fascinating sermon on man as the master of his genes. When scientists wax utopian in the ordinary world of politics, we may think of the shoemaker and his last, but when a Nobel Prize winner does it in his own field it is time to listen, however much amazed. Not that Muller would not have first to conquer the political world as well as his own, if we are to expect, with him, "genetic upgrading" by rapidly developing means of insemination or inovulation, or the preservation of sperm or ova of highly selected donors, over generations, for use in manifolding Einsteins, Leonardos, or Lincolns as needed. This may sound like pure science fiction, but Muller is talking about possible things, in the technical sense, and building on a theme that has long occupied him: ways of relief from the population's load of detrimental mutations. Fellow geneticists have reservations, some of which he discusses, but he nevertheless poses a striking contrast between what we might do and what our mores have us do. He definitely does not wish to step out as a leader in a Brave New World, making decisions from the top, but rather to persuade individuals to see the good, where it is good, of raising someone else's seed in place of their own. Pride in biological parenthood and in the perpetuation of personal but inferior genetic endowment, he sees as only one of the sacred cows that would have to be slaughtered. There will be many, and perhaps we will never try his experiments. Perhaps, in spite of Lysenko and his ilk, the Russians will do it first.

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Evolution and Culture. Marshall D. Sahlins and Elman R. Service, Eds. University of Michigan Press, Ann Arbor, Mich., 1960. xii + 131 pp. $3.75.

If anthropology has a great debate, its subject is the evolution of culture. Still unresolved in many of its major aspects, the whole problem of cultural evolution has, in recent years, undergone something of a sea change: where for a long period the dominant voices were those of the opponents and critics of evolutionary approaches, the present is filled with new sounds of approbation. Yet, when a staunch and longtime supporter of theories of cultural evolution studies the work of some of the more recent contributors, he is often dismayed by its revisionist character, and we are treated to the spectacle of a scholar, who once bemoaned the lack of evolutionary thought among his colleagues, now regretting their adoption of such thought. At the heart of this apparent paradox is the uncertainty and murkiness with which many concepts crucial to the analysis of cultural evolution are beset. *Evolution and Culture* is a major contribution to the task of clearing away some of the deadwood that has accumulated about certain aspects of the manifold problem of cultural evolution.

The four chapters which comprise the heart of *Culture and Evolution* are closely linked but independent works, each by a different contributor. The papers have been slightly edited, but are otherwise unchanged from the versions first read at a symposium held during the 1959 meeting of the Central States Branch of the American Anthropological Association; at the symposium they were greeted with prolonged discussion and the enthusiasm that led to their appearance as a single volume. They are introduced by a foreword by Leslie A. White and by a brief chapter written jointly by Sahlins and Service.

Marshall Sahlins' paper is entitled "Evolution: general and specific." This essay supplies the theoretical *mise en scène* for the other chapters. As the title suggests, Sahlins is primarily concerned with two very different faces of evolution, which he identifies as "specific" and "general." The first of these is explicitly phylogenetic and "interested in how one species grows out of another and how the new species gives rise to still other species." General evolution need not be phylogenetic; at times there may be relative concurrence with phylogeny, but no necessary relation exists between speciation and advance, the fundamental concept on which general evolution rests.

Biologists will associate the distinctions advanced by Sahlins not only with Julian Huxley but with Novikoff and Needham and others who have worried about levels of biological integration. Cultural anthropologists should direct their thoughts beyond the strong voices that nourished cultural evolution during its dark days in this century, beyond the great anthropologists of the second half of the 19th century until they reach such pioneers as Comte, who, as John C. Greene has pointed out elsewhere, was struck by "the recurrence of an identical pattern of historical development in civilizations isolated from each other. The recurrence of this pattern seemed to prove beyond doubt that social evolution was not haphazard but issued inevitably from 'the fundamental laws of human organization' and was governed by 'a natural law of progress, independent of all combinations, and dominating them.' "

