# Further Thoughts on Natural Selection

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*Although from a logical perspective the concept of natural selection need not fail as a formal tautology, in practice it is exceedingly difficult to divorce fitness from survivability. As a result, invoking the concept of natural selection generally results in uninformative circular reasoning. Attempts to rescue natural selection from the tautology problem tend to inadvertently underscore the difficulty of endowing the concept with any substantive meaning. This is true in both its classical form, as well as its Neo-Darwinian incarnation of "greater reproductive success."*

Having become interested in the evolution debate in the spring of 2003, I ploughed through the sixth edition of Charles Darwin's *The Origin of Species* cover to cover and was struck by the logical and rhetorical stance taken by Darwin in that work. In further reviewing the question of a possible tautological formation in Darwin's description of natural selection, I came across a 1997 FAQ by John Wilkins on the Talk.Origins Archive entitled "A Good Tautology is Hard to Find." In his article, which still enjoys a prominent link on the Talk.Origins site, Wilkins contends that the concept of natural selection is not a tautology. He further contends that natural selection rules out many possibilities, which adds to its substantive explanatory power.

In my first effort to place pen to paper in the evolution debate, I wrote a short article in which I challenged Wilkins' contentions and, in a word play on the title of Wilkins' article, entitled my piece "A Good Tautology is Hard to Avoid."

Recently I learned that David Ford had posted my article to a Google discussion group. In reviewing the postings, I note that several members of the group have raised various challenges, concerns and complaints regarding my article. I am unfortunately unable to respond to each of these points on an individual basis, but would like to provide a response on a consolidated basis.

For ease of discussion I quote below the principal issues raised by members of the discussion group and then provide a response. No doubt readers would be benefited by first reviewing my original piece (and Wilkins' article for that matter) to get the proper background. Nevertheless, I trust that this response will be somewhat intelligible as a stand-alone document.

Incidentally, I corresponded with John a couple of months ago about my critique of his article, and received a very kind reply acknowledging my points and indicating that he

still viewed natural selection as a non-tautology, but for different reasons than those provided in his original article. I am hoping that John will have an opportunity to post a follow-up to his 1997 article, and trust that he will raise interesting and challenging points. In the meantime, however, I would like to address the issues raised in the Google discussion group.

**1. Ferrous Patella:**

> "I do not see how natural selection can be a tautology. Natural selection only claims that the more fit *are more likely* to survive. For it to be a tautology the fitter must *always* survive and reproduce.
>
> We can observe that the obviously less fit do sometimes survive by sheer dint of luck. Very fit specimens are brought down by the same.
>
> As a thought experiment, picture a herd of antelope. One genetically sickly member is trailing behind. Out of nowhere, a bolt of lightening zaps the herd's alpha male. The sickly member has no superior fitness to survive that lightening bolt . . . yet he survived.
>
> So there you have it. The fit do not always survive. 'Survival of the fittest' is not a tautology."

This is an amazing argument, but I have seen it in more than one place (including an indirect nod by Howard Hershey in the last section below) so it must be making the rounds. Apparently Patella believes that in order for there to be tautology problem natural selection must argue that the fitter "always" survive. Patella then cheerfully informs us that because natural selection does not mean that the fitter *always* survive, but rather that the fitter are *more likely* to survive, then *voilà*, there is no tautology problem.

Let's examine this position for a moment. According to Patella if we formulate natural selection as follows we have a tautology: "Survival of the fittest means that the fittest always survive," but if we formulate natural selection thusly, we will not have a tautology: "Survival of the fitter means that the fitter are more likely to survive."

Patella's approach is substantively no different than John Wilkins' statement that natural selection can be saved from the tautology problem by formulating it as "expected" survival rather than actual survival. I have already addressed this point in my previous piece, but it may be worth discussing again, as there is an important nuance here.

The problem with both Wilkins' and Patella's approaches is that they seek to avoid the tautology problem simply by tweaking the verb tense or mood or changing the superlative adjective "fittest" to the comparative adjective "fitter." But these cosmetic changes are irrelevant to the logical structure of the formulation. Further, Patella's

inclusion of the adverb "always" simply alters the inclusiveness of the hypothesis' proposition, but not the structure of the formulation.

It makes absolutely no difference for purposes of analyzing the logical formulation whether we focus on the creatures that did survive or the creatures that will survive. Nor does it matter whether we talk about the "fittest" surviving, or the "fitter," or even the plain old "fit" for that matter. The concern with natural selection arises not because an adjective is in the wrong declension from a morphological standpoint, but because from a logical standpoint the substance attributed to the adjective is defined in terms of its premise.

