as the setting for the struggle for existence and for natural selection. Here the manuscript offers new illustrative details. Moreover, it makes clear the prime influence of Linnaean essays such as the "Oeconomy of Nature," the "Police of Nature," "On the Increase of the Habitable Earth," "The Flora of Insects," and the "Swedish Pan." Darwin studied all of these and more in English translations, dug out many useful facts and ideas, and cited them in the notes of his manuscript chapters.

Thus we are led to a paradox. The conventional view is that Darwin overthrew the work of Linnaeus in so far as he replaced the orthodox dogma of fixity of species by his theory of evolution. But in regard to Linnaeus' ecological concepts of an economy of nature, Darwin used these ideas as major explanations of the working of natural selection. So Linnaeus was of major assistance to Darwin in the latter's formulation of his theory of evolution.

In conclusion, what can be said about the implications of Darwin's "Natural Selection"? It is tempting to speculate as to the historical outcome if Darwin had been left undisturbed and free to publish his theory in the form he originally planned. It would have been a detailed two-volume work with full documentation, appealing to an audience of specialists but probably not to a wider public. It might even have been ignored by Bishop Wilberforce and by other hostile critics in some of the great literary review journals. *Darwinism* might have been less subject to misuse by would-be scientific supporters of laissez-faire economy and of imperialism. Darwin himself, instead of having to devote months to frequent revision and qualification of the *Origin of Species*, for five more editions, might have been free to develop more extensively the concept of the economy of nature as a background for the struggle for existence, and to carry out the plan mentioned in 1859 in the *Origin of Species* in regard to the latter subject: "In my future work this subject shall be treated as it well deserves, at much greater length." In the late 19th century there might have been less "Social Darwinism" and more ecology (*7*).

References and Notes

1. *Nature* **150**, 535 (1942).
2. C. Darwin, in a letter to Wallace, 22 Dec. 1857.
3. S. Butler, Ed., *The Life and Letters of Dr. Samuel Butler*, vol. 2, p. 144 [volume 11 of S. Butler, *Works*, H. F. Jones, Ed. (London, 1924)].
4. Letter to Hooker, July 1854 (letter No. 36 in *More Letters*).
5. C. Darwin, *Autobiography*, N. Barlow, Ed., (London, 1958), p. 121.
6. F. Darwin, Ed., *Life and Letters of Charles Darwin* (London, 1888), vol. 2, p. 95.

7. The research for this article was made possible by research leave and travel funds for 1957 granted by the Graduate School Research Committee of the University of Wisconsin and supplemented for 1958 by a travel grant from the American Philosophical Society. I wish to thank the Cambridge University library for granting me permission to have Charles Darwin's long manuscript version of the *Origin of Species* microfilmed, and H. R. Creswick, university librarian, and Mr. Gautrey of the Anderson Room for their hospitable assistance.

Darwin or Spencer?

Why has Darwin's reputation risen, while that of Herbert Spencer has declined?

George Kimball Plochmann

The writings of Herbert Spencer, formerly so influential, now line the back shelves of second-hand bookstores. Yet the chief books of Darwin are forever being republished and are so much read that their author's name is virtually a synonym among ordinary folk for "evolution," and among sophisticates for "natural selection." I am speaking, of course, about the way these men are received now, in the 20th century; in his own day, which was that of Darwin too, Spencer was regarded as a giant, and his *Principles of Biology* was adduced as one of the chief evidences for this high estimation. Of course this could not be on literary grounds; Spencer is no more a first-class stylist than Darwin, and it must have been content and general arrangement rather than any niceties of diction that kept readers faithful through his dozen volumes, so stuffy in their confidence, so heavy in their repetitions and summaries. But then, there is also *The Origin of Species*, winding in its periodic sentences, replete with modifiers, disclaimers, and exceptions.

Had Darwin and Spencer been more tendentious men, they would doubtless have become embroiled in Newton-Leibniz disputes regarding priorities; as it was, both writers were eminently fair and shared with each other and with Alfred Russel Wallace their findings, hypotheses, and honors. It would be difficult to establish the interlocking priorities here: Spencer's preliminary essays were published some time before *The Origin of Species*, yet the definitive statement of his biological views was printed a dozen or so years after (*1*). For this reason it should be the implications of the theories, rather than their order in time, that concern us here. And for all these reasons, it is not my intention to trace the course of biologic history in the past hundred years to account for the disproportion in the respective influences of these outwardly rather similar thinkers. Rather shall I suggest a number of methodological and conceptual reasons why one man has been in good part forgotten, the other raised to such an elevation.

