different perspectives from the author. Sometimes I wanted to plead with him that it is not only the guy frenetically running around organizing, planning and talking about vaccine programmes, but also the bench scientist working to solve some crucial problem, who is making big contributions. I was irritated at times by his tendency, Hollywood-style, to embrace mavericks, some of whose work has not stood the test of time. I was also puzzled by the omission of any reference to the solution of the structure of the virus surface protein gp120, which I believe will eventually be seen as a major milestone on the route to an HIV vaccine. But, reservations aside, my emphatic overall conclusion is that this is an excellent book which demands to be read. ■

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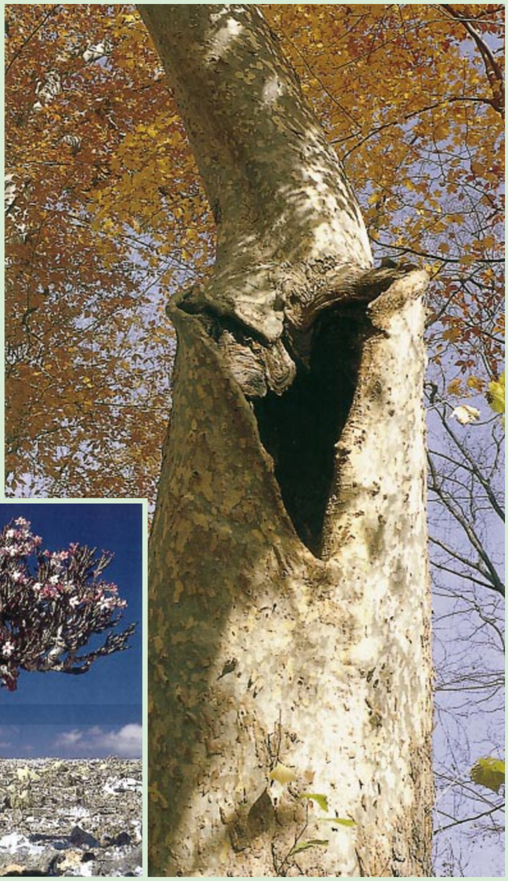
The injured and the ingenious

A case of brittleheart has decimated the sycamore tree (*Platanus occidentalis*) shown on the right. Its trunk has been hollowed out by the action of fungi, putting it at risk of collapsing with the next bout of windy weather. The strange-looking tree shown below is the aptly named sack-of-potatoes or Socotran desert rose tree (*Adenium obesum sokotranum*), which is found on the Indian Ocean island of Socotra. Its swollen trunk stores essential water. *Trees* by Roland Ennos (Natural History Museum, London, £9.95, $14.95) explores the world of this most familiar group of living organisms.



Fungal fables

Slayers, Saviors, Servants, and Sex: An Exposé of Kingdom Fungi
by David Moore
Springer: 2001. 175 pp. $29.95, £20

Nicholas J. Talbot

Collecting wild mushrooms is not generally viewed as a pastime for the truly adventurous. But there is a group of thrill-seeking mushroom collectors who attempt to distinguish between two almost identical species: one, *Amanita caesarea*, is perfectly edible, whereas the other, the death cap mushroom *Amanita phalloides*, will invariably kill you. Indeed, eating just one cubic centimetre of the death cap is thought sufficient to kill the average person. This story of the lunatic fringe of mycologists (presumably a rapidly dwindling group) is one of the anecdotes recounted in David Moore's new celebration of the fungi. The author is a big fan of moulds in all their various forms, and conveys his enthusiasm consistently throughout this quirky but entertaining book.

Fungi are important. This is the central message of Moore's book and one that he illustrates with numerous examples. Fungal diseases kill humans, kill crops and rot harvested foods. In describing the spectacular epidemics and diseases caused by fungi the book is compelling. The symptoms of St Anthony's fire, for example, are given in grisly detail: burning fevers, hallucinations, swollen limbs, severe inflammation followed by numbing of the extremities and complete loss of fingers, toes, arms and legs. All are caused by the ergot fungus *Claviceps purpurea*, consumed in contaminated rye bread. One outbreak of the disease reputedly killed 40,000 people in France in AD 944, and ergotism has even been suggested to have been the cause of symptoms that took hold of eight young girls in Salem and led to the witch trials of 1692. This story, and the production of potent toxins such as α-amanitin and aflatoxin, are used to demonstrate that fungi demand our respect.

The beneficial applications of fungi, from gastronomy to bioremediation, are given equal coverage. Fungi are, of course, well known as producers of antibiotics, and the story of the discovery of penicillin has been told many times. But our modern dependence on antibiotics is poignantly illustrated here by the story of Albert Alexander, a British policeman who died in 1941 after being scratched by a rose thorn. Initial treatment with the newly available penicillin made him well enough to sit up in bed, but he quickly succumbed to his infected wound once supplies of the drug ran out. The discovery and application of the immunosuppressant cyclosporin, and the best-selling cholesterol-lowering agents, the statins — both natural fungal products — are similarly well described.

Although relatively light-hearted and anecdotal in style, there is a serious underlying theme throughout the book, because David Moore is clearly not a happy man. He is unhappy that fungi are viewed only as curiosities and consequently occupy, in his view, the peripheries of mainstream science. Ignored by biology departments pensioning off mycologists, by funding agencies, simplistic politicians and international development bodies, fungi offer tremendous untapped potential but are constantly overlooked. Having devoted a career to their study, Moore wants us to know he is annoyed. He also describes the history of mycology as littered with the 'nearly' men of science: the Reverend Miles J. Berkeley, who studied the origin of the potato-blight epidemic and anticipated the germ theory of Louis Pasteur by almost 25 years, but did not prove his case; and Agostino Bassi who, similarly, recognized fungi as agents of disease at an even earlier date.