Whether we say "survival of the fittest," or "survival of the fitter," or "survival of the plain old fit," as soon as we start defining the fittest/fitter/fit in terms of those that survive we have circular reasoning, which in a causative argument amounts to a tautology.

I should point out that in my original piece I explicitly acknowledge that "survival of the fittest" does not itself constitute a tautology. It is that statement *coupled with a definition of the fit in terms of survivability* that results in circular reasoning and deprives the concept of meaning.

I believe Patella's confusion and fixation on the adverb "always" may result from the way the term tautology is sometimes used in the Boolean algebra context, which is roughly that in a given problem a tautology is a formulation that is true in all circumstances. This formulation can be found in this classic riddle (borrowed from Wikinfo):

> "On the Keikei Island, there lived two kinds of people – knights and knaves. The knights always tell the truth, but the knaves always tell a lie. John and Bill are residents of the Keikie Island. John says: 'We are both knaves.' Who is who?"

In the above example, if you run through the various possibilities it turns out that the proposition "John is a knave and Bill is a Knight" is the only proposition that is true in all circumstances. This proposition is sometimes called a "tautology" for purposes of Boolean algebra, and one can solve the puzzle by solving for the tautology, or in other words, solving for the one case which is always true.

As a result, I am suspicious that Patella's focus on the adverb "always" may be the result of confusing the *definition* of a tautology as something that is "always" true in all circumstances, with the underlying *substance* of the formulation in question. He therefore proposes that by eliminating the "always" and substituting in its place "more likely" he can avoid the tautology. There are two problems, however, with Patella's suggestion.

First, the fact that a Boolean algebra tautology is "always" true is completely separate from the question of whether the tautological formulation itself contains the word "always." Certainly one can have a tautology with propositions such as "never,"

"occasionally," "usually," "tend to," or any other number of adverbs and adverbial phrases. For example, if we said "the unfit never survive," and then defined the unfit as "the ones who never survive" we would still be left with a tautology, without ever using the word "always." Indeed, we can easily have a tautology without using any adverb: "the fit survive," coupled with "the fit are those that survive."

Amusingly, the online encyclopedia Wikipedia provides the following example of a tautology: "As a humorous example, the tautology is famously defined as 'that which is tautological'. (That definition is, of course, tautological.) In a more realistic example, if a biologist were to define 'fit' in the phrase 'survival of the fittest' as 'more likely to survive', he would be forming a tautology." One need not of course rely on Wikipedia as the authority in this matter, but the point is that "more likely" is just as good for creating a tautology as "always." The particular adverb is irrelevant. *It is the definition of the resultant by reference to the antecedent that creates the tautology*.

Second, the Boolean algebra situation is somewhat different from the context of the natural selection discussion, which is a proposition of causation. In the Boolean algebra context there is nothing wrong with seeking a tautology. Indeed, in our example of the knights and the knaves, we solve the puzzle by solving for the tautology, or the statement that is true in all circumstances.

In the context of our present discussion, however, Darwin's entire point in trotting out the concept of natural selection in *The Origin of Species* was to propose a causative element or explanation for one creature's survival over another (which could ultimately be extrapolated, he thought, to the formation of new species). Within the context of such an explanatory argument, Wikipedia defines a tautology as "a statement which is true by its own definition, and is therefore fundamentally uninformative. Tautologies use circular reasoning within an argument or statement." The freedictionary.com defines tautology as "redundancy, repetition, and circular reasoning within an argument or statement." Finally, it may be helpful for us to go back to the Greek for a moment: *tautos* (the same) + *logos* (saying), or literally, *the same saying* or stating the same thing in a redundant manner (often using different words).

Now my point here is not to defend the above definitions as the only or best definitions of a tautology. Indeed, at the end of the day it is of little importance to me whether natural selection is viewed as a strict tautology or whether it is viewed simply as an example of circular reasoning. In either case – when the resultant is defined in terms of the antecedent – the effect is the same: the concept is inherently uninformative.

