yonic forms of dark matter. Although hard evidence for particle contributions to dark matter has not been found, the connection between the inner space of particle physics and the outer space of cosmology is leading to innovative ways of thinking about both old and new problems in extragalactic astronomy.

Dark matter is being recognized as a fundamental phenomenon in the structure of the universe. The organizers of the conference and the editors of the book have provided an excellent topical summary of research in this exciting field.

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A Life in Physics

Rabi. Scientist and Citizen. JOHN S. RIGDEN. Basic Books, New York, 1987. xiv, 302 pp. + plates. $21.95. Alfred P. Sloan Foundation Series.

"Isn't physics wonderful?" I. I. Rabi wrote to Ernest Lawrence in 1948. Physics had indeed been wonderful to a boy raised in the lower East Side of Manhattan by immigrant parents with a weak grasp of English who, according to the author of this biography, changed the course of his adoptive country's physics in the 20th century from ordinary to extraordinary. Only in America? No, only by Rabi.

Rigden, himself a notable physicist and teacher, has produced a superb account that comes very close to being an actual autobiography of Rabi—indeed, it is part of the Sloan Foundation's series of autobiographies. He has made extensive use of taped interviews and frequently quotes Rabi directly. Rigden has a special knack for giving lucid explanations of arcane technical matters. Thus without mathematics or jargon, and without compromising the physics, he tells how in the late '20s at Columbia Rabi educated himself as well as his colleagues in the new quantum ideas being developed in Europe, and how he then went to Europe to participate himself in the quantum excitement. It seems to me that Rigden reaches poetic heights in explaining the intricacies and subtleties of Rabi's famous molecular beam experiments. If to my mind Rigden's explanations are about the best I have ever read, I do worry a little that his uncompromising honesty and close reasoning may still be a bit too difficult for the general reader, may turn the reader away from the nontechnical but equally important material that is to follow.

Rabi's talents were full of contradictions. Was he a great teacher? According to Rigden, his students uniformly testify that he was "simply an awful lecturer." Even so, some of his many students are now among the most illustrious of physicists. If they did not like his lectures, they still praise the inspiration he gave them, provoking them to think independently and deeply about physics. I personally remember the many times I have seen Rabi pocket a prepared speech (which I probably would not have liked) and then deliver a spirited talk full of wit and insight. Some of the phrases coined by Rabi have become a part of history: "What do you want—mermaids?" he asked the prosecutor in the matter of J. Robert Oppenheimer. In his 80s, at the 40th anniversary at Los Alamos, just the title of his speech, "We Meant So Well," summed up the sentiments of us who were there.

Was Rabi a theorist or an experimenter? He seemed to be so maladroit with his hands, we are told, that he was sometimes not allowed by his colleagues even to come near the apparatus. Was Rabi painstaking? Easily bored by the drudgery of an experiment he had initiated, he would show up, as if by magic, just as the results were emerging—just in time to analyze their meaning and to decide what should be done next. He has always insisted that he is a whole physicist, that he has done what it has been necessary to do to get on with revealing the underlying nature of physics. His students have especially learned this Rabiesque unity of approach to physics: it is in the great tradition but it is not too often in evidence today.

Religion too is a leitmotif of the book. We learn that Rabi seems never to have adopted the orthodox Jewish views of his parents. In place of a conventional Bar Mitzvah, his father invited in some friends to listen to Rabi's comments not on the Torah but on science. Yet he did inherit the sentiment of religion, for he says, "When I chose physics I was no longer practicing the Jewish religion, but the basic attitudes and feelings have remained with me. Somewhere way down, I'm an Orthodox Jew." Rabi goes on, "The whole idea of God, that's real class . . . real drama. When you're doing good physics, you're wrestling with the Champ." He is also quoted as having said, "I think that God is a good heuristic principle—a standard by which you judge things." These few quotations are but an enticing part of Rigden's fascinating treatment of this aspect of Rabi's life.

