cess in tempering the apparent bias of their profession for headlong growth and development. For instance, the Gross National Product, now accepted as a principal indicator of the national well-being, rests on a limited concept of national accounting. The lumber company sawing up a grove of centuries-old redwoods, the strip-miner desecrating a landscape, and the paper mill spewing air and water pollutants all are making their contribution to the GNP, even though in doing so they commit acts of corporate vandalism.

How is one to correct the account? In time the national bookkeeping perhaps will be refined to show the losses that go along with the gains. Meanwhile, the Sierra Club tries to reveal to us places which never should be sacrificed to the claims of economic progress.

Alaska's Glacier Bay National Monument is such a place. This remnant of the Little Ice Age is well described by Dave Bohn, in photographs and text, as a land "sombre, bold, austere, and brooding," where the Fairweather Range rises spectacularly from the sea and where a "booming primeval thunder" comes from great glaciers. Reflecting on his first sight of the Monument, Bohn writes: "Below us was the great land, unique, wild, and magnificent. It should exist intact solely for its own sake. No justification, rationale, or excuse is needed. For its own sake and no other reason."

Yet for some Alaskans the value of Glacier Bay lies chiefly in the mineral wealth they suspect it may hold. The National Monument was established by President Coolidge in 1925 at the urging of the Ecological Society of America. In 1936, however, Congress enacted a law opening the area to mining. This was done largely at the instance of the novelist Rex Beach, who had appealed to President Roosevelt on behalf of his friend Joe Ibach, a prospector whose right to work certain mining claims antedating the establishment of the Monument had been somehow compromised. In 1939, by executive proclamation, the Monument was more than doubled in size (with 2.7 million acres, Glacier Bay is the National Park Service's largest unit), but then, as now, it remained open to mining, though to date mining has been negligible.

In recent years appreciation of Glacier Bay has grown among officials of the Park Service and the Department of the Interior. In 1965 the Advisory Board on National Parks recommended that Glacier Bay be elevated from monument to national park status and that the 1936 act allowing mining be repealed. Stanley A. Cain, Assistant Secretary of the Interior for Fish, Wildlife, and Parks, says that both he and Secretary of the Interior Stewart L. Udall are in full accord with these recommendations. A study to work out details of a park plan for Glacier Bay has been scheduled by the Park Service but will not be completed before next year. Following this study, legislation to establish the park could be submitted to Congress, although by then a full year (an election year, at that) will have elapsed, and Udall and Cain may no longer be present to promote it.

Alaska's congressional delegation does not want mining forbidden in Glacier Bay, and park status may therefore be long in coming. Legislation of this kind seldom gains headway in Congress against the opposition or indifference of the delegation from the state directly affected. There is slight chance that the people of Alaska will exert significant political pressure for the park proposal. In fact, some conservationists believe that the tendency of Alaskans is to look too much to the gold rush days of the past, and to fail to see that, in the future, Alaska may be known less for its mineral wealth than for its other resources—oil, forests, fish and wildlife, and spectacular scenery.

Glacier Bay National Monument makes up less than 1 percent of the land area of Alaska. While mineral deposits occur within the Monument, the park proponents do not regard them as significant enough to justify mining. Nevertheless, the possibility that sizable mining operations may begin in the next few years cannot be dismissed. In the summer of 1966 the U.S. Geological Survey, acting at the Park Service's request, investigated the Monument's known mineral deposits and also discovered some others. Found to be the most important were the Nunatak molybdenum deposit, adjacent to Muir Inlet, and the Brady Glacier nickel-copper deposit. Of the former, the Survey reported that it contained a large reserve of low-grade ore which, given current trends in price and demand, may be minable in the near future. Less is known about the Brady Glacier deposit, much of which lies under hundreds of feet of ice, but it, too, soon may be minable. The possibility that other mineral deposits in the Monument might be mined was considered more speculative and remote.

If there should be a critical shortage of metals, any prohibition imposed by Congress on mining in a Glacier Bay National Park could, of course, be lifted by Congress. In fact, such authority could be delegated to the President for use at his discretion. The fear of some that critically needed resources may be kept permanently "locked up" in wilderness preserves always has been baseless.

Ironically, Joe Ibach, the prospector whose appeals led to opening up the Monument to mining, was a free spirit who thrived in the immense space and solitude of Glacier Bay. As Dave Bohn concludes, had Ibach ever found himself crowded by an invasion of miners, he no doubt would have retreated to some place more remote, for his need was for space and his tolerance for the intrusions of an industrial society was low.

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Thermodynamic Information

Principles of Statistical Mechanics. The Information Theory Approach. AMNON KATZ. Freeman, San Francisco, 1967. xii + 188 pp., illus. $8.

It is one of the ironies of recent intellectual history that modern physics, which is the culmination and vindication of two or three millennia of atomistic and deterministic theories, is so much involved with the knowledge or lack of knowledge ascribed to some human observer. The experimenter with his measuring rod, clocks, and frames of reference is a well-known character in the theory of relativity, and according to its almost universally accepted interpretation the goal of quantum mechanics is to determine what an observer can expect to observe rather than what is objectively the case.

