 'If superior creatures from space ever visit earth, the first question they will ask, in order to assess the level of our civilisation, is: "Have they discovered evolution yet?"' Shake a stick at a Darwinist treatise and you're sure to find, usually in the first chapter, claims for the indispensability of adaptationism. Well, if adaptationism really is the only game in town, if the rest of biology really does presuppose it, we had better cleave to it warts and all. What is indispensable therefore cannot be dispensed with, as Wittgenstein might have said. The breaking news, however, is that serious alternatives to adaptationism have begun to emerge; ones that preserve the essential claim that phenotypes evolve, but depart to one degree or other from Darwin's theory that natural selection is the mechanism by which they do. There is now far more of this sort of thing around than I am able to survey. But an example or two may give the feel of it.

Adaptationism is a species of what one might call 'environmentalism' in biology. (It's not, by any means, the only species; Skinnerian learning theory is another prime example.) The basic idea is that where you find phenotypic structure, you can generally find corresponding structure in the environment that caused it. Phylogeny tells us that phenotypes don't occur at random; they form a more or less orderly taxonomic tree. Very well then, there must be nonrandomness in the environmental variables by which the taxonomic tree is shaped. Dennett has put this idea very nicely: 'Functioning structure carries implicit information about the environment in which its function "works". The wings of a seagull . . . imply that the creature whose wings they are is excellently adapted for flight in a medium having the specific density and viscosity of the atmosphere within a thousand metres or so of the surface of the Earth.' So, phenotypes carry information about the environment in which they evolved in something like the way that the size, shape, whatever, of a crater carries information about the size, shape, whatever, of the meteor that made it. Phenotypes aren't, in short, random collections of traits, and nonrandomness doesn't occur at random; the more nonrandomness there is, the less likely it is to have been brought about by chance. That's a tautology. So, if the nonrandomness of phenotypes isn't a reflection of the orderliness of God's mind, perhaps it is a reflection of the orderliness of the environments in which the phenotypes evolved. That's the theory of natural selection in a nutshell.

But as soon as it's put that way, it's seen not to be the only possibility. External environments are structured in all sorts of ways, but so, too, are the insides of the creatures that inhabit them. So, in principle at least, there's an alternative to Darwin's idea that phenotypes 'carry implicit information about' the environments in which they evolve: namely, that they carry implicit information about the endogenous structure of the creatures whose phenotypes they are. This idea currently goes by the unfortunate soubriquet 'Evo-Devo' (short for 'evolutionary-developmental theory'). Everybody thinks

evo-devo must be at least part of the truth, since nobody thinks that phenotypes are shaped directly by environmental variables. Even the hardest core Darwinists agree that environmental effects on a creature's phenotype are mediated by their effects on the creature's genes: its 'genome'. Indeed, in the typical case, the environment selects a phenotype by selecting a genome that the phenotype expresses. Once in place, this sort of reasoning spreads to other endogenous factors. Phenotypic structure carries information about genetic structure. And genotypic structure carries information about the biochemistry of genes. And the biochemical structure of genes carries information about their physical structure. And so on down to quantum mechanics for all I know. It is, in short, an entirely empirical question to what extent exogenous variables are what shape phenotypes; and it's entirely possible that adaptationism is the wrong answer.

One can think of the Darwinian account of evolution as prompted by the question: why are some phenotypes more similar than others? Darwin's answer was that phenotypic similarity is, pretty generally, explained by common ancestry; and the more similar two creature's phenotypes, the less remote is the nearest ancestor that they share. There are isolated examples to the contrary, but there's no serious doubt that this account is basically correct. And, if it's not the best idea anybody ever had, it's pretty good by any of the local standards. When you ask Darwin's question – why are phenotypes often similar? – you do indeed get Darwin's answer. But if you ask instead why it is that some phenotypes don't occur, an adaptationist explanation often sounds somewhere between implausible and preposterous. For example, nobody, not even the most ravening of adaptationists, would seek to explain the absence of winged pigs by claiming that, though there used to be some, the wings proved to be a liability so nature selected against them. Nobody expects to find fossils of a species of winged pig that has now gone extinct. Rather, pigs lack wings because there's no place on pigs to put them. To add wings to a pig, you'd also have to tinker with lots of other things. In fact, you'd have to rebuild the pig whole hog: less weight, appropriate musculature, an appropriate metabolism, an apparatus for navigating in three dimensions, a streamlined silhouette and god only knows what else; not to mention feathers. The moral is that if you want them to have wings, you will have to redesign pigs radically. But natural selection, since it is incremental and cumulative, can't do that sort of thing. Evolution by natural selection is inherently a conservative process, and once you're well along the evolutionary route to being a pig, your further options are considerably constrained; you can't, for example, go back and retrofit feathers.

That all seems reasonable on the face of it; but notice that this sort of 'channelling' imposes kinds of constraint on what phenotypes can evolve that aren't explained by natural selection. Winged pigs were never on the cards, so nature never had to select against them. How many such cases are there? How often does a phenotype carry information not about a creature's environment but about aspects of its endogenous

structure? Nobody knows.

