here" (27 March 1901). Mileva wrote to a friend of hers, "You know my darling has a very sharp tongue and moreover is a Jew" (23 November–mid-December 1901).

Hermann Einstein was a loving father without academic connections who saw his boy desperate and depressed and who was eager to improve his son's prospects. He humbly appealed to the eminent Wilhelm Ostwald at Leipzig for a few words of encouragement to Albert. A note from Ostwald, pled the father, would restore Albert's joy in life. Father Einstein also asked for an assistantship for his son and cautioned that Albert knew nothing of his initiative.

In the summer of 1901 Einstein worked as a substitute teacher in a technical school in Winterthur. Then he applied to several secondary schools for teaching positions, unsuccessfully. He was finally reduced to being a private tutor for an English boy who was preparing for the ETH. During this depressing period he wrote Mileva, "I swear a solemn vow that I will always help gifted young men whenever it is in my power" (12 December 1901). It was a promise he kept.

The appointment to the Swiss Patent Office came as a deliverance. Einstein was elated with the job and the security it offered, with the coziness and charm of medieval Bern, and with the large room he rented for himself and Mileva. He drew a sketch of it for her describing the placement of every picture and piece of furniture (4 February 1902). This was to be their home in Bern, where he wrote the three great papers of 1905 that transformed modern science.

What made Albert Einstein the creative person he was? Unquestionably he had genetic endowment, but what were the psychological specifics of this genius and what was their etiology? If we knew how to create an Einstein every ambitious middle-class family would be following the formula.

On the basis of these newly published documents we can say that Albert had an early, strong sense of autonomy as expressed by his leaving home, applying for admission to the ETH before he had reached the usual age of admission, giving up his citizenship to be a stateless person at age 16, and refusing to let his mother dictate his personal relationships.

Certainly such a sense of self-worth has much to do with a supportive home environment. His mother was immensely proud of Albert's early intellectual achievements. She wrote her sister of his excellent grades in primary school and her pleasure in his being first in the class. However, support alone is not enough—it can also stultify development and foster dependency. What Einstein had was the special balance of intense early nurture and autonomy that gave him a self-esteem that would carry him through the years when he was homeless, degreeless, and jobless. He was consequently never hopeless or loveless.

There are, of course, a number of puzzles and unanswered questions left by the publication of this correspondence. Why did Einstein begin his doctoral work with Heinrich Weber and continue it with Alfred Kleiner? Why did he withdraw his dissertation in 1902? Was it truly, as the editorial note suggests, out of consideration for Kleiner's friend Ludwig Boltzmann, whom Einstein had sharply criticized? Did Weber really stand in the way of his getting a job, as Einstein believed? There is no evidence produced, although it should be available. Lastly, what happened to his daughter Lieserl? If she died, when and where? If not, there could be an 85-year-old lady in Novi Sad today bearing Albert Einstein's genes.

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The Vertebrates Updated

Vertebrate Paleontology and Evolution. ROBERT L. CARROLL. Freeman, New York, 1987. xiv, 698 pp., illus. $52.95.

For decades A. S. Romer's *Vertebrate Paleontology* in its three editions was the standard textbook in the field in the English language, consulted by several generations of students of its increasingly fact-filled subject. Common wisdom had it that Romer would surely be the last mortal to survey the whole field between two covers. To do this, Romer had found it necessary to approach the subject from a nearly completely biological point of view, giving only the briefest of comments on other facets of the discipline. Indeed, Romer was a strong advocate of the notion that vertebrate paleontology is scarcely a discipline at all; rather, it is a subdivision of biology, not just a "service subject" to be taught in geology departments that recognize the value of biostratigraphy. Romer cut Gordian knots without remorse; to the unsuspecting reader, few problems clouded the didactic scenery. Yet as any who wrestle with the complex issues in the field know, scientific problems abound—a major factor that makes the subject interesting and fun for researchers and general readers alike. For those requiring a deeper view, Romer wrote a supplemental book, *Notes and Comments on Vertebrate Paleontology*, in which various murky problems were discussed less dogmatically. With the last edition of *Vertebrate Paleontology*, in 1966, the "Romer view" became frozen, and inevitably it became outdated rapidly as the field experienced relentless and seemingly exponential expansion. No single-authored textbook attempting the same broad sweep and offering so much detail in a single volume could be named successor.