It is here that I take issue with Moore's thesis. As this year's Nobel prize for medicine aptly demonstrated, fungi are at the centre of scientific endeavour. From the one-gene–one-enzyme theory to the control of cell division, we have learned a huge amount of fundamental biology from fungi. Indeed, this is the most striking omission in the book, because if there is one thing about fungi of which the public are really uninformed, it is their use in biomedical research. Fungi, both yeasts and filamentous species, are superlative experimental organisms, and their widespread use in biological research means there are more mycologists working today than ever before.

I would recommend this book particularly to those who know, or currently care, little about fungi. They will learn a lot in this easy read, and they can even try the anagrams at the back of the book. Here I learned that 'fantastic ugly mess' is an anagram of 'fungal systematics', which should upset the taxonomists. ■

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Elements of galactic evolution

The Chemical Evolution of the Galaxy
by Francesca Matteucci
Kluwer: 2001. 308 pp. £72, $106

Stuart Ross Taylor

Walter Baade, at Palomar during the Second World War, observed that the halo of the great spiral Andromeda galaxy was dominated by red, metal-depleted stars, whereas its disk contained mainly blue, metal-enriched stars. (Astronomers, to the exasperation of chemists, persist in using 'metals' to describe all the elements heavier than helium. But the term, along with 'metallicity', is too thoroughly entrenched to be replaced). Baade's observations enabled Olin Eggen, Donald Lynden-Bell and Allan Sandage to erect their classical model of galactic evolution, in which a spherical halo collapses to a disk. But it was Beatrice Tinsley who, in the course of her brief life, focused attention on the chemical evolution of galaxies, and stimulated the explosive growth in this field.

All of this was possible because of the elegant explanation of how chemical elements are synthesized — surely one of science's greater achievements — by Margaret and Geoffrey Burbidge, William Fowler, Fred Hoyle and Alastair Cameron. This, in turn, was based on an understanding of the relative abundances of the chemical elements, first established by Victor Goldschmidt from meteorite data.

Now the topic of galactic chemical evolution has become a major field of research. Francesca Matteucci's book is the second to address the subject, following on from the definitive 1997 text by Bernard Pagel, *Nucleosynthesis and Chemical Evolution of Galaxies* (Cambridge University Press). David Arnett's monumental work, *Supernovae and Nucleosynthesis* (Princeton University Press, 1996), is weighted more towards nucleosynthesis — the cosmic formation of atoms through nuclear reactions in the cores of stars and through supernova explosions. However, it deals specifically with the chemical evolution of galaxies in a final chapter.

Matteucci's book usefully complements these two, more advanced texts, concentrating on the Milky Way. She begins with an assessment of the observational evidence for chemical evolution, now so greatly enhanced by the development of high-resolution spectroscopy, and continues with a major section on stellar evolution and nucleosynthesis. As a planetary geochemist, I found her clear and precise treatment very useful. Matteucci concludes with a major discussion of the formation and evolution of the Milky Way, finishing with a brief assessment of the age of the Galaxy and some comparisons with other spiral galaxies.

As is typical in the astronomical literature, the text is replete with acronyms. Readers unfamiliar with the subject will be relieved to discover that, in the relatively peaceful field of astrophysics, IRA refers to 'instantaneous recycling approximation' and ICM to 'intracluster medium', not to their deadly alternatives. And they will discover that IMF, the 'initial mass function', has nothing to do with finance. These caveats aside, the book is an example of straightforward writing that might well be emulated by native writers in English. There is no index, but this surprising omission is mostly covered by a very detailed table of contents, so that it is easy to find one's way around.

The development of the field in the past two decades is impressive, Matteucci herself having made significant contributions. The earlier concepts have been replaced by a model of the Milky Way in which the Galaxy is divided into four distinct stellar populations, respectively the halo, bulge, thick disk and thin disk, which do not have simple relationships with one another. Thus we learn that the "evolution of the thin disk is completely disentangled from the evolution of the inner halo".

So galaxies have a much more complex history than previously imagined. Like terrestrial continents, they have undergone collisions and have grown by accretion of disparate material. Our Milky Way Galaxy appears to have evolved along at least two independent paths. One was the classical collapse from a spherical halo to a disk. And superimposed on this was accretion of gas and other galaxies, so that the present Galaxy contains components that formed in several distinct environments. As the accreting gas may be deficient in heavy elements, younger stars forming from this late-arriving material will not necessarily show the expected enrichment in metals that would be predicted to occur had the Galaxy evolved in isolation.

In an interesting assessment of the age of the Galaxy, Matteucci concludes that 13–15 billion years seems probable, with the age of the disk being in the range of 8–10 billion years. There is a useful discussion of nucleochronology — a technique for dating stages in stellar nucleosynthesis by examining the relative abundances of radioactive isotopes. Also discussed is the promise shown by measurements of thorium/europium ratios. It seems likely that these will yield ages for stars which are based on the radioactive decay of thorium-232, and will be totally independent of ages based on the Hubble expansion rate of the Universe — that is, once the formidable technical problems have been overcome and we have a "specific and correct model for the growth and chemical evolution of the solar neighbourhood".

Although Matteucci notes the interesting fact that the Sun is more metal rich than most similar stars in the solar neighbourhood, she does not comment on the observation of Guillermo Gonzalez that the planets so far discovered beyond the Solar System have formed around the more metal-rich stars. This also raises other interesting questions. As the metallicity of stars varies with location in the Galaxy, so the regions in which habitable planets may form may likewise be limited. The most favourable location (in which we find ourselves) is apparently the thin galactic disk, as discussed by Peter Ward and Don Brownlee in *Rare Earth* (Copernicus, 2000). ■

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