Marcel-Paul Schützenberger—French Darwin doubter

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Marcel-Paul 'Marco' Schützenberger was a leading scientific researcher who achieved prominence in several fields. From his research, especially in the area of mathematical analysis of the purported mechanisms of evolution, he increasingly became disenchanted with Darwinism. In later life he became more outspoken about his opposition. An example is that he presented a paper at a conference of scientists that was published in a book titled *Mathematical Challenges to the Neo-Darwinian Interpretation of Evolution.* The conference illustrates the fact that valid scientific problems exist with Darwinism. Some of Schützenberger's arguments against evolution were reviewed, most of which are mathematical, and all of which are still valid today. Although mixed reactions resulted, the conference was widely discussed by scientists in forums such as *Science*. Several of the responses were reviewed, showing that Schützenberger's work has generated much productive thought about the very real scientific problems with Darwinism.

Marcel-Paul 'Marco' Schützenberger (24 October 1920–29 July 1996) was an eminent French scientist whose work impacted many academic and scientific fields, including biology, linguistics, and information theory.

Schützenberger's first doctorate was in medicine from the Faculté de Médecine de Paris. His doctoral thesis, a statistical study of gender at birth, was awarded the French Academy of Medicine Baron Larrey Prize. Schützenberger's second doctorate was awarded in 1953 from Université Paris.[1] This degree thesis became a very influential work in information theory.

His academic career

Schützenberger was a professor in the Faculty of Sciences at the University of Poitiers (1957–1963), a research associate at MIT (1956–1957), a lecturer in the Faculty of Medicine at Harvard University (1961–1962), and a full professor in the Faculty of Sciences at the University of Paris from 1964 until his death in 1996.

Elected a correspondent in 1979, Schützenberger was made a full member of the French Academy of Sciences in 1988.[1] His impact in his fields of expertise includes two formal linguistic theorems (the Chomsky–Schützenberger and the Kleene–Schützenberger Theorems) and one in combinatorics (the Schützenberger Theorem). Combinatorics is the branch of mathematics concerning the study of finite or countable discrete structures used to decide when certain criteria can be met, and constructing and analyzing objects meeting the criteria. A simple example is the study of the number of different ways a group of objects can be combined or arranged, such as the bases in a DNA code. This field is a perfect tool to study evolution.

Professor Pin, a leading mathematician, noted that Schützenberger was a 'visionary' who made "tremendous contributions to science", and his work with Noam Chomsky became a cornerstone of the theory of language understanding.[2] With mathematician Professor Alain Lascoux, Schützenberger is credited with the foundation of the combinatorial structure called the Lascoux–Schützenberger Tree. Several other notable mathematic theorems bear the Schützenberger name, such as The Schützenberger Group Theory named after Marcel-Paul's great-grandfather, Paul Schützenberger.

Mathematician Professor Dominique Perrin credited Schützenberger with deeply influencing semi-group mathematical theory, plus "rational functions and transducers", and many other mathematical contributions.[3] A co-author with Schützenberger, biologist Jacques Besson, after noting that Schützenberger is mostly remembered for his work in pure mathematics, credits him with introducing statistical sequential analysis into French hospital practice.

After Schützeneberger's death, several theoretical mathematics journals dedicated an issue to him.[3] His life was also commemorated by the journal *Theoretical Computer Science* in 1998,[3] and again by *The International Journal of Algebra and Computation* in 1999.[1] The mathematician David Berlinski, in his 2000 book, *The Tour of the Calculus*, wrote that Schützenberger had provided him with "an enduring model of the mathematical intelligence".[4]

His opposition to Darwinism

In addition to his formal mathematics work, Schützenberger was "deeply involved in [a] struggle against the votaries of Darwinism", a stance that resulted in mixed reactions from

his peers and critics, both biologists and mathematicians.[5] Professor Pin added that the "brilliant mind" of this "truly pluridisciplinary researcher" also carefully researched "the deficiencies of Darwinism".[6] Professor Perrin wrote that throughout his life Schützenberger was "passionately interested in … the many flaws in the Darwinian theory of evolution."[5]