The importance of this issue is such that overstatement is difficult. For years anthropology has heard from noted scholars, who would replace Morgan and Tylor's "unilineal" evolution and White and Childe's "universal" evolution with something they call "multilinear" evolution. The argument was further complicated by the fact that careful reading of such a "unilinear" theorist as Spencer revealed no doctrinaire unilinealism but outspoken recognition of the local action of what, since Haeckel, we call ecology. It was further complicated by White's repeated insistence that he was not a "universal" evolutionist but simply an evolutionist, a follower of Tylor and Morgan, though one who had benefited by the decades of research that separated him from his theoretical ancestors. A further complication lies in the question of the relationship between history and evolution: Is evolution, as Kroeber asserts, simply history written large, or, as White assures us, are these two qualitatively different ways of analyzing the same data? Sahlins' viewpoint can be a source of clarification, though less in the area of the difference between history and evolution than in distinguishing the approach of, let us say, Leslie A. White from that of Julian H. Steward. Most importantly, Sahlins enables us to see clearly that Steward's "multilinear" approach is not a substitute for or an improvement on White's, but something very different. Furthermore, as briefly suggested above, the difference was recognized, at least implicitly, by the 19th-century theorists who *chose* to investigate general evolution.

The next chapter, "Adaptation and stability" (by Thomas G. Harding), investigates a central aspect of the process of specific evolution. Crucial to Harding's argument is the recognition of the distinction between the two kinds of evolutionary analysis: adaptation per se is a mechanism of specific, not of general, evolution. In Harding's words, "One of the major consequences of adaptation for culture as a whole has been the production of cultures in particular, the production of diversity"

(page 50). Harding emphasizes ecology, which he defines as embracing "the relations between cultures, the superorganic setting, as well as the natural features of the habitat." He also sets the stage for Service's later chapter by noting that in culture, as in biology, adaptation frequently involves specialization and attendant conservatism. Successful occupation of an ecological niche is correlated with stability; advance in a given phylogenetic line may be stymied by success.

In logical sequence, the next chapter, "The law of cultural dominance" (by David Kaplan), explores a phenomenon, the mere existence of which gives a powerful tool to those who would push beyond relativism. Biologists, at least since Darwin, have noted that at particular times certain forms have been conspicuous for their numerous varieties, for their apparent prolificacy, or for the wide range of environments they exploit. A similar phenomenon exists with reference to culture: certain cultures or culture-types appear to be dominant and show their dominance not merely in biological terms of population, but in such culturological terms as the direction of acculturative change and the replacement of one culture by another in specific localities.

Kaplan recognizes that the phenomenon of dominance has two facets which may be viewed in different perspective; these accord with the previous distinction between specific and general evolution. The former kind of dominance is associated with the process of adaptation, as discussed by Harding. Kaplan agrees that such dominance is related to increasing specialization, to competitive success in the exploitation of a specific environment. But, says Kaplan, "if specific evolution leads to increasing *adaptation* . . . general evolution leads to greater *adaptability*" (page 70). General dominance is then linked to successive widening of the ecological horizon, this process being based upon what Kaplan calls "new biological inventions," for example, "improvements in temperature regulation, prenatal protection of the young, and a number of other features . . . which make it possible . . . to function effectively under a much wider range of environmental conditions" (page 71).

Kaplan enunciates the "law of cultural dominance": "that cultural system which more effectively exploits the energy resources of a given environment will tend to spread in that environment at the expense of less effective systems" (page 75). Though freshly stated, Kaplan's generalization resembles those of White and Cottrell (whom he cites). It also returns to an important theme in Sahlins' chapter, namely, the attempt, following Lotka and similar theorists, to subsume cultural evolution under the great rubric of energy transformation, a theme well known in the work of Leslie A. White, who credits Ostwald with the distinction of having been a pioneer in this area.

The fifth and final chapter of *Evolution and Culture* is "The law of evolutionary potential" (by Elman R. Service). Weaving together some of the implications of the previous essays and his own views of evolutionary process, Service states the generalization for which his paper is named: "The more specialized and adapted a form in a given evolutionary stage, the smaller is its potential for passing to the next stage." He then states a startling corollary: "Specific evolutionary progress is inversely related to general evolutionary potential" (page 97).