Principles and Their Extension

Spencer's *Principles of Synthetic Philosophy* begins with a kind of metaphysic of nature, then passes through biological principles, psychological, sociological, and ethical. Within the volume *First Principles*, Spencer exhibits the applications of each principle, with a glance at convenient facts in each of the sciences he is later to develop at length, thereby clarifying but neither proving nor intending to prove his primary generalizations. The account in the *Principles of Biology* follows a

The author is on the staff of the department of philosophy of Southern Illinois University, Carbondale. This article is adapted from a paper presented before the section on "Darwin and Evolution" at the April 1959 meeting of the American Philosophical Association, Western Division, in Madison, Wis.

fixed order: first the physicochemical principles and particulars, then a discussion of their effects in biology. So the construction of the biology mirrors that of synthetic philosophy as a whole. For Darwin, this movement from physics to biology is not in question.

In Spencer's biology there are a vast number of topics tied to the general laws of evolution, illustrative of them, and interpreted by them alone. However, the formula of evolution is first reached not in the *Biology* but in *First Principles* (*2*), and is held to be quite universal in application. In the biological treatise, therefore, Spencer is able to take his principle wholly for granted, a procedure by the way just the reverse of Charles Darwin's, for the latter takes endless pains to establish one. So Spencer needs merely to pass from the "data" (which are not at all the raw facts, but what is "given" to biology by physical chemistry) to biological "inductions"—namely, the topics of growth, development, structure, function, adaptation, heredity, variation, and so on, of *living* things, not things in general. A third section of Spencer's book examines the formula of evolution as it gives meaning to biological phenomena and elaborates the arguments, drawn from the earlier topics, in favor of this second application of evolution to simple living forms. Development, both morphological and physiological, is next, the treatise then being brought to a close with the laws of multiplication of individuals and of species.

In Spencer's metaphysic of nature, forces and their resultants work as well upon the solar system as upon the universe as a whole, upon the burning of a candle and the melting of ice, and upon molecular alterations. Spencer conceives this to be part of the great strength of his theory—its immediate and universal applicability. Nature is always and everywhere the same. No doubt this view has cost Spencer many followers, who are unwilling to base their biology upon such simple physics. For example, in organic growth, Spencer holds that the line of movement is the resultant of tractive and resistant forces (*3*, pp. 233, 234; *4*). Where both attractive and repulsive forces are appreciable, movement takes place along the resultant of *all* the tractions and resistances (*3*, p. 225). So in this respect it is impossible to say anything about plants which you cannot say about bricks also. It is not that Spencer favors mechanism over vitalism, but that his mechanism is so crude (*5*).

Life and Matter

I find nothing parallel to Spencer's broad extension of principles in Darwin—at least nothing systematic. For Darwin, biology has its own proper topics, methods of inquiry, conclusions. *The Origin of Species* is steadfast in its refusal to draw upon mathematics, physics, chemistry—indeed upon anything outside of biology except the socioeconomic theory of Malthus. For Darwin the relation of part and whole, one of the key notions in his whole theory, is conceived in uniquely organic terms; and so also are the ideas connected with alteration, life, specific characters, motion, and so forth (*6*). The chapters which occupy the middle portion of his book are on geology, true enough. But they too are conscious importations of geological subject matter into the account, importations which are packaged and sealed against contamination by principles relating to organic life (*7*). Geology, for Darwin, explains ecological distribution and the facts of paleontologic placement by its *findings* but does not lend its resources to answering such questions as: What is an animal? What are animal species? What does it mean to say that species have an origin and development?

