

upon selfing or upon open pollination, indicating that this plant was completely female sterile.

Discussion

The spindle is probably a composite structure in most organisms and a normal spindle appears to be the product of a spindle fiber organiser located on the chromosomes plus pole determinants, synchronized in time and space, although either can produce the spindle unaided in some organisms. The structural abnormalities described here can be interpreted as variations in the behaviour of pole determinants (Swanson and Nelson 1942). The spindle organiser described by Walters (1958) and Tai (1970) is essentially the same as pole determinants described by earlier workers. A unit spindle organiser if broken randomly results in the formation of multipolar spindles (Tai 1970). Multipolar spindles were recorded in *Triticum aestivum* when treated with acetone (Kabarity 1966). When *Allium cepa* was subjected to low temperature treatment multipolar spindles were obtained in their PMCs (Huskins and Chang 1950). In the case of wheat grass the spindle organiser was broken spontaneously due to a gene mutation, resulting in the formation of multipolar spindles (Tai 1970). When 0.2% of aqueous colchicine was injected into young flower buds of wheat which had not entered meiosis it resulted in either achiasmatic meiosis (Dover and Riley 1973) or the induction of multipolar spindles (Dover and Riley 1977). In all these cases colchicine or other experimental agents seem to act directly on the pollen mother cells in producing spindle abnormalities. In the present experiment, on the other hand, colchicine was applied long before the initiation of flowering and therefore could not have acted directly on PMCs. In the present case, colchicine could have altered the stability of the pole determinants in the early seedling stage at the time of treatment and this abnormality could have persisted over many cell generations and been expressed in the PMCs. The wrinkled leaves and other morphological abnormalities listed are possibly the result of similar abnormal spindle behaviour in the somatic tissues.

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Book Reviews

Stanley, S.M.: *The new Evolutionary Timetable; Fossils, Genes and the Origin of Species*. New York: Basic Books 1981. 222 pp., 56 figs.

Since Darwin in 1859 published his "Origin of Species", the discussions on the evolution theory went through alternating periods of great vehemence and of relative quietness. In the last few years the vehemence is increasing again, focussed

on two discussion items: is evolution to be accepted as an historical fact (antithesis evolutionism/creationism), and if so, does evolution elapse gradually or by fits and starts (antithesis gradualism/punctuationalism). Sometimes this discussion even is brought into political spheres (N. Wade, *Science*, Vol. 211, 2 Jan. 1981, pp. 35–36; L. Beverly Halstead, *Nature* Vol. 292, 30 July 1981, pp. 403–404). Among the

evolutionists the punctualism forms a new school, which – considered from whatever point of view – offers much matter for reflection.

Steven M. Stanley is a convinced punctualist. The aim of his book is to popularize the punctualistic view. In Stanley's opinion (and in contrast with what gradualists think, he says), species are not subjected to everlasting, slow and gradual changes; after having come into existence, they hardly show any further evolution. The arising of new species, on the contrary, occurs rather suddenly in small, isolated populations of stabilized species (quantum speciation). The course of evolution is determined not so much by positive selection of the fittest individuals in a population as by the success of species with higher speciation activities. Evolution progresses unpredictably, undirected, by fits and starts, by trial and error.

Stanley pays much attention to the development of the opinions on the essence of the evolution process since Cuvier's times. Cuvier adhered to a creationistic catastrophism. Opposite to this view Darwin propounded his evolutionism, which, as Stanley tries to demonstrate, could not be otherwise than gradualistic. After genetic sciences had come to prosperity and the occurrence of mutations had been demonstrated, a new school arose, defending the fundamental influence of macromutations and the existence of a jerky mode of evolutionary change. As shortly afterwards the difficulty was recognized that it should be hard for an isolated, strongly deviating mutant to pass on its genetical material, a renewed gradualism arose, adapted to the newest insights of modern genetics and based on the belief in the fundamental influence of long series of micromutations (Modern Synthesis, Neodarwinism). When the centenary of the appearance of Darwin's "Origin" was celebrated, the insights of Modern Synthesis were still accepted rather generally. In the early 1970s Eldredge and Gould put forward punctualism as the better alternative for gradualism. From then the discussion on the true nature of the evolution mechanism adopted a very vivid character once more (M. Ridley, *Nature*, Vol. 286, 31 July 1980, pp. 444–445; R. Lewin, *Science*, Vol. 210, 21 Nov. 1980, pp. 883–887; R. Lewin, *Science*, Vol. 214, 6 Nov. 1981, pp. 645–646).

