

Pacific at this very early time. That tiny Easter Island, surrounded by the vastness of the empty ocean, was reached by a Polynesian craft from the west is remarkable. If it seems unlikely that one craft would reach Easter Island, it seems more unlikely that the island would be reached twice, and the same holds for a drifting Peruvian raft.

Archeological evidence revealed by the Norwegian Expedition of the sudden appearance, toward the end of the Early Period, of great *ahu* platforms of remarkably fitted, Andean-like masonry, followed by a period of intensive activity in making and erecting huge stone images upon the *ahu*, indicates the introduction of a powerful influence that could well have been exerted by a strong chief from the Andean area of Peru. Although the archeologists of the expedition point out some traits that might possibly be of South American origin, they cautiously nowhere claim in their summaries that they have discovered a substratum of Andean culture underlying and preceding the Polynesian.

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## Interpretative Essays

**This is Life.** Essays in modern biology. Willis H. Johnson and William C. Steere, Eds. Holt, Rinehart, and Winston, New York, 1962. xii + 354 pp. Illus. Paper, \$3.95.

**Frontiers of Modern Biology.** Twenty lectures originally broadcast over the Voice of America. Coordinated by Gairdner B. Moment. Houghton Mifflin, Boston, 1962. xv + 192 pp. Paper, \$1.95.

How to interpret science to the educated layman is impressively demonstrated, at least for biological science, in these recent paperbacks. Each volume consists of a collection of essays on particular aspects of modern biology. Each essay is written by a scientist active in the subject field. *This is Life* is intended for the beginning student of college biology, and the essays are more detailed and demanding than those in *Frontiers of Modern Biology*, which were originally delivered as lectures in the Forum Series on the Biological Sciences, prepared by the Voice

of America in cooperation with the American Institute of Biological Sciences. Each collection, however, is admirably adapted to its audience, and each presents the spirit and challenge of biology forcefully. One paramount characteristic of the two volumes is the fascinating insight into the scientific method which each author so skillfully provides. Biology comes alive between the covers of these two volumes.

It is interesting, but not of great importance, that the essays in both volumes are arranged according to the general concept of levels of organization, but the books begin at opposite ends of the biological spectrum; they agree only in placing the origin of life in the last chapter. The 12 essays included in *This is Life* are: "Photosynthesis" by C. S. French, "Energy release and utilization" by A. C. Giese, "Ultrastructure of cells in relation to function" by R. V. Dippell, "Nutrition of protists" by S. H. Hutner, "Viruses: Reproduction and heredity" by A. Siegel, "Bacteria: Reproduction and heredity" by H. R. Garner, "Structure of the genetic material and concept of the gene" by G. W. Beadle, "Plant growth and plant hormones" by F. W. Went, "Plant morphogenesis" by I. M. Sussex, "Animal morphogenesis" by M. V. Edds, Jr., "The role of hybridization in evolution" by E. Anderson, "The origin of life" by S. L. Miller. The volume is well illustrated and has a 10-page index. At the end of each chapter there is a carefully selected bibliography. Perhaps in its treatment of modern biology, the volume is overbalanced toward molecular and cellular considerations to the extent that new and exciting advances in other areas are omitted.

In *Frontiers of Modern Biology*, the 20 essays are: "Biological science today" by G. B. Moment, "Historical studies" by J. M. Oppenheimer, "Animal populations" by E. S. Deevey, "The timing of spring migration and reproduction in birds" by A. Wolfson, "Newer paths in taxonomy" by J. O. Corliss, "Instinctive behavior" by W. G. Van der Kloot, "The development of visual behavior" by L. S. Stone, "Biological clocks" by V. G. Bruce, "Plant photoperiods" by H. A. Borthwick, "The biochemistry of human heredity" by H. B. Glass, "Tissue transplantation" by J. B. Ebert, "Chemical control of cell growth and cell division: An aspect of growth and morphogenesis" by F. C. Steward, "Human chromosomes and tissue culture"

by T. T. Puck, "Modern aspects of cell division" by W. R. Duryee, "Fertilization" by C. B. Metz, "Regulation of enzyme-catalyzed reactions" by DeWitt Stetten, Jr., "Photosynthesis as an energy conversion process" by D. I. Arnon, "Nucleic acids and the physical basis of inheritance" by A. Rich, "Energy and life" by W. D. McElroy, "Theories of the origin of life" by G. Wald. Regrettably, the lectures are published without illustrations, bibliographies, or an index. Nevertheless, once begun, this book is hard to put down. I hope we will see more books like this one.

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## Economic Anthropology

**Economic Development and Social Change in South India.** T. S. Epstein. University of Manchester Press, Manchester, England; Humanities Press, New York, 1962. 369 pp. \$8.50.

More than two-thirds of the world's population is in underdeveloped countries, and in these countries most people live in rural villages where the technology, the economy, and the social and political relationships partake more of traditional than of modern culture forms. But the winds of change are blowing on these villages. With no significant exceptions that I can think of, the less-developed nations are now seeking to move toward technological and economic modernization. They are being aided by the United States, the U.S.S.R., other nations in both camps, and by the United Nations and its specialized agencies, such as the Food and Agriculture Organization and the World Bank. All over the world, development programs are bringing to the villages such powerful instruments of change as roads, irrigation, fertilizers, agricultural extension agents, and schools; to nearby towns they often also bring factories, movie houses, hospitals, and specialized training centers. What will be the nature of the effects on traditional village societies? This is a question of major significance in today's world, and one on which social science research should be able to throw light. The book under review does so. It is a first-rate contribution—a field study,

well planned and carefully executed, the results objectively and clearly reported and related to theory, without unnecessary jargon or overgeneralization.

