Hands-on taxonomy

Describing Species: Practical Taxonomic Procedure for Biologists
by Judith E. Winston
Columbia University Press: 2000. 518 pp. £11, $35 (pbk)

Henry Disney

The discipline of taxonomy traditionally covers three areas: alpha, beta and gamma taxonomy. These areas respectively cover the recognition and description of species; the arrangement of species in classifications, which today aim to reflect phylogenetic affinity; and infraspecific categories such as subspecies, ecotypes and polymorphisms. There is currently considerable interest in beta taxonomy, particularly in using novel molecular data, and molecular techniques have also revived interest in problems concerned with gamma taxonomy. The bedrock discipline of alpha taxonomy, however, continues its relentless decline. Today, most specialists are retired professionals or amateurs, with the result that other biologists, such as ecologists, must frequently describe the novel species they encounter themselves.

With current estimates suggesting that around 90 per cent of the world's species remain undescribed, this situation will not soon change. Indeed, it reflects my own experience. Although primarily an ecologist/naturalist, even when working on well-studied insect groups as a medical entomologist, I was forced into describing new species. Now alpha taxonomy is my principal tool for investigating the natural histories of scuttle flies (Phoridae). Only about 25 per cent of my publications are straight ecology, whereas 19 per cent are ecology plus alpha taxonomy and 45 per cent are alpha taxonomy alone. Thus, my largest contribution has been in alpha taxonomy, even though I have not been trained in this discipline and consider it only a means to an end.

A bug's world: Cornelia Hesse-Honegger's painting *Leaf Bug (Miridae, Cremnocephalus).*

A welcome arrival on this scene, Judith Winston's book is primarily concerned with alpha taxonomy. It is arranged in three parts — how to recognize that a specimen belongs to an undescribed species; how to prepare a description of the new species (including the choice of a name that conforms with the provisions of the relevant code of nomenclature); and how to deal with other problems, such as beta and gamma taxonomy, key construction and missing types.

The book is probably the most exhaustive treatment available of the practical aspects of describing new species or higher taxa. It enables the novice, such as an ecologist who finds that a species of interest is new to science, to prepare for publication an acceptable description of a hitherto undescribed taxon. If I had had Judith Winston's book at the beginning of my career, I would not have fallen into so many of those holes — be they nomenclatural or scientific — that seem to litter the path of the would-be alpha taxonomist. ■

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The Wonderland of primordial life

Life Without Genes
by Adrian Woolfson
HarperCollins: 2000. 409 pp. £17.99

John Godfrey

Complex features of organisms have, since Darwin, challenged anyone thinking deeply about evolutionary explanation. The vertebrate eye, or the interaction between the physiology and behaviour of a female mammal and her offspring during lactation, have obvious adaptive value when, but only when, fully developed. J. B. S. Haldane and others have argued that each stage of the origin of such features must have conferred selective advantage, with the finesse that the primordial stages may often have served a different function from the present one. These explanations are essentially darwinian, relying, as they do, on variation and natural selection. They apparently fail to account for the origin of the thing that varies: the integrated system of proteins, DNA, transcription and repair that characterize living cells.

Adrian Woolfson argues that earliest life forms had limited inheritance and that this was analogue in nature, rather than the precise digital kind that DNA now provides. This liquid life without clear boundaries and lacking genes would have been unstable and evanescent. He sets himself the task of showing that there are many possible paths from there to here, and also that the future, too, has many options. He makes a good case that these geneless entities may have been parasitized by digital proto-genes that took over their metabolism. The parasites were presumably polymers that encoded information in their combinatorial sequences. Ribosomes, too, may originally have been independent bacterial entities, now retaining their own common characteristics, including a few genes, even in current organisms of the most diverse kinds. Being shared by all, they must have been conservative for 3,000 million years or so, more, if cosmic dust imported life from space. Elsewhere, Woolfson discusses the genetic 'wild-type', but without mentioning that heterozygosity is the norm. The latter probably arose as a means of defence against parasitism and disease, as sex itself is likely to have done.

New in paperback

Mammals of the Neotropics, Volume 3: The Central Neotropics: Ecuador, Peru, Bolivia, Brazil
by John F. Eisenberg & Kent H. Redford
University of Chicago Press, $28, £40

From White Dwarfs to Black Holes: The Legacy of S. Chandrasekhar
edited by G. Srinivasan
University of Chicago Press, $18, £13

Wildlife of the Tibetan Steppe
by George B. Schaller
University of Chicago Press, $20, £14

"*Wildlife of the Tibetan Steppe* will long remain a unique, important source of biological, but also sociologist, insights and challenges." Valerius Geist, *Nature* **395,** 236 (1998)

Animal Revolution: Changing Attitudes Towards Speciesism
by Richard D. Ryder
Berg, £14.99, $19.50

Ecology and Evolution of Darwin's Finches
by Peter R. Grant
Princeton University Press, £14.50, $22.95

In a characteristically revealing episode, Woolfson outlines how molecules such as haemoglobin change their form reversibly to good adaptive effect in the lives of, for instance, penguins and crocodiles. The folding of haemoglobin makes its affinity for oxygen suit the changing physiological demands during diving. Elsewhere, he mentions that fungi and yeasts use a protein-based system of inheritance to a small extent. Perhaps this is a relict of a previously more important mode, ousted as determination of protein sequences by genes became the norm. If the protein-only theory of prion disease is indeed correct, then the strain variation in scrapie, for instance, must be based on fine changes of conformation that can pass from generation to generation of the host. This could be of great importance for the prospects of dealing with vCJD.

