verses the (by now) familiar field, but does take the trouble to describe most of the experiments that he mentions in sufficient detail for the reader to be able to grasp what was done, and he does adopt a more critical approach than some of his competitors.

KEITH OATLEY

Brain Histochemistry

Macaca mulatta: Enzyme Histochemistry of the Nervous System. By Sohan L. Manocha and Totada R. Shantha. Pp. xii+348. (Academic: New York and London, August 1970.) £10.05.

THIS work is based on the histochemistry of material from twelve monkeys. The oxidative (monoamine oxidase, succinic and lactic dehydrogenase) and hydrolytic (acid and alkaline phosphatase, ATPase, simple esterase, true and pseudo-cholinesterase) enzymes are investigated using fresh frozen sections. The regions examined include the cerebral cortical areas, the hippocampus, basal ganglia, diencephalon, brain stem, cerebellum, spinal cord, dorsal root ganglia, olfactory bulb, retina, optic nerve and other eye parts, choroid plexus, ependyma and peripheral nerve perineurium. With some two hundred and fifty three micrographs (no electron micrographs) the text is well illustrated although a number of the plates look rather fuzzy—perhaps indicating a need for thinner sections. The material is well laid out, and the introduction to the methods employed should be clearly comprehensible to the novice. The book could well serve as an introduction to brain histochemistry, for the findings are related to numerous references to the literature on corresponding regions in other species (the references stop short, though, at 1968).

Investigators who have kept up to date with the literature in brain fine structure and the localization of transmitter substances will, however, find the discussions disappointing, for in many places the authors seem to have little grasp of these very relevant topics. In the cerebral cortex, for example, they are unaware that most synapses are located on dendritic spines, and that there is growing evidence that (in pyramidal cells) these have an excitatory transmitter. On the other hand, somatic contacts may have mostly inhibitory chemically mediated synapses. The literature on transmitters in the subformical organ has not really been explored. The presence of choline esterase in dorsal root ganglion cells known to be noncholinergic could have been discussed at much greater length. The cerebellar glomeruli not only contain mossy fibre contacts but a second set—the Golgi cell granule dendrite contacts. The former are excitatory and the latter are inhibitory. Thus we have a dual system which can be precisely pinpointed with the microscope—is it any wonder that the histochemistry of the cerebellar cortex is in such a state of chaos when topics like this are ignored?

E. G. GRAY

Identifying Yeasts

The Yeasts: a Taxonomic Study. Edited by J. Lodder. Second edition, revised and enlarged. Pp. xvi+1,385. (North-Holland: Amsterdam and London, 1970.) £27.40.

"THE main intention of this work," says Lodder, "is to produce a book for identifying yeasts." Indeed, anybody now wanting to identify yeasts must have it constantly on his laboratory bench. The fourteen authors, who include most of the leading yeast taxonomists, have apportioned the genera among themselves. For this unique book, they have examined 4,300 strains and classified them into 39 genera and 349 species. Each species is described extensively: the macro- and microscopical appearance, the life cycle (if known), the ability to use 30 or 40 organic compounds as sole sources of carbon for aerobic growth ("assimilation"), 5 to 13 of them for semi-anaerobic "fermentation" and some additional physiological tests. The account of each species includes the number of strains examined, their sources and some information about how they vary, one from another. There is an invaluable bibliography for each chapter, and the book has a comprehensive index to the names of taxa which makes it easy to find the currently accepted synonym for almost any yeast. There is no general index.

I propose to discuss the book principally as one using it for identifying yeasts, and not to review the detailed classification. The accepted primary division of yeasts is into those that do and those that do not form ascospores. In his chapter on methods, Walt says "In view of the importance of ascospore formation as a taxonomic criterion, a strain may only be regarded as anascosporogenous when (a) it has failed to yield ascospores on a wide variety of media; (b) it has been shown not to be a haploid mating type of some or other heterothallic species." Walt lists fourteen ascogenic media. When one is faced with hundreds of strains to identify, using even half these media may be a formidable task; after inoculation they must be examined with the oil immersion objective at three days and then weekly "for at least 4–6 weeks", unless ascospores have been seen. Even after this, a negative result is equivocal. Recently, a colleague and I isolated and identified nearly 1,000 yeasts; as over 800 were (anascosporogenous) *Cryptococci*, it would have been futile to have tested them for ascospore formation.

Although ascosporulation is important in classification, formation of ascospores need not be made important in identification. An alternative to Lodder's identification key could be based primarily on growth and fermentation tests. Microscopical appearance, and even ascosporulation, could then be used for confirmation of identity and for distinguishing between species with the same responses to the physiological tests.

The nutritional tests must, of course, be uniformly carried out. On this Lodder is sanguine: "With certain minor exceptions . . . identical methods were used for every standard description, so that the individuality of each observer should not have significant effects on the results of the tests." Nevertheless, Walt refers to several methods that can be used. Though he evidently favours unshaken tubes of liquid media for growth tests, I found no statement that these were used by all the authors. The exact method of testing may not affect results when the yeast grows either well or not at all; but, even when aeration is not a limiting factor, the utilization of many test compounds often involves lags of up to several days (not a consequence of selection) and doubling times of as long as twenty hours. Such slow responses are particularly sensitive to test conditions. Hence the reaction of a given strain to one substrate may be described by different authors as positive, slow, weak or even negative. Accordingly, a new key derived from this book might use three categories of test response: positive, negative and query; the last would include all equivocal responses and those varying between strains of one species.

Compared with the first edition, written by Lodder and Kreger-van Rij and published in 1952, more than three times as many strains have been classified into over twice the number of species. The number of physiological tests has been increased from 15 to between 40 and 60, depending on the genus. The description of each species in the first edition included excellent drawings which greatly help identification; unfortunately in the second edition a number of species are illustrated sparsely or not at all.

Although the book is unwieldy, it is convenient as a single volume. Its high price will stop many buying their own copies, but the amount of information justifies the cost to any laboratory concerned with yeasts. The wealth of information about the capacities of all known kinds of yeast to utilize many organic substrates, combined with the summaries of the life cycles, is potentially of great industrial interest. It could also be an important basis for much research in microbial physiology and genetics.

JAMES A. BARNETT