I stated in my previous article, and will state here again, that the phrase "survival of the fittest" is not necessarily a tautology. There are ways to keep it from falling into that trap, but *only if we carefully define the fit in terms other than survivability*. It is exceedingly easy to fall into the trap of defining the fit in terms of survivability, and it is this tendency that plagues the concept as it is so often used in evolutionary discussions. Howard Hershey feels that he has found an adequate way of avoiding the tautology and

providing a useful working definition of natural selection, but we shall have to read on to the last section to see if he has been successful.

**2. Alan Jeffery:**

> "Darwin was basing his idea, to some extent, on Malthus. And he used the metaphor of a wedge. When a new species, or change to an existing species, occurred, all the other species were 'pushed' in some direction by the new wedge. Darwin's suggestion was toward extinction. So, although 'adequate' is probably correct as well, so can 'failure', because a species that is a failure somewhere, may be a raving success somewhere else. As for instance when genus Homo left the trees. Ask the question why did we leave the trees. I think one answer that makes perfect sense, is that we were pushed out by other species that were better at living in trees."

Or perhaps we were never in the trees in the first place? I agree with Jeffery that a species that is having difficulty in one environment may be more successful elsewhere. However, one of the problems with the above approach is that the current state of affairs gets reduced to an explanation based on being "pushed" out of various environments. Unfortunately, there is rarely decent evidence on this score (and certainly none in the above "just-so" story of our ancestors being pushed out of the trees). Rather, it is simply *assumed* that there must have been a particular competitive landscape in the past that resulted in the "selection" of one species over another, ultimately culminating in the state of affairs we see around us today. Jeffery is in good company, of course, as Darwin made the same assumption. This is a wonderful example of incorporating in one's premise the very thing one is trying to prove.

Further, the above does not even get at the real concern of evolutionary theory, which is explaining how the various competing species came on the scene in the first place. We seem to forget that explaining the *origin* of species was Darwin's whole point in writing his opus. Evolutionists tend to miss the irony in the fact that Darwin had to assume the existence of the very thing he was trying to explain. This is an example of circular reasoning, not just in the particular formulation of the idea of natural selection, but at the highest level of the theory itself. But that is a topic for another time . . .

**3. Ian Braidwood:**

> "Anderson has missed the point here by ignoring why those who survive do so. It is as if biologists were arguing that there is some mystical quality of 'survivability,' which of course they don't propose at all.
>
> Those who are expected to survive will do so, because they have an adaptation which confers an advantage in relation to those individuals who lack it. Thus

there are independent criteria by which fitness can be defined and this saves Natural Selection from tautology.

In the peppered moth example, the darker coloured moths survived because their colouring provided better camouflage where there were high levels of pollution; similarly, the lighter forms flourished where pollution was less severe. So here, fitness is defined as 'best camouflaged' and the fact that the moths did proliferate in the environments to which they were best suited supports Natural Selection.

In flying insects preyed upon by bats, camouflage provides no advantage and so can be no part of the definition of fitness, however the ability to detect ultrasound would confer an advantage and examples are found in nature.

Lacewings can detect bats' ultrasound. They stop beating their wings when they hear the mammal approach and fall out of the bat's grasp. Some moths go a step further, by actually emitting a powerful ultrasound signal of their own, effectively jamming the bat's sonar.

Sometimes, camouflage is the last thing you need. If you're an insect which stores plant toxins in your body as a defense, then you need to warn any potential predator that you're poisonous and so conspicuous colouration is what you need.

It's clear from these examples that, depending on context, camouflage can aid, be irrelevant to, or actually detrimental to an organism's fitness; so fitness means different things in different circumstances.

The word fitness is a generalisation for any quality or characteristic which confers an advantage and its precise meaning is dependent on the environment in which the organism in question lives.

If biologists merely accepted that any survivor had some mystical quality of 'fitness,' then the charge of tautology would be justified. However they don't, they specify a particular characteristic which confers an advantage to the survivour."

I certainly agree with Braidwood that the characteristics constituting fitness will be different in different circumstances and will be somewhat dependent on the environment in which the organism lives. What I find hard to accept is that biologists regularly "specify a particular characteristic which confers an advantage" on the survivors. I enjoyed Braidwood's examples of lacewings and ingenious moths responding to a bat's ultrasound. But they are certainly not examples of biologists specifying any predictive characteristics. Indeed, there are plenty of creatures that are surviving very well without these characteristics. What we see in each case is that biologists look around in nature *after the fact* and observe that certain creatures survive. They then assume that the survivors must have had some kind of adaptation that would prompt natural selection to select them for survival. Thus in practical application, we fall back on defining the

survivors in terms of fitness. While it is no doubt true that survivors survive, such a proposition is inherently uninformative. It teaches us nothing about what is going on at the genetic, biochemical, and environmental levels to cause survival in the first place. By calling the results of the process "natural selection," we have not learned anything that we would not have learned without applying the label.