But it bears emphasis that, on this way of thinking about evolution, the mechanisms by which phenotypes are constructed may very well be numerous and heterogeneous. This is one of the important ways in which evo-devo differs from adaptationism. Darwinists generally hold that natural selection, even if it isn't all there is to evolution, is vastly the most important part. By contrast, channelling couldn't conceivably explain the structure of phenotypes all by itself. But that leaves it open that channelling might be one among many mechanisms by which phenotypes express endogenous structure, and which, taken together, account for (some? many? all of?) the facts of evolution. If, as I suggested, the notion of natural selection is conceptually flawed, such alternatives would be distinctly welcome.

Here's another kind of process that appears to explain some (very striking) facts about phenotype formation, but is quite different from either adaptation or channelling. In fact, it takes us back to spandrels. Gould and Lewontin say that spandrels are an artefact of selection for arches. Lacking arches, domes fall down; so arches are selected for supporting domes. But arches are linked to spandrels for reasons of geometry; so spandrels aren't selected for, they are 'free riders' on selection for arches. The moral is that phenotypic traits can carry information about linkages among the mechanisms that produce them. Free-riding is always suggestive of such linkages, and free-riding is ubiquitous in evolution.

There's a really lovely experiment that provides an example. The working hypothesis was succinctly summarised by Lyudmila Trut in *American Scientist* in 1999: 'Because behaviour is rooted in biology, selecting for tameness and against aggression means selecting for physiological changes in the systems that govern the body's hormones and neurochemicals. Those changes, in turn, could have had far-reaching effects on the development of the animals themselves, effects that might well explain why different animals would respond in similar ways when subjected to the same kinds of selective pressures.' In the vocabulary I've been using: one might expect a galaxy of other phenotypic traits to be endogenously linked to tameness, and hence to free-ride on selection for it. Such properties would co-evolve with tameness even if they have little or no systematic effect on fitness; in effect there would be evolution without adaptation. Moreover, insofar as the genetic and physiological mechanisms that link tameness to its free-riders hold across a range of species, one might expect that selecting for tameness will have similar phenotypic by-products in creatures of quite different kinds.

The experimental investigation of these hypotheses involved forty years of inbreeding for tameness in thirty or so generations of silver foxes. The results are impressive. On the one hand, foxes that were bred for tameness also tended to share a number of other phenotypic

traits. Unlike their feral cousins, they tend to evolve floppy ears, brown moulting, grey hairs, short curly tails, short legs and piebald coloration (in particular, white flashes). Inbreeding for tameness also had characteristic effects on the reproductive cycles of the foxes and on the average size of their litters. And these are all traits that other domestic animals (dogs, cats, goats, cows) also tend to have. An adaptationist might well wonder what it is about dogs, cats etc that makes curly tails good for their fitness in an ecology of domestication. The answer, apparently, is 'nothing'. Curly tails aren't fitness enhancing, they just happen to be linked to tameness, so selection for the second willy-nilly selects the first.

This case is much like that of spandrels, but much worse from an adaptationist's point of view. You can explain the linkage between domes, arches and spandrels; the geometry and mechanics of the situation demands it. But the ancillary phenotypic effects of selection for tameness seem to be perfectly arbitrary. In particular, they apparently aren't adaptations; there isn't any teleological explanation – any explanation in terms of fitness – as to why domesticated animals tend to have floppy ears. They just do. It's possible, of course, that channelling and free-riding are just flukes and that most or all of the other evolutionary determinants of phenotypic structure are exogenous. It's also possible that palaeontologists will someday dig up fossilised pigs with wings. But don't bet on it.

So what's the moral of all this? Most immediately, it's that the classical Darwinist account of evolution as primarily driven by natural selection is in trouble on both conceptual and empirical grounds. Darwin was too much an environmentalist. He seems to have been seduced by an analogy to selective breeding, with natural selection operating in place of the breeder. But this analogy is patently flawed; selective breeding is performed only by creatures with minds, and natural selection doesn't have one of those. The alternative possibility to Darwin's is that the direction of phenotypic change is very largely determined by endogenous variables. The current literature suggests that alterations in the timing of genetically controlled developmental processes is often the endogenous variable of choice; hence the 'devo' in 'evo-devo'.

But I think there's also a moral about what attitude we should take towards our science. The years after Darwin witnessed a remarkable proliferation of other theories, each seeking to co-opt natural selection for purposes of its own. Evolutionary psychology is currently the salient instance, but examples have been legion. They're to be found in more or less all of the behavioural sciences, to say nothing of epistemology, semantics, theology, the philosophy of history, ethics, sociology, political theory, eugenics and even aesthetics. What they have in common is that they attempt to explain why we are so-and-so by reference to what being so-and-so buys for us, or what it would have bought for our ancestors. 'We like telling stories because telling stories exercises the imagination and an imagination would have been a good thing for a hunter-gatherer to have.' 'We don't

approve of eating grandmother because having her around to baby-sit was useful in the hunter-gatherer ecology.' 'We like music because singing together strengthened the bond between the hunters and the gatherers (and/or between the hunter-gatherer grownups and their hunter-gatherer offspring)'. 'We talk by making noises and not by waving our hands; that's because hunter-gatherers lived in the savannah and would have had trouble seeing one another in the tall grass.' 'We like to gossip because knowing who has been up to what is important when fitness depends on co-operation in small communities.' 'We don't all talk the same language because that would make us more likely to interbreed with foreigners (which would be bad because it would weaken the ties of hunter-gatherer communities).' 'We don't copulate with our siblings because that would decrease the likelihood of interbreeding with foreigners (which would be bad because, all else being equal, heterogeneity is good for the gene pool).' I'm not making this up, by the way. Versions of each of these theories can actually be found in the adaptationist literature. But, in point of logic, this sort of explanation has to stop somewhere. Not all of our traits can be explained instrumentally; there must be some that we have simply because that's the sort of creature we are. And perhaps it's unnecessary to remark that such explanations are inherently post hoc (Gould called them 'just so stories'); or that, except for the prestige they borrow from the theory of natural selection, there isn't much reason to believe that any of them is true.

