tinued to make decisions based on their practiced intuitions, not on tables and routinized lists of risk factors.

In the course of the 18th century, however, a change took place in public attitudes toward insurance. In the later part of the century, the purchase of life insurance came to be thought of as a conservative, risk-aversive choice rather than a bet. The change, Daston suggests, was not a simple case of increasing rationality. Purchasers of the new table-based insurance policies of the Equitable Society, which minimized the gambling element, paid dearly for the privilege: the participants would probably have done better with the old kind of insurance, in part because of the extreme fiscal conservativism of the Society, which resulted in a huge reserve and low payouts. But the character of the assumptions that intelligent people made about the world were changing in ways that fit with the Society's treatment of the probability of death as an objective feature of the world. In general "regularity" replaced "ignorance" as the key concept in probabilistic thinking. The urn model, accordingly, was replaced by the model of natural laws governing fixed or at least very orderly aggregate-level rates, such as the increasingly predictable death rate.

The subjective aspect of the classical interpretation had a different fate. The problem of weighing court testimony probabilistically, which had been a central concern of the classical probabilists, was abandoned: mathematicization, as Daston observes, is not irreversible. Also, informal probability concepts figured heavily in the associationist psychological theory shared by writers on the theory of knowledge in the 18th century. The effect of associationism, which posited a mechanism of belief or judgment formation by which repeated jointly occurring impressions were transformed into expectations, was to support the confusion of subjective and objective probability. Associationism faded, for many reasons. The experience of the French Revolution was hard on democratic ideas of universal rationality. The Lockean idea of common in-built cognitive mechanisms was replaced by the idea of social mathematics as a technique that an elite of experts could employ as an antidote to mob politics. The implicit practical model of probability from which the classical interpretation had departed and the psychological and social ideas that had propped it up thus disappeared, piece by piece; the classical interpretation disintegrated with them.

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Lamarck in Context

The Age of Lamarck. Evolutionary Theories in France, 1790–1830. PIETRO CORSI. University of California Press, Berkeley, 1988. xiv, 360 pp. $42. Translated from the Italian edition (Bologna, 1983) by Jonathan Mandelbaum.

If there ever was an "Age of Lamarck," it was the period 1890 to 1940, when, after neo-Darwinism had "outdarwined Darwin," to use the phrase of George John Romanes, those biologists who were not convinced by mutationism looked to neo-Lamarckism as the general theory of evolution. This is not the subject of this book. The title is not a misnomer, however, for the book stresses that Lamarck's endeavors make sense only when understood as embedded in the issues of and interwoven with the science of his own time. This may seem obvious, but it has not always been so. Indeed, as Corsi underlines, Lamarck himself, and Lamarckian historiography, built the myth of a romantic genius, isolated and ignored by his contemporaries. Even recent scholars have not always been immune to this fabrication. The purpose of this book is precisely to move beyond this myth, as the title of the original Italian edition, *Oltre il mito*, makes clear.

In congruence with this goal, Corsi's analysis—though he has written the most painstaking of internal exegeses—could not rest upon the assumption that Lamarck's theoretical choices and constructions can be accounted for simply as stages in his individual development. Among the major contributions of this book is a convincing elucidation of the positioning and the originality of Lamarck's approach in the midst of contending attempts to impose a working conception of what natural history is, the Buffonian tradition (kept alive up to 1815) and the variety of rival classificatory programs. Corsi also shows that Lamarck repeatedly encountered transformist hypotheses in the works of others, even before his first commitment to transformism in 1800. For his analysis of Lamarck's reactions to these innovations and their role in the transformation of his own views. Corsi seems to have virtually read all of French natural history books and papers published during the formative years of Lamarck's theorizing. In his reconstruction of the debates that followed Buffon's death, even specialists of the period are likely to come across names and works they have overlooked—not only J.-J. Virey, Bory de Saint-Vincent, J.-C. Delamétherie, and C. Prévost but also Sonnini de Manoncourt, P. Bertrand, F. Chaussier, Coquebert de Montbret, L. Cotte, F.-M. Daudin, C.-L. Dumas, F. Levaillant, D. Plan, J.-J. Sue, and many others.