As in the essays of Harding and Kaplan, and to a lesser extent Sahlins, the main points are illuminated with briefly sketched ethnographic data. In giving examples, Service is careful to avoid creating the impression that he wishes (as a historian of science has put it) "to explain the assumed development by means of a few judiciously selected principles supported by an assortment of judiciously selected facts." Service admits that illustrations are not proof. Instead, he asks that the principles enunciated in this book be judged on the basis of their utility or their explanatory value rather than on the basis of their absolute truth.

Each of the essays in this book has its share of controversial features, but Service's chapter will probably provoke the largest number of general readers, for he applies his principle of evolutionary potential to the present sociopolitical situation. He suggests that the present world posture of the United States represents that of an overspecialized, overadapted culture—one that he predicts will have great difficulty getting over the divide that represents the next general stage in the evolution of culture. To head off disaster (from our point of view), it will be necessary to encourage all of the processes that are bringing new cultural forms to the fore, even if this means hastening our fall from the position of dominance presently enjoyed.

Having stated some of the most important theses contained in this book, it seems proper that I make some evaluation more specific than mere allusion to its possible effect as a stimulant. Certainly the distinction between specific and general evolution is of great importance, though it has been neglected by biologists and often denied by anthropologists. With regard to specific evolution, it should be noted that "adaptation" is much less satisfying as a mechanism when applied to culture than when applied to biology. Underlying adaptation in biology is natural selection, which operates through differential reproduction—ultimately through life and death. But in dealing with culture we must not place too much emphasis on simple demography, lest the differential viability of populations be confused with the differential viability of cultures.

Related to this, and of equal importance, is the problem of the mechanism of general evolution. Sahlins dips directly into Lotka and comes up with "total energy flux." But this raises many questions with regard to which I share Sahlins' lack of *expertise*. Thus, Sahlins is unequivocal in stating that "general progress is not to be equated with thermodynamic *efficiency*" (page 34). He prefers to regard, as his index of advance, the amount of energy trapped by an organism and converted to "a higher state," for example, from inorganic to organic compounds, or from the latter state into protoplasm. According to such a scheme, the presumptive index of biological advance would be metabolic, and a creature such as the shrew would represent a peak of energy flux and, therefore, a very advanced type, relative to other mammals.

A critical point that may be addressed to all the papers concerns the unit of analysis. It is not clear in any given paper, still less in the volume as a whole, what constitute the boundaries of the units under consideration. Difficult as this problem may be in the biological sciences, there is no comparing the discreteness of a particular organism, or even of a breeding population, with the fluidity of a culture or the amorphousness of a culture area. Though the definition of a biological species is essentially arbitrary, it has greater consistency in logic and in procedure than most definitions of cultures or culture types. It is not in criticism of these essays that I raise this problem, for it is beyond their scope to treat it.

Nevertheless, I note that the suggestions of the various contributors will suffer a lack of clarity and precision until the units involved are more specifically bounded.

Related to this point is a final comment addressed to the Service paper: *If* it is true that China, enjoying "the privilege of historical backwardness," is on the verge of a great leap forward, which (due to the "law of proportional development" so hotly discussed by the economists of Mainland China) will place China ahead of both the United States and the U.S.S.R., it is at least equally true that, until a bare 150 years ago, China was representative of a dominant culture capable of assimilating most others or, at least, of shrugging them off. Obviously the "law of evolutionary potential" does not, under present conditions, favor the truly backward and unspecialized cultures, but only those which have temporarily dropped a stride behind the leaders.

Although brief, *Culture and Evolution* is a valuable work that merits a wide readership, not only among anthropologists but among biologists and those in the physical sciences as well. Compliments to these bold authors; I hope that they have whipped up a storm, initiated a debate that will cross disciplinary lines and, perhaps, lead on to a more triumphant synthesis.

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I.C.A.R. Monographs on Algae. No. 1, *Zygnemaceae*. M. S. Randhawa. 478 pp. Illus. Rs. 26. No. 2, *Cyanophyta*. T. V. Desikachary. x + 686 pp. Illus. Sh. 72. Indian Council of Agricultural Research, New Delhi, 1959.