Rigden compares the creative brilliance of Rabi with the astonishing quickness, breadth of mind, and talent for lucid expression of J. Robert Oppenheimer. The two were lifelong friends with complementary talents who first met in the Europe of the '20s. Both returned from Europe determined to raise the level of American physics. This they did, Oppenheimer by establishing in California the first school for theorists and Rabi by training generations of superb experimenters in his Columbia laboratory. During World War II both played critical roles, Rabi in the development of radar and Oppenheimer with the atomic bomb. After the war both men become important in national as well as international affairs. Oppenheimer used his fame as the "father of the nuclear bomb" to promote his plan for international control of nuclear energy and then to oppose the hydrogen bomb. Rabi, characteristically working behind the scenes, was a driving force in the creation of the Brookhaven National Laboratory, of CERN, of Eisenhower's Atoms for Peace conference, and of the President's Scientific Advisory Committee and in many other such enterprises. Rigden's analysis of these two mutually supporting but very different friends is the best chapter of the book.

Jeremy Bernstein has produced, with his usual elegance and eloquence, a biography of Rabi (published in *The New Yorker* in 1975), but Rigden, by going into greater detail and by going deeper into Rabi's nonscientific life and thoughts has more thoroughly fleshed out and captured Rabi, both as scientist and as citizen, and set him neatly in his time.

The 20th century has been a time of high adventure in physics. It is no wonder that Rabi, with his ebullience and complex genius and wisdom, found his profession "wonderful." As Rigden demonstrates in this complete and very good book, physics was wonderful for Rabi and Rabi was wonderful for physics.

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Modernization and Health

The Changing Samoans. Behavior and Health in Transition. PAUL T. BAKER, JOEL M. HANNA, and THELMA S. BAKER, Eds. Oxford University Press, New York, 1986. xii, 482 pp., illus. $49.95. Research Monographs on Human Population Biology.

As more and more traditional societies grapple with the problems introduced by acculturation to Western technology, certain generalizations about the process of modernization and its health consequences have achieved the status of dogma. The first is the concept of demographic transition: High

fertility and high mortality will be replaced by low fertility and low mortality, although not necessarily in that order. A second assumption is that change to a diet higher in refined sugar, salt, and saturated fat, combined with decreased physical activity, will lead to increased fatness and the appearance of "modern" chronic diseases, such as diabetes and heart disease. The role of stress generated by rapid change in this process is also acknowledged, but rarely defined.

The Samoan studies described in this volume set out to investigate this scenario in detail. Although modernization is not explicitly defined, a gradient from least to most modernized is established at the population level, from Western Samoa, with relatively little outside contact, to American Samoa, site of American military bases during World War II, to migrant populations in New Zealand, Hawaii, and California.

Virtually every aspect of Samoan biological and cultural responses to this gradient of modernization is described in one chapter or another, with the interesting theme that Samoan cultural, demographic, and biological responses do not exactly fit the pattern followed by most other modernizing populations. Demographically, fertility has remained high, even with decreased mortality and limited physical resources. Samoans export their excess population to other countries. The value of numerous offspring is maintained because migrant workers return money to their families in Samoa.

The physiological responses of Samoans to a high-fat diet and reduction in physical activity are also different from those found in other populations. Chapters by Bindon and Zansky on body composition in children and by Pawson on the morphology of adults show that fatness has increased even in infants and many Samoan adults are distinctly obese. Yet the blood lipid studies summarized by Pelletier and Hornick conclude that mean serum cholesterol levels and the incidence of cardiovascular disease are much lower than expected on the basis of the experience of other groups. Triglyceride levels, on the other hand, are comparable to those in other populations undergoing modernization.

The effect of modernization on blood pressure is clearly shown in the chapter by McGarvey and Schendel. Mean blood pressure rises with exposure to modernization. Samoan blood pressure is also significantly affected by fatness, salt intake, and psychosocial factors such as education and occupation (and status incongruity between the two), family size, and expression of psychological complaints as measured by the Cornell Medical Index.