The high tide of adaptationism floated a motley navy, but it may now be on the ebb. If it does turn out that natural selection isn't what drives evolution, a lot of loose speculations will be stranded high, dry and looking a little foolish. Induction over the history of science suggests that the best theories we have today will prove more or less untrue at the latest by tomorrow afternoon. In science, as elsewhere, 'hedge your bets' is generally good advice.

As for Sachs, I wouldn't think of arguing that we are either mostly happy or mostly good. But I doubt that's because of what our minds were selected for. Maybe the real trouble is that our neurones aren't hooked together quite right, or that some of our hormones aren't entirely reliable; with the effect, in either case, that getting some of the things we want isn't compatible with getting the others. Or that some of them we can't have at all. Anyhow, for what it's worth, I really would be surprised to find out that I was meant to be a hunter-gatherer since I don't feel the slightest nostalgia for that sort of life. I loathe the very idea of hunting, and I'm not all that keen on gathering either. Nor can I believe that living like a hunter-gatherer would make me happier or better. In fact, it sounds to me like absolute hell. No opera. And no plumbing.

Vol. 29 No. 20 · 18 October 2007 » Jerry Fodor » Why Pigs Don't Have Wings (print version)
pages 19-22 | 5138 words

Letters

Vol. 29 No. 21 · 1 November 2007

From Simon Blackburn

My colleague Jerry Fodor has added his name to the list of those who have taken themselves to have 'conceptual' objections to the idea of adaptation by natural selection (*LRB*, 18 October). His problem is fortunately quite easily solved. He takes from Stephen Jay Gould and Richard Lewontin the question: if two traits occur together, how do we know which was 'selected' for without appeal to the mind of a designer? Fodor urges that when we take away the designer, the question is unanswerable, unless we make a metaphorical and flat-footed appeal to Mother Nature. But this is not so. Two traits may be found together in nature, but one can play a causal role in producing a reproductive advantage, when the other does not. It may be that all and only vertebrates with eyes weigh a little bit extra because they carry various proteins (crystallins) around that go to making up eyeballs. But the sensitivity to light is what gives the advantage, not the little bit of extra weight due to carrying crystallin. Otherwise flatfish might as well have eyes on their undersides, and we might have turned out blind, but with devices for holding crystallin in our armpits. Similarly Fodor triumphantly asks whether it is being white or being the same colour as the environment that is good for polar bears. A brief look at the life of polar bears, and other bears, and animals such as ptarmigan or mountain hares that change colour with the seasons, forces just one answer. Camouflage helps across the board; being white only helps when it coincides with it.

Simon Blackburn
Department of Philosophy, University of Cambridge

From Tim Lewens

When one is consciously designing something, it makes perfect sense to say that some features are there on purpose, others mere side-effects of intentional decisions. Jerry Fodor thinks that no parallel distinction is available in the mindless world of evolution, hence there is no way to say which organic traits are adaptations, and which are merely side-effects of selection going on somewhere else. This, he believes, means that the very ideas of adaptation and natural selection are incoherent.

Yet Fodor's comments later in his article suggest a perfectly good answer to a problem he says is insoluble. He tells us that 'curly tails aren't fitness-enhancing, they just happen to be linked to tameness, so selection for the second willy-nilly selects the first.' To be sure, he is discussing an example of an artificially selected trait. Even so, the conceptual resource he uses to distinguish between the trait that is selected for, and the trait that is merely linked to one that is selected for, is fitness enhancement, and there is nothing in this concept that draws on notions of what a designer intentionally

chooses. If Fodor's test for adaptation works in the realm of artificial selection, it works in the realm of natural selection, too.

Further, Fodor suggests that most attempts to make adaptation respectable appeal to suspect metaphors of what Mother Nature is aiming at. Some do, but here is the philosopher of biology Elliott Sober's solution to the problem, which he gave in 1984, and which is basically the same as Fodor's own implicit proposal: '"Selection of" pertains to the effects of a selection process, whereas "selection for" describes its causes. To say there is selection for a given property means that having the property causes success in survival and reproduction.' If a property doesn't cause success in survival and reproduction, but is linked to one that does, then there is no selection for that property. This is precisely why Fodor thinks that although there is selection of curly tails, there is no selection for curly tails.

