ries in rearrangement collisions (including exchange). The definition of the Glauber approximation within the eikonal series is never really given; thus in the prescription of the recent Byron-Joachain eikonal Born series method one really does not know what f_{G_3} is.

One wonders for what audience the book is intended. As a book of self-study for the student, it is not sufficiently detailed or complete. It will be more useful as an outline accompanying a set of lectures, but it will rely heavily on the subsidiary material the lecturer will bring to bear. For the working scientist it will be a valuable guide, provided that he or she is aware of its selectivity and its several (but on the whole minor) shortcomings. I myself will be happy to have this book for reference.

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Hydromechanics of Swimming

Nekton. YU. G. ALEYEV. Junk, The Hague, 1977. vi, 436 pp., illus. Dfl. 120.

Functional-morphology ideas and observations from Eastern countries, particularly the U.S.S.R., are poorly incorporated into Western literature. Publications by Aleyev have been valuable to aquatic biologists, especially ichthyologists, in partly rectifying the situation. *Nekton* is no exception. If anything, the book should be more useful because Aleyev attempts to provide a broad, comprehensive account of adaptations for a particular way of life among animals from 12 classes. Within the limits of a single volume Aleyev succeeds in reaching his objective.

Nekton are animals in the water column capable of swimming at sustained speeds where inertial (pressure) forces dominate flow for fusiform fishlike bodies. The ratio of inertial forces to viscous (frictional) forces is traditionally expressed by Reynolds number (Re), which takes into account physical properties of water (viscosity, μ, and density, ρ), animal length, L, and velocity, V. Then Re = $\rho LV/\mu$, and nekton are defined as those organisms for which Re $> 5 \times 10^3$. Biologically, an increase in Reynolds number is associated with trends in body form away from adaptations to minimize sinking speed by maximizing hydrodynamic drag and trends toward adaptations to maximize swimming speed by minimizing locomotor drag. Typical nekton (eunekton) are further defined as swimming with Re $> 10^5$ when flow in the entrained boundary layer tends to become turbulent. Aleyev believes these Re present the greatest problems in minimizing drag and the greatest potential for boundary layer control. In the Re range from 5×10^3 to 10^5 planktonekton are defined. Two additional nektonic types are defined in terms of their affinities for submerged surfaces (benthonekton) or land (xeronekton).

Fish dominate the nekton. Therefore the book serves partly to update Aleyev's *Function and Gross Morphology in Fish* (1963; English translation, National Technical Information Service TT67-51391, 1969). This work on fish provides the principles for a general study of convergent adaptations for nektonic life in representatives of Cephalopoda, Sagittoidea, Amphibia, Reptilia, Aves, Mammalia, and six classes of fishes. Crustacea are not mentioned, although portunid crabs can sustain speeds when Re $> 10^5$ (Lochhead, in *Scale Effects in Animal Locomotion*, T. J. Pedley, Ed., Academic Press, 1977).

The definitions of nekton emphasize adaptations for swimming and drag reduction. Morphological adaptations for swimming are interpreted mainly through steady-state hydrodynamic theory for rigid bodies. In the United States and Britain, major advances in interpretation of body form and swimming have come through application of slender-body theory to swimming fishlike bodies. This approach emphasizes development of thrust and Froude efficiency and leads to some conclusions differing from those given by Aleyev. For example, Aleyev regards an eel as having a higher hydrodynamic swimming efficiency than a scombroid fish at sustained speeds because the eel has a relatively larger surface area. According to calculations of Lighthill (*J. Fluid Mech.* **44**, 265 [1970]) and Wu (*Adv. Appl. Math.* **11**, 1 [1971]), improved swimming efficiency might be expected with evolution of scombroid body form and locomotor movements. Most advances following from application of slender body theory to fish locomotion have come relatively recently, and the literature covering them is not discussed. Papers from Western sources more recent than 1971 do not appear to have been available to Aleyev during the preparation of the book. The most up-to-date source for this literature is Pedley's *Scale Effects in Animal Locomotion*, cited above.

Although adaptations for swimming and drag reduction are well represented, about 45 percent of the text discusses other adaptations, providing a well-rounded view of nekton as a group. Buoyancy control is discussed in detail. Adaptations for maneuvre, defense, camouflage, and senses are considered, as well as origins and geographic distribution of nekton. Principles established for extant forms are applied regularly to extinct animals. Changes in functional morphology during ontogeny are discussed in each chapter.

The book contains a wealth of data, primarily for morphological parameters, but Aleyev's coverage of Western literature is not much better than the usual Western coverage of Eastern literature. As a result, his account of observations sometimes becomes a catalogue from Russian sources, others being rejected. This is most apparent in the discussion of animal density. Only Aleyev's data and a few other Eastern sources are cited, the remainder being rejected on the grounds of differences in method. The basic method Aleyev describes for calculating density is from fish mass and volume, the latter measured by water displacement. The same or comparable methods are widely used in the rejected sources. Nevertheless, the data Aleyev presents are not readily available outside the U.S.S.R., and his book will be a valuable source for those working on the various groups of animals it deals with.

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