it is an eloquent invitation to think about political and economic institutions as perpetually dynamic in their relations.

Though the Valley of Mexico is dealt with through a rather straightforward distillation of current data, the authors try to present an alternative to the population-pressure, ecological-adaptation model favored by survey archeologists there. It is, generally, a negative argument to the effect that population size never approached the carrying capacity of the land and hence the causes of complexity must be sought elsewhere. The authors evidently favor an explanation that will ultimately be based on the need to regulate social and economic relationships in the context of dense, but not starving, populations. More impressive is the comparison of the Valley of Mexico with the Valley of Oaxaca with respect to vertical integration and complexity: Classic Teotihuacan, regarded as primarily an economic and religious nexus, "washed out" the complexity of its hinterland by abrogating the functions of secondary centers and concentrating people and business in the capital. Monte Alban, on the other hand, actively encouraged the development of secondary centers in its hinterland. These premier examples of urbanism are viewed not only as distinctive in their origins and functions, but also as expressions of distinctive regional organizations.

If the highland valleys have strong vertical integration, the Maya lowlands are posited to be "flat" politically and economically as well as geographically. This attribution, along with a general diatribe on the inadequacies of the data in the region to address the issues of interest, will no doubt raise the hackles of professionals devoted to the Maya. In contrast to other scholars, who have regarded the Maya as less advanced than their highland neighbors, the authors here emphasize that they were different: complexity is substantial but resides in the horizontal dimension. In essence the authors envision an economic network of great intricacy, specialization, and durability underwriting a relatively ephemeral political order. The generality here is that geographically bounded systems are more likely to produce complexity in the vertical dimension than are geographically open systems such as the Maya lowlands. It is a worthwhile challenge to Mayanists to address the relations between the economic and political orders in such a comparative framework.

Granted the commitment to the region as a primary unit of analysis, it is not surprising that the authors attribute little causality to the larger, Mesoamerican network of relations. They suggest that the interaction between elites helped to widely distribute many kinds of rare and precious goods, as well as many ideas and customs. The "prestige system," however, was merely a means of reinforcing power based on other political and economic means operating at the regional level. Many of the goods traded over long distances at the time of the Spanish Conquest were used as currencies regulating local economies—a form of interdependence characteristic of economic "world systems"—and it is surprising that the authors, given their interest in such institutions as markets, fail to regard the luxury goods of Classic Mesoamerica in a similar light.

The book is, in the last analysis, an application of process archeology. Complexity, integration, and scale are the processes of change here; but, as is not the case in Kent Flannery's brilliant manifesto (*Annu. Rev. Ecol. Syst.* **3** [1972]) on this viewpoint, the "evolutionary mechanisms"—determinable, regular, perhaps predictable ways in which organizations respond to stressful "movers"—are vague and undefined. There are allusions to "diminishing returns to scale" precipitating important change in organization, such as the transition from Monte Alban I to II; the notion that government is self-perpetuating at the expense of economic development is offered. The book remains comparative social history rather than provides an explanatory framework because it never squarely faces the fundamental question of cause. If one rejects movers and measures, then mechanisms become the last resort for causality. Archeological discovery of such mechanisms remains a most promising route to explanation of past social systems.

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Island Primates

The Primates of Madagascar. IAN TATTERSALL. Columbia University Press, New York, 1982. xvi, 382 pp., illus. $40.

Madagascar, a roughly California-sized chunk of Gondwanaland, lies in the Indian Ocean 400 kilometers off the southeastern coast of Africa. The geological evidence suggests that it has been at least 65 (and possibly as many as 250) million years since a mammal could have walked from Africa to Madagascar. Yet six orders of non-flying mammals somehow reached Madagascar, where the absence of other competitors led four of them to evolve into a fascinating array of ersatz cats, anteaters, hedgehogs, rabbits, and so on. The best-studied and most spectacular of these evolutionary radiations is that of the lemurs. These primitive primates not only managed to produce reasonable imitations of various anthropoids, from gelada baboons to orangutans, but went on to evolve more outlandish forms resembling larger versions of some Australian marsupials. Ian Tattersall's excellent book, which is the first in English on this important subject, provides a literate, thoughtful, and compendious survey of what is currently known about the Malagasy primate radiation.

The scope of Tattersall's subject has not seduced him into constructing grand theoretical schemes that ignore the intricacies of the facts, or into the opposite mistake of piling up vast blank drifts of minutiae with no theoretical context. For example, in describing the varied locomotor patterns of the Malagasy lemurs, Tattersall neither classifies them into quadrupeds, hangers, vertical clingers, and suchlike "locomotor categories" (which invariably obscure important differences within each category) nor resorts to that dreary, theory-free tabulation of hopping, hanging, and trotting frequencies that so often passes as a substitute for a research problem in studies of primate locomotor behavior. Instead, he summarizes the characteristic movements, postures, and support preferences of the various living lemurs in five pages of lucid prose and then goes on to try to draw a modest number of plausible correlations between behavior and certain aspects of limb morphology. The reader emerges from this convinced that there is something here to be understood and feeling a wholesome impatience with the inadequacy of our present understanding. Tattersall's approach in the sections dealing with lemur social organization, diet, ecology, physiology, distribution, and alpha taxonomy is similarly thorough, restrained, and stimulating. The chapter describing the subfossil giant lemurs, a special interest of Tattersall's, is the best and clearest summary of the subject available.