Ultimately, it seems that Braidwood's comments may go more to testability than the strict logical construction of the formulation. Coming up with a working definition of fitness, in the context of the overall environment and the various other creatures making up that environment, is no small task. The late R.H. Brady suggested, more clearly and more eloquently than could I, that until we come up with a comprehensive theory of the organism, there is no practical way to test proposed fitness characteristics. Thus we are left to discuss fitness in terms of survival and survival in terms of fitness, "the friction between concepts," to borrow a phrase from David Berlinski's tongue-in-cheek essay, "kindling nothing more illuminating than the observation that some creatures have been around for a very long time."

Should someone proposing a predictive concept of fitness that can be subjected to objective testing I would have no complaint – indeed, I would welcome it. But to look around in nature *after the fact* and observe that certain creatures seem well adapted to their environments does little but confirm my suspicion that we are dealing with circular reasoning, which, according to Wikipedia, is "fundamentally uninformative."

**4. Thomas Faller:**

> "So 'those we observe to survive' survive is a tautology, and 'those we predict to survive according to our theory' survive is also a tautology? What about 'I get X from my experiment, according to my prediction'? That isn't a valid way to determine if a theory is successful? I think that Anderson has warped words to please himself, not to get at the truth.
>
> > [Quoting Anderson:] 'Second, with apologies to Dawkins, whom Wilkins cites, I believe a moment's reflection will tell us that natural selection does not rule out violations of genetics; genetics does. It does not rule out violations of molecular biology; molecular biology does.'
>
> Bait and switch. He [Wilkins] didn't say natural selection rules out violations of genetics. He said that if genetic change is not possible in *gradual* and *adaptive* steps to get from one species to another, natural selection will not allow it. If you have to get from dragonfly ancestor to dragonfly through a genetically possible intermediate with twelve wings and no mouth or legs, it won't happen, even if it is consistent with genetically possible changes."

Allow me to repeat what I said in my original piece: if you successfully divorce fitness from survivability and make a concrete prediction, then we do have something we can

test. But, pray tell, precisely what fitness predictions have been made by natural selection that have proven true? What we generally find, as in each of the examples cited by Braidwood above, is that we are very good at looking around in nature *after the fact* and saying "Gee, this creature must have been more fit than others, because it survived." The alarm bells of logic should start going off in response to that kind of thinking. I have no problem with getting a predicted result from an experiment. The difficulty, going back to Brady's article, is coming up with any concrete predicted result.

With respect to Faller's last salvo, one might be benefited by rereading Wilkins' FAQ. Wilkins in fact does state that natural selection rules out changes in organisms that violate genetics, and suggests that this somehow adds to natural selection's explanatory power. My point is that natural selection rules out no such thing, genetics does. Wilkins goes on to propose that because genetics is testable, then natural selection is somehow supported. This is nothing but wishful thinking and conflation of unrelated concepts. We do not need to appeal to natural selection to conclude that violations of genetics are not allowed. We can get to the same result without ever invoking the term "natural selection." Thus the careful observer would be correct to suspect that natural selection brings nothing new to the table on this score.

Faller is of course right that Darwin specifically rejected large leaps and proposed that evolution must proceed with "slight successive modifications." (Modern evolutionists are less comfortable with a blanket "slight successive" approach.) Darwin's thoughts on what kinds of modifications are allowed, however, has nothing to do with natural selection, as natural selection only selects *after* the modifications are already on the scene. Natural selection has no say in whether changes occur quickly or slowly, whether they are small or large, miniscule or miraculous. For the answer to this question one must appeal to mutations, chance, the laws of biochemistry, genetics or similar concepts. In his attempt to support natural selection, Faller inadvertently underscores another disconnect in the theory: natural selection is very often described as having some kind of moderating or regulating ability over the kinds of changes that can take place in nature. Indeed, Darwin used it in precisely this way. Yet natural selection is logically limited to selecting changes after they have occurred.

**5. Frank J.:**

> "There's only 2 things you need to know about 'Darwinism.' It's unfalsifiable, and it's falsified. Wait a minute, didn't I just post another example of how anti-evolutionists try to have it both ways?"