This superb command of the literature does not lead Corsi to gratuitous erudition. It permits him to understand contextually the peculiarity and significance of Lamarck's own ambitious research program for a "terrestrial physics" encompassing the study of the atmosphere, of the changes of the surface of the earth, and of the organization of living beings. Through his broad synchronic reading of the literature and acute analysis Corsi brings an abundance of new data and interpretations bearing on all of the main historiographical issues, such as Lamarck's rejection of the occurrence of any extinction of species, his views on spontaneous generation, the relationship between his anti-Lavoisierian chemistry and his biology, or the place he occupied on the French scientific scene.

For instance, it had already been noted as a puzzling fact that, in the Inaugural lecture for the year 1800, his first presentation of a mechanism for the transformation of organized beings through the action of circumstances, Lamarck, whose own studies were focused on plants and invertebrates, used examples taken from the anatomy and behavior of birds. But it is from Corsi that for the first time we understand where these examples came from and why this is a far from trivial question: Indeed what we have here, at the birth of Lamarck's new theory, is a transformation operated upon statements that had just been made by the ornithologists François Levaillant and François-Marie Daudin. In his *Histoire naturelle des oiseaux d'Afrique*. Levaillant had stressed, against the Buffonian notion of some plasticity of species under the influence of food and climate, "that habits depend upon forms, and that nature modifies these when it wants to diversify the animal's habits"; Daudin in his *Traité élémentaire et complet d'ornithologie* had also emphasized that form controls the behavior of birds and the satisfaction of their needs. Corsi has detected that Lamarck in 1800 was making a "point-by-point reply" to such assertions. It is in this polemical mode, where he closely paraphrases these two ornithologists, that Lamarck, inversing the Levaillant sequence from forms to needs and habits, advances his own theory, according to which changes in circumstances will induce changes in habits and thence in forms. We may not yet fully understand the basis for that reverse transformation, but to have established its existence is a major breakthrough.

Other interpretations that Corsi puts forth are likely to generate some debate. A case in point is his contention that though Lamarck's *Recherches sur l'organisation des corps vivants* of 1802 seems to posit two distinct causes for the transformation of living be-

ings—namely, the tendency of life to produce more complex and higher organization and the influence of circumstances explaining the branching of the phylogenetic tree—these are only two aspects of a single cause, the mechanical or hydrodynamic action of internal fluids producing organizational diversity and complexity. Lamarck's terminological uncertainties, mirroring attempts at finding the proper expository strategy, would have misled most historians. However, Corsi admits that "the ambiguity of the expressions that the author used to summarize his own doctrine were to be accentuated" in later years. Indeed, Lamarck's *Philosophie zoologique* of 1809 and the *Histoire naturelle des animaux sans vertèbres* of 1815 do emphasize the existence of a dual mechanism: it is the inner drive of life that accounts for the traces we find of an ascending series of animals, a series that has been distorted by the branching effects of the action of circumstances. It seems difficult to maintain that we have here only a terminological artifact; one may wonder whether Corsi is not trying to introduce a consistency that Lamarck never achieved or even aimed at.

Be that as it may, in his broad and careful examination of the relevant texts of Lamarck and of his contemporaries, Corsi has set an exacting standard for Lamarckian scholarship.

This may not be the definitive book on Lamarck; but there could be no such book. Lamarck was far from being a consistently lucid writer; he will probably remain up to a point intractable, in part because of the lack of manuscript sources and in part because of the palimpsest nature of his writings. Lamarck often reused whole segments of previous works and incorporated them word for word in new contexts, not always with perfect fit; and it is likely that there are in his works many such segments whose absent former contexts we will never know anything about.