Unfortunately, when we arrive at the chapter on phylogeny and classification, it becomes evident that Tattersall's admirable reluctance to draw facile adaptive lessons from the facts of lemur biology has an ulterior motive. He hopes to convince the reader that the diversity of the Recent lemurs was not produced by

adaptation to the environments of Madagascar but largely established before any of their ancestors arrived on the island. His reasons for thinking this stem from his commitment to the "New York cladism" school of phylogenetic reconstruction. Even nonsystematists who have sniffed the fumes of emotion rising from the term "cladism" in the pages of *Science*, or who followed last year's debate in *Nature* over whether cladism is a Marxist plot to grab control of the British Museum's dinosaur exhibit, will have surmised that systematics is currently racked by a doctrinal controversy. This controversy was originally simply over Hennig's contention that classification should be isomorphic with phylogeny. However, the more refined cladists of today have converted Hennig's scheme into a system of principled refusals to look at certain kinds of evidence—geography, stratigraphy, immunology, parallel evolution—in deciphering evolutionary relationships. Adopting these principles, Tattersall concludes from various dental characteristics that the living sportive lemur (*Lepilemur*) of Madagascar is the phylogenetic sister of *Notharctus*, a North American Eocene fossil. No matter that Tattersall's phylogeny implies six or more different waves of lemur immigration into Madagascar, or that his scheme pushes the divergence of the living lemurs back to a time at least 55 million years ago, before the appearance of the earliest known uncontested primates: these problems are not taken very seriously because, in Tattersall's words, "Neither time nor geography has any *necessary* connection with evolutionary relationship." True; but neither do premolar molarization, size of the metastylid, or the other minor (and probably convergent) dental features Tattersall points to in justifying the idiosyncracies of his phylogeny.

Tattersall's phylogenetic machinations, and some related dismissals and omissions of contrary evidence, constitute the only serious flaws in an otherwise authoritative book. But he is so undogmatic and conciliatory about his evolutionary diagrams, and so willing to admit the justice of the opposition's case, that knowledgeable readers will be less outraged than noncladists usually get when they read current cladistic systematics. Traditional systematists will also be gratified to find that Tattersall has returned to the fold on the classificatory issues that spawned cladistic systematics in the first place. "The fatal practical problem with phylogenetic classifications," he writes, "is that they require a potential reordering whenever a new taxon (these days, mostly fossil) is included in the group . . . and a classification changing with every twist in phylogenetic thought, superior though it may be intrinsically, is unfortunately impractical. In any event, there exist far better and simpler ways of expressing phylogeny than through classification." Amen, brother.

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A Botanical Classification

The Monocotyledons. A Comparative Study. ROLF M. T. DAHLGREN and H. TREVOR CLIFFORD. Academic Press, New York, 1982. xiv, 378 pp., illus. $98.50. Botanical Systematics, vol. 2.

Rolf Dahlgren of Copenhagen published a classification of the angiosperms in 1975 and has since developed a distinctive approach to higher-level taxonomy, focusing directly on the distribution of character states. Dahlgren has been working for several years with the Australian botanist Trevor Clifford, a numerical pheneticist and student of the monocotyledons. The book that has resulted from their collaboration is a remarkable compilation of information about the characters of the monocots and a revised classification of the group. It is a reference work that will be of great value to monocot systematists and to angiosperm phylogenists generally. However, in my opinion, there are several fundamental problems with the treatment that render it less useful than it might have been—problems that, unfortunately, characterize most recent efforts to assess relationships among angiosperm families and orders.

Dahlgren and Clifford set out "to investigate the monocotyledons with respect to a wide range of characters and to determine the distribution of these over the whole group" (p. 1). Indeed, 240 pages of the text are devoted to a survey of about 100 characters, including some that are seldom considered, such as root hair development, the host specificity of fungi and insects, and a wide variety of chemical features. Most of the data were assembled from previous literature, but some new information is presented and several sections were contributed by specialists. For each character the authors briefly describe the variation among monocots and often among several groups of presumably related dicotyledons. Character states are generally illustrated with line drawings compiled from a variety of sources. The character discussions also include speculations about function and adaptive significance.

My main criticism of the character treatments is that often the authors have not been sufficiently concerned with homology, a word they seldom use and never define. Clearly homology is difficult to assess and even very similar structures may turn out not to be homologous. However, treating obviously dissimilar conditions as single character states (considering bamboos, palms, and century plants to have the "tree and shrub habit") is apt to lead to confusion in phylogenetic analysis.

The taxonomic distribution of each character state is plotted on a diagram in which orders are depicted as bubbles that are supposed to represent transections through the branches of an imaginary phylogenetic tree. In fact, the bubbles are arrayed so as to indicate overall similarity rather than to specify cladistic relationships. Although it seems useful to superimpose character states on the Dahlgren classification, this unfortunately allows preconceptions of relationship to color the interpretation of the taxonomic significance of the characters. "Good characters," indicators of true relationship, are the ones whose state distributions correspond to the preconceptions of relatedness embodied in the diagram. Conversely, "bad characters" are those that do not conform. In this way the system is continually reinforced by the data rather than tested by them. Thus, it is hardly surprising when the authors conclude that "the supposition on the outset of this study that the Ariflorae are closely connected with the Alismatiflorae has been supported and strengthened in the course of the study" (p. 324). Characters with state distributions that support this preconception are positively weighted even when a state is not unique to the two groups (as in the case of basifixed anthers), and even when only a few members of one or both groups have the state (as in the case of intravaginal squamules). Similar state distributions involving orders or superorders that the authors think are not closely related are usually considered of little taxonomic importance (for example, poricidal anthers).

Following the character survey, the authors relate the character information to the classification used throughout the survey, and this results in a somewhat modified classification. At the outset of the evaluation section (p. 286) the authors explain that they "estimate the