

# BOOK REVIEWS

## English Science Policy

*The Organisation of Science in England.* By D. S. L. Cardwell. Pp. xii+268. (Heinemann Educational Books: London, October 1972.) £2.80. Revised edition.

FIFTEEN years after Dr Cardwell's *The Organisation of Science in England* first appeared we now have a revised edition (a paper-back version of which is issued as an Open University set book). Although it incorporates a good deal of recent scholarship on the social history of 19th-century British science, the argument of the book remains fundamentally unchanged.

The process by which English science was transformed from the "amateur" pastime of 1800 into the professional enterprise of the present day is the story of success over remarkable adversity. Reliance on individualism, voluntarism and self-help was reinforced by a deep-rooted suspicion of State intervention which made Victorian men of science initially reluctant to demand Government support of research. Government, on the other hand, did not, until quite late in the 19th century, recognize scientific research as something essential to national welfare. As late as 1869 the Chancellor of the Exchequer refused a request for a mere £300 from a meteorological society with the icy pronouncement that it was "our duty not to spend public money to do that which people can do for themselves".

Yet throughout the century statesmen of science like Babbage, Playfair, Tyndall and Huxley were vigorously arguing the dependence of national progress on the endowment of research, both pure and applied. What was good for the professionalization of science was good for Britain and State subvention was necessary. In 1878 Colonel Strange claimed that "the tendency of progressive civilization must be to supersede individual effort", and four years later Sir B. C. Brodie announced, with typical hyperbole, that a class of professional researchers "does not exist

among us and its absence is the greatest defect in our social system". Continental models came to the aid of a characteristically British capacity for self-criticism. German liberality in the support of science and applied science was the most frequently cited example of what Britain ought to be doing for her men of science. But it was not until the Great War that the consequences of British parsimony became fully evident.

The most intriguing theme of Dr Cardwell's book is the congruence between the professionalization of science and the reform of English education. While scientific training of the highest quality was always available to the upper classes, it was not until elementary, secondary and technical education was vastly expanded that England could produce the requisite "rank and file" of the scientific enterprise as well as the "officers". And, until the lower levels of education received adequate support, English science could not offer trained men of science the teaching positions which professional science requires.

Cardwell's work is still the most thorough and competent treatment of the subject available. Good as it is, it may be criticized on two main heads. First, it must be recognized that the relevant policy for professionalizing 19th-century science is Britain and not England. The bleak portrait Cardwell paints of the early institutional standing of science might have been quite different had the Scottish situation occupied more than a peripheral place in his account. Second, one feels that Cardwell has been unnecessarily harsh about early century "amateurism" and "dilettantism". The spread of scientific culture across the British landscape, notably in the form of the "literary and philosophical societies", very probably had quite a lot to do with emerging public approval of science as something to be encouraged and supported. "Amateurism", and a favourable public image of science, was probably a neces-

sary pre-condition for later "professionalism". Cardwell focuses on the politics of professionalizing science but gives the reader very little feeling for the social and cultural background against which the process unfolded.

STEVEN SHAPIN

## Pattern Recognition

*Fundamentals of Pattern Recognition.* By Edward A. Patrick. Pp. xxiv+504. (Prentice-Hall: Englewood Cliffs, New Jersey; Prentice-Hall International: London, 1972.) £9.

THIS book is concerned with purely statistical approaches to the design of systems which, given specimen vectors belonging to distinguishable clusters or classes, will automatically classify any further given vector of the same dimensionality. The classification of the specimen vectors may or may not be known *a priori*, and in cases where it is unknown we are confronted with the essential problem of numerical taxonomy.

A 115-page chapter is devoted to techniques for estimating statistical parameters. The other main topics of the book are decision rules, non-parametric techniques, clustering techniques, and dimensionality reduction. The mathematical level is fairly advanced, and the treatment is for the most part thorough, rich in theoretical insight, and unusually coherent. Anyone who has fairly advanced mathematical accomplishments and is specifically interested in the theory of the statistical approach to pattern recognition will find this book valuable: in some respects more so than *An Introduction to Statistical Pattern Recognition* by K. Fukunaga (Academic Press, New York and London, 1972).

When patterns are subject to severe distortion, it is seldom useful to apply statistical techniques directly to digitized versions of the data. It is usually better to apply statistical techniques to vectors whose components are results of distortion-invariant tests on the raw data. To