Wangala and Dalena are two villages not far from the town of Mandya in Mysore state, South India. In 1931 water for irrigation began flowing from a big dam in the region. A sugar factory started operation at Mandya in 1933 and encouraged farmers to grow a cash crop, sugar cane, on their newly irrigated land. The traditional subsistence economy of the region began to shift to a money economy. Irrigation came to Wangala's lands in 1939. But Dalena's lands, because of topography, remained nonirrigated. Nevertheless, Dalena's economic opportunities were broadened by the growing prosperity in the region. From 1954 to 1956 Scarlett Epstein, trained at the University of Manchester in both economics and anthropology, lived in and studied these two villages. She chose them because at the beginning of irrigation they were basically similar in their economic characteristics, cultural traditions, social and political organization, and caste composition. But now, for 15 years, one had been "wet," the other "dry." Could the effects of irrigation and the lack of it be seen in different social changes?

The answer was decidedly yes. Dalena, the village without irrigation, had changed very much more than Walanga—perhaps, at first blush, a surprising result. In Walanga, irrigation presented opportunities for increased gain from farming; these could be utilized without much change in the traditional way of living, and traditional ways have persisted in most respects. Dalena residents, on the other hand, without new opportunities on their village lands but adjacent to a region of growing cash incomes, were stimulated to go in for entrepreneurial activities (trucking, public works contracting, grain milling, cane crushing) or to take factory or office jobs in the prospering town (13 percent of Dalena's male population of working age have become "commuters").

Both villages had changed in certain respects; notably, the extended family system had yielded to the nuclear family unit, confirming the principle that replacing a subsistence economy by a money economy (and thus bringing opportunities for individual gain) breaks down the extended family. But Dalena had become a servicing center for

neighboring irrigated villages, while Walanga remained almost purely a farming village. Dalena's economic diversification was associated with, and in Epstein's well-supported view was the chief causal factor in, drastic changes in its economic, political, and social organization. Dalena, compared with Walanga, was found to have more entrepreneurs, greater participation in the wider economy outside the village, about 10 percent higher income and expenditure per consumer unit, a more "modern" physical appearance (electric lights in the main streets), wage rates for casual agricultural labor 20 percent higher than in Walanga. The people of Dalena had also abandoned the system of Untouchable client labor, were much more aware of and alert to modern types of technical development (for example, Dalena's farmers are more progressive, and the people there know more about machines), had displaced ritual sources of prestige by economic sources, and had decreased their expenditures on the traditionally lavish wedding feasts. But they purchased many more watches, clocks, bicycles, and fountain pens (a literacy symbol). The people of Dalena were more concerned with (and had information about) political activities of the region, state, and nation. They were moving from the "hereditary and personal principle" to the "impersonal competitive principle" in economic, political, and social relations (erosion of caste authority, more individualism). The replacement of hereditary village political authority by elected authority was a reality in Dalena but only nominal in Walanga.

These comparisons rest on meticulous observations and analysis. For example, on the economic side, Epstein prepared tables of costs, outputs, and inputs per acre for each type of crop; from a stratified sample of richer, middle, and poorer households she compiled (with excellent and interested cooperation from the villagers) an income-expenditure budget; she even drew up a balance of payments for each village, showing what it bought from outside and how it earned the money. The political and social analyses are almost equally detailed. Woven in with calm, anthropological objectivity are fascinating and illuminating human incidents. We see how a government official from outside, who seeks to implement in Walanga the state government's decision that village

councils should be democratically elected, has to make concessions on land rights to village elders before he finally gets a purely nominal conformant that leaves the hereditary power system practically unchanged. We follow in Dalena an epoch-making case in which a washerman struck a member of the socially higher peasant caste in a quarrel over the seduction of the washerman's wife; the attempt of the peasant caste council to discipline the washerman by fine and boycott broke down because (i) the washerman could earn more money anyway by washing for people in the expanding town, and (ii) the village headman, a leader of the "progressive" faction and an energetic entrepreneur-innovator who by now had most of his economic interests outside the village, was able to flout the decision of the conservative-dominated caste council and refused to boycott the washerman.

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## Polyadic Boolean Algebra

**Algebraic Logic.** Paul R. Halmos. Chelsea, New York, 1962. 271 pp. \$3.75.

Hopefully, the fragmentation of science caused by increasing specialization will be counterbalanced by the development of new modes of unification. In the contemporary development of mathematics one such unifying influence is the massive intrusion of algebraic concepts and methods into all mathematical fields. Mathematical logic has been intertwined with algebra from its beginnings, through Boole's discovery that simple laws of logic can be expressed symbolically as algebraic equations. But only in very recent years has the algebraic viewpoint in logic been systematized to the point where an almost complete account of logic can be given in algebraic terms. Alfred Tarski pioneered this enterprise through successive exploration of Boolean, relation, and cylindric algebras. The most detailed contributions are found in the papers of Paul Halmos on polyadic Boolean algebras. In this volume Halmos collects his papers (unchanged) and adds a brief preface, a bibliography, and an index.

The nonmathematician is virtually