Carroll's encyclopedic tome succeeds in replacing Romer's masterpiece, although contentious specialists will surely quibble about the depth and accuracy of Carroll's treatment of "their" animals or about his eclectic systematic principles. But Carroll has single-handedly done Romer one better by bringing the ever more complex story either up-to-date or close to it. He writes extremely well, as did Romer. As before, coverage proceeds from "fishes" to mammals, with well-illustrated and well-organized chapters covering various real as well as paraphyletic groups. Scattered through these are discussions of such topics as the methodology of phylogenetic systematics, dinosaur extinction, flight in its various forms, and the evolutionary process.

Philosophically, *Vertebrate Paleontology and Evolution* is a book in transition. While for the most part true to the Romer tradition of dogma, phenetics, and paraphyly, Carroll has stuck an exploratory toe into cladistic waters. Interspersed with familiar but nearly useless "balloon," "stick," and "spaghetti" phylogenies are a few cladograms supported by characters at the nodes. In contrast to the older-style phylogenies, in which constituent taxa are often left unconnected and convey little more information than what is known about geologic ranges, the cladograms express explicit and testable hypotheses of genealogical relationship. These breathe scientific method into the subject and set the stage for further progress rather than scholastic stasis. Carroll attempts to acquaint us with the basics of phylogenetic reconstruction in chapter 1, but I found his understanding flawed. In place of words like "established," "known," "recognized," "revealed," "found," and "refutes," I wish he were thinking in modest terms like "hypothesized" or "contradicted." Carroll gets into hot water when he deals with the biological species concept, lineage branching, and stratofanatic assumptions of lineage continuity in the known fossil record that remind me of "connect-the-dots" art. *Mirabile dictu*, he also treats paraphyletic groups as an inevitable result of the process of evolution, whereas I would hold that paraphyletic groups are the result of what researchers do when they create a "non-group" remainder by the subtraction of one hypothesized monophyletic group from another one.

The text ends with an interesting chapter

on evolutionary processes, followed by a classification of the vertebrates and an index. The book is well edited and is virtually free of typographical errors. There is even at least one joke (p. 487). The illustrations are good, copious, and apposite, although I wish that some drawn by the stipple technique could have done more justice to foramina, to sutures between bones, and to details of dental patterns. Translucence of the pages is occasionally an annoyance: illustrations and text sometimes show through and can be confusing.

Vertebrate Paleontology and Evolution is a worthy successor to Romer's textbook. We need books like Carroll's in order to keep track of an explosively expanding subject and to serve as introductory texts for courses on vertebrate evolution.

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Oceanic Island Evolution

Islands. H. W. MENARD. Scientific American Books, New York, 1987. xvi, 230 pp., illus. $32.95. Scientific American Library, vol. 17.

This book, H. W. Menard's last to be published, presents a lifetime of observations and research on oceanic islands, including their discovery and exploration, their geologic, economic, and political histories, and the adaptation of their plants and animals to life on (as Menard terms it) "a down escalator." The book clearly departs from a dispassionate view of the subject, with frequent references to the impact of humans (Polynesian and European) on the idyllic island setting during periods ranging from the time of first population through World War II and its destructive battles to the recent era of selective annihilation by nuclear testing. Menard was ahead of his time (or perhaps old-fashioned) in believing that scientists need a social conscience.

The emphasis of the book is on the subject that Menard knew best: the geologic evolution of oceanic islands and the theories about why it occurred as it did. He presents many topics central to earth science, such as the drifting of plates, subduction of oceanic lithosphere, and eustatic changes in sea level, in terms accessible to nonspecialists before explaining their relevance to the study of oceanic islands. The point is well made that islands are major departures from the otherwise fairly uniform process of oceanic crust and lithosphere production and therefore may figure prominently in unexplained phenomena such as the segmentation of downgoing slabs and the formation of accreted terranes. Particular attention is paid to vertical motions of islands and the various processes contributing to them that Menard documented, such as cooling of the oceanic lithosphere, thermal rejuvenation of midplate swells, erosion and reef development, and flexural warping of the sea floor. I noted only a few inaccurate statements in the book: for example, the San Andreas Fault is described (p. 33) as a ridge-ridge transform instead of a ridge-transform transform (since the Mendocino Ridge is actually a transform fault), and one of the figure captions indicates that the oceanic crust (rather than *lithosphere*) thickens with age.