In statistical mechanics the connection between physics and knowledge is expressed through Boltzmann's principle, that entropy is proportional to the logarithm of thermodynamic probability. This practically important and suggestive principle has had a number of vicissitudes and transmigrations since Boltzmann stated it. L. Szilard showed by an analysis of appropriate thought experiments how the negative of thermodynamic entropy can be exchanged for information and vice versa. Claude Shannon transformed the rather vague concept of thermodynamic probability into a precisely defined measure of information and made it the basis of a mathematical theory of communication. Other authors have found important applications of the concept of information in the theory of statistical inference. Recently E. T. Jaynes has completed the cycle of transmigration in his attempt, using the arsenal of information-theory concepts, to outflank the unresolved difficulties at the basis of statistical mechanics.

In his introductory textbook *The Principles of Statistical Mechanics: The Information Theory Approach,* Amnon Katz has chosen to use Jaynes's approach to the foundations of statistical mechanics. He has written a lively book in which the important questions of principle are clearly brought out and which provides the student with a well-defined rationale for formulas which he must eventually use to relate the properties and behavior of bulk matter to the properties of atom and molecules.

The "information theory approach" is expressed through an extensive discussion of Shannon's measure of information and the use of the principle of maximum missing information to assign a probability distribution for all observables when information about some observables is known. The latter principle is illustrated in equilibrium theory by the derivation of the laws of thermostatics and a discussion of quantum ideal gases and the ionization of hydrogen, and in nonequilibrium theory by the derivation of correlation formulas for transport properties and an elementary discussion of the Boltzmann and master equations.

The book contains a number of interesting theoretical discussions which might find their place in any text on statistical mechanical principles from whatever approach. Especially interesting are the discussions of the adiabatic compression of a slightly imperfect nondegenerate quantum gas and the classical and quantum mechanical adiabatic theorems, as well as a short remark explaining why local integrals of motion cannot in general be extended to global measurable integrals.

Introductory books in statistical mechanics are difficult to write, not primarily because we lack appropriate philosophical concepts but rather because we lack sufficiently detailed mathematical knowledge about the trajectories of dynamical systems. It is possible that recent Russian work on ergodic theory, especially that of Ya. Sinai, will soon fill the lack. In the absence of this knowledge, Katz's book is a concise and attractive introduction to statistical mechanics which may, perhaps, serve to initiate a generation of graduate students, educated to expect an intimate connection between knowledge and physics, into the mysteries of statistical mechanics.

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Measuring Gravitation

The Gravity Field of the Earth from Classical and Modern Methods. MICHELE CAPUTO. Academic Press, New York, 1967. xiv + 202 pp., illus. $9.75. International Geophysics Series, vol. 10.

Compared with, say, its electromagnetic counterpart, a gravity field may seem simple: no effects of media, no conductivities, no retarded potentials, no waves as far as we know today; and even if some such phenomena are discovered later, they will be far too small to affect our geodetic results.

But this impression is erroneous. The simplicities are more than outweighed by three inconspicuous complications seldom encountered in electromagnetism. First, the gravity field tends to influence the boundaries, thus affect the distribution of sources, thus modify the inertial parameters, thus again modify the field, and so on. Second, adjustments may proceed at such a slow pace that equilibrium may not be reached for eons. And finally, there is no direct way to measure the very quantity that satisfies the comparatively simple partial differential equations, namely the gravitational potential; *instead*, we measured various directional derivatives of that potential—usually different components with different techniques and different accuracies—and perturbations of the orbits of other bodies in the gravitational field.

To derive the gravity potential and, as far as possible, the mass distribution within the earth from such data is not a simple task. In fact, some of the problems involved in this operation taxed the ingenuity of the brightest minds of recent centuries and were thus responsible for the development of some of the most elegant mathematical methods.

Those are the problems that Caputo is treating. As is to be expected from this author, the book leans more toward the mathematical than toward the observational aspects. It may be for this reason that the reader will not find any reference to such authors as Woollard, Bowie, or Vening Meinesz. More surprising is the absence of quotation of work of men like Jardetzky, Liapunov, or Lichtenstein.

In a sense, the title of the book is misleading. The reader will find only three pages devoted to the "actual field." But he is more than compensated by a thorough account of the theory of gravity potentials in rotating ellipsoidal systems, Morera's functions, the density distribution in the interior of the earth and the moon, the theory of the geoid, and implications and applications of the results to satellite orbits. The text is clear and the amount of mathematical derivation is just right.

Question may be raised as to whom the book is addressed to. It is definitely not for the prospecting geophysicist, nor is it for the geologist who uses gravity information to help him understand the subsurface mass distributions. But it will be invaluable for anybody interested in higher geodesy and can be highly recommended to students of theoretical physics and applied mathematics. It may be used as a textbook in geophysics by students who have already acquired the necessary background in mathematical methods, particularly the theory of potential. And it is a good guide for those who want to be directed to the original publications. A book of this sort has long been wanting.

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Hazards and Preventives

CRC Handbook of Laboratory Safety. NORMAN V. STEERE, Ed. Chemical Rubber Company, Cleveland, Ohio, 1967. xii + 568 pp., illus. $19.00.

Fortunate indeed is the laboratory worker whose supervisor, despite the pressures and demands of today's research or testing operations, has found the time to make himself not only cognizant of all the safety hazards in his operation but also knowledgeable in the best methods for minimizing or eliminating them. The *CRC Handbook of Laboratory Safety* should prove to be an immediate source of information to the harried supervisor and also a handy