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BOOK REVIEWS

Conceptual issues in evolutionary biology edited by Elliott Sober. The MIT Press, Cambridge, Massahusetts, 1984, pp. xiv + 725, $ 22.94.

In a short piece called 'Darwin's Mistake', Tom Bethell in 1976 threw a stone in the tranquil waters of Darwinism. Bethell was not the first to do so but he was the first to do so effectively, forcefully and in popular language shorn of all the scientific verbiage of the biologist. Rumblings of discontent and doubt had been heard earlier; they have since assumed an intensity which can no longer be ignored. What lay for over a hundred years as an intellectual preserve of the biologist has since been exposed to the naked, glaring light of the physicist and the philosopher and both have found Darwinism wanting. This has been altogether a good thing, for the biologist has at last come to the realization that it is not enough that he be convinced; others have to be convinced too. Evolution is too important to be merely the concern of the biologist. It is of such universal application and relevance that thinking man as a whole should view it as a phenomenon which touches him; he is a part of Nature.

Elliott Sober, a Professor of Philosophy at the University of Wisconsin, Madison, has put together 35 papers, published during the past 10 years or so, by both biologists and philosophers, who have thought about the problems of Evolution as seen in the light of modern science. It is a pity that no physicist has figured in the anthology; for physicists too (as well as other scientists) have spoken of Evolution, Freeman Dyson, for one. Also, one gets the impression that the choice of papers is biased by the Editor's own preferences and much literature critical of Darwinism has been ignored - perhaps on constraints of space.

However, there is much that is useful and a good deal that is provocative among the essays chosen; 'Fitness' has received fair treatment. The motto 'Survival of the fittest' was satisfying to Herbert Spencer and handily useful to Darwin, but is hardly adequate to the biologist today who finds it too circular. Indeed, for the first time in over a hundred years, Darwinism is being challenged on almost every count and every word he employed is being scrutinized with care and in the light of recent understandings in philosophy and the sciences.

'The units of selection' is another area of worrisome uncertainty. The naïvete of 19th century Darwin who viewed the organism as the Unit stands exposed in the light of the possibility of a whole series, from the gene to the species, as contenders for this status.

Function, Teleology, Reductionism are other areas of concern. 'Anatomical structure does not logically determine its function though it sets bounds to the kinds of activities in which it engages' says Ernest Nagel. Why a given anatomical structure is associated with a specific function is an irresolvable question. Its bearing on Evolution in general and Darwinism in particular can be easily perceived.

Reductionism has been a favourite game with scientists. To be sure, it has yielded valuable results in the past, especially in the physical sciences, but it is admitted that it has been relatively unproductive in the biological sciences, perhaps even harmful. Derivational Reductionism has never been able intelligently to deal with questions of relationship between biology and physical sciences. Unification of sciences will not come this way, says Nancy Maull, a philosopher. Embryological processes can never be explained by mechanical phenomena or in physico-chemical terms, and the Cartesian concept that biology is simply a chapter of physics should be resisted. Biological methods have an intrinsic autonomy as well as authenticity and it is meet and proper that this is recognized by both physicists as well as philosophers.

The anthology brings together, for the first time since the 1970's, papers on conceptual and philosophical issues on Evolution. That views of biologists and philosophers have been put together has been essentially the choice of the Editor. That other views are called for and will in the coming years, find abundant relevance will probably be one of his ready admissions.

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Protoplasts 1983 - Lecture proceedings edited by I. Potrykus, C.T. Harms, A. Hinnen, P.J. King and R.D. Shillito, Birkhauser Verlag, AG, Ringstrasse 39 CH-4106 Therwil, Switzerland, 1983, pp. 269, S. Fr. 84.

The Sixth International Protoplast Symposium held at Basel, from August 12 to 16, 1983 was attended by over 300 scientists from more than 30 countries. This volume presents the manuscripts of the symposium lectures (12 each in plant and microbial protoplasts) and summaries of majority of the workshops. All the aspects of modern protoplast research have been reviewed and the present day art of technology has been presented in detail by leading authorities in the field.

A. Plant protoplast

Davey (England) has highlighted the need to develop broad spectrum lytic enzymes for the isolation of protoplasts from a wide variety of species. The nature and physiological status of the plant material used in obtaining protoplasts are considered as important as the nutrient environment used to culture them. Problems encountered in developing protoplast technology suited for legumes and graminaceous crops have been discussed. A great potential exists for pollen tetrad protoplasts and tree protoplasts from seedlings.

The 'state of the art' of protoplast culture and plant regeneration in cereals, forage grasses and legumes were presented by Dale (England). The recent findings such as DNA diminution in the mutant leaf parts of monocot species were discussed. Suspension cultures of callus

obtained from basal part of the leaf was found to be the only alternative tissue culture system in monocots due to its maximum morphogenetic potential. The use of *Ustilago maydis* to study wound healing may be exploited to study the morphogenetic potential in monocot systems.

