physics. Moore is assisted in this aspect of his enterprise by a number of striking pictures of the women; but it is a little disappointing that the identity of the inspiration of wave mechanics is unknown and that the inspiration of the unified field theory is not named.

As if this were not enough to make a best-seller among scientific biographies, Moore also does justice to Schrödinger's exciting adventures. In this respect his early life was straightforward; his sojourn in the Austrian army in the First World War was uneventful. But when the Nazi threat erupted in 1933 Schrödinger had been in Berlin for seven years. As a good Aryan Catholic he could have made peace, but he chose to leave instead, having made no secret of his dislike of the regime. He exiled himself in Oxford, where he was far from happy and where the bohemian *ménage à trois* of the time was frowned upon. Then, despite advice from his friends, he accepted the chair in Graz; he had no idea of the possibility of the *Anschluss*. It was only two years before he was dismissed from the chair by the Nazis, but he was at first unable to leave the country. He finally got out via Italy, which was the only country then requiring no visa, and so to Oxford again. Meanwhile de Valera organized the Dublin Institute for Schrödinger to be head of the school of theoretical physics, but, while waiting to take up the appointment, Schrödinger gave some lectures in Ghent and was nearly trapped by the advancing German armies. Dublin was reached only through the United Kingdom, where he needed special treatment as an enemy alien. The story encapsulates the century we have lived through.

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Tales of Invention

My Life With the Printed Circuit. PAUL EISLER. Lehigh University Press, Bethlehem, PA, 1989 (distributor, Associated University Presses, Cranbury, NJ). 170 pp., illus. $29.50.

The autobiography of Paul Eisler, an Austrian electrical engineer who settled in Britain in 1936, is a personal account of one of the many technical and scientific careers of refugees from the Continent who strengthened the Allied side during World War II. The author describes the obstacles placed in his way by the lack of any sort of entrée to major manufacturers in prewar Britain and by his status as an "enemy alien," which meant temporary internment once the war broke out in 1939. By then he had gained a narrow foothold in a chain of movie houses and had introduced several innovations in them. After his release he returned to an idea he had first thought of in 1936, of replacing the wiring in radio receivers by metal strips attached to bakelite sheets. In 1941 he went to work for a music printer with offices in London's theatrical district, in the hope of finding a way of depositing the strips by printing techniques. By 1943 he had advanced far enough to apply for three patents (which were not issued until 1950) on the technology and manufacture of printed wiring and to build some demonstration models that were shown to potential users, including some Allied military personnel—without success. "Not a single industrial firm or Government department in [Britain] could be found who would give the invention even a trial," writes Eisler. "However, during the demonstrations in Shaftesbury Avenue the Americans had—unknown to me—picked up the idea and their National Bureau of Standards developed a proximity fuse using a printed circuit."

On the basis of this unlikely and wholly undocumented scenario, the author assumes credit for initiating a development that he avers led to the use of proximity fuzes containing printed circuits in 1944, in particular in the shells used to bring down the V-1 flying bombs (the pilotless aircraft launched from the Continent against London and other targets). In actual fact, the only printed circuit used in proximity fuzes in World War II was a part of the fuzes of trench-mortar shells; and this circuit was fabricated by a long-established technique, silk-screen deposition on a ceramic substrate (followed by heating), not by Eisler's foil technique. Not only that, Eisler asserts that the printed circuit's "principles of design have given birth to the transistor, the integrated circuit, the 'chip', and the microprocessor." On the contrary: it was the invention of the transistor that first made printed circuits interesting to manufacturers of electronics equipment; in the older vacuum-tube devices, wiring costs were a negligible part of the total production cost.

The book is further marred by an apparent lack of editoral attention, as evidenced by the misleading title (less than a third of the book concerns printed circuits) and such errors as "Philip's laboratory" for the Dutch research organization, "ordinance" for ordnance, "principle" for principal, "neurolgia," and "Pittsburg." British and U.S. patents are listed separately and not cross-referenced. The author has provided next to no bibliographical apparatus, and the bibliography and notes that were supplied by Mari Williams, a researcher from the London School of Economics, range far afield in the general literature of technology and innovation.

The book's real interest lies in the account of a hapless inventor's tribulations in postwar Britain under the wronghead sponsorship of the National Research and Development Corporation (which is here made to look like the Office of Circumlocution that Dickens described in *Little Dorrit* in 1857). Eisler recounts how he finally extricated himself from its clutches and achieved commercial success, without government sponsorship, with another invention, the use of metal foils attached to insulating sheets for heating elements. Possible applications ranged from heating prepared foods to defrosting car windows and keeping entire rooms comfortable by radiant heating from walls and ceilings, but the first returns came from a licensee in California—a manufacturer of waterbed heaters! That is a story well worth recounting and full of insights for budding inventors.

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Shore Life

Shore Ecology of the Gulf of Mexico. JOSEPH C. BRITTON and BRIAN MORTON. University of Texas Press, Austin, 1989. viii, 387 pp., illus. $49.95; paper, $22.50.

Viewed from space, or vicariously via a Landsat photo or geologic map, the Gulf of Mexico coastline is dominated by beaches, some of them strikingly set off as slender barrier islands guarding lagoons along the Texas and Mexico coasts. Upon closer view, the shifting sands are seen to present a harsh environment where few species of plants and animals cope successfully, forming biotic communities of limited complexity. Britton and Morton turn this potential liability for their book into an asset. It allows them space to explore other shore environments, to introduce the biology of major groups of organisms, and to recount the known biological features of most species present. Their goal was to provide a guide to these organisms and their ecological relationships.