According to Stanley the fossil record confirms the punctualistic view: species appear rapidly and after that maintain themselves for millions of years without important changes. Here we find the cause why fossil transition forms are so extremely rare (*Archaeopteryx* excepted, no typical transition forms are mentioned in Stanley's book; even the term "transitional form" is not to be found in the index). The fact that in modern genetics the existence of regulatory genes is accepted now beside that of structural genes is for Stanley a strong support for the punctualistic view. He thinks that only a few mutations in regulatory genes could be sufficient for the arising of a new species.

Stanley illustrates his point of view with numerous examples of species that suddenly appear among the fossils and then survive for hundreds of thousands of generations without evolving very much. He also extends his vision to man, and here it is striking that he does not recognize the transition form *Homo habilis* as such. In the cultural evolution of man, too, Stanley observes a punctualistic tendency.

In one of the chapters Stanley meddles with the struggle between creationists and evolutionists, which, especially in the U.S.A., is fought out with great vehemence in the last few years (D. Dickson, *Nature*, Vol. 284, 17 Apr. 1980, pp. 588–589; W. J. Broad, *Science*, Vol. 211, 20 March 1981, pp. 1331–1332; letters from N. Eldredge and others in *Science*,

Vol. 212, 15 May 1981, pp. 737–738). Creationism, Stanley states, belongs to religion, evolutionism to natural sciences; so a discussion between creationism and evolutionism hardly offers any starting-points. In this opinion he is supported now by a verdict of the federal judge of Arkansas, where the latter had to arbitrate upon the legal obligation of teaching creationism on public schools (Editorial, *Nature*, Vol. 295, 14 Jan. 1982, p. 85; D. Dickson, *Nature*, Vol. 295, 14 Jan. 1982, pp. 87–88; R. Lewin, *Science*, Vol. 215, 29 Jan. 1982, pp. 484–487).

Occasionally Stanley surprises the reader with somewhat singular remarks. According to him Darwin believed that the variability required for the fine tuning of the organism to nature is usually present within the gene pool (p. 11). Where Stanley rejects the existence of internal forces in living matter striving for evolutionary changes in a fixed direction (orthogenesis) (pp. 180–181), it is surprising that he holds the view that successful groups triumph simply by virtue of an inherent tendency to speciate at a high rate (p. 188). Where Stanley states that the lack of known fossil transition forms is wrongly ascribed by gradualists to the incompleteness of the fossil record (pp. 40, 73, 106), it should have been better that he did not repeatedly appeal to this incompleteness himself (pp. 83, 140, 176, 186).

In Stanley's opinion Darwin had the tendency to polarize when he opposed the Cuvier catastroph theory (p. 48). It is hard to withdraw from the impression that Stanley does the same where he opposes gradualism. Most gradualists do not hold the extreme view – as Stanley thinks they do (pp. 36, 85, 96) – that all species are subject to a permanent process of gradual changes. In certain cases, for instance where species are highly adapted to a scarcely changing environment, many gradualists will have no troubles with stagnation in evolution. The concept of "conservative taxa" (the brachiopod genus *Lingula* being a frequently quoted example) is substantially older than punctualism! Nor would most gradualists be disturbed by ancestral taxa holding their own for some time at the side of their descendants (e.g. the *Seymouriamorpha!*), a point of view that is thought by Stanley to be irreconcilable to gradualism (p. 118). If an evolutionist holds the gradualistic view, this does not mean that he believes in an absolutely constant evolution rate for all times. Phases of accelerated, anyway intensified, evolution (e.g. in the case of the relatively sudden opening of new habitats or life possibilities) have been accepted by many students thinking in gradualistic terms (the accelerated developments then being thought to have passed off gradually in themselves); examples can be found in the adaptive radiations of Amphibians in the Carboniferous, of the Reptiles in the Permian and Triassic, and of the Mammalia in the Tertiary Periods. Considered in retrospect, most gradualists indeed always have accepted some "punctualism".

On the other hand the following pronouncements can be found in Stanley's book: "Chronospecies, by definition, grade into each other and each one encompasses very little change", and "speciation . . . must have occurred . . . in less than a few thousand or at most a few tens of thousands of years" (pp. 93 respectively 111). Perhaps gradualistic punctualism or punctualistic gradualism will turn out to be the most acceptable conception in the long run (J. S. Jones, *Nature* Vol. 293, 8 Oct. 1981 pp. 427–428)!

Stanley's book has the merit that it enables the educated layman to make acquaintance with old and new opinions within evolutionism. The professional, too, will find matter for reflection in it.

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