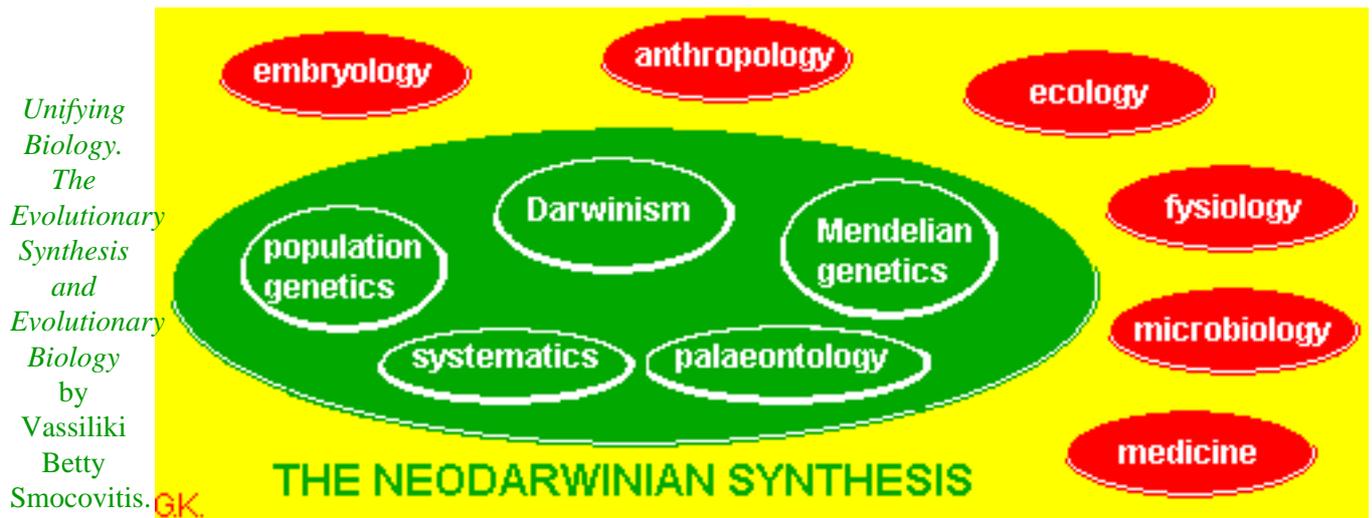


Was
Darwin
Wrong?

The neo-Darwinian Synthesis:

- A synthesis of biological disciplines



review by **Gert Korthof**
6 Sep 2001

Darwin published his *Origin of Species* in 1859. It was a synthesis of all the relevant biological knowledge of his time. Darwin's synthesis included palaeontology, systematics, morphology, embryology, geology and animal and plant breeding. Genetics did not exist at Darwin's time. Mendel, the founder of modern genetics, was rediscovered only in 1900. Darwin had a theory of heredity that included the heredity of acquired characteristics. This kind of heredity is completely rejected by today's geneticists. Genetics is now a solid and central discipline in the life sciences and is radically different from Darwin's theory of heredity. However Darwin's theory of evolution is accepted by virtually all biologists. So to integrate the new science of genetics into the Darwinian framework a lot of work needed to be done. This work took place between 1920-1950. The project is called 'The Evolutionary Synthesis', and its product is called 'neo-Darwinism'. The history of the Synthesis is the subject of Smocovitis' book.

The Neo-Darwinian Synthesis

One of the remarkable historical facts I learned from this book is which biological disciplines were included, as well as which were excluded. **Mendelian genetics** and **Population genetics** were the two most important disciplines that were included. The development of genetics solved many longstanding disputes about heredity. **Mendelian** genetics showed that characteristics inherited as discrete, nonblending

factors and that blending inheritance (accepted in Darwin's time) was wrong and therefore must be rejected. Secondly, Lamarckian inheritance (also accepted in Darwin's time) was rejected because nobody had demonstrated it conclusively and it contradicted the new genetics.

Population genetics was going to determine the very definition of evolution: the change of gene frequencies in populations over generations.

Further all kind of 'soft' theories such as mysticism, vitalism, supernatural design, directed evolution and progressive evolution were judged incompatible with this 'hard' mathematical science and were rejected. So a sifting out process occurred. One could even say that neo-Darwinism dominated by 'elimination of the competition'. These events, I think, explain a lot of later criticism directed at the neo-Darwinian synthesis (4).

A number of biological subdisciplines were not included in the Synthesis either (see figure): **embryology** (1), **biochemistry** (2), **medicine** (3), **microbiology, ecology**.

Among the reasons for this exclusion were that people in those disciplines had different type of problems and methods to solve those problems. They could not easily integrate their practices with the evolutionary paradigm. An interesting example is embryology or developmental biology.

Evolution & Developmental Biology

I will illustrate the 'deep intellectual divide' between Developmental biology (embryology) and Evolutionary biology based on Rudolf Raff's analysis (1):

	Evolutionary Biologists	Developmental Biologists
organism ¹	adult	embryo
causes	natural selection	proximate mechanisms
causes ²	external	internal
genes	source of variation	directors of function
history	phylogeny	cell lineage
time scale	10 - 1 billion years	minutes - months

1) this row is mine. 2) based on Cor van der Weele(1999).