Finally, Fodor tells us that 'the crucial test is whether one's pet theory can distinguish between selection for trait A and selection for trait B when A and B are coextensive: were polar bears selected for being white or for matching their environment? Search me; and search any kind of adaptationism I've heard of.' What adaptationists need is a test that tells them, for example, whether there is selection for polar bears having white fur, having warm fur, or both. The Fodor/Sober test can tell us that: if we dye the fur of polar bears green and there is no impact on their survival or reproduction, then this provides evidence that there is selection for warm fur, and that whiteness simply follows along because whiteness and warmth are linked. But it is not necessary that our test tell us whether there is selection for whiteness or for matching the environment. If you dyed the fur of polar bears green, then they would also fail to match their environment. If we then observe that they do worse in terms of survival and reproduction, our test suggests that there is selection both for being white, and for matching the environment. But that is hardly surprising, because polar bears are camouflaged in virtue of being white. The fact that our test doesn't discriminate between selection favouring whiteness and selection favouring matching the background doesn't show that we have a test with no discriminatory power. It consequently fails to undermine the distinction between 'selection of' and 'selection for', it fails to show that the concept of adaptation is flawed, and it fails to make problems for natural selection.

Tim Lewens
History and Philosophy of Science, University of Cambridge

From Ian Cross

There is a significant word missing from Jerry Fodor's entertaining dismissal of Darwinian theory: variation. Darwin starts *The Origin of Species* by ruminating on the causes of variation within species, particularly species that have been domesticated. Variation allows for differential chances of survival of members of a species through

processes of natural selection; some, by virtue of being somewhat different from their conspecifics, will be better able to cope with environmental pressures and be more likely to survive, procreate and hence pass on their genes to the next generation. This is why, in Darwin's original formulation, evolution occurs through processes of natural variation and natural selection. What Fodor appears to be attacking is not so much natural selection but rather an extreme adaptationist view of the evolutionary process wherein each and every trait of an animal is held to arise as an adaptation to the environment. But it would be difficult to find any reasoned expression of such a view; as Fodor himself points out, pigs don't have wings not because it would not be evolutionarily advantageous for them to fly, but because they're just not built that way.

Ian Cross
Faculty of Music, University of Cambridge

Vol. 29 No. 22 · 15 November 2007

From Jerry Coyne, Philip Kitcher

Jerry Fodor makes the striking claim that evolutionary biologists are abandoning natural selection as the principal, or even an important, cause of evolutionary change, and that 'it's not out of the question that a scientific revolution – no less than a major revision of evolutionary theory – is in the offing' (*LRB*, 18 October). This is news to us, and, we believe, will be news to most knowledgeable people as well. The idea of natural selection is, in fact, alive and well, and remains the only viable explanation of the apparent 'design' of organisms – the remarkable fit between them and their environments and lifestyles – that once was ascribed to the divine.

Fodor's 'conceptual' charge against natural selection is that the whole notion is incoherent. Breeders can select for features of organisms, because they can identify the traits they wish to develop. Unless you have some illicit personification – Mother Nature – who observes and chooses, natural selection doesn't work like that. So, to cite Fodor's example, we can't tell whether polar bears were selected for being white or for matching their environment. This is very odd reasoning. The concept of 'selecting for' characteristics is largely a philosopher's invention, one put to hefty work by philosophers of mind and language in particular as they strive to understand how psychological states can have content. Fodor knows all this, but he seems to know nothing about the way the notion of natural selection has been used in evolutionary explanations for the past 148 years.

Darwin would have seen the history of the polar bears along the following lines: some ancestors had different versions of the hereditary material that caused them to be paler than their fellows; this difference caused them to be less visible to their prey in their Arctic environment, and thus to have an edge when it came to hunting; that edge made

them more successful in leaving descendants who inherited the fortunate variation. After Mendel, Thomas Morgan, Watson and Crick, we can do better: the ancestral bears had some difference in their DNA (perhaps a mutation or a gene rearrangement); that difference led to a difference in the type or expression of proteins affecting the biochemistry of hair follicles; that difference led to paler fur and a better match to the surroundings, producing greater prowess in hunting and increased reproductive success. Nobody has to decide if there was selection 'for' the modified DNA, or 'for' the protein differences, or 'for' the different organisation of the cells, or 'for' the whiteness, or 'for' the camouflage.

It is easy to see that natural selection makes sense of the important distinctions. Suppose, by some accident, that all and only the bears with the lucky variation were born on a Thursday. It would not follow that bears have been selected 'for' being born on Thursdays. This was an important insight underlying the work of Stephen Jay Gould and Richard Lewontin, cited by Fodor. In philosophical discussions, that insight has grown in an extraordinarily distorted fashion, so that philosophers struggle to develop a notion of 'selection for' that will discriminate finely among all traits. That is a mug's game, as Fodor correctly sees. It is a large leap, however, to suppose that the fact that you cannot make all distinctions means that you cannot make any. As the bear example illustrates, biologists can make the important distinctions. Whiteness and camouflage (along with protein balances and forms of genetic material) are candidates 'for' natural selection because they figure in the causal history of the changes in the bears; being a Thursday's cub isn't a candidate because it doesn't play a comparable causal role.