For Spencer, however, the parts of living bodies arrange themselves in virtue of certain movements of their own, though the forces proper to living aggregates are derived from kinds of physical energy found throughout all nature—energy types such as heat and light, which are the primary conditions, according to Spencer, of growth (*3*, p. 210). He talks of a community and exchange of energy between inanimate and animate, the latter receiving its working supply from the former. Some of the components of organic matter are gases, and in their uncombined states these gases have so much molecular motion that they are incondensable. Thus, the essential characteristic of living matter is that it unites much of its contained motion with a degree of cohesion sufficient for a temporary fixity of arrangement (*3*, p. 300). Thus, living matter differs from nonliving in degree, not kind. This, I believe, is primarily a consequence of the fact that Spencer no longer thinks mainly of the individual substance as being alive, but of matter of a certain kind as having life, as being actually alive. In Aristotle, and in much the same fashion in Darwin, the composite substance is the main thing; Aristotle even says that the matter is no more than a possibility of the life and the substance (*8*). For Spencer, matter here is as good as matter there, so long as it shares the common properties of motion and coherence (*9*). Only metabolic changes can be really considered as vital—that is, nutritive activities and growth—for such changes are characteristic of protoplasm only (*4*, pp. 42*e*-43*a*, 69*b* ff.). Again we move away from Darwin; not only is matter alive, but it is in terms of matter that we determine the essential characters of life, not in terms of motion (as in Plato) (*10*), or a complex of biological functions (as in Aristotle), or intellection (as in Hegel). Spencer takes the hypothesis of evolution, which allows us to assume that the first units of protoplasm could appropriate directly from the inorganic world both the nitrogen and the materials for carbohydrates without which protoplasm cannot be formed (*4*, pp. 63-64; *11*). Others might object that this is no real explanation, that it merely sets back the difficulty one more step in time. What it comes to is that for Spencer life is definable in terms of that matter which evolves, and evolution is not definable strictly in terms of things living.

Origin of Alterable Characters

The title of Darwin's book, on the other hand, is an indication that he takes life and its peculiarities pretty well for granted and is content to look for the origin of species, or what he might better call the origin of alterable characters, inasmuch as the species as an inflexible class largely disappears from his work (*12*). His book is a massive effort to apply two-part distinctions over the whole field of what he regards as strictly biological change. His first and major division is between domestic selection and natural agencies—between weak and external agencies, producing alterations, and strong and internal ones. The weaker, domestic agencies have two subagencies, those kinds that tend to cause variation and those that promote endurance of the variations (*13*). Of the causes of variability there are four, of which two—changed conditions of life and the law of use and disuse—are the most significant. Changed conditions of life, again, are of two kinds, direct and indirect, the direct are of two subtypes, and so forth. Darwin admits that reasoning from domestic selection to natural is an analogy but points out that animals in the pen and

in the wild must struggle alike for their existence. Natural agencies are again two: the general selection that permits only the fittest to survive, and so-called sexual selection, which operates to much the same effect. Natural selection operates on both new and old forms, bringing about adaptation and divergence of the former, preservation or destruction of the latter. Such, in outline, is the set of distinctions which Darwin employs—contrary terms drawn from the language of ecology and genetics (*14*). It is with these that he frames the idea of evolution, which has been in the history of science primarily a biological one, as Darwin understood biology. Spencer, for his part, takes evolution from biology, then strips it in good part of its biological character, as in his famous jawbreaking formula for evolution, which is pure physics (*15*).

Spencer now hazards several definitions of life, each one taking care of the two functions farthest apart in the scale—namely, assimilation and reasoning (*4*, vol. 1, p. 81). He is best pleased with the definition of life as the continuous adjustment of internal relations to external relations (*4*, vol. 1, p. 99). In other words, it is a series of reciprocal and complex adjustments; yet the explanation of each adjustment referred to is sought in physicochemical forces—up to the point where we reach the Unknowable (*16*). The adjustment is thus mechanical—the reaction to incident forces impinging upon the organism.

At this point Spencer's analysis admittedly breaks down; life is an unspecified principle of activity, since life cannot be conceived, as he reluctantly admits, in purely physicochemical terms, and yet the hypothesis of a vital principle, he is quick to add, is equally unsound (*4*, vol. 1, pp. 114-115, 120). The ultimate behind all living manifestations is incognizable. All he can say with assurance is that as the parts continue to function and integration increases, languor supervenes, since the motions of the parts require more energy, temporarily, than the parts or the whole of the organism are able to supply from the material absorbed as nutriment. This is the equilibrium that always supersedes evolution; evolution, in Spencer's mind, always aims at some medium or mean, and the excesses or deficiencies are quickly removed—by the process of evolution itself. Darwin, of course, asserts that species lose the function of organs through disuse, but this is quite incidental, and there is no reason to insist categorically that it is bound to occur—it is contingent upon the accidents of changed environment.

