Supplemental Material for Chapter 8, "The Meta-Darwinian School"

# External Genetic Storms as a Meta-Darwinian Theory

**Version 1.0**



*The discussion of the Meta-Darwinian school in the book was restricted to theories that are fairly close to Neo-Darwinism in most respects. This was done in the interests of space. Here we present the theory of Fred Hoyle, which is rather far removed from those theories, but which is nonetheless a Meta-Darwinian hypothesis. The gist of Hoyle's criticism of Neo-Darwinian mechanisms can be found in another essay on this website.*

The External Genetic Storm Theory is the brainchild of physicist and astronomer (and longtime critic of Neo-Darwinism) Fred Hoyle, together with Chandra Wickramasinghe and others. Hoyle believes that the random processes proposed in Neo-Darwinism, when analyzed mathematically, utterly fail to be credible as a means of generating the order and complexity we see.[1] This leaves some form of intervention as the only alternative. Since Hoyle is quite hostile to religion, the external intervention must come in another form, and he believes that it is genetic storms or invasions, the first of which brought life to the earth:

> There is a more efficient way of seeding a planet with life than a genetically random process of acquiring genes would be. If life exists in the universe on a very grand scale, we would be likely to have received it on the run only after a great deal of evolution had already taken place. In which case, the most efficient procedures would have become established already by 570 million years ago [beginning of Cambrian].[2]

He argues that natural selection can only fine-tune organisms to their environment; therefore all genetic information must have come early:

> …all genes in present-day organisms were here already in the metazoans that invaded the Earth 570 million years ago at the beginning of the Cambrian Era, making the subsequent story of terrestrial evolution into one in which genes have been called into operation as ecologic conditions permitted them to be so. For example, it would have been pointless [to] call in a genetic system leading to the appearance of flowering plants before the means of successful pollination existed.[3]

This, however, is not the end of the story. Observed periods of radical change in organisms, such as those of the Permian-Triassic and Cretaceous-Tertiary boundaries, cannot be explained

by Neo-Darwinian mechanisms because they rely on random mutation and natural selection, which are unable to find improvements requiring simultaneous changes of several DNA base pairs.[4] Fine-scale adaptation, so apparent in nature, "comes from the ability of species to optimize adaptation with respect to single base-pair changes."[5] Beyond this the mechanism cannot go. Hoyle believes that external genetic storms, which stir up genetic systems, are what is required to boost them over the hills they face. Hoyle does not give details about how these storms affect life; presumably new material arrives from space which, when integrated with existing genomes, allows them to reach new fitness peaks. He specifically addresses the problem of mammals:

> The reason why no connections are seen in the geological record between the orders of mammals is that [they] are fragments from a genetic explosion, probably an explosion resulting from the immense storm of 65 million years ago [Cretaceous-Tertiary boundary]. The explosion happened so quickly, producing creatures dissimilar to what had been there before, that the geological record failed to capture the explosion itself, only its products.[6]

Hoyle argues that something similar occurs more frequently, with storms of lesser magnitude causing such changes as the fragmentation of an order into various families, which then settle into fine-scale adaptations before the next storm causes further changes.[7]

Is there any corroborating evidence for this radical hypothesis? Hoyle believes that there is, in the form of interstellar grains. An outstanding question is the composition of these grains. According to Hoyle, they cannot be made out of any ordinary solid materials because such materials have refractive indices which are too high.[1] If the particles are hollow, then this problem can be resolved. And as it happens, bacteria become hollow when they dry out. By using size distribution data for bacteria, Hoyle and Wickramasinghe were able to obtain precise agreement with astronomical data for the grains, at least at visual wavelengths (400-700 nm). They extended their work by predicting absorption at infrared (longer) wavelengths, around 3400 nm. Their predictions were confirmed subsequently by direct observations.[8] Hoyle further argues that travel of genetic material through space is eminently feasible:

> Microorganisms and genetic fragments are extremely space-hardy. They can withstand very low pressures and wide fluctuations of temperature, and they are remarkably resistant to radiation damage, especially if protected by a little shielding material against ultraviolet light. The Earth's atmosphere would permit space-incident biomaterial to make a soft terrestrial landing without damage occurring due to excessive heating, provided the biomaterial were in the form of small particles with diameters less than ~100 mm. The physical conditions therefore permit both microorganisms and the eggs and sperms of lower animals to be incident from space, as well as virus and viroids, which can add further genes to species already established here on the earth.[9]

Because of the presumed richness from which these organisms come, a general fit with the Earth's environment would exist, which could then be honed by natural selection.

But what of the obvious objection that this whole approach fails to address the real question, namely, the origin of the genetic material in the first place? Hoyle does not think this is a serious problem:

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[1] The index of refraction for a given material is the ratio of the speed of light *in vacuo* to the speed of light in the material.

> The issue properly within the range of science is whether the basic genetic features of terrestrial species—enzymes, t-RNA molecules, the histones, the genetic code itself—are indigenous to the Earth at all. Biologists have sometimes said that they see no advantage in transferring the problem of the origin and evolution of life onto a cosmic stage because the deeper problems would still have to be solved. I find this point of view strange. When in science several paths are open to investigation it makes little sense to try the apparently simplest one first. But if what at first appeared the simplest path turns into a morass, it then makes sense to investigate other paths. The aim of science should be to discover the correct path, not to adhere to an incorrect route because at first glance it seemed simplest.[10]

Hoyle's response, however, does not really help us. Even if we grant that life must have come from elsewhere, we still do not know why it originated there. Presumably conditions were more favorable for the origin and development of life at some *other* location in the universe, but Hoyle does not specify what sort of place this might be, or how it would overcome the objections he has so carefully marshaled against the random mechanisms at the heart of Neo-Darwinism.

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[1] Fred Hoyle, Chandra Wickramasinghe, *Why Neo-Darwinism Does Not Work*, Cardiff: University College Cardiff Press, 1982.
[2] Fred Hoyle, *The Mathematics of Evolution*, Memphis: Acorn Enterprises, 1999, p. xvi.
[3] Fred Hoyle, *The Mathematics of Evolution*, Memphis: Acorn Enterprises, 1999, p. xvi.
[4] Hoyle, p. 108.
[5] Hoyle, p. 108.
[6] Hoyle, p. 108-109.
[7] Hoyle, p. 109.
[8] Hoyle, p. 4.
[9] Hoyle, p. 104.
[10] Hoyle, p. 103.