Although modernization appears to be causing an increase in Samoan blood pressure, fatness, serum triglycerides, and psychosocial stress, mortality studies in American Samoa and the United States indicate that the rate of deaths from heart disease is lower than would be expected. The authors offer two possible explanations for this phenomenon. Either Samoans have different physiological responses to the stresses of modernization or the stresses must be present from an early age in order to affect mortality from heart disease, and thus have not yet been expressed in the population. Of course, the possibility of underreporting must also be considered.

The enigma of Samoan resistance to coronary disease is not resolved by the studies presented in this book. Rather, the various psychosocial stresses, nutritional factors, and decline in physical fitness are painstakingly documented in an effort to eliminate the obvious explanations. Genetic adaptation may play a role, given that the degree of obesity declines with non-Samoan admixture. Long-term adaptation to high dietary fat intake may also exist, because Samoans traditionally consumed a diet high in saturated fats, owing to extensive use of coconut oil.

The chapter authors and editors are forthright in their own assessment of the studies conducted, pointing out problems due to multiple observers, missing pieces of data, and changes in research design necessitated, for the most part, by human factors. Although the reader may feel frustrated that certain key elements remain to be studied so that a definitive picture of Samoan biocultural adaptation can be painted, one can gain from this book a greater appreciation of the pitfalls and rewards of doing anthropologically oriented research.

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Far-Traveled Terranes

Tectonostratigraphic Terranes of the Circum-Pacific Region. DAVID G. HOWELL, Ed. Circum-Pacific Council for Energy and Mineral Resources, Houston, TX, 1985 (available from the American Association of Petroleum Geologists, Tulsa, OK). x, 585 pp., illus., + loose map. $32. Earth Sciences Series, no. 1. From a meeting, Stanford, CA, Aug. 1983.

For the past six years, geologic terranes have been the subject of much discussion and debate among earth scientists and the focus of numerous scientific meetings. This enormous volume was the outgrowth of one of these gatherings, the Second International Meeting on Circum-Pacific Terranes. (A detailed report by Richard Kerr on the meeting was published in *Science* 7 October 1983, pp. 36–38.)

The volume consists of 42 papers divided into five sections. The first section is titled Principles and Applications of Terrane Analysis and comprises five papers, but only the opening summary paper by Howell and colleagues and the paper on terrane dispersion by Crowell readily fit under this heading. The papers in subsequent sections are subdivided by geographic location and cover the Pacific Northeast (19 papers, including 5 on Alaska, 8 on California-Oregon, and 4 on peninsular California and Mexico), the Pacific Northwest (3 papers on Japan and 2 each on the Philippines, northeast Asia, and China-Taiwan), the Pacific Southwest (6 papers on southeast Asia, Australia, New Zealand, and Antarctica), and the Pacific Southeast (3 papers concerning a small island offshore of Colombia, Andean evolution, and Antarctica). The papers range from presentations of new research and new thorough reviews to recyclings of previously published studies in the new terrane terminology (for example, terrane "docking" and "dispersion," "pluton stitching," "provenance linking"). The authors are a mix of old pros and newcomers. The volume is well produced and will serve as an excellent source of basic geologic information and references for the geology of much of the circum-Pacific region for a long time to come.

At the time the meeting was held, enthusiasm was spreading rapidly through the earth sciences community—and even to the popular literature and television—about terrane analysis and conclusions from it concerning the shape and size of continents. The first paragraph of the volume's preface, written by Howell, identifies what seems to have been the principal cause of the excitement: "The modifier 'tectonostratigraphic' specifies that a terrane is defined on the basis of stratigraphy and that its position and dimensions result from tectonic processes involving dislocations of tens to thousands of kilometers." The theme that many of the terranes of the circum-Pacific region may have moved long distances (hundreds of kilometers or more) before collision with and accretion to a continent is implied by most and directly stated by several contributors. The volume would have been greatly strengthened by the inclusion of a brief concluding chapter that explicitly identified all the terranes around the Pacific for which there are hard data indicating that such movements occurred.