It is not clear that this comment is directed specifically at my piece, but I wanted to briefly address it because, beneath the sarcasm, I believe Frank makes a good observation: critics of evolutionary theory are often a bit too hasty in trying to play both sides of the falsifiability fence. However, by simply making that observation, Frank is not quite off the hook so easily. The idea of evolution is broad indeed, and within its framework are numerous concepts, some of which may be subject to testing and some of

which may not. For example, it would not be logically inconsistent for a critic to argue that the concept of natural selection is a tautology and therefore not falsifiable, while at the same time arguing that Darwin's expectations about a gradual fossil record have not been realized, and therefore, for all practical purposes, have been falsified.

Frank's comment should indeed motivate evolutionary critics to be more careful in their arguments, and certainly Frank and each of us should continue to be on the lookout for faulty thinking.

## 6. Howard Hershey:

Howard Hershey's comments are more detailed and represent more sophisticated arguments in favor of natural selection. Thus, although this section is rather lengthy, I want to quote his position nearly in its entirety to capture the essence of his arguments. Let us see, however, how his arguments hold up under careful scrutiny. Hershey writes:

> ". . . the tautology objection to the observation that natural selection exists is silly and is largely based on a definition that one rarely uses or even sees anymore in standard texts (except to discuss its defects, starting with its use of the superlative -est ending rather than the comparative -er ending). . . . One does not need to think that evolution happens to recognize that natural selection does. Natural selection was well recognized prior to Darwin."

I have already addressed the adjectival declension issue in response to Patella above in some detail, and thus will not discuss it further, other than to point out that it rests on a misunderstanding of what constitutes a tautology.

That observations of natural selection do not necessarily lead to a conclusion of evolution is an important admission, and is one that is becoming more widespread. No less a proponent of evolutionary theory than Skip Evans of the National Center for Science Education made the same point to me in personal correspondence a few months ago. I wholeheartedly agree that observations of small-scale changes in a population do not allow us to conclude that the broader message of evolution is true. Stated more bluntly, *microevolution does not necessarily lead to macroevolution*. What I find more puzzling is why the implications of this fact are apparently lost on faithful evolutionists.

For Darwin and for Darwin's theory, the concept of natural selection was inextricably linked to evolution. Variations in species provided grist for the mill of natural selection, which in turn acted as the moderating force for more significant changes down the road, which would become the new grist for natural selection, and the cycle repeats itself. Or as Sir Julian Huxley proclaimed, "all reality is a single process of evolution . . ." Divorcing natural selection from evolution eliminates the very engine that is supposed to be driving evolution, at least insofar as Darwin's theory is concerned. It is true that modern evolutionists, when pressed regarding natural selection's limitations, like to propose other kinds of evolution – perhaps driven by pure chance, or self-organizational

properties, or other vague proposals. But at the end of the day, they always fall back on natural selection as, if not the only engine behind evolution, then at least the most important and universal one.

Finally, I would suggest that there is very little value in the concept of natural selection, except as it relates to evolution. If I proclaim that something called natural selection takes place but that it does not lead to evolution or to the origin of new species or to any biologically significant change, then I have removed the concept from everything that makes it of scientific value. The valuable claim of natural selection, from a scientific standpoint, is that it can operate as the engine of evolution – that over time it can produce new organisms, new species and biologically significant change.

Evolutionists are understandably loath to discard the concept of natural selection because it is such a great stop-gap explanation. Whenever we face difficulties explaining features in nature we can always waive our hands, invoke natural selection acting over eons of time, and pronounce that we have solved the mystery. The skeptic, however, noting evolutionists' admission that natural selection does not *always* lead to large-scale evolution, might be inclined to ask whether we can be sure that it *ever* does, and if so, in what circumstances and under what conditions. The careful observer might also begin to suspect that if natural selection can be so easily divorced from evolution (as suggested by some moderns, in contrast to Darwin's approach), then perhaps the concept does not really bring much useful information to the scientific table. When we look closely we realize that this is because the concept operates as an essential tautology.