Shore Ecology of the Gulf of Mexico takes its topical and organizational cues from the second author's *Sea Shore Ecology of Hong Kong* (with J. E. Morton, 1983). As in that book the writing is felicitous, and the authors achieve their goal. This aim is, however, more modest than the title suggests, with respect to both geography and substance. Britton and Morton treat only the western half of the Gulf, from the Mississippi delta through Texas and Mexico to the Yucatan.

Their generally descriptive ecology focuses on species, from two main viewpoints: natural history of their component individuals, and species as components of communities. The authors devote little attention to such important ecological topics as population-level phenomena, energy flow, and cycling of materials or to dynamics at any ecological level.

Readers familiar, for example, with U.S. Pacific Coast shores may be surprised at the absence of incisive information, based on field observations and experiments, identifying the important physical factors and biological interactions that influence community organization, particularly in the substantial section on hard shores. Britton and Morton tend to list known interactions and suggest others, but they can draw few strong inferences from such a primarily inductive approach.

I don't mean to imply that this is the authors' fault; they develop habitat and community structure and energy relationships as far as available data permit. They do address other conceptually important topics such as succession, predation, competition, and natural disturbance, but the very limited data available constrain these discussions to speculative hypotheses and references to studies of similar organisms, assemblages, and processes elsewhere in the world.

A concise, well-illustrated introductory guide to the physical factors affecting shore biotas is followed by chapters on natural and man-made hard substrates. Although narrowly limited in size and number in the Gulf, these habitats support more diverse communities than sand beaches, and they exhibit clear patterns and gradients that invite study of how they relate to physical variables and biological interactions. Striking differences between northern and southern and granite and limestone jetties, and their windward and leeward and Gulf and inlet sides, provide a matrix of independent environmental variables for hypothesis testing. These habitats also provide the closest analogues to better-studied hard shores elsewhere, and the authors raise enough unanswered fundamental ecological questions to occupy the next generation of dissertation-seeking graduate students in marine ecology.

In keeping with their dominance of the Gulf coastline, beaches and other soft or sedimenting shores—the barrier islands, bays and lagoons, and mangrove shores—occupy the largest section of the book. Subtidal sands and coral-dominated habitats are also covered. Each habitat account discusses and illustrates in line drawings the major species likely to be encountered there. Both authors are marine zoologists whose emphasis in these sections indicates that they share this reviewer's view that the most important problem an animal faces in nature is getting enough of the right kind of food, and that feeding modes, strategies, and interactions are important forces structuring marine communities.

The authors' broad temporal perspective, including analysis of the effects of sea and land level changes on modern shore ecology, enhances the usefulness of the book. The final chapter, "The future for Gulf shores," stresses their inherently dynamic nature and the history of human influences via fisheries, development, mining, and pollution, as well as protection of national parks, seashores, and wildlife refuges. Although the beaches themselves support a biota of low diversity, much of the simplicity is more apparent than real. Britton and Morton's book makes clear that a surprisingly diverse array of distinctive marine shore environments occurs in the Gulf of Mexico, and it should generate educated support for protecting and sustaining these environments.

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A Coastal Project

Nearshore Sediment Transport. RICHARD J. SEYMOUR, Ed. Plenum, New York, 1989. x, 418 pp., illus. $85.

This long-awaited book written by a group of leading U.S. coastal engineers and scientists provides a summary of theoretical and field results of the Nearshore Sediment Transport Study (NSTS). The NSTS was an ambitious six-year long (1977–1982), four-million-dollar field data collection project that had as its major objective the development of "improved engineering models for predicting the motion of sediment along straight coastlines under the action of waves and currents in the nearshore zone." The NSTS was one of several such multi-institutional projects conducted in the 1970s and 1980s in Canada, Europe, Japan, and the United States. (Papers describing some of them are to be found in volume 1 of the *Proceedings of Coastal Sediments '87*, published by the American Society of Civil Engineers.)

The material is arranged in 30 independently authored chapters organized under 17 general headings. With respect to subject, the major technical chapters fall broadly into three categories: field measurements and instrumentation, nearshore hydrodynamics, and sediment transport. All chapters are self-contained and focus directly on the subject at hand with a minimum of literature review and cross-reference to other chapters. With rare exceptions, literature citations peak around 1978 to 1982, particularly in the treatment sediment transport. Although essentially all of the material has long since been published in journals and conference proceedings, the collective power of so many original and well-written articles warrants their being brought together under one cover.

The chapters on measurement procedures and instrumentation, many of them only a few pages long, hold the fruits of hard-won experience and careful analysis. Sediment-sensing and sampling devices produced under the purview of the NSTS are described, including the highly successful optical backscatter (OBS) sensor developed by John Downing and Richard Sternberg, with results of applications presented in two chapters. Other chapters describe nearshore bathymetry survey techniques, fluorescent sand tracer methodology, and measurement of the long-term (order of months) longshore sand transport rate by impoundment at breakwaters and jetties. In two of these, Ole Madsen provides a thorough analysis of the theory of sand tracer measurements and Robert Dean describes the principles and analytic procedures of large-scale trap experiments and results at two sites. Coastal-processes researchers will appreciate the care taken by the NSTS group in analyzing errors in their instrumentation and measurement techniques.

Much of the gold in this book is contained in five chapters on nearshore waves and currents written jointly by Edward Thornton and Robert Guza. Their contributions are the most up-to-date, including citations to 1985 and 1986, and, taken

"Rack for emptying and rinsing . . . suspended sediment sampling devices. The rack holds a row of funnels which drain the water and sediment into numbered bottles." [From *Nearshore Sediment Transport*]