These excellent monographs constitute the first steps in the realization of an ambitious and commendable project undertaken by the Indian Council of Agricultural Research: the comprehensive taxonomic treatment of all groups of Indian algae. Randhawa's *Zygnemaceae*, however, is much more than a local floristic account. He treats this sharply defined group of fresh-water algae on a world-wide basis, recognizing 580 species in 13 genera, of which 174 species in 9 genera have so far been recorded from India. Most of the many species originally described from India have not yet been found elsewhere. Randhawa's task, on first consideration, would seem formidable, but was made possible (as he acknowledges) by the existence of several monographs on this group; the most recent was the monograph by Transeau (1951), who recognized 534 species in 13 genera. Part of the increase in the number of species recognized by Randhawa is due to the publication in the present work of 14 new species identified by M. O. P. Iyengar (unfortunately these species are invalidated by lack of Latin diagnoses). Randhawa follows the example of Kolkwitz and Krieger in providing chapters on occurrence and geographical distribution, cytology, and reproduction, in addition to an interesting introductory account of the history of phycology with special reference to the Zygnemaceae and to India. But the fact that Randhawa had excellent models to guide him should not diminish the high praise that he deserves for producing a first-rate work which retains the best features of existing treatments and enhances the subject by consistent and accurate bibliographic documentation and by incorporating the results of recent investigations.

Desikachary's monumental treatment of blue-green algae is limited to India and its neighboring countries, largely because of the size of the group: the number of species recognized is about 750, representing 85 genera. The systematic account is preceded by a welcome discussion of the cytology, morphology, reproduction, ecology, and phylogeny of Cyanophyta. Steering a middle course between Drouet and Elenkin, Desikachary accepts Fritsch's scheme of classification with certain modifications. Several new taxa are described. The illustrations, mostly redrawings, generally are satisfactory, but some are sketchy. The bibliographic documentation is thorough and accurate.

Both authors write in a clear and pleasing style. The books are well manufactured, although the bindings may not be strong enough to support the weight of the high-quality paper. The Indian Council of Agricultural Research and the authors are to be congratulated on these scholarly achievements, which bring to public attention the prominent rôle that Indians play in phycological research.

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The Mysterious Earth. Lester del Rey. Chilton, Philadelphia, Pa., 1960. xii + 214 pp. $2.95.

You and the Universe. N. J. Berrill (with support from Walt Whitman). Dodd, Mead, New York, 1958. viii + 215 pp. $3.50.

The Forest and the Sea. A look at the economy of nature and the ecology of man. Marston Bates. Random House, New York, 1960. 277 pp. $3.95.

These three books are all concerned, in one way or another, with man's place on the planet or in the universe. Lester del Rey's book is a factual popularization of material about the earth and life, apparently summarized for the most part, from *Scientific American* articles. It is for brighter young people and will serve a useful purpose, although it might have been improved by some illustrations.

N. J. Berrill, a zoologist turned philosopher, wants to know "just what are we doing here, spinning on a tilted planet swinging round a star" and examines the nature of the planet and the life on it in chapters with themes set by quotations from Walt Whitman. It is the sort of book intended for those fascinated with the "Wonder Of It All," pinnacled, as Shelley said somewhere, deep in the intense inane.

The book by Marston Bates is something else again, an attempt to bring to the reasonably educated man the essence of ecology, and of man's place in nature, in the ecological rather than in the philosophical-evolutionary sense. It is a significant, careful treatment that deserves to be widely read by all who are concerned with nature and with where man's bread is to come from. However, it is not a plundered planet book except, perhaps, by implication, but an original treatment of what might best be called general ecology.

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Introduction to Theoretical Meterology. Seymour L. Hess. Holt, New York, 1959. xiv + 362 pp. Illus. $8.50.

This is a very useful addition to the list of meteorological textbooks. It has many didactic merits. In particular, the attempt to deduce the complex atmospheric conditions from basic physical