The skeptic might become further uneasy with the proposition that natural selection, according to Hershey, results in evolution . . . except when it does not. Yet again at another level of the theory we are met with the possibility of a tautology. But let us read on to see if Hershey is able to save natural selection from its circular reasoning:

> "Natural selection is a frequently observed feature of the *interaction between organisms and their environment*. It is the observation that the *environment* (which is unintelligent) in which organisms live often can, but does not inevitably do so, discriminate (in a stochastic fashion) between *different phenotypes* of an organism living in that environment, favoring one phenotype over the other and specifically favoring phenotypes that are better adapted to life in that particular environment. When it does so, the phenotype which is favored will (in the stochastic sense of 'be more likely to' rather than the inevitable causal sense 'must') have *greater reproductive success* than the alternate phenotype; that is, greater reproductive success is a consequence of being better adapted to a particular local environment.
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> (Of course, for evolution to be a consequence of natural selection, the phenotypic differences that the environment discriminates between must be a consequence, at least in part, of genetic differences. However, we are talking solely about natural selection at this point. And natural selection occurs just as relentlessly and ruthlessly (and unintelligently) if the phenotypic differences are due to accident or

> environment or developmental abnormality. The unintelligent environment, as it relates to and interacts with life as a dog, will favor the dog with four good legs and discriminate against the one with none regardless of whether the legless condition is due to genetic defect, accident, or developmental abnormality.)"

Hershey makes the fair point that variations resulting from accident etc., will not result in evolution, and that we are really talking about inheritable variations, or genetic differences. Yet if we can point to a particular genetic difference and say that the genetic difference will result in x percentage more likelihood of survival, then we can make a workable testable prediction based on genetics alone. We do not learn anything new by calling the result "natural selection," when all we have done is attach a rhetorical label to the result of a process that occurred at the genetic level. Probably more problematic is that natural selection is so often described as some kind of force responsible for the change – forever "scrutinizing" and "selecting" – when it is logically limited to being a dishonest observer, waiting around for the creative change to take place and then surreptitiously taking credit for the creative work. Hershey continues:

> "Note the basic requirements for determining whether natural selection has occurred: There must be *different phenotypes* that are interacting with the *environment* relevant to that organism. Natural selection, when it occurs under these conditions, is an observational consequence of a comparison. Natural selection is a population phenomenon and is a comparison of *phenotypes* and not *individuals*. Thus, one can talk about the fitter *phenotype* but not the fitter *individuals*. The survival of any single individual in a population may be a simple anomaly (the environment only provides a stochastic bias, not a virtual certainty). To declare that one *phenotype* is *fitter than* another, one must be looking at a population average, not an individual.
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> Although a comparison of *different phenotypes* and their interaction with a particular *environment* is the basic requirement for determining whether natural selection has occurred, merely having two (or more) different phenotypes in an environment does not guarantee that natural selection will occur (or will have occurred). *Natural selection* is only said to occur when one of the two phenotypes has a *statistically significant* difference on the metric of reproductive success. Phenotypes which do not affect nor produce a statistically significant difference in the metric of reproductive success are *selectively* neutral with respect to one another.
>
> *By convention, and in accordance with the common usage of the term 'fitter', the phenotype which has the significantly greater reproductive success is called the fitter phenotype in that particular environment. That is because reproductive success is the only recognizable universal 'goal' of or metric upon which to compare living organisms.*
>
> (I emphasized the above paragraph, because it is, in fact, crucial. If one wants to argue against natural selection, one must argue against this point. I am claiming

that the only *apparent* or *scientifically detectable* or *empirically useful* universal 'goal' of *all* life on earth is, empirically if not theologically, maximal reproductive success. This makes reproductive success the only valid metric for measuring natural selection and defining 'greater reproductive success' as 'fitter' is indeed consistent with common understanding of the term 'fitter'. If one agrees with the validity of using differential reproductive success as the metric for determining whether natural selection occurs (or has occurred), then anytime that one observes differential reproductive success of one phenotype relative to another significantly greater than can be accounted for by random genetic drift, one is observing an event due to natural selection – that is, a difference due to the local environment discriminating between phenotypes. That means that even if Kettlewell had not done his experiments, industrial melanism in moths would *still* be an example of natural selection.)

So let's summarize: Natural selection is said to have occurred when, in any comparison of two phenotypic variants in an organism in a specific environment, there is a significant average difference in reproductive success of organisms with alternate phenotypes in that environment. By convention, the phenotype which leads to greater reproductive success is called the 'fitter' phenotype.

It is important to realize that observing a phenotypic difference does not, by itself, tell us which, if either, phenotype is 'fitter' in any particular environment. One can certainly use standard engineering reasoning (by recognizing that the goal is greater reproductive success) to make educated guesses, but must be prepared for surprises. (For example, longevity, if it interferes with net reproductive success as is the case in C. elegans and many other organisms, can be less 'fit' than quick burnout due to high reproduction early on.)