Fodor's second argument turns on an 'empirical' issue. Allegedly, 'serious alternatives to adaptationism have begun to emerge.' The rival mechanisms Fodor cites are supplements to natural selection, not replacements. Moreover, they are further articulations of ideas that have been evolutionary orthodoxy for generations. The first of Fodor's alleged alternatives is 'evo-devo', the field of evolutionary developmental biology. The remit of evo-devo is to explain how adaptive differences in animal form – say, the camouflage patterns on butterfly wings that protect them from predators – have resulted from the way the genes themselves behave (how particular genes deposit pigment in the right place on a wing). Evo-devo is not an alternative to adaptation; rather, it is a way to explain how the genes mechanistically produce adaptations. In fact, Sean Carroll, one of the most prominent 'evo-devotees', notes in his recent book, *Endless Forms Most Beautiful,* that evo-devo is completely consistent with the Darwinian theory of natural selection producing adaptations via cumulative genetic change. The constraints of development may tell us why an eye, for example, has a particular form (our retina lies behind the blood vessels and nerves that feed it because retinas evolved from everted portions of the brain), but they cannot tell us why eyes are there in the first place. They are there because the gradual acquisition of vision gave animals a leg up in the evolutionary struggle for existence.

Similarly, as Fodor notes, many features of organisms can be by-products of evolution

rather than the direct objects of natural selection. Our blood is red, for example, not because it is good for blood to be a particular colour, but because the haemoglobin molecules that carry oxygen absorb light in such a way as to make them red. But the 'by-product' explanation cannot explain apparent design. Why are so many animals camouflaged to match their background? Can that be a result of evo-devo or a mere by-product of something else? Neither is likely. Experiments have shown that more camouflaged animals are eaten less often by predators. This is exactly what you'd expect if natural selection built such adaptations, and not what you'd predict if camouflage resulted simply from developmental constraints or was a by-product of something else. And how do Fodor's alternatives explain the sharp teeth of sharks or the ability of some Arctic fish to load their blood with 'antifreeze' proteins to keep them from freezing solid in cold waters? Adaptation is not a failed explanation: it is a testable hypothesis, and has been tested – and confirmed – many times over.

Jerry Coyne, Philip Kitcher
University of Chicago, Columbia University

From Daniel Dennett

I love the style of Jerry Fodor's latest attempt to fend off the steady advance of evolutionary biology into the sciences of the mind. He tells us that 'an appreciable number of perfectly reasonable biologists' are thinking seriously of giving up on the half of Darwinism that concerns natural selection. Did you know that? I didn't. In fact, I wonder if the appreciable number is as high as one. Fodor gives no names so we'll just have to wait for more breaking news. He does provide two of his favourite foretastes, however: evo-devo and the famous case of the domesticated Russian foxes. These interesting developments both fit handsomely within our ever-growing understanding of how evolution by natural selection works. Briefly, evo-devo drives home the importance of the fact that in addition to the information in the genes (the 'recipes' for making offspring), there is information in the developmental processes (the 'readers' of the recipes), and both together need to be considered in a good explanation of the resulting phenotypes, since the interactions between them can be surprising. Of course the information in the developmental processes is itself all a product of earlier natural selection, not a gift from God or some otherwise inexplicable contribution. The foxes are a striking instance of how selection acting on one trait can bring other traits along with it – which may then be subject to further selection. It corrects the naive assumption that *everything* is directly evolvable – docile foxes with zebra stripes, or green foxes, or pigs with wings – but nobody makes that assumption, aside from the straw men constructed by some ideologues.

I won't bother correcting, one more time, Fodor's breezy misrepresentation of Gould and Lewontin's argument about 'spandrels', except to say that far from suggesting an alternative to adaptationism, the very concept of a spandrel depends on there being adaptations: the arches and domes are indeed selected for, and they bring spandrels

along in their wake. No 'perfectly reasonable biologist' has claimed that the hugely various and exquisitely tuned sense organs of animals, or the superbly efficient water-conserving methods of desert plants, are spandrels, even if they spawn spandrels galore.

What could drive Fodor to hallucinate the pending demise of the theory of evolution by natural selection? A tell-tale passage provides the answer: 'Science is about facts, not norms; it might tell us how we are, but it couldn't tell us what is wrong with how we are. There couldn't be a science of the human condition.' There can indeed be a science of the human condition, but it won't tell us, directly, 'what is wrong with what we are'. It can, however, constrain our ultimately political exploration of what we think we ought to be by telling us what is open to us, given what we are. Fodor's mistake, which he is hardly alone in making, is to suppose that if our minds are scientifically explicable bio-mechanisms, then there could not be any room at all for values. That just does not follow, but if you believe it, and if you cherish – as of course you should – the world of values, then you have to stand firm against *any* physical science of the mind. It's admirable, in a way, if you like that kind of philosophy. But it is better to repair the mistake; then you can have a science of the mind and values too. And you don't have to misrepresent science out of fear of what it might be telling us.

Daniel Dennett
Tufts University

From Steven Rose

Jerry Fodor's attack on ultra-Darwinian pan-adaptationism (and Flintstone evolutionary psychology) is spot on, but he does less than justice to Darwin, or to modern pluralistic evolutionary theory. Fodor argues that Darwin was unwise to draw analogies between the artificial selection employed by animal breeders and the mechanism of natural selection. But whether the selection pressure is provided by breeders choosing among pigeons for the most spectacular fantail, or a lion-rich environment selecting for faster-running antelopes, the analogy holds. The difference is that, far more than in artificial selection, the natural environment itself changes in response to the presence of the faster-running antelopes (more intensive grazing, reduction in lion population or whatever). The metaphor of selection is unfortunate as it implies that the 'selected' organisms are merely passive, whereas in fact organisms select environments just as environments select organisms.

