BOOK REVIEW

Stephen Childress, *Mechanics of Swimming and Flying*, Cambridge University Press, Cambridge, 1981, 155 pp., $14.50

This short monograph grew out of a course given at the Courant Institute and should be read as a first introduction to the rapidly expanding field of biofluid dynamics.

The first chapter consists of a concise summary of fluid dynamics. For biological applications there are essentially two realms, depending on the order of magnitude of the Reynolds number Re (ratio of the viscous force to the force of fluid inertia): the Stokesian realm $Re \ll 1$ applies to bacteria, for example, and the Eulerian realm $Re \gg 1$ to the swimming of fish and to the flight of birds and insects.

Chapters 2–7 are devoted to the Stokesian realm. Childress presents some of the basic solutions (like flow past a sphere), and gives examples of swimmers and nonswimmers in these viscosity-dominated situations. The treatment of the swimming of an infinite sheet in chapter 3 is very elegant and reminiscent of Arnold Sommerfeld's lecture notes on theoretical physics. In the next chapter, the structure and physiology of various microorganisms is reviewed, as well as their actual swimming behavior. I found this chapter quite useful; it should probably have been placed in the beginning of the book. The theory of flagellar propulsion is the subject of chapters 5–7. Some of the mathematics in these chapters is hard and a few more pictures might have been of help.

The inertia-dominated Eulerian realm is discussed in the remaining chapters, 8–12. As a preliminary, Childress first reviews the hydrodynamics of potential flow and of vortex lines. In chapters 9 and 10 this material is applied to the swimming of fish, the flight of birds and insects, to locomotion by recoil, and to squirming, flapping, and hovering.

When I read this book two types of problems were mentioned that seem to me to touch upon other fields of theoretical physics, and which might deserve further research. First, the discussion in chapter 4 of the physiology of the swimming of microorganisms could be placed in the much wider perspective of the physics of chemoreception, which forms the subject of much current experimental and theoretical research. Second, the discussion in chapter 7 of the coordinated movement of a large number of flagella, and in chapter 12 of schooling and formation flight, could be related to the current work on hydrodynamic interactions in polymer solutions and on the flow in porous media.

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In summary, this short monograph is quite useful as an introduction to biofluid dynamics and will be of help to the advanced student and to research workers alike.

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