Most readers will appreciate this book for its breathtaking photographs, lavish illustrations, absence of jargon, and lively narrative style. The text is punctuated by Menard's wit, with its tendency toward understatement. For example, in explaining how the European discovery of various island groups was influenced by the distribution of the trade winds, he writes of Magellan: "After beating his way through the straits that bear his name, it could hardly have escaped his attention that he was in the wrong latitude to sail west" (p. 8).

But in my opinion, the book's principal value stems from the author's ability to distinguish facts based on observation from currently accepted models and untested hypotheses. It represents a unique resource of new ideas concerning geologic evolution of the ocean basins from an island perspective as well as of suggestions about where to test them. It is a book that only Menard, whose encyclopedic knowledge of the oceans inspired so much of the work of his students and colleagues, could have written. For those who never had the opportunity to work with him, and those who miss that interaction now, this book carries on the Menard tradition.

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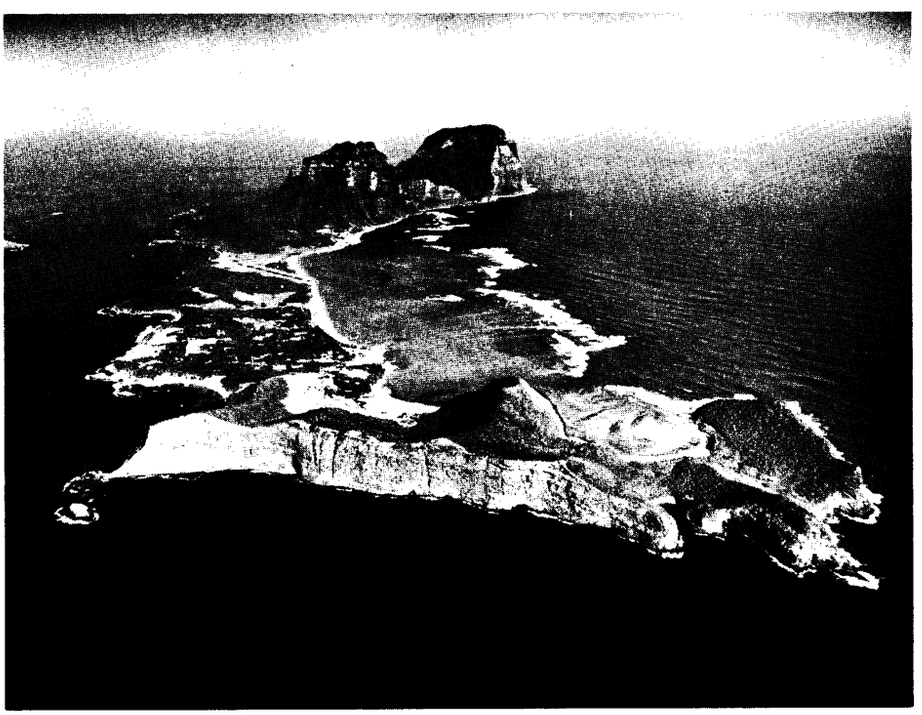
Microbial Metabolism

Phosphate Metabolism and Cellular Regulation in Microorganisms. ANNAMARIA TORRIANI-GORINI, FRANK G. ROTHMAN, SIMON SILVER, ANDREW WRIGHT, and EZRA YAGIL, Eds. American Society for Microbiology, Washington, DC, 1987. xii, 316 pp., illus. $49; to ASM members, $39. From a symposium, Concarneau, France, 1986.

Unlike many volumes of symposium proceedings, this book reads as an engrossing whole. The timing of the symposium from which it derives was adroit—a number of areas in the large and active field of phosphate metabolism are now on the verge of major advances; the symposium was well planned, with an outstanding selection of



"Lord Howe Island, east of Australia, sits well off center on its shelf. The isolated pinnacle in the distance is Ball's Pyramid." [Promotion Australia; from *Islands*]