select adequate tests which are more or less invariant to distortion, it has been necessary in practice to use *a priori* intuitive knowledge of distortion. This knowledge is of vital practical importance and has to be imported from outside a purely statistical framework such as Dr Patrick's. Dr Patrick is aware of this: he constantly advocates making maximal use of *a priori* structural knowledge, and in chapter seven he introduces a method for testing hypothesized structural relationships. But this does not tell us positively and specifically how to deal with highly correlation distortion. Because distortion raises by far the biggest fundamental and practical difficulty in many applications, and because Dr Patrick scarcely tackles this difficulty, a safer title for his book would have been "Fundamentals of Statistical Pattern Recognition'.

J. R. ULLMANN

Cerebral Iconography

An Illustrated History of Brain Function. By Edwin Clarke and Kenneth Dewhurst. Pp. 154. (Sandford Publications: Oxford, 1972.) £5.50.

MEDICAL-historical iconography is not only a pictorial history of observations, discoveries and cures but also, and perhaps more informatively so, of ideas. Nothing can be more explicit about this than the remarkably well devised and annotated atlas of historical illustrations of brain function under notice.

Looking into the history of ideas, the most interesting point is that it took only a little more than fifteen years to perform the long jump from rigidly unrealistic and schematic mediaeval delineation of sensory perception, imagination, rational thinking and memory in circles on the surface of the head to the realistic-observational and basically modern representation of the brain (Magnus Hundt, *Anthropologium*, 1501, to Laurent Fries, *Spiegel der Artzny*, 1518). Moreover this was achieved twenty-five years before Vesalius's *Fabrica* and a little more than twenty years before such pre-Vesalians as Dryander. The mediaeval idea was that of "cellular location", that is, the reservation of the brain ventricles for the functions: sensorium and sensory-conditioned imagination in the largest (lateral—"anterior") spaces, rational thinking in the narrowest sieve-like (middle) and memory in the most remote, posterior cell. This idea was brought about by a strange mixture of ancient Alexandrian and Galenic *pneuma* (spirit)—theories with materialistic connotations linking certain functional differences with different regions and textures. It appealed to the Fathers of the Church (Nemesius) and ever since ruled for more than a thousand years.

As the authors most aptly show, it had not died with the opposition by the great anatomists, but survived in texts and illustrations not only with the mystical crypto-mechanist Fludd, but into the times of phrenology in the early nineteenth century when the mediaeval model was suitably revised and reproduced in the translation of Blumenbach's *Physiological Institutions* by John Elliotson (1789–1868). Talking about progress we are well reminded at the end of the mediaeval chapter in the caption of a normal ventriculogram of today that the "cells" are now known to be receptacles of the cerebrospinal fluid, but that "the exact nature of its production and function is still not fully understood". Nor would it be otiose to probe into the ideological motives that account for the popularity and long persistence of ventricular localization—a subject naturally outside the scope of the present work. A certain mediaeval—schematic—touch remains in at least one of the illustrations of the persistently overrated physiological speculator Descartes and even some of the ingenious and often underrated observationalist Vieussens. On the ideological side Thomas Soemmering (1755–1830) in spite of fundamental contributions including pictorial masterpieces to brain anatomy "reverted to the mediaeval theory of ventricular function when he contended in 1796 that fluid in the brain ventricles could be animated and was the immediate organ of the soul". His *Über das Organ der Seele* was inspired (though also criticized) by and dedicated to Immanuel Kant ("unserm Kant gewidmet vom Verfasser").

And so we come by way of full and highly interesting chapters on Eastern models and phrenology in its own right to the scientific investigation of cerebral convolutions in the nineteenth century, via Flourens, J. Hughlings Jackson, Fritsch and Hitzig, and the cyto-architects to Penfield's direct cortical stimulation studies and a final extensive assessment of cortical localization today — ending with isotope radioactive brain scanning (illustrated).

Here, then, is a wealth of pictures synoptically integrated with a full historical, medical and artistic discussion. William of Conches's description of the brain (O'Neill, Y. V., *Clio Med.*, **3**, 203 ; 1963), Tiedemann's illustrations of the cortex in negroes (influential in the controversies around the slave trade), Kurt Goldstein's attack on anatomical localization on a broad front against a background of deep insight, neurological as well as general-biological, and the changing experimental techniques from Joh. Gotfried Zinn to W. Feldberg deserve additional attention. Nothing like that, however, can detract from the distinct merit of this most admirable treatment of the subject including the elegant atlas of impressively evocative illustrations.

WALTER PAGEL

Microphysical Phenomena

Quantum Physics and Ordinary Language. By T. Bergstein. Pp. xii+61. (Macmillan: London and Basingstoke, October 1972.) £3.

QUANTUM theory treats of microphysical, and therefore not directly observable, phenomena. This raises the problem of language and its descriptive powers. We have only two concepts—wave and particle—describing space-time movement as established in classical physics. These concepts must serve for describing the phenomena on the atomic level and below it where, however, they are found to be complementary. The two concepts are mutually exclusive in the sense that they cannot be used in the same descriptive statement without incurring contradiction. They are exhaustive of the universe of discourse since together they suffice to describe all the phenomena that can be observed.

This book deals with the conceptualization of experience as first given by Niels Bohr by his principle of complementarity. Ultimately, all laboratory experiment, whatever its object and however "abstract" the theory on which it is based, must come down to the level of classical physics and ordinary language since the scientist can only read meters and clocks. The fundamental concepts of classical theory, like space, time, and cause, cannot be used without restriction in quantum mechanics. A physical observation implies an action which is an integral multiple of the quantum of action, h. The uncertainty principle precludes the use of classical concepts in the quantum domain while we cannot do without them in the laboratory. The situation presents us with an "aporia" as known from standard philosophy. Complementarity overcomes it but at a price: there is an interdependence of phenomenon and concept. The dividing line between phenomenon and instrument, or between object and subject, is movable since no meaning can be assigned to a result apart from the measuring method by which it is obtained.

Objectivity is expressed by the use of ordinary language and of classical physics. If this view is accepted, then there is always a part of experience that cannot be made "objective". The complementarity between observation and