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Time to Revive Systematics

Systematics, the study of biological diversity, is sometimes portrayed as the mere classification of organisms, but in fact its range and challenge are among the greatest in biology. At the present time we do not even know, to the nearest order of magnitude, how many species there are in the world. Approximately 1.7 million have been described since Linnaeus, including about 250,000 flowering plants, 47,000 vertebrates, and according to one meticulous estimate published earlier this year, 751,012 insects. But these numbers are far below the actual diversity. Recent studies in rain forests and other major habitats indicate the presence of as many as 30 million kinds of insects alone.

The magnitude of biological diversity has many ramifications of general interest. For example, if there are really 30 or 40 million animal species, why didn't just a thousand evolve—or a billion? It is not known to what extent diversity is controlled by physical properties of the planet as opposed to the mechanics of evolution itself. Nor do we know to what degree species numbers can be raised or lowered artificially without destabilizing local ecosystems. In another dimension, biologists have only begun to assess the complexity and potential of each species individually. Every species is the terminus of an ancient lineage that has been hammered and shaped into its present form by a complex interplay of genetic recombination and natural selection. In a purely technical sense the resulting genome is richer in content than a Caravaggio painting, a Bach fugue, or any other great work of art. The billion bits of genetic information in the house mouse, for example, if transformed into an equivalence of printed English text, would just about fill all editions of the *Encyclopaedia Britannica* published since 1768.

Because of the largely unknown nature of diversity, systematics remains a fountainhead of discoveries and new ideas in biology. If a biologist is well trained in the classification of the organisms encountered, the known facts of natural history are an open book, and new phenomena come more quickly into focus. The irony of the situation is that successful research then gets labeled as ecology, physiology, or almost anything else but its true source, the study of diversity.

Much of the research also has economic and medical importance. The discovery of new sources of biomass energy, lumber, pharmaceuticals, and pollination complexes depend ultimately on taxonomic exploration. Also, the design of natural reserves, critical to the preservation of diversity in tropical countries, cannot be performed reliably without a thorough knowledge of local faunas and floras. The problem is intensified by the accelerating destruction of natural habitats and extinction of species.

At present the community of systematists is sadly inadequate to the immense task before it. In North America about 4000 specialists, most part-time, work on 3900 collections. Probably no more than 1500 trained professional systematists in the world are competent to deal with tropical organisms. To cite one striking example, there are exactly two such persons qualified to deal with termites, which are among the principal insect pests and soil movers of the world. In fiscal 1985, the National Museum of Natural History, our largest institution of basic research, spent $12.8 million to support the activities of 85 scientists engaged partly or wholly in systematics. The Program in Systematic Biology of the National Science Foundation, the principal funder of independent projects, granted $12 million. Other programs in the NSF and Department of Interior provided $13.8 million for support of museum services and other activities related to systematics. At this level, which reflects a low priority worldwide, less than 1 percent of the species of organisms are under active investigation.

Systematics deserves more cultivation and the attention of our brightest minds. It is in a position to yield increasing returns to scale, with a variety of benefits for both science and society.—EDWARD O. WILSON, *Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138*