Bourgin (France) described the advantages of mesophyll and haploid protoplasts in the selection of pure mutants obviating the problems of chimeric effects. A wide range of biochemical and developmental mutants can be developed using protoplasts. An overview of the mutants selected from protoplast-derived cells was presented.

The exploitation of somaclonal variation using protoplast system was discussed in detail by Larkin's group. Protoplasts serve as ideal model system to study the effect of environment and in understanding the mechanism underlying the origin of somatic variability in plants. There is evidence to suspect a genetic or atleast an epigenetic basis for somoclonal variation. Various mechanisms of origin of somatic variations in the products of protoplast fusants were described (Harms, Switzerland). They include nuclear genomic disharmony, mitotic crossing-over, cytoplasmic incompatibility, interorganellar competition, ploidy levels and differentiation potency. The present state of protoplast fusion and hybrid selection possibilities in higher plants is summarized (Lazar, Hungary).

Various uses of protoplasts in genetic engineering are described by Manzara and Lurkin (USA). They raised the potentiality of substituting *A. tumefaciens* by *A. rhizogenes*, the advantage in using the latter was that the roots induced by bacterium were easy to regenerate into plants, contrary to crown gall tumors.

Segregation of cytoplasmic traits in postsomatic fusion progeny is a multifactorial process. Fluhr (Israel) assessed the influence of various factors on this process and suggested several novel methods using *Nicotiana* protoplast system to study chloroplast inheritance. Using mesophyll protoplast system, Meyer and Aspart (France) described for the first time experimental strategies to resolve interaction between cell wall formation and mitotic development, which are intriguing problems of plant developmental biology. The role of plasma membrane in the process of cell wall regeneration was elucidated by Fowke's (Canada) group. Protoplasts have found use in studying the role of plasma membrane-associated organelles, plant microtubules and coated vesicles in cell shaping and differentiation of plant cells. Finally, the prospects of protoplast technology in virus research and crop improvement are summarized by Muhlbach (FRG) and Cocking (England).

B. Microbial protoplasts

Ferenczy (France) a pioneer in protoplast fusion technology has discussed various methods of genome engineering using microbial protoplast systems. These serve as useful tools to obtain novel cellular hybrids with organelles from different species and genera. Even interkingdom fusions between fungal and plant protoplasts can be obtained, thereby facilitating breeding plant varieties resistant to phytopathogenic fungal strains. Several methods are already available for fusion and transformation of protoplasts, despite the genetic instability associated with the fusants (Baltz and Matsushima, USA). Morgan (England) has

reviewed the nature and application of new methods to the genetic manipulation of yeasts for strain improvements. Anne (Belgium) discussed how protoplasts from diverse origins can be fused resulting in novel genetic combination. In such fusants changed gene expression can result in the synthesis of novel or hybrid molecules. Protoplast hybrids in genus *Aspergillus* are also used to study genetics of nuclear and mitochondrial genomes and in the analysis of incompatibility gene families (Croft and Dales, England).

The non-complementary diploids (Ncds) is one of the intensely discussed topics (Hotchkiss and Gabor, USA). These arise at high frequency in *Bacillus* protoplast fusants, indicating the signs of chromosome inactivation. They would serve as excellent model system for probing chromosome inactivation in mammals. Makins (England) discussed the use of liposome systems for delivering a variety of substances into different organisms through liposome-protoplast fusion. These liposomes have a great potential to transfer genes (in cloning), mRNA for *in vitro* translation and even organelles. The recent discovery of fibronectin-liposomes having affinity for DNA, glucose, gangliosides and acetylcholine esterase would herald a new era of cellular engineering.

Kotyk (Czechoslavakia) through his detailed studies on the transport of nutrients in yeast protoplasts has demonstrated significant differences in the physiology of intact cells and protoplasts. The stable L-forms were the subject of discussion by Gumpert Taubeneck (GDR) and Martin (FRG). The general properties of L-forms and their relationship to true protoplasts were described. Their use in studies on resistance to bacteriophages and colicins were illustrated. Martin described the osmotically stable L-forms of *Proteus mirabilis* produced by penicillin treatment and the presence of a modified lipopolysaccharide in its outer membrane. Its role in the stabilisation of cytoplasmic membrane and alteration of transport system was implicated. The use of protoplast system in studying secretion of extracellular proteins was illustrated (Lampen, USA).

The topics chosen encompass all aspects of protoplast technology and its varied applications. In each lecture the subject is briefly reviewed and an up-to-date appraisal of the developments was presented. An attempt to cover each lecture in detail would require a lengthy review. But it could be emphasized that the volume would be found interesting and of great help to both the beginners as well as experts in the area of protoplast research, an area of great potentialities.

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