Editorial

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The cardinal principle that governs evolution by natural selection is the independence of the processes of mutation and selection. In other words, mutations occur spontaneously irrespective of whether they are beneficial or deleterious and are not influenced by the selection process. Organisms that carry advantageous mutations survive better whereas those that carry deleterious ones perish. Experimental evidence for the spontaneous origin of mutations arrived nearly a hundred years after the proposal of the theory of evolution in the form of the classic experiments by Luria and Delbrück in 1943. It was also confirmed by the simple and elegant demonstration by Joshua and Esther Lederberg (see article by Jayaraman in this issue). These results remained unchallenged for the next forty five years.

The scientific community was shaken up with the publication in 1988, exactly twenty years ago, of a paper by John Cairns and colleagues with the innocuous title, *The Origin of Mutants*. The paper challenged the notion that all mutations are spontaneous and suggested that they could be directed by the selection process. The finding was so controversial that Frank Stahl, writing a commentary in the same issue of *Nature* in which the Cairns paper appeared, titled his piece *A Unicorn in the Garden*. For the next several months, the correspondence section of the journal was flooded with letters both supporting and refuting the findings of Cairns *et al*. Additional work, carried out during the two decades to follow, explored different aspects of the origin of mutations. The main conclusion from these studies was that mutations can and do occur even when cells are not dividing and bacteria have evolved mechanisms to modulate mutagenesis even during stationary phase. Evidence for mutations "directed" by the selection process however remains inconclusive.

The controversy had a significant positive impact on bacterial genetics. It opened up the whole field of stationary phase physiology and highlighted the extraordinary versatility and adaptability of microorganisms. It also helped discover new genes that enable bacteria to cope with stress. These studies have enhanced our ability in terms of formulating strategies for mounting counter attacks against pathogens.

Controversies are a part of the scientific enterprise. They keep scientists on their toes and prevent them from becoming complacent. They make science a dynamic endeavour.