Furthermore, Darwin was himself a pluralist; as he insisted in later editions of the *Origin of Species*, natural selection is only one of a number of motors of evolutionary change. Modern selection theory (in the hands of other than ultra-Darwinists) recognises multiple levels at which selection works: gene, genome, organism (phenotype), population and species. It also recognises that what evolves is not an adult phenotype but an entire developmental system (faster-running antelopes do not

emerge fully grown). By contrast with pan-adaptationism, pluralistic evolutionary theory recognises the presence of spandrels (non-adaptive features of a phenotype, such as the red colour of blood) and exaptations: features originally selected with one function which then come to have another, such as feathers, which were a thermo-regulatory mechanism before they took on their role in flying birds.

Steven Rose
Open University, Milton Keynes

From Colin Tudge

Jerry Fodor tells us: 'There is no Mother Nature.' This is biology's common assumption (and was probably Darwin's), but it does not come out of science. It is a piece of metaphysical dogma. Many philosophers and scientists argue that 'mind' is part of the fabric of the universe, and this embedded intelligence might indeed be equated either with 'Mother Nature' or with God in such a way that imbues the universe with purpose. This is a perfectly reasonable position, and Fodor's denial is simply a decision, common to all atheists, not to take this position seriously. Darwin's idea of evolution by means of natural selection is perfectly compatible with the idea of God, as many theologians and quite a few scientists acknowledged as soon as *Origin* was published.

It is a long time now since I read Dobzhansky's essay of 1973, but it was not called 'Nothing in biology makes sense without Darwinism'. It was called 'Nothing in biology makes sense except in the light of evolution' (*American Biology Teacher*, Vol. 35). Since Fodor is at pains to point out that 'evolution' should not be conflated with 'Darwinian natural selection', this is a strange lapse. In fact, Dobzhansky admired Teilhard de Chardin, who came very close to saying that intelligence is embedded in the fabric of the universe.

Colin Tudge
Wolvercote, Oxfordshire

From Kit Evans

San Marco may well have spandrels, but what Jerry Fodor describes as 'those more-or-less triangular spaces that you find at the junctures' – junctions, surely? – 'of the arches that hold up a dome' are actually pendentives, the principal innovation of Byzantine architecture. A spandrel has nothing to do with a dome, being the panel formed between the curve of the arch and the horizontal base of the entablature it supports. Spandrels are therefore flat, while pendentives are curved in three dimensions.

Kit Evans
Celles, France

Vol. 29 No. 23 · 29 November 2007

From Jerry Fodor

A perceptible flurry in the dovecote. Here are some replies to my critics. It seems to me that Simon Blackburn has comprehensively missed the point (*LRB*, 18 October). He takes the problem I raised to be epistemological: 'If two traits occur together, how do we know which was "selected" for?' But I don't do epistemology, and that isn't what I'm worried about (nor, by the way, is it what worried Gould and Lewontin). My question was: how can the operation of selection distinguish traits that are coextensive in a creature's ecology? Perhaps news about mountain hares and such tells us what colour was selected for in polar bears. But selection didn't consider mountain hares when it coloured polar bears. Nor, quite generally, did it consider such counterfactuals as 'what would happen to white bears if the colour of their environment changed?'

The same applies to Tim Lewens's line of thought. The selection of colour in polar bears can't be contingent on such counterfactuals as: 'what if one dyed their fur green?' In fact, it can't be contingent on any counterfactuals at all. We can apply the 'method of differences' to figure out what colour evolution made the polar bear; but selection can't apply the method of differences to figure out what colour to make them. That's because we have minds but it doesn't.

Some of my critics point out the importance of linkage as a mechanism that might explain why, for example, domesticated foxes have floppy ears. Quite so, but linkage is an endogenous trait, and adaptationism is committed to explaining phenotypes by reference to exogenous variables.

The same applies to the remarks by Steven Rose (Letters, 15 November). To give up on the idea that selection is determined by largely exogenous forces is to abandon adaptationism in all but name. No doubt, if we knew enough about the macro and microstructure of organisms (and of their ecologies) we would understand their evolution. If that's adaptationism, then I'm an adaptationist too (and so is every materialist since Lucretius).

Jerry Coyne and Philip Kitcher make the usual mistake. In fact, I am not worrying about whether we can tell if 'polar bears were selected for being white or for matching their environment'. I repeat: I don't do epistemology. Nor do I deny that we can often focus on different aspects of the causal history underlying an episode of selection. The problem is that it makes no sense at all to speak of the aspect of a causal history that selection focuses on; to say (as it might be) that selection focused on the whiteness of the polar bear rather than its match to the surround. Selection doesn't focus: it just happens.

Coyne and Kitcher then say that 'the concept of "selecting for" characteristics is largely a philosopher's invention.' I don't know who invented it, but that can't be right. If the

theory of adaptation fails to explain what phenotypic traits were selected for, it won't generalise over possible-but-not-actual circumstances; it won't, for example, tell us whether purple polar bears would have survived in the ecology that supports ours. It will not be 'news to most knowledgeable people' that empirical theories are supposed to support relevant counterfactuals. If adaptationism doesn't, that *is* news.

Coyne and Kitcher suggest that evo-devo doesn't purport to be an alternative to adaptationism but rather is 'consistent with' natural selection. That's right but not relevant. Part of my point was that if adaptationism is independently incoherent (as, in fact, I believe it to be) then we're in want of an alternative. Evo-devo may reasonably be considered a step towards supplying one.

