that, if empire time is by its nature different from newtonian time, then one might expect someone heavily committed to the establishment of empire time to differ from those habituated to newtonian time. Poincaré should differ from Lorentz, at least, and be closer to Einstein. If empire time was simply understood as being newtonian time put into practice, then Poincaré would resemble Lorentz and differ from Einstein, who believed that time had to be defined by means of clocks (and not merely captured).

Perhaps Poincaré's deep intellectual and political immersion in the creation of empire time with its global sense of simultaneity worked against him when he had the chance to reformulate time as Einstein did, and even to accept it afterwards as, steadily, his contemporaries did. But there are other possible explanations and such inferences are risky. Ultimately, the methodological sophistication in this book may not deliver what its author hopes, but the wealth of information it contains is surely stimulating. ■

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M. PROBST/AP

Making a splash: immortalists make dramatic claims that there really is a fountain of youth.

Fountain of hype

Merchants of Immortality: Chasing the Dream of Human Life Extension
by Stephen Hall
Houghton Mifflin: 2003. 440 pp. $25

S. Jay Olshansky

One can imagine an alchemist some 2,000 years ago weaving a tale for the investors and politicians of his day. They cling to every word as he tells them how the properties of immortality thought to exist for gold could be transferred to humans by ingesting minute quantities of the rare metal. According to the alchemist, 'science' is only 10–20 years away from a breakthrough that would give rise to immortality for those willing to invest. All that is needed is money and time to figure out the recipe.

Such merchants of immortality have been spinning their tale since time immemorial. So it is not surprising that in today's rapidly ageing society, where medical technology can manufacture survival time, there is an abundance of scientists and longevity salesmen (on occasion they are one and the same) who seek lucre from the promise of a longer and healthier life. Are the modern immortality salesmen on the trail of the genuine fountain of youth, or are contemporary investors and consumers of the anti-ageing industry being duped, like countless before them? In *Merchants of Immortality*, Stephen Hall provides the answer.

Hall begins with an account of Leonard Hayflick's discovery that some cells have a limited capacity to replicate. The irony is that Hayflick, who is the father of biogerontology, is also the most ardent voice of authority against the immortalists, yet his view on the topic is barely mentioned. Instead Hall goes into detail about Hayflick's battle with the government over a human cell line he developed that was later used to produce life-saving vaccines.

The one scientist who appears repeatedly throughout the book as the most ardent merchant of immortality is Michael West, the budding priest turned scientist and entrepreneur who wrote about the longevity-enhancing effects of telomerase, cloning and embryonic stem cells. Hall takes issue with West's recipe for immortality, which has lured in a bevy of investors who were all too willing to have a financial stake in the fountain of youth.

Several chapters are devoted to similar tales of scientists-turned-entrepreneurs. They are mainly fascinating but sad stories of how money both corrupts and enhances modern science. But it is exactly this kind of entrepreneurship that, despite its potential to corrupt and the numerous roadblocks placed before science by politics and ignorance, has the potential to create a new field of regenerative medicine from recent developments regarding embryonic and adult stem cells.

It is often difficult for scientists to see the importance of their work and its relevance in a world where social norms and ethics can mesh and clash at the same time. There is no area of research where this dichotomy is more evident than studies of ageing. Hall pays what seems at first to be an inordinate amount of attention to the politics behind cloning and the use of embryonic and adult stem cells, but it soon becomes evident how debates about abortion and right-to-life issues have a direct influence on funding for research. He stresses that the politics of science in this case is not about the quest for immortality or the battle against ageing itself, but about efforts to combat disease.

Hall makes the case that the modern search for the fountain of youth, through the study of telomeres and embryonic and adult stem cells, is built on a house of cards. It is a mirage, he says, offering everlasting (or at least much longer) life, and has been placed on the horizon by a handful of scientists who seek wealth by making some exaggerated claims. What may realistically be on offer is not an extended lifespan but rather a healthier old age. Hall mentions scientists (including Hayflick) who have challenged the remarkable claims of the immortalists. But given the tales being spun and the pot of money awaiting a victor in the quest for a fountain of youth, it is no surprise that he has chosen to focus on the immortalists.

The field of ageing research should be grateful to Hall for applying his journalistic wizardry to the story of the modern quest for immortality. In this book he captures the drama, excitement, competition and

rewards, both personal and professional, of scientific research. He treats the reader to a behind-the-scenes look at the jealousy, backstabbing, ambition and embellishment that comes with the territory of the modern scientific quest to halt or turn back the hands of time. In the end, Hall makes it clear that although today's immortalists may be whispering optimistically about their own immortality as they take their own last breath, there is a glimmer of hope that the true fountain of youth could be just over the horizon.

Merchants of Immortality is a remarkable book that is a must-read in the world of science and medicine. And lay readers will be interested in this revealing story about the odd mixture of science, politics and ethics, and how they all come together in the modern quest for immortality. ■

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Ecology you can count on

Population Ecology: First Principles
by John H. Vandermeer & Deborah E. Goldberg