It is sad to be less than totally enthusiastic, because this is a lavishly produced book. The illustrations and most of the photographic plates are of high quality, the two maps and two sets of profiles in the end pocket are very informative, and there are few typographical errors. But I have the feeling this could all have been done less lavishly and conveyed just as much information—perhaps even more had the book been edited with a harsher hand.

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A Readily Identifiable Neuron

Neurobiology of the Mauthner Cell. DONALD S. FABER and HENRI KORN, Eds. Raven, New York, 1978. xii, 290 pp., illus. $25.

Cellular neurobiology depends upon the investigator's being able to resolve the structure and activity of single neurons. If it is also possible to identify homologous neurons in different animals, a qualitative improvement in rigor occurs. Identifiable neurons are common in higher invertebrates, but what about vertebrates? It turns out that in most species of fish and in many Amphibia the brainstem contains a large neuron so distinctive in shape and location that it can be identified reliably in every normal individual. Named after its discoverer, who described its axon in 1859, the Mauthner cell (M-cell) has become "the most studied neuron." This book is an extensive review of what has been learned, and I recommend that neurobiologists read it.

In goldfish, the M-cell is a command neuron that mediates the fastest forms of startle responses, in which a strong flip causes the fish to yaw abruptly. An early notion that M-cells mediate swimming is wrong—the cells are silent during swimming. Eaton and Bombardieri summarize the evidence for the behavioral function of the Mauthner neuron in goldfish and zebrafish. Zottoli discusses the occurrence and structure of the M-cell across species. The cell has been recognized in over 100 fish and amphibian families, but its features vary considerably, so it provides an ideal object for comparative studies.

In the longest chapter, Faber and Korn review the physiology of the M-cell. The chapter is often dense, resembling too closely the style of primary papers. It is rewarding even so, for the work is elegant and important. The demonstration of neural interactions via nonsynaptic field effects is of special interest, and good progress has been made in relating structure to function, with regard to both field effects and synaptic actions. Structural studies are dealt with in detail by Nakajima and Kohno, who document six kinds of synapses upon the M-cell. They also discuss the remarkable "axon cap," a dense structure of nerve fibers and glia, whose properties help mediate the electrical field effects.

Kimmel and Model review M-cell development, a subject of renewed interest now that physiological studies complement anatomical ones. The M-cell develops early, responding first to tactile and then to acoustic stimuli. Inhibition seems to come last, but not much is certain yet. A chapter by Rovainen reminds us of the great usefulness of lampreys, which, of all the vertebrates, come closest to invertebrates in having many identifiable neurons. This brings us back to the question we started with: How likely is it that other vertebrate neurons will be found that, like the M-cell, can be identified in individuals? In the opening chapter, Bullock takes a useful approach to this question by defining an "equivalence class" as sets of neurons that, as a class, can be identified in different individuals. Bullock estimates that most neurons of vertebrates will fall into classes with sizes of from 30 to 100 neurons. Though uniquely identifiable neurons are predicted to be rare, this is still a remarkable estimate of heterogeneity, yielding over 10^7 equivalence classes for the human brain.

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A Neurotransmitter

Acetylcholine Synthesis in Neurons. S. TUČEK. Chapman and Hall, London, and Halsted (Wiley), New York, 1978. xiv, 260 pp., illus. $37.50.

Some 20 endogenous chemicals are known or suspected to be neurotransmitters in the higher animal phyla, and anyone who thought of ranking them in hierarchical order would probably feel obliged to put acetylcholine close to the top of the list. Besides its ancient phylogeny, its widespread distribution, and its multiplicity of actions, it has two further distinctions: it was the first neurotransmitter to be isolated from nervous tissue and the first to have its transmitter role established. The further analysis of that role, in the 1930's and 1940's, gave medical scientists a basis for understanding the action of some familiar drugs, like atropine, physostigmine, and nicotine, and some awesome poisons, like curare, botulinum toxin, and the synthetic organophosphorus "nerve gases." Other successes promptly followed, with the introduction of the neuromuscular blocking agents that revolutionized surgical anesthesia and the ganglion-blockers that pointed the way to effective medical treatment of hypertension. With all of this 30 or more years in the past, it may seem surprising that there is anything important still to be learned about acetylcholine's biosynthesis, especially since the process involves only one enzyme, choline acetyltransferase, characterized by Nachmansohn and Machado in 1943, and two apparently abundant substrates, the parent base choline, a normal constituent of all the body fluids, and acetyl coenzyme A, a product of the mitochondria in every cell.

In fact our understanding of the process is far from complete, as Tuček's book makes clear. The enzyme itself has not been obtained in pure form, and its histochemical localization is still in the rudimentary stage. We have some information, but not enough, about the axonal delivery system that carries it from the neuronal soma, where it is made, to the nerve terminals, where it is put to work. The enzyme's in vivo activity is coupled somehow to need, for it works faster when the transmitter is being discharged, but the nature of the coupling is unclear; substrate supply, product removal, and allosteric action tied to transmembrane ion movements are all plausible mechanisms, but which is the important one? The mystery remains too of how acetyl coenzyme A, supposedly locked behind mitochondrial membranes, can escape to reach the enzyme in the cytosol.

Tuček knows as much as anyone about these problems. Within the limits indicated by its title, his book presents the relevant facts and theories as fully (over 1000 references, with a few from 1978), as clearly, and as critically as anyone could wish; his own speculations are kept to a judicious minimum. The book's limitations are deliberate. Tuček does not concern himself, except tangentially, with the processes involved in the storage and release of acetylcholine; consequently he has little to say about the morphological and biophysical studies that focus on those topics rather than on the synthesis of the transmitter. I think his choice was wise. I found the book