The Evolutionary Principle

Spencer seems not to have studied Darwin very thoroughly (*17*), but he comes closest to him as he passes from evolution within the animal to what the biologist ordinarily tries to signify by the term *evolution*: the historical development of morphologic traits, and the consequent origination of new species. Spencer's procedure here is to assume that progressive speciation (not accepted in his time by an imposing number of leading biologists) is the best instance of the more general phenomenon of evolution. He is *not* proving that the universe evolves because a great animal evolves (Whitehead), or that the universe is animate (Plato), or that animals are no more than mechanisms (although that sometimes appears to be his contention). It is Spencer's point, rather, that organic "evolution" as Darwin conceived it is one more example of a phenomenon rooted in the distribution of forces. Darwin was concerned with the total biological adjustment, considered as a complex, not a set of forces; Spencer, with the effects of discrete causes upon parts. Of course, it is difficult to see how the *parts* of biological environment could be anything but physical forces, so we must admit that Spencer is not obviously mistaken.

After noting that the evolutionary principle explains important subtopics of organic speciation, such as the resemblances of embryos to the body plans of phylogenetic forebears, and such as homologues, vestiges, and the like, Spencer next comes to grips with the modifications of species themselves (*3*, pp. 418-419). He notes, in many parallels to Darwin, that such groups are modified with respect to growth and functions, and that their modifications in turn produce new functions. Unlike Darwin, he barely raises the question, "What is a species?" but assumes that the animals of a single species will follow the same general reactions to varying forces in their environment. Yet species do become divergent, by the subjection of their members to unlike sets of circumstances (*3*, p. 419). The individuals are not *quite* similar, and the first differences are the occasion for further differentiations. Thus, modifications of species, like the modifications of organs during embryonic growth, are brought about by aggregates of external forces. Here Spencer almost ignores one of the questions most troubling to Darwin, for whom a species is not so much a type as a population, parts of which may be altered while the rest remains nearly the same (*18*, pp. 38, 373). How is it, Darwin wonders, that some species remain homogeneous while others break up into several varieties (*19*)? It should be noted that the species type, like the organic form, is only hinted at by Spencer in a vague way, and no further allowance is made for it in biology or the metaphysic of nature. We have previously noted that the species are produced as the "fixities"—whatever that may mean—of the natural organic process. Thus nature, for Spencer, seems to be outside the living species; and it is that which shapes them, being the forces incident to them. This is quite analogous to the proposition about individuals: Vitality is not a principle of the natural unity of the organism. The individual organism evolves, but not through an internal nature (*3*, p. 447).

For Spencer as for Darwin, survival of the fittest is the best explanation for natural selection; in the *Principles of Biology* it amounts to nothing more than dynamic equilibrium of functions in the presence of forces outside—that is, those creatures which do survive are able to adjust to the changes in the environment quickly and completely enough to maintain their internal stability; they have, not an evolution or a dissolution, but an equilibrium toward which their evolution has led them. In the *Origin of Species,* on the other hand, survival represents the interactions of chance and necessity within a living population which may be better adapted than other living creatures to the circumstances at hand (*20*).

Methods

Darwin has a single, all-embracing analysis of biological evolutionary phenomena (he turned to the problem of human descent in a separate book not because it was intrinsically a different problem but because of tactical considerations). In like fashion, Spencer uses one procedure throughout *First Principles* and, with little alteration, throughout *Principles of Biology*. In its