Schützenberger, while acknowledging that biology was not his major specialty, stated that his use of mathematics "in the overall assessment of evolutionary thought has been encouraged by the biologists themselves, if only because they presented such an irresistible target."[7] His work in support of the conclusion that random mutations consistently produce not progressive evolution but rather degeneration, resulted in the 1966 Wistar Symposium held at the University of Pennsylvania. This symposium

> "… brought together a collection of renowned … scientists … . At that meeting Marco became one of the first distinguished scientists in the world to point out that a theory of evolution that depends on uniformly randomly occurring mutations cannot be the truth because the number of mutations needed to create the speciation that we observe, and the time that would be needed for those mutations to have happened by chance, exceed by thousands of orders of magnitude the time that has been available."[5]

At this meeting, Schützenberger openly presented, along with MIT professor Murray Eden, the evidence for the fact that the mathematical probabilities against neo-Darwinism are enormous. He concluded that, as a result of the discovery of genetic coding, scientists have realized that genes are

> "… like a word composed in the DNA alphabet; such words form the genomic text. It is that word that tells the cell to make this or that protein. Either a given protein is structural, or a protein itself works in combination with other signals given by the genome to fabricate yet another protein."[8]

He stressed that a central evolution postulate is that genes undergo mutations "that may facilitate the reproduction of those individuals carrying it; over time, and with respect to a specific environment, [these] mutants come to be statistically favored, replacing individuals lacking the requisite mutation[s]."[8] He concluded that

> "Evolution could not be an accumulation of such typographical errors. Population geneticists *can* study the speed with which a favorable mutation propagates itself under these circumstances. They do this with a lot of skill, but these are academic exercises … because none of the parameters that they use can be empirically determined … . We know the number of genes in an organism. There are about one hundred thousand for a higher vertebrate … . But this seems grossly insufficient to explain the incredible quantity of information needed to accomplish evolution within a given line of species."[8]

Although some of his peers have chosen to ignore Schützenberger's work in this area, many have praised it alongside his thinking on artificial intelligence as one of his '*bête-noires*'. Others have characterized his work as effectively exposing "the many flaws in the Darwinian theory of evolution as it is commonly presented".[9] One review of Schützenberger's argument concluded "the case made by the mathematicians, which involves … the challenge that computer simulation of evolution shows evolutionary theory to be inadequate."[10] MIT Professor Murray Eden agreed with Schützenberger, and

> "… was particularly concerned with the element of randomness which is claimed to provide the mutational variation upon which evolution depends. 'No currently existing formal language', he contends, 'can tolerate random changes in the symbol sequences which express its sentences. Meaning is almost invariably destroyed. Any changes must be syntactically lawful ones.'"[10]

Professor Eden argued that

> "… what one might call 'genetic grammaticality' has a deterministic explanation and does not owe its stability to selection pressure acting on random variation."[10]

Eden concluded "that attempts to provide for computer learning by random variation have been unsuccessful, and that an adequate theory of adaptive evolution would supply a computer programmer with a correct set of ground rules."[10]

Schützenberger took an even more extreme position on evolution than did Eden, noting

> "… that all genetic information should consist of a rather limited set of words in an alphabet of 20-odd letters—in which evolution is typographical change—he finds a need for algorithms 'in which the very concept of syntactic correctness has been incorporated'. He compares this 'syntactic topology' with the 'phenotypic topology' of organisms as physical objects in space-time, and a major part of his challenge to neo-Darwinian theory is 'the present lack of a conceivable mechanism which would insure within an interesting range the faintest amount of matching between the two ... topologies … an entirely new set of rules is needed to obtain the sort of correspondence which is assumed to hold between neighboring phenotypes.'"[10]

Information theory and computer science

Although evolutionist Ernst Mayr and Nobel laureate Jacques Monod were both very interested in his ideas and respected Schützenberger's views, his person, and his scientific viewpoint, unfortunately the dialogue with those who did not share his point of view soon turned into 'street fighting'. A major objection to evolution related to Schützenberger's own field is information theory and computer science, which

