IN MEMORIAM

TRACY M. SONNEBORN

'Nature is written in mathematical language.'

Galileo Galilei

After a very painful illness, Tracy M. Sonneborn died on 26th January, 1981. The discipline of Theoretical Molecular Biochemistry has lost one of its innovators. Above all he will be remembered for his discovery of extrachromosomal hereditary transmission mechanisms in the paramecium. But this was not the most fundamental part of his work. He was one of the first to use a new symbolism to explain the internal logic laws of the genetic code and to glimpse an informative level of organization. His ideas, published in a single article, did not receive the widespread recognition they deserved, as his revolutionary concepts had been badly received.

In 1964, on the occasion of a Congress at Rutger's University, T. M. Sonneborn put forward a theory of genetic coding. The idea of resistance to mutation effects in coding systems was broached. He introduced the concept, new in Biology, of transmission noise on a coding route. The genetic code was likened to logical correspondence rules between languages. Thus he discovered certain properties of error detector and corrector codes. Using a statical study, he showed that theoretical codes with 20 codons and 44 terminators were more resistant than others to the occurrence of nonsense mutations. Codes with optimum resistance had the closest resemblance to the experimental results. T. M. Sonneborn foresaw the role played by other restraints such as mutation rates, frequency of codon usage, length of dictionary words. Several types of optimization of resistance to mutation effects were noticed. He proposed the study of synonym connections and underlined the importance played by corresponding assignments. It is remarkable to note that T. M. Sonneborn succeeded in extracting ideas that were correct from very incomplete experimental data.

Alas, this publication was not very detailed, and remained almost unknown. To see this, we only have to count the number of times his work was quoted by the ISI Dialog File 94 between 1974 and 1977, for example. It needs large computer resources to exploit this model, and the studies were not carried out. In the evolution of ideas about the origin of the genetic code, we can distinguish two important periods. From 1952 to 1961, this field belonged to the theoreticians and their codological work was essentially a pursuit of the 'magic number 20'. In 1961, there was a breakthrough: the perfection of a technique of incorporating amino acids. The study of new phenomena became fashionable. From then on, any theoretical model was considered with distrust and was pushed into oblivion. In biology, several descriptive levels succeeded each other, but very few explanatory theories were produced. Ideas about organization levels vary with the times. And so we are not at all surprised at the fate reserved for living science theoreticians. The prolonged ignorance of a Mendel model is not the

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result of a particular era, because Sonneborn's work may also pass unknown today. In fact, very few people recognise that analysing the dynamics of the functions of a system is more interesting than a simple description of its elements.

Tracy M. Sonneborn proposed a new approach to understanding the logic and origins of life. We must continue his work. His ideas are to be defended and made widely known. When this new stage of organization has been explored, new questions will be asked. The use of new symbols will be necessary and to use a famous phrase: 'a new dissection will break down our elements to site them in a new space'. The field of the origin and evolution of the genetic code has been neglected. But the combinatory and the theories of information and coding could solve this problem. Bringing these specialities closer together allows this scientific no man's land to be invaded. This was without any doubt one of the hopes of T. M. Sonneborn. This is why it is necessary to carry out research, free from the constraints of the present way of thinking, as he did, into unknown levels of organization. The results of the combinatory of the new informative symbolism do not exclude in any way predictions obtained using other symbols. On the contrary, these different ways of talking about the same object can be brought together, and complement each other. The primordial property of this system of storage, transmission and carrying out of information is its resistance to mutation effects, noise and errors. Study of this phenomenon, which is particular to life, using chemical symbolism does not offer the same fertility of discovery as manipulation of other coding symbols.

Tracy M. Sonneborn was the first to make this attempt.

Dr. JEAN-MICHEL LABOUYGUES
George Gamow Institute
23, Rue Delarbre
63000 Clermont-Ferrand – France

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