For foreign readers, however, probably the most informative chapter is the one devoted to research (more precisely, to remain in tune with the book's general theme, to the "Dangers Looming over Research"). This gives a good description of what really works well in French research (apart from Big Science): the unique symbiosis of the National Research Council (the Centre National de la Recherche Scientifique) and the universities, which might well be a worthwhile export item. Schwartz believes it is endangered; I do not, and I do not believe that any law can threaten it more than our natural tendency to divide Gallia into as many little fiefdoms as we can.

Anybody interested in understanding the currents now flowing in French academia, and shaping it anew, should read this short and intelligent book. A complementary audience might also include students of academic research as well as some sociologists and historians. But whatever their background, all readers should remember to place Schwartz's thesis within a general perspective of the French political situation in which it is rooted. □

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Underwater illumination

M. J. Dring

Light and Photosynthesis in Aquatic Ecosystems.
By John T. O. Kirk.
Cambridge University Press: 1983. Pp.401. £37.50, $74.50.

THERE are advantages and disadvantages in attempting to bridge the gap between two scientific subjects. Ideally, the bridge will provide a route for the two-way traffic of ideas and scientists; but if the two subjects are in very different states of development, it may result instead in a brain-drain from the weaker to the stronger subject.

By bringing together the physics of underwater light and the biology of aquatic photosynthesis, Dr Kirk's book seems more likely to produce the latter result. Part I ("The Underwater Light Field") constitutes such a superb manual for would-be modellers that it may well persuade many aquatic biologists that, given the availability of modern underwater irradiance meters and microcomputers, it is very much easier to measure light than to measure photosynthesis. Part II ("Photosynthesis in the Aquatic Environment"), on the other hand, creates the impression that biologists are still far from the position where they can make much use of the exact information about underwater light described in Part I. There is, therefore, little incentive for physicists to become involved with photosynthetic problems and to reciprocate the movement of biologists into their field. This is a familiar problem at the boundaries of biology and physics, but one which is accentuated to a possibly unnecessary degree by the contrast between the two parts of Dr Kirk's book.

Part I is rigorous, lucid and concise. A review of the optical properties of water leads into thorough accounts of what to measure and how to measure it, and how these measurements can be used to characterize fully the underwater light field. Biologists may wonder from time to time if they really need to know all of the details discussed, but Dr Kirk provides clear, complete answers to their commonest questions, together with valuable compilations of measurements from water bodies around the world. Here, at last, is the complete manual on underwater optics for biologists, which must become an essential reference for students of all photobiological processes underwater.

The excellence of Part I sets such a high standard that it may seem churlish to complain that Part II fails to live up to it. The problem lies partly in the nature of the subject matter — the physiology and ecology of diverse and variable organisms cannot be treated as rigorously as the physical properties of light and water — but also in the author's approach. Acknowledging that light is not the only controlling factor, he has attempted a reasonably comprehensive account of aquatic photosynthesis, in which few references to underwater optics are couched in more than general and qualitative terms. Consequently, those readers who know enough about aquatic photosynthesis to appreciate and benefit from Part I are liable to be disappointed by Part II. Instead of retracing the steps of other recent books and reviews, I feel that Dr Kirk should have tried to illustrate how our understanding of aquatic photosynthesis might be advanced by applying the knowledge of underwater light presented in Part I. Bridge builders must establish their bridgeheads before advancing into the hinterland. □

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Seeing new light

Alan E. Shapiro

Optics after Newton: Theories of Light in Britain and Ireland, 1704–1840.
By Geoffrey Cantor.
Manchester University Press: 1984. Pp.257. £20, $25.

THE traditional history of optics from the publication of Newton's *Opticks* in 1704 to 1840 runs roughly as follows. The Newtonian emission or projectile theory of light dominated the wave theory in the eighteenth century, which, however, was overall a "sterile" period for optical research. The wave theory began to gain the upper hand at the beginning of the nineteenth century, when Thomas Young discovered the principle of interference, although initially his work was unjustifiably ignored. Finally, within a decade of Augustin Fresnel's comprehensive formulation of the wave theory (1815–1825), that theory vanquished its rival.

Geoffrey Cantor's primary aim in *Optics after Newton* is to reinterpret many elements of this story. He rejects the "sterility" thesis for the eighteenth century; he adds a third major theory of light, fluid theories, in which light is conceived to be a subtle fluid of interacting particles — not independent projectiles — flowing from a luminous source; and he argues that Young's principle of interference was rejected because it was perceived to be part of his otherwise unoriginal wave theory of light. I find Cantor's reinterpretation to be largely unconvincing. The primary cause of this is that the author is more concerned with historiography than with the history of optics, which he