> "… is precisely the domain that sharpens our intuitions about these [evolutionary] phenomena. A typographical change in a computer program does not change it just a little. It wipes the program out, purely and simply. It is the same with a telephone number. If I intended to call a correspondent by telephone, it doesn't matter if I am fooled by one, two, three or eight figures in his number."[8]

Schützenberger also documented the existence of major gaps in the current evolution theory, namely the problem of the enormous number of beneficial random mutations and massive selection that are required for evolution to occur, noting that

> "… it is clear that even on the most schematic models the number of cycles involved is truly enormous. Thus, when we reach the level of 10^{1000}, whether or not we take a few square roots makes little difference."[11]

When a computer program simulation designed to research evolution is modified by simulated mutations

> "… it just jams … . Thus no selection effected on the final output (if any!) would induce a drift, however slow, of the system toward the production of this mechanism if it were not already present in some form. Further, there is no chance ($<10^{-1000}$) to see this mechanism appear spontaneously and, if it did, even less for it to remain."[12]

This is another crucial argument against Darwinism. Anything that was produced by a random process is more likely to be destroyed by the very same process than it is to be improved by further random changes. This extends the functionality problem ever further. Not only do Darwinists have to produce life by chance, they then have to maintain it over billions of years by the same process.

Schützenberger refers to this problem elsewhere by pointing out that biologists almost universally assume the functionality of life without questioning it, while physicists and the mathematician can see this as a glaring oversight that is fatal to the Darwinian position. The problem of error tolerance was widely recognized, and consequently, since Schützenberger wrote this, has been dealt with to some degree, but error tolerant computer systems are far more complex than their predecessors and this point is hugely important to the anti-Darwinian argument. Schützenberger concluded that scientists can easily predict what would occur if such a mechanism was installed, namely

> "… for almost all the mutations the computation performed would have no relationship to the ones executed before; hence, no relationship to the selective pressure exercised on the output. All this … is a simple consequence of the lack of matching between the space of the outputs and the space of the programs."[12]

The functional complexity of life

Another reason for his rejection of evolution was that its foundational idea—the interpretation of functional complexity—was lethally flawed. One cannot grasp the phenomenon of life without understanding this

> "… concept, the two words each expressing a crucial and essential idea. The laboratory biologists' normal and unforced vernacular is almost always couched in functional terms: the function of an eye, the function of an enzyme, or a ribosome, or the fruit fly's antennae—*their* function; the concept by which

Figure 1. Marcel-Paul Schützenberger (1920–1996).

such language is animated is one perfectly adapted to reality. Physiologists see this better than anyone else."[13]

He added that Neo-Darwinism asserts "that without anything further, selection based upon the structure of the second space brings a statistically adapted drift when random chances are performed in the first space in accordance with its own structure."[11] He concluded that evolution is not conceivable because, if we "simulate such a situation by making changes randomly at the typographic level (by letters or by blocks, the size of the unit does not really matter), on computer programs we find that we have no chance (i.e. less than $1/10^{1000}$) even to see what the modified program would compute: it just jams."[11]

And the specific problem was that physiologists tend to see everything living as a matter of function. The various complex body systems that they study, such as the circulatory, digestive, and excretory systems, all can be characterized by

> "… simple, ineliminable functional terms. At the level of molecular biology, functionality may seem to pose certain conceptual problems, perhaps because the very notion of an organ has disappeared when biological relationships are specified in biochemical terms; but appearances are misleading [because] certain functions remain, even in the absence of an organ or organ systems."[13]

Schützenberger concluded that "neo-Darwinism cannot explain … evolution" and the

> "… inability of biology to provide a coherent explanation of evolution is best seen when contrasting it with geology … for each of the most important phenomena, there exists a simplified model which accounts for it … . At no point does geology need to use such phrases as 'creation of information', 'increase of efficiency', 'self-organization', and the like [as do Darwinists]."[11]

The problem Darwin saw with his theory, a problem that is still very much with us today, is the enormous level of complexity required of all life, from bacteria to humans, to be alive. One example is even "among unicellular organisms, the mechanisms involved in the separation and fusion of chromosomes during mitosis and meiosis are processes of unbelievable complexity and subtlety."[13]