Woolfson has written a remarkable book, in a new literary form, to elucidate these problems, both for biologists and for a much wider audience. He carefully avoids obvious jargon. At the same time he coins a lot of his own terms as he leads readers towards fresh ways to comprehend the actual biological world by introducing them to possible alternative worlds. He does this by interspersing throughout the book episodes of science fiction, leading us like a modern Alice through dreamy wonderlands of potentiality. These imaginative excursions serve to depict many levels of complexity. We tour landscapes of whole animals, of RNA, DNA, information and more — though he does not include an epigenetic landscape, such as C. H. Waddington used as a metaphor for the action of genes during development. Each provides vast choice and illustrates how what we have had in evolution is but a tiny sample of what might have been. Few readers will fail to be helped out of the mental rut that tends to limit the imagination of most of us.

Suggesting experiments is far more difficult, and the author is less successful in this. Indeed, at one point he says: "We are obliged to sit back and wait for the appropriate experiments to be conducted". The book is, however, laced with unexpected curiosities. Explaining analogue memory, he tells how Puccini, auditioning singers for the part of Rodolfo in *La Bohème* and hearing Caruso for the first time, exclaimed, "Who sent you to me? God?".

Life Without Genes is excellent for certain readers, but for whom is not so clear. Some people may be annoyed by its stylistic idiosyncrasy. Others may think it would have been better if shorter; but many will be charmed by it and be grateful for the mental jerks it encourages us to take. Most will learn a lot, but may be irritated by the lack of an index, or even reference from the text to the extensive bibliography. HarperCollins, please note. ■

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Science in culture

A celebration of civilization

Seven Hills: Images and Signs of the 21st Century, an exhibition at the Martin-Gropius-Bau museum in Berlin, running until 29 October.

Alison Abbott

This is not the usual apocalyptic vision of science, nor is it the didactic, self-consciously 'entertaining' public-understanding-of-science display to which the German public is usually subject. This grandiose exhibition in Berlin places science and technology alongside the other aspects of culture that define our civilization, in a distinctly intellectual and sophisticated juxtaposition.

The 'Seven Hills' of the exhibition, Berlin's millennium project, are thematic installations created by the authors of our civilization — artists and architects, as well as scientists — and displayed in a nineteenth-century building in east Berlin.

The themes are big and somewhat abstract: nucleus, jungle, cosmos, civilization, knowledge, faith, dream. The overall aim is also big and somewhat abstract, portraying the essence of our social evolution. Each installation is designed by a different architect and different teams of scientists. Ken Adam, the Berlin-born film architect best known for creating the style of James Bond films and *Dr Strangelove*, has made in the building's central atrium a cathedral whose windows are represented by a five-metre-diameter particle detector suspended below the atrium's glass dome and above a pyramid of displayed objects, many shown from their inside view. The main focus is a globe whose burning interior erupts through magma canals to the surface. Below the globe, robot dogs and the Japanese P3 humanoid — the world's most advanced robot — stalk the busy floor, around DNA sequencers and other high-tech hardware. Other displayed artefacts, for example the skull of philosopher René Descartes and the brain of the nineteenth-century biologist Ernst Haeckel, serve as reminders that these technical advances are but the products of the human mind, individually ephemeral but feeding the collective memory that is our civilization.

The message conveyed by the Jungle installation is that nature is no longer natural, but bends to the will of our culture, even in matters of conservation. The immense statue of Athena, on loan from the neighbouring Pergamon museum, stonily monitors visitors to the Knowledge installation, with its displays of the artefacts that have been used to record knowledge, from parchments to computers, and those representing the political and religious institutions that control knowledge and its acquisition.

The architectural design of the Faith installation is a huge sphere splintered into ever-smaller fragments symbolizing the fragmentation of religions during the history of civilization. The Dream installation, which deals with subjectivity,

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The glowing globe, part of the exhibition's 'Nucleus' installation.

the preserve of both artists and neuroscientists, is housed in a theatrical set of rooms created by Japanese stage designer Kazuko Watanabe.

The work of artists from every century cuts through each installation. A huge seventeenth-century painting by Johann Melchior Roos, *The Menagerie of Landgrave Carl von Hessen-Kassel*, newly restored for the exhibition, opens the Jungle installation, which also displays sixteenth-century watercolours by naturalist Giorgio Liberale, and the shocking works of the contemporary artists Jan Fabre, who makes sculptures from beetles, and Cornelia Hesse-Honegger, whose drawings record the anatomical deformations of bugs collected from around nuclear power plants.

Most of the installations feature hands-on tricks. In Jungle, one can interact with a sculpture of the Indian goddess Kali, viewing fantastic worlds literally through her eyes; in Space one can walk through a revolving tunnel that conveys a feeling of weightlessness.

But the exhibition is not play. Nor does it attempt to aestheticize science. Rather it integrates science into a complete aesthetic representation of civilization. The whole is also an optimistic statement about Berlin, which seeks to integrate its torn twentieth-century history into world civilization, the metaphoric Seven Hills, and into a positive future. This optimism is also represented by the participation of Ken Adam, a Jew forced out of Berlin during the rise of Nazism in the 1930s. Those Berliners rooted more prosaically in the present see not the optimism, but the DM28 million price tag presented to the reunified, but bankrupt, city. ■

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