On the other hand, because of the definition of 'fitter' given above, if one observes a case in nature where one phenotype is observed to have *significantly greater* reproductive success than an alternate phenotype, one can reasonably infer that natural selection is involved in determining the relative numbers of the two phenotypes both now and in the future (so long as the environment remains constant) and look for reasons why the local environment dumbly and unintelligently significantly favors one phenotype over the other.

In other words, the alternative to natural selection are simply cases where there is no selection at all. Those are the only two alternatives that exist in nature: *No selection or selection (in a specific environment).* To say that natural selection does not occur . . . is contrary to observed reality. . . ."

If we distill the above, Hershey is making two principal arguments: (i) when looking at natural selection or survival of the fittest, we must look at the population average, not the individual organism, and (ii) the true measure of fitness is greater reproductive success of one phenotype over another. Let us examine each of these arguments.

I agree with Hershey that a particular organism, subject to the vagaries and hazards of nature as it is, may be an anomaly, and that thus it is helpful to look at the population average. We might do well to keep in mind, however, that survival takes place only at the individual level. Averaging helps to even out anomalous situations, but at the end of the day, the survivability average must be driven by something that occurs at the individual level, whether genetic or otherwise.

More importantly, I want to make sure that we understand that using a population average in no way addresses the tautology problem, as I explained in some detail in response to Ferrous Patella above. It makes no difference whether we talk about the fittest, fitter, fit, or whether we talk about those that will survive, are expected to survive, tend to survive, have the greatest probability of survival, and so on. As long as we fall back on defining the fit in terms of survivability, we are left with circular reasoning. To say that the survival of the fittest means that those of a particular phenotype have a greater likelihood of survival over another phenotype based on a population average, is no doubt a more accurate and detailed description than simply saying that the fittest will survive, and I applaud Hershey's effort to provide this more detailed description. But if we then describe the survivors in terms of that definition, we are right back where we started with our circular reasoning. This brings us to Hershey's second argument.

The Neo-Darwinian synthesis suggests, and Hershey forcefully argues, that the only true measure of fitness is greater reproductive success (again, within the particular environment in question). Under this approach, we might say that survival of the fittest means that the most prolific will tend to survive. Thus, at first blush, it seems we may have come up with an independent criterion for identifying fitness, and that we may be able to save natural selection from failing as a tautology. Let us examine this formulation, however, in some detail. The Neo-Darwinian proposition is essentially as follows:

1. If we look at a particular population today and count the number of organisms of a particular phenotype and the number of organisms of another phenotype, there will be a certain ratio between the phenotypes in the population. (Incidentally, biologists love to talk about different phenotypes, both because "phenotype" is an official sounding word, and because it implies *small* differences and *small* changes, which are always more believable to the average person than large changes. In fact, however, it makes no difference whether we are talking about two slightly variant phenotypes or two wildly different organisms, as long as they compete in the relevant environment. Nevertheless, I will discuss phenotypes, as this is the term used by Hershey.)

2. If we come back some time later and count the two phenotypes, there may be a different ratio. If so, then we pronounce that natural selection has occurred.

If we stop and think for a moment we will realize that the essence of the above proposition is nothing more than the wholly unremarkable observation that the exact ratio of organisms within a particular geographic area is not completely static over time. That this is so regularly true persuades evolutionists that natural selection is busy indeed – its

effects are seen in almost every population, given enough time. Thus, for the evolutionist, the fact that nature is not static is seen as compelling and regular confirmation of the power and importance of natural selection operating in the natural world. This is why evolutionists are so frustrated with the obduracy of skeptics and why they soundly rebuke these unfortunate skeptics, as does Hershey, by pronouncing that denial of natural selection "is contrary to observed reality."

Yet the skeptic (at least the thoughtful skeptic) does not dispute that populations exhibit a certain change in phenotypic ratios over time. However, upon making the observation that phenotypic ratios do not remain forever static, the skeptic is not struck with a sense of awe and wonder at the power of natural selection, but rather is moved to inquire: "So what? What does this teach us about the underlying processes at work? What does this tell us about the origin and diversity of life on the earth?" The unfortunate answer to these questions is "Nothing." Put another way, the skeptic does not dispute the initial observational data. The skeptic simply questions the wisdom of applying the rhetorical label "natural selection" to the observation after the fact, when at best the label does not teach anything new, and at worst it creates the deceptive impression that some kind of real force is at work and that we have a solution to the puzzle of nature.