This is not to say, however, that the study of Lamarck is a futile enterprise. There is much that we ought to consider firmly established, and with *The Age of Lamarck* Corsi has contributed to that body of knowledge outstandingly. Indeed, because of its scope, its thoroughness, and the wealth of challenging new interpretations it offers, I see this book as a turning point in the interpretation of Lamarck in his historical context.

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The Sociobiology of Plants

Plant Reproductive Ecology. Patterns and Strategies. JON LOVETT DOUST and LESLEY LOVETT DOUST, Eds. Oxford University Press, New York, 1988. xiv, 344 pp., illus. $49.95.

A volume on plant reproductive ecology has a great deal of material to cover. Included are life history strategies, competition, dispersal, pollination, and herbivory, topics that are each large enough in themselves to merit substantial review volumes. Each of these topics receives some treatment in the 15 reviews that constitute *Plant Productive Ecology*, but the most distinctive feature of the volume is the amount of attention given to the nascent field of plant sociobiology.

Sociobiology has come relatively slowly to the plant kingdom. That there could even be a field of plant sociobiology may come as a surprise to the uninitiated. Sociobiology is the discipline that studies the evolution of social interactions, and we do not usually think of plants as highly social organisms. There are, however, a number of ways in which a sociobiological perspective can be helpful. If plants must divide their effort or their time between being male and being female, then we might expect to gain some insights from the game models of sexual allocation theory. If plants compete for mates, or if plants do not raise the progeny of all pollen contributors at random, then sexual selection theory would seem to be relevant. If plants must allocate limited resources among seeds, with each seed potenially exerting some influence on the allocation, then kin selection theory leads us to expect conflict between the parent and its offspring.

All of this implies that botanists have something to gain from the sociobiological perspective, and this book could be recommended for this reason alone. But the gain is not one-sided, with sociobiologists doing the teaching and botanists the learning. Indeed, the gain to sociobiologists is more than simply having a few examples from the plant world to fill out their undergraduate lectures. Plants differ in profound ways from the animals, primarily vertebrates and insects, around which sociobiological theory developed. One need only reflect on how plants get their gametes together to appreciate how different their social lives are from our own. In addition, they are autotrophic, their growth tends to be modular, with considerable vegetative reproduction, and they do not sequester germ lines early in development. These differences and others have consequences for social evolution, and as a result plants present interesting new problems for sociobiologists to consider.

For example, while we can use sexual allocation theory to predict how hermaphroditic plants should allocate resources to male and female functions, how are we to include investment in flowers, which presumably function in both male and female reproduction? With respect to sexual selection, much of what might be called mate choice in plants occurs by abortion of seeds, and choosing on the basis of embryo traits may be very different from choosing on the basis of male traits. Finally, when seeds compete for resources from the maternal plant, the process is not necessarily a simple analogue of parent-offspring contests in animals. Seeds may include not only maternal and embryonic tissue but also the haploid gametophyte and the (usually) triploid endosperm. This makes the inclusive fitness situation more confusing but also much richer. Even these differences have to do primarily with the more familiar flowering plants, and additional differences appear in algae, bryophytes, and pteridophytes, covered in the last three chapters of this book.

Among previous books, those most similar to this one in ground covered are Mary Willson's *Plant Reproductive Ecology* and (with Nancy Burley) *Mate Choice in Plants*. In comparison, the present volume has both the advantage and the disadvantage of having many authors; it gains diversity of viewpoint at the expense of singularity of purpose and tightness of organization. It also has the advantage of five extra years of coverage, and in this new and growing field five years is significant. As was not the case when Willson wrote, the authors of this volume can write for a fairly large group of colleagues familiar with both plants and sociobiology. This may make it somewhat more difficult for outsiders. Botanists with little background in sociobiology will not always find the theories explained in sufficient detail, but references to the primary literature are provided. Similarly, those coming from the other side may have to devote some effort to keeping straight the welter of botanical terms. But, despite the costs, both botanists and sociobiologists should appreciate that cross-fertilization has advantages, not only in plants but also in science.

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