They also say that it doesn't matter whether selection can draw all the distinctions between traits so long as it can draw the important ones. I don't know how they tell which ones are important, but they ought to bear this in mind: selection is insensitive to the difference between any traits that are even *locally* confounded (i.e. that are confounded in a creature's actual history of causal interactions with its ecology). It can't, for example, distinguish encounters with big tails from encounters with colourful tails if all and only the big tails Miss Peacock has come across are colourful. (Of course, *we* can tell the difference between selecting for one and selecting for the other; that's because, unlike natural selection, we have minds.) If it isn't important (to, for example, ethology) whether it's big tails or colourful tails that lady peacocks like, then so much the worse for importance.

Finally, Coyne and Kitcher ask how anything but adaptationism can explain the match between a creature's phenotype and its ecology. This question is entirely pertinent. But they will have to read about it in Fodor and Piatelli-Palmarini (forthcoming).

Over the years, I've been finding it increasingly difficult to figure out which bits of Daniel Dennett's stuff are supposed to be the arguments and which are just rhetorical posturing. In the present case, I give up. I'll take it more or less paragraph by paragraph. Dennett speaks of the 'steady advance of evolutionary biology into the sciences of the mind'. He provides no examples, however, and surely he knows that there is a considerable body of literature to the contrary. (See, for example, David Buller's book *Adapting Minds*.) Even Dennett's fellow-critics of my piece express, in several cases, attitudes towards the evolutionary psychology programme ranging from scepticism to despair: it's a recurrent theme of theirs that Fodor is, of course, right about EP; but he's wrong about natural selection at large.

I cite the fox experiments and the literature on evo-devo as evidence of the importance of endogenous factors in directing the course of evolution. Dennett does not deny that lots of endogenous factors constrain the course of evolution; or that the cases I cited are instances; or that appeals to endogenous variables are alternatives to natural selection. 'Of course the information in the developmental processes is itself all a product of

earlier natural selection.' What's the argument for that, I wonder. It appears, prima facie, simply to beg the question at issue.

Dennett can't be bothered to correct my 'breezy misrepresentation of Gould and Lewontin'. In fact, he can't even be bothered to say what it consists in. That being so, I can't be bothered to refute him.

'The very concept of a spandrel depends on there being adaptations.' This suggests that Dennett has utterly lost track of the argument. Of course the spandrels are free-riders on the architect's design for the arches and domes. But the question I wanted to raise was precisely whether this account of selection-for can be extended to cases where, by general consensus, there isn't any architect. In particular, I claim, Darwin overplayed the analogy between artificial selection (where there is somebody who does the selecting) and 'natural' selection (where there isn't). How could anybody who actually read my article have missed this?

I said that metaphors like 'evolution selects for what Mother Nature intends it to' have to be cashed. The rules of the game require respectable adaptationists to give an account of selection-for that doesn't appeal to agency. Suppose (what's not obvious) that explaining the scientific results really does require a notion of biological function (hence of selection-for). It simply doesn't follow that it requires a notion of biological function that is reconstructed in terms of selection history. Dennett must know that, de facto, there is no such notion. Biological function is itself an intentional concept, so appeals to it don't cash the Mother Nature metaphor; they just take out loans on its being cashed sooner or later. It seems that everybody understands this except Dennett.

Finally, Dennett says I am worried about preserving my values in the face of scientific reduction. Where on earth did he get that idea? I've spent more of my life than I like to think about arguing that ontological questions about reduction are neutral with respect to epistemological questions about intentional explanations. As a matter of fact …

But on second thoughts, to hell with it.

The reader may wonder whether there are any general morals to draw from all this. There are three: don't forget the importance of getting the counterfactuals right; don't confuse your ontology with your epistemology; and do try to keep your cool.

Jerry Fodor
Rutgers University, New Jersey

Vol. 30 No. 1 · 3 January 2008

From Simon Blackburn, Jerry Coyne, Philip Kitcher, Tim Lewens, Steven Rose

Jerry Fodor persists with two provocative claims: first, that natural selection

explanations are incoherent; second, that there is some alternative explanation for adaptive phenomena such as camouflage or beak shape (Letters, 29 November 2007).

To show the incoherence of anything, you have to address it in the form in which its professional expositors deploy it. In large numbers of articles and books, published from 1859 to the present, evolutionary biologists use the following style of explanation. A characteristic of an organism (the colour of an animal's coat, say) is as it is because of a historical process. In some ancestral population there was a variant type that differed from the rest in ways that enhanced reproductive success. (White polar bears, for example, more camouflaged than their brown confrères, were better at sneaking up on seals, were better fed and left more offspring.) If the variant has a genetic basis, its frequency increases in the next generation.

Is this incoherent? Nothing Fodor says bears on that question. Instead, he opposes a very particular way of presenting the explanation. Some people think we can talk of 'selection for' a characteristic, and identify rather precisely the traits that have been 'selected for'. Fodor tries to argue that this is wrong: that there is no single correct answer (whether we know it or not) to the question of whether it was the whiteness of polar bears or their blending in with their surroundings that was 'selected for'. Whether he is right is a philosophical issue about which people can disagree, but it has nothing to do with the coherence of Darwinian explanation. Natural selection proceeds if three elements are in place: variation in a trait, an effect of the variation on reproductive success, and some means by which the trait is inherited. Both the whiteness and the environmental blending emerged from the historical process that the selection explanation describes.