main outlines and applications, his method is quite simple: an inductive-deductive cycle. Induction leads always from instances to a general truth; deduction, from a general truth to instances; and for reasons of exposition Spencer uses the two methods side by side, in nearly every chapter. However, the meaning of *instance* changes in the two methods: in induction, the instances are familiar, well-received examples founded upon observation, which lead to propositions about the general character of evolution or life. In deduction, the general truth from which all knowledge starts is the persistence of force, and the instances derived are only less general; they do not yet relate to particular examples. There is thus a rhythm of induction and deduction, which makes an arbitrary starting-point of the concept of force, just this side of the Unknowable. But the rhythm is incomplete, and though the inductions begin with matters of observation, the deductions do not end there. For Darwin, on the other hand, there is a simpler method: One begins with vast catalogs of facts (catalogs which he regrets he is unable to print in full in the *Origin of Species*) (see *18*, p. 82), and one proceeds directly to the most convenient inductions regarding them. The entire method is an attempt to confirm a leading hypothesis and its corollary supposals (*21*).

In Spencer, there is an immediate relation between general principle and uninterpreted fact. A theory can be upset by a fact, a definition can be shown, in the light of facts, *the* facts, to be deficient (*4*, vol. 1, p. 111). Yet we can accept a definition—of life, say—as it stands, while at the same time restricting its scope of application. Now a definition amounts, in Spencer, to a generalization or hypothesis; hence, the same kinds of facts can be used to support a definition and to support a hypothesis. The definition or formula of evolution, furthermore, is at the same time a law, which stands or falls on instances (*4*, vol. 1, p. 437). Thus, in his physical and biological method, Spencer reduces everything to the same level of intelligibility, priority, necessity, and truth.

But for Darwin, definitions are hardly on the same footing with other types of assertion. Gone is the machinery for showing that a definition *must* hold, and instead we have the rather limp admission that a species is whatever the experts want to think it is—and other statements to more or less the same effect.

Spencer seems happiest in his method when he begins with least parts or simple parts and builds them into compounds, and complexes of compounds, by integration (which simultaneously produces differentiation). This integrative method is not quite simple addition, since the whole reacts to external stresses somewhat differently from the way its original elements did but the new reactions are resultants of the old and may, so to speak, be mechanically defined and computed. Evolution is conceived by Spencer as a route from simplicity to complexity, life in one sense being a complex result of the process; in another sense, the cause of further complication. For Darwin, nothing is a simple part, and his method seeks to locate casual factors in an already functional whole. Evolution he limits to groups of animals, making little attempt to find a likeness between the growth of the individual and that of the genealogical "tree" (*22*).

Conclusion

We have seen that Spencer's approach to every biological problem is to seek for characteristics applying to the inorganic, or to both the organic and inorganic together. But to designate these characteristics he sometimes uses terms drawn from biology narrowly conceived and then extends the application of these terms to the whole physical world; and sometimes he does the same with physical terms (*23*). The result is the confusions in terminology, subject matter, and scientific method that I have enumerated. It is my conclusion that these confusions, rather than questions of biological expertness or matters of detail, account for the discrepancies in the positions of the two men in the history of science, viewed from the standpoint of today. I suppose one could make a good case for the contention that Spencer has anticipated about as many latter-day theories relating to evolution as has Darwin (*24*), but this still does not seem to entitle him to a place of first importance in the history of science. It is not the fact that Spencer espoused some pre-Darwinian ideas, Lamarckian in origin (*25*), that has relegated him to the side lines, for many pages of Darwin himself wear a very old-fashioned look. It is rather, I think, that the biologist fears that he would have to adopt a whole stack of mediocre physical concepts along with some quite interesting botanical and zoological explanations were he to accept Herbert Spencer, whereas Darwin leaves him freer to pick and choose physical, mathematical, and chemical explanations more in accord with 20th-century ways of thinking, because of a cautious silence concerning them.