Because organisms are a "complex ensemble of functional interrelationships … to explain their evolution, one must at the same time explain [the origin of] their functionality and their complexity."[11] He added that the evolution of living creatures requires one essential ingredient that must first exist, namely a specific functional organization. And understanding the origin of this organization

> "… lies beyond anything that our present knowledge of physics or chemistry might suggest; it is a property upon which formal logic sheds absolutely no light. Whether gradualists or saltationists, Darwinians have too simple a conception of biology, rather like a locksmith improbably convinced that his handful of keys will open *any* lock. Darwinians, for example, tend to think of the gene rather as if it were the expression of a simple command: *do this, get that done, drop that side chain* … the story on this level is surely incomplete, and Darwinian theory is not apt to fill in the pieces."[14]

Schützenberger convincingly argued that the genome (the software) does not contain the level of information required to explain the evolution of organisms, but now geneticists realize it requires both the software and the hardware to function, plus massive levels of regulation elements, such as miRNA, iRNA and other regulatory RNA. One example is the eye, concerning which Schützenberger notes

> "Darwinists imagine that it requires … two thousand genes to assemble an eye, the specification of the organ thus requiring one or two thousand units of information … . This is absurd! [because] … . A few thousand bits of information … yields only a single paragraph of text."[13]

Another example is:

> "Darwinists say that horses, which were once mammals as large as rabbits, increased their size to escape more quickly from predators. Within the gradualist model, one might isolate a specific trait—increase in body size—and consider it to be the result of a series of typographic changes. The explanatory effect achieved is rhetorical, imposed entirely by [the] trick of insisting that what counts for [a] herbivore is the speed of its flight when faced by a predator."[8]

He concluded by asking how can life

> "… with so few elementary instructions, … fabricate objects that are so marvelously complicated and efficient? This property with which they are endowed—just what is its nature? Nothing within our actual knowledge of physics and chemistry allows us intellectually to grasp it."[11]

The problem is that no known general principle can

> "… explain how to match blueprints viewed as typographic objects and the things they are supposed to control. The only example we have of such a situation (apart from the evolution of life itself) is the attempt to build self-adapting programs by workers in the field of artificial intelligence. Their experience is quite conclusive … without some built-in matching, nothing interesting can occur. Thus … there is a considerable gap in the neo-Darwinian theory of evolution, and we believe this gap to be of such a nature that it cannot be bridged within the current conception of biology."[11]

Conclusion

Schützenberger was one of the most scholarly and effective critics of Darwinism, and the critical objections to evolution that he and others have raised have not yet been answered.[15] Schützenberger's contributions include his demonstration of the inability of pure chance to achieve anything of value; the vast complexity of life that is assumed without explanation by Darwinists; and the lack of any regulatory mechanism that can interpret and relate any one random change to those that came before it. Recent biochemical research has further supported his many central concerns about the feasibility of Darwinism as the explanation for the creation of all life.[16] For example, it is now known that many gene products (such as proteins, tRNAs, rRNAs, miRNAs, and RNAs) are all required for the development of specific animal body plans, structures, and organs from a zygote.

These gene products transmit signals that affect how individual cells differentiate.[17] These signals also must interact with each other during embryological development to affect how cells are organized. The cell's many types of signaling molecules, such as hormones and cytokines, influence each other to form networks of coordinated systems that interact in ways similar to how circuit boards are designed to achieve complex integrated circuits. Research on gene regularity networks has determined that to build a new animal design from a pre-existing one by mutation and selection requires altering the pre-existing developmental gene regulatory network. This requires hundreds of coordinated mutations, and Davidson's work has shown that this much alteration inevitably causes catastrophic consequences.[18] He writes that since mutations in early development

> "… are always catastrophically bad, flexibility is minimal, and since the subcircuits are all interconnected, the whole network partakes of the quality that there is only one way for things to work. And indeed the embryos of each species develop in only one way."[19]

This fact "cannot be accommodated by micro-evolutionary nor macroevolutionary theory".[20] As a result of this and other research, Denis Noble, Professor in the Department of Anatomy and Genetics at Oxford University, wrote that "all the central assumptions of the Modern Synthesis (often called Neo-Darwinism) have been disproved".[21]

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