Let us return to the Neo-Darwinian formulation of "greater reproductive success" and examine the formulation in terms of a specific thought experiment:

> Let us assume that we come upon a particular population of organisms with two phenotypes: A and B. Upon counting the organisms in each phenotype we discover that phenotype A makes up 40% of the population and phenotype B makes up 60% of the population. We leave for a time and return to discover that phenotype A now makes up 70% of the population and phenotype B makes up only 30% of the population.

Faced with the above scenario, the evolutionist will triumphantly proclaim that this is a wonderful example of natural selection in action. But what can we really conclude from our observations? We can conclude that the population experienced a change. We can conclude that there was a significant shift in the ratios of the two phenotypes. And that is about it. By applying the label "natural selection" to the result, we do not learn anything at all about what happened with the population. The triumphant proclamation that phenotypic ratios change over time constitutes little more than the unremarkable observation that nature is not forever static.

Fair enough, Anderson, but does not the change in phenotypic ratios at the very least show that phenotype A experienced greater reproductive success than phenotype B?

Perhaps. I say "perhaps" because it depends on what we mean by "greater reproductive success." If we mean that phenotype A tends to leave more offspring, then it does not follow that phenotype A would end up increasing in numbers over phenotype B. For example, if the offspring are less likely than phenotype B to reach reproductive age, or if the reproductive age is later, or if reproduction is more difficult, or any number of other

factors, then simply leaving more offspring will not necessarily lead to an increase in the percentage of phenotype A in the population. In addition, we have other factors that exist in the environment outside of the organism, such as predators, disease, drought, etc.

Given all the various factors and possibilities, whatever they may be, at the end of the day the only thing we can say for certain about our population is that phenotype A *tended to survive* in greater numbers as compared to phenotype B. *We are thus left to view "greater reproductive success" in terms of tendency to survive and are right back where we started.* Upon careful examination, the much-lauded "greater reproductive success" of the Neo-Darwinian formulation, is nothing more than a surrogate for survivability. It has not been quite so easy to avoid the tautology as Hershey might have hoped.

**Conclusion**

I conclude by repeating what I said in my original piece: natural selection or "survival of the fittest" is not, in and of itself, a tautology. However, when we define the fit with reference to survivability, the concept becomes a tautology and loses all explanatory power. While from a logical perspective it would thus seem rather simple to avoid the tautology, from a practical perspective it has proven exceedingly difficult to come up with any useful working definition of fitness. Darwin certainly did not propose one, and his modern-day disciples struggle mightily with the same challenge. Indeed, it is very rare to have any kind of discussion about natural selection without a tautology sneaking into the evolutionary argument.

I do not believe this has so much to do with evolutionists' motives or capabilities, as it has to do with the enormity of the challenge: identifying all the characteristics of a particular organism and its dynamic environment, predicting the myriad interactions, and drawing any kind of concrete conclusion about a particular fitness variable. Given our current state of knowledge, about the best we can do is gaze about in nature and note that a particular organism has survived or that a particular organism seems well adapted to its environment. Such observations, however, tell us nothing about how the organism came to be, nor do they give us any insight into the organism's likelihood of being around in the future. And if we appeal to "survival of the fittest" to explain the organism's current survival or fitness, we jump straight back into the tautology.

In the present exchange we have seen various attempts to save natural selection from the tautology: Patella's use of adverbs, Jeffery's "just-so" story about our ancestors, Braidwood's observation that some creatures seem well adapted to their environment, and Hershey's focus on population averages and reproductive success. When carefully analyzed, however, these various arguments inadvertently confirm my main thesis, which is that it is very difficulty to divorce fitness from survivability. As a result, such arguments will almost invariably incorporate in their premise the very conclusion they are trying to reach.

We have ignored the “fittest” and examined instead the “fitter” and even the plain old “fit.” We have agreed that the fit do not always survive but rather tend to survive. We have acknowledged that natural selection does not necessarily lead to evolution. We have focused on the population average, rather than individual organisms. We have proposed that the key to fitness is greater reproductive success. We have analyzed, poked, and prodded, but at the end of the day we are still reduced to defining the fit in terms of survivability.

Given the current exchange, it appears that my original title is more apropos than ever: A Good Tautology is Hard to Avoid.

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