References and Notes

1. A few dates would be helpful here. Darwin's accounts of his voyages were published in 1832, 1839, and 1845. His geological conclusions, gained from observations while on the *Beagle*, were first printed in 1842, and more were added in 1844 and 1846. Spencer envisaged the problem of change in a book published in 1850, *Social Statics*. At a time Darwin wrote a whole series of highly detailed papers on insects and on geology, Spencer was writing his "The Development Hypothesis" and "The Theory of Population" (1852) and his *The Principles of Psychology* (1855), which became, in somewhat altered form, a part of his great work on synthetic philosophy. The joint work of Darwin and Wallace was put before a not wholly alert scientific public in 1858, and the following year saw the first of six editions of *The Origin of Species*. *First Principles* appeared in 1862, and it likewise had gone through six editions by 1900. In 1864 Spencer began publication of his *The Principles of Biology*, and 4 years later Darwin issued the two volumes of *The Variation of Animals and Plants under Domestication*.
2. "Evolution is an integration of matter and concomitant dissipation of motion, during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent, heterogeneity; and during which the retained motion undergoes a parallel transformation" [*First Principles* (Appleton, New York, 1892), p. 367]. We are reminded of the simplification by which William James came close to parodying this definition: "Evolution is a change fom a no-howish untalkaboutable all-alikeness to a somehowish and in general talkaboutable not-all-alikeness by continuous sticktogetherations and something-elseifications" [R. B. Perry, *The Thought and Character of William James* (Little, Brown, Boston, 1935), vol. 1, p. 482].
3. H. Spencer, *First Principles* (Appleton, New York, 1892).
4. ———, *Principles of Biology* (Appleton, New York, rev. ed., 1904).
5. A much better version of the mechanics of growth, showing the interaction of multitudes of heterogeneous forces, is to be found in D'Arcy W. Thompson's brilliant studies. "D'Arcy Thompson: His conception of the living body" [*Phil. Sci.* **20**, No. 2 (1953)], an essay of my own, presents some of the methodological problems in a brief compass for those not familiar with the great *On Growth and Form* (Cambridge Univ. Press, New York, 1942).
6. I even find very little reference in *The Origin of Species* to *evolution* as a separate term. But see pages 99-100 of that work [C. Darwin, *The Origin of Species* (Modern Library, New York)].
7. I refer to chapters 10 and 11 of *The Origin of Species*. Geography is put to the same kind of use in chapters 12 and 13. The edition to which page references are given here is a Modern Library "Giant," which reprints the sixth edition of 1872.
8. See → "Nature and the living thing in Aristotle's biology" [*J. Hist. Ideas* **14**, 167 (1953)] for a general review of that theory.
9. I have often wondered why Spencer, who foreshadows a number of the tenets of physicalism, has been little read and appreciated by the positivists, who have instead turned their attention to Hume, one of Spencer's own sources.
10. The first third of the discourse by Timaeus in the dialogue bearing his name is an account

which links motion with the life of the heavens.