Although Fodor follows a long line of people, including Darwin himself, who recognise constraints on natural selection, he advocates something far more ambitious than his predecessors. He wants a replacement of natural selection, not supplements to it. Some of the signatories to this letter have emphasised the importance of constraints, and have written against the hyper-Darwinian practice of seeing adaptation everywhere. None of us has ever supposed that the appeal to constraints could eliminate all mention of selection.

Cases of convergent evolution are vivid illustrations of natural selection's importance. Ichthyosaurs, sharks and dolphins share a similar body form; marsupial and placental mammals have counterparts that are almost identical in form. In different lines of descent, similar traits emerge. Fodor would have us believe that natural selection plays no role whatsoever in explaining these facts. Indeed, he doesn't say how he thinks convergence – or any adaptation – should be explained, but merely tells us that he and a coauthor have something up their sleeve. The task they envisage is far more ambitious than that attempted by brilliant evolutionary theorists who have wanted to 'expand' Darwinism (for example, Stephen Jay Gould). Given the evidence that at least one of these would-be revolutionaries has little acquaintance with the biological theory

he aspires to replace, we have little reason to think they will succeed.

Simon Blackburn, Jerry Coyne, Philip Kitcher, Tim Lewens, Steven Rose
University of Cambridge, University of Chicago, Columbia University, University of Cambridge, Open University

Blackburn et al have a number of complaints about what I wrote. The first is exegetical: they say that the kind of adaptationism I've attacked is not one that paradigm adaptationists endorse. I think that even a cursory glance at the relevant literature shows this is false. The standard current formulation has it that a main goal of evolutionary theory is to explain the distribution of phenotypic traits in populations of organisms, and that natural selection is the key to such explanations: organisms are selected for the ecological fitness of their phenotypes. Patently, any such theory is in want of a coherent account of what it is for a creature to be selected for some or other of its traits. But I don't propose to argue the exegetical point. Let those the shoe fits wear it. I'm content if what I wrote serves a cautionary function: if you find yourself tempted to espouse this sort of adaptationism, don't!

Their second claim is that there is no incoherence (or, anyhow, none of the sort that I alleged) in selection theory as correctly understood. They don't, however, say what the correct understanding is. Rather, they offer some potted polar bear history: 'White polar bears ... more camouflaged than their brown confrères, were better at sneaking up on seals, were better fed and left more offspring.' I don't know whether this story is true (neither, I imagine, do they), but let's suppose it is. They ask, rhetorically, whether I think it's incoherent. Well, of course I don't, but that's because they've somehow left out the Darwin bit. To get it back in, you have to add that the white bears were selected 'because of' their improved camouflage, and that the white bears were 'selected for' their improved camouflage: i.e. that the improved camouflage 'explains' why the white bears survived and flourished. But now we get the incoherence back too. What Darwin failed to notice (and what paradigm adaptationists continue to fail to notice) is that the theory of natural selection entails none of these. In fact, the theory of natural selection leaves it wide open what (if anything) the white bears were selected for. Here's the argument. Consider any trait X that was locally coextensive with being white in the polar bear's evolutionary ecology. Selection theory is indifferent between 'the bears were selected for being white' and 'the bears were selected for being X.' What's 'incoherent' is to admit that the theory of natural selection can't distinguish among locally coextensive properties while continuing to claim that natural selection explains why polar bears are white. Do not reply: 'But it's just obvious that, if the situation was as Blackburn et al describe, then it was the whiteness of the bears that mattered.' The question is not what is obvious to the theorist; the question is what follows from the theory. Why is it so hard to get this very rudimentary distinction across?

Having got all that wrong, Blackburn et al add that 'Fodor tries to argue that ... there is no single correct answer ... to the question of whether it was the whiteness of polar

bears or their blending in with their surroundings that was "selected for".' But I don't argue anything of the sort. Since the hypotheses that the bears were selected for being white and that they were selected for matching their environments support different counterfactuals (what would have happened if their environment had been orange?) they can perfectly well be distinguished in (for example, experimental) environments in which one trait is instantiated and the other one isn't. I don't claim that locally coextensive properties are indistinguishable in principle. I claim that, since the theory of natural selection fails to distinguish them, there must be something wrong with the theory. (I also don't claim to have 'some alternative explanation for adaptive phenomena'; only that there had better be one sooner or later; and that it's a plausible guess that, when there is, it will explain adaptive phenomena largely by appeal to endogenous constraints on phenotypes.)

Finally, they say that whether I'm right about all this is 'a philosophical issue'. I don't know how they decide such things; maybe they think that philosophical issues are the ones that nobody else cares about (a masochistic metatheory that many philosophers apparently endorse). Anyhow, the kind of philosophy I do consists largely of minding other people's business. I am, to be sure, in danger of having insufficient 'acquaintance with the biological theory that [I aspire] to replace'; but I'm prepared to risk it. A blunder is a blunder for all that, and it doesn't take an ornithologist to tell a hawk from a handsaw. Tom Kuhn remarks that you can often guess when a scientific paradigm is ripe for a revolution: it's when people from outside start to stick their noses in.

 ^ Top