Developmental biologists searched for immediate causes of the unfolding embryo; they didn't need evolution. According to Ernst Mayr embryology was absent from the Synthesis because embryologists simply did not *want* to be included. Furthermore, evolution was perceived as a non-experimental science (p198). Mayr noted already that embryologists were only interested in proximate rather than ultimate causes. However, before embryology could integrate with evolution, another obstacle needed to be removed: the reciprocal antipathy of geneticists and embryologists (5). The integration of Evolution and Developmental Biology ('Evo-Devo') is more than just the next step of the Synthesis. It promises to solve a hard problem in neo-Darwinism: how mutations and gene frequencies (microevolution) translate into changes of the forms of animals and plants (macroevolution).

Michael Behe, Biochemistry & Evolution

Right in the preface of his famous *Darwin's Black Box* Michael Behe complains that there has been virtually no attempt to account for the **origin** of specific complex biochemical systems. Behe devoted a chapter to *The Journal of Molecular Evolution*. So there is a journal and clearly biochemists started working on evolution. Apparently they did not work on Behe's problem. However, could it be that Evolution is an unfinished synthesis? Could it be that there are no models of the origin of complex biochemical systems because biochemists think that those models are too speculative and cannot be experimentally tested? Just as embryologists perceived evolution as a non-experimental science? Michael Behe had his own answer (2). Smocovitis' book however could suggest some historical reasons for the failure of biochemistry to explain to origin of complex biochemical systems. Knowing the historical and sociological background of the neo-Darwinian Synthesis and the different nature of the disciplines helps to understand the partial integration of Developmental biology, Biochemistry and Medicine into the Darwinian framework.



Chapter 5 & 6 of Smocovitis' book are important for biologists. Philosophers and historians of science will also be interested in chapters 2, 3, and 4. Is Smocovitis' book unorthodox or orthodox history of science? It is orthodox in its full acceptance of evolution, and unorthodox in its emphasis on individual scientists and the role of social groups in creating scientific

knowledge (known as contextualism). Despite this unorthodox approach Smocovitis' approach to science is quite natural. She developed a philosophy of science that integrates both external and internal influences on science.



"Unifying Biology. The Evolutionary Synthesis

and Evolutionary Biology."

by Vassiliki Betty Smocovitis

Princeton University Press

1996, hardback

230 pages.

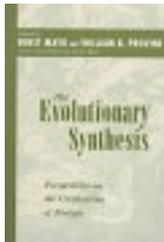
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Notes:

1. Rudolf Raff (1996) *The Shape of Life. Genes, Development, and the Evolution of Animal Form*, p20. At the same time Raff is a good example of a synthesis of developmental biology and evolution. A concise explanation of the relation embryology - evolution is: John Maynard Smith(1998) *Shaping Life. Genes, Embryos and Evolution*. See [review](#) on this site.
2. Michael Behe (1996) *Darwin's Black Box*. Behe's answer is that biochemical systems cannot be explained by Darwinian principles, and must be explained by design.
3. R.M. Nesse, G.C. Williams(1996) *Why we get sick. The new science of Darwinian Medicine* is one of the first full-scale attempts to include Medicine into the Darwinian Synthesis. Others are: Mel Graves(2000) *Cancer: The Evolutionary Legacy*; M. Rose (1991) *Evolutionary Biology of Ageing*.
4. Robert Reid (1985) *Evolutionary Theory. The Unfinished Synthesis*. is an example, but many more critics can be added. For example: Niles Eldredge(1985) *Unfinished Synthesis : Biological Hierarchies and Modern Evolutionary Thought*.
5. Scott Gilbert (2000) *Developmental Biology*, p80,81.

Further Reading:



- Ernst Mayr, William Provine(1998) (editors) "**The Evolutionary Synthesis. Perspectives on the Unification of Biology**" is a paperback reprint with a new preface by Ernst Mayr. The original edition is 1980. The book contains the presentations of a conference held in 1974 with leading evolutionary biologists including some of the architects of the synthesis. The aim was to reconstruct what happened during the period of the synthesis and, interestingly from the point of view of the critics of evolution, what were the objections to Darwinism? Unexpectedly, Lamarckism, anti-Mendelism and anti-evolution have been the dominant type of science in France, and Lamarckism was present in Britain, Germany and the United States too. In general the pre-Synthesis period was a period of doubt, scepticism, and criticism about the all-sufficiency of mutation and natural selection.
- [Unifying Biology: The Evolutionary Synthesis and Evolutionary Biology](#) is a draft version of Chapter 5 available at stanford.edu. The text looks like an uncorrected output of an OCR-scanner, with all pages in one big html file, but gives a reasonable impression of the chapter.
- [80 Years of Watching the Evolutionary Scenery](#) by Ernst Mayr. *Science*, Vol 305, Issue 5680, 46-47 , 2 July 2004. "Having reached the rare age of 100 years, I find myself in a unique position: I'm the last survivor of the golden age of the Evolutionary Synthesis."
- [National Evolutionary Synthesis Center](#). Our goal is to help foster a grand synthesis of the biological disciplines through the unifying principle of descent with modification. 25 Mar 2005

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