11. Spencer effectively raises questions which have recently been treated under the head of proto-evolution, or chemical evolution. See also A. I. Oparin, *The Origin of Life* (Dover, New York, 1953), especially chapter 1. Geneticists, organic chemists, and physiologists are all converging upon this problem of what happens to simple salts, metals, and so on to make them capable of self-transformation so that they can sustain life processes.
12. This is not quite an innovation of Darwin's. See, for example, M. Mandelbaum, "The scientific background of evolutionary theory in biology" [*J. Hist. Ideas* **17**, 345 (1957)]. Much remains to be done to find out whether, for Aristotle himself, species are fixed in the sense that Darwin denied that they are. Before an answer could be given, one would need to master a great deal in Aristotle's metaphysics, logic of science, and physics, as well as his biology.
13. See E. Rádl, *The History of Biological Theories* (Oxford Univ. Press, London, 1930). On pages 63 and 64 Rádl seems to hedge on whether Darwin gives more descriptive or more causal accounts of variation. Rádl ought to be altered to read "causal," without question. This opinionated and often fuzzy book should be read for the valuable leads it gives into material not ordinarily examined nowadays.
14. Most of these distinctions are made in the first four chapters of *The Origin of Species*, and many are summarized in the final recapitulation.
15. Rádl goes even further when he says (*The History of Biological Theories*, p. 71): "It is true that Spencer did pursue definite biological studies, but these hardly bore any relationship to the substance of his explanations—and his explanations far exceeded the range of his observations, both in quantity and in quality."
16. Spencer himself says (*First Principles*, chap. 1) that the analysis of many phenomena can go only so far before it ends in contradiction or an unanswerable question. For Bradley's neat reply to this, see *Appearance and Reality* (Clarendon Press, Oxford, 1930), p. 111, footnote.
17. For a compact account (taken from the *Autobiography*, mainly) of Spencer's education and of his principal doctrines, see W. Durant, *The Story of Philosophy* (Simon and Schuster, New York, 1929), chap. 8.
18. C. Darwin, *The Origin of Species* (Modern Library, New York).
19. The laws of variation are given in *The Origin of Species* (chap. 5, summarized on p. 122).
20. A grain in the balance, says Darwin (*The Origin of Species*, p. 359) determines which individuals, and even which species, shall survive.
21. The last chapter of *The Origin of Species*, entitled "Recapitulation," gives in striking form the evidence of observations throwing light upon the hypothesis and its attendent objections.
22. The "tree" appears on pages 99-100 of *The Origin of Species*, but not in connection with growth of individuals, only of groups.
23. Of course, this is not so old-fashioned as it may seem. William King Gregory, in the text volume of his comprehensive *Evolution Emerging: A Survey of Changing Patterns from Primeval Life to Man* (Macmillan, New York, 1951), differentiates what he calls polyisomeres and anisomeres in terms that would apply just as well to cosmic phenomena as they do to the invertebrates and vertebrates.
24. One excellent summary of the contributions of Darwin was contained in a public lecture delivered at Southern Illinois University by Alfred E. Emerson, 1 Oct. 1958. The lecture was entitled "The Impact of Darwin on Biology," and its author, the well-known ecologist and zoologist from the University of Chicago, presented a comprehensive list of ideas that were enunciated by Darwin but more fully elaborated by his successors. Among those foretastes of later evolutionary theory which Emerson located in *The Origin of Species* are the following: latency of genetic characters, spontaneous variability (mutations), heterosis, palingenesis, recapitulation, and homeostasis. Nowhere was it asserted by Emerson that these notions all originated with Darwin, but certainly Darwin gave them clearer voice than did most of his predecessors or even his contemporaries.
25. See Spencer's essay "Progress" for the admission that he derived a number of ideas on evolution from Lamarck. However, most of the *Principles of Biology* is neutral as regards the inheritance of characters acquired through practice.

Introducing Industry in Peasant Societies

Modern industrial production need not drastically disturb local ways of life.

Manning Nash

In the Malay Archipelago, in China, in Africa, and in India the spread of industrial technology and factory production methods has destroyed many aspects of native cultures. Many thinkers have come to regard such destruction as inevitable. Social scientists in particular have almost taken it for granted that industrialization sets up a chain of social and cultural events that sunders the social fabric of peasant and primitive societies. There is evidence, however, that under proper conditions an indigenous, non-Western community can adjust to factory production and still maintain the main features of its own special way of life. A case in point is the coexistence of a textile factory and a peasant society in Cantel, an Indian community located 200 kilometers west of Guatemala City in the Guatemala highlands. The factory was established some 70 years ago and employs about one quarter of the population. Cantel has the same family structure, the same role in the regional market, the same roster of saints, the same notions of law and justice, the same basis for status and prestige, and the same quality of social life that it had before the factory was established. Cantel is like the neighboring Indian communities in all respects except that among the economic opportunities that it offers is a wage job at a factory.

The author is on the staff of the Graduate School of Business of the University of Chicago, Chicago, Ill.

Cantel and Its Neighbors

The cultural pattern of the Indian communities in the western highlands of Guatemala reflects a blend of Spanish-Indian influences, more or less stabilized in the region some 400 years ago. The chief features of the pattern are a simple farming technology, without the plow or machine tools (Fig. 1); a low level of wealth, without class lines; a political organization, tied to a religion with a hierarchy of saints; and a system of markets based on local specialization. Each community in the western highlands has some economic specialty. Markets are held in different communities on different days of the week (Fig. 2); people bring their goods to sell, and buy the things they need. The village markets are held in conjunction with central markets held daily in the larger towns.

Witches, spirits, mountain demons, and the personification of many aspects of nature are all part of the culture and world view, as is the use of the old 260-day Maya divinatory calendar.

These Indian societies, while sharing a single broad cultural pattern, vary endlessly in dialect, costume, economic specialty, roster of saints, and sacred ceremonies and even in the physical appearance of their members. Each of the Indian societies is a locally organized culture, distinct from its neighbors in fact and in its own view, and each is made up of a "people" who