A number of cases of extra-nuclear heredity were described, and these were thought to be controlled by cytoplasmic units called 'plasmagenes'. In the USA a leading part in this controversy was played by T. M. Sonneborn, who discovered the cytoplasmically inherited 'kappa' particles in the ciliate protozoan *Paramecium*; while in France B. Ephrussi showed that some yeast types ('petites') were also cytoplasmically inherited. Even in *Drosophila*, the organism *par excellence* of the Morgan school, another French scientist – Ph. L'Héritier – discovered that CO_2-sensitivity was controlled by a factor (or génoïd) which was transmitted through the cytoplasm of the egg. All these findings, and much else, are discussed by Jan Sapp in his highly entertaining book, which is much enlivened by numerous personal details of the workers concerned. There are also lengthy discussions of the historical development of attitudes to biological theories in various European countries, as well as some account of the infamous Lysenko affair in the USSR.

Nowadays interest in these matters has rather died down, and they are not considered worthy of serious consideration by most teachers of genetics. It is clear that modern molecular biology has developed directly from the *mainstream* of classical chromosomal genetics, and most of the previously described cytoplasmic 'exceptions' have in the end turned out to be not so exceptional after all. They are all, or nearly all, controlled by DNA- or occasionally RNA-containing structures, which are exceptional only in their location in the cell. Sonneborn's kappa particles are now seen to be bacterium-like symbionts, while Ephrussi's 'petite' yeasts are controlled by mitochondrial DNA and L'Héritier's CO_2-sensitive 'génoïds' turn'out to be RNA-containing viruses. Finally in green plants, the chloroplasts have their own quite elaborate DNA-containing genetic system. Of course all these 'cytoplasmic' factors are interesting in themselves, and add to our knowledge of cell biology, but in no way do they conflict with the basic principles underlying gene reproduction and expression.

So the question arises – especially for those like the present reviewer who formerly devoted much time and effort to the study of extranuclear genetics – was it worth while? Ephrussi evidently came to have some doubts for in 1958 he wrote in a letter to Sonneborn: 'I suddenly felt my life wasted'. He thereafter left the study of yeast to others (some of them, e.g. P. Slonimski reaped from them a magnificant harvest of knowledge about mitochondrial genes). Sonneborn however held out till the end of his life in 1981, maintaining his opposition to what German writers have called the 'Kernmonopol', and firmly maintained his belief in the existence of a cytoplasmic system, supplementary to that of the nucleus. Even though he eventually conceded that 'kappa' was not a plasmagene but a symbiont, he believed that certain structural patterns of ciliate cells were not governed by nuclear genes, but by some 'invisible unknown, guiding force', lying beyond the reach of current molecular principles. However ill-defined, that exception to the current molecular dogma is still valid.

Bench-working researchers may find Sapp's approach to these matters rather peculiar. All controversies are interpreted in terms of 'power relations' between rival scientists. This seems rather far-fetched. While there is no doubt that certain dominating figures, who were perhaps more common in scientific circles formerly than now, may have had an undue influence over their students and subordinates, in the end scientific controversies have been settled, not by gladiatorial contests between eminent personages, but by the more mundane procedures of laborious accumulation of evidence, publication of experimental data, and logical analysis. Only under very exceptional circumstances, such as those which enabled Lysenko to overcome his opponents by political pressure and terror, can deviant scientific views be imposed by brute force. Fortunately that is not the usual situation in the modern scientific world.

Leaving aside Sapp's unorthodox views on the importance of 'power conflicts', we can thoroughly recommend his book as an excellent account of the history of controversies concerning cytoplasmic genetics.

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Teratocarcinomas and Embryonic Stem Cells: A Practical Approach. Edited by E. J. ROBERTSON. Oxford: IRL Press, Practical Approach Series. 1987. xii+268 pages. Subject index. Softbound £17.00/$US 32.00 (hardcover £26.00/$US 47.00).

Teratomas and teratocarcinomas arise spontaneously in the testes or ovaries of certain inbred strains of mice; they can also be produced experimentally by transplanting early mouse embryos to ectopic sites. For more than 30 years these tumours have been used in the study of developmental biology, cell biology, genetics and experimental oncology.

In the last few years molecular biologists too have shown a considerable interest in these objects. It has become clear that an understanding of the in vitro development of stem cells derived from teratocarcinomas (TSCs) can throw light not only on the molecular mechanisms of cell differentiation, but also on the mechanisms controlling gene expression during differentiation. Their relevance to gene engineering in mammals has been in no doubt since 1981, when two teams of scientists in the USA and in England independently succeeded in obtaining stem cells from early mouse embryos (ESCs) that resembled the stem cells of teratocarcinomas. ESCs could be cultured in

vitro for long periods of time without any alteration of pluripotency. When introduced back into mouse embryos, i.e. in genetic chimaeras, ESCs not only contributed to the development of all the organs of the body, but – and this is very important – they were also able to establish germ cell lines. This was possible, because ESCs, unlike TSCs, usually retain a normal karyotype, even after mutagenization. Thus, ESCs can serve as a reliable vector for the construction of mutant animals.

The book under review is a practical manual with emphasis on techniques and approaches required for work with teratocarcinoma and embryonic stem cells. Chapter 1 deals with the technique for producing teratomas and teratocarcinomas by transplanting mouse embryos under the kidney capsule. A protocol is given for the establishment of TSC lines. Chapter 2 gives a detailed description of methods for culturing TSC lines and inducing their differentiation. Of special interest is Chapter 3, devoted to mutagenization and selection of genetic variants of TSCs and cell hybrids produced by their fusion. Chapter 4 focuses on the technique of isolating ESCs from the early mouse embryo, and methods for culturing them. This is of particular importance as these procedures have so far not been practised in many laboratories. Chapter 5 describes methods of producing genetic chimaeras not only by injecting ESCs into blastocysts, but also by aggregating them with morulae. Techniques for constructing chimaeric mice are well known; nevertheless, the reader will find some valuable information here concerning the use of ESCs for making chimaeras. Chapter 6 is of the utmost importance, especially for those who are attempting to use ESCs for purposes of genetic engineering, e.g. to construct mice with mutations in specific genes. Several approaches to the introduction of recombinant DNA molecules, cloned genes in particular, into the ESC genome are described in detail. These rather sophisticated techniques are not easy to follow. The information presented in this chapter may help to overcome a variety of technical obstacles. Chapter 7 is concerned with TSC proliferation factors, and techniques for isolating growth factors produced by these cells. Chapter 8 is devoted to tumours induced by human germ cells and methods for obtaining stable TSC lines from them.

Almost every chapter contains detailed recipes for media and other solutions, and tables showing the number of steps in various experiments and the order in which they must be followed. This manner of presentation is very convenient for the reader, but makes repetition unavoidable, so that descriptions of the same solutions, or discussion of the same technique (such as the technique for obtaining early embryos) can be found on several different pages. One advantage is that it allows the reader to compare techniques practised in different laboratories working with TSCs and ESCs.

The book is richly illustrated with good diagrams and photographs, though the photographs of histological preparations (pp. 10–13) leave much to be desired.

The book makes a very good impression and deserves much praise. It will without doubt be a very popular desk book in many laboratories and will help bring about a wider use of teratocarcinomas and embryonic stem cells in the study of numerous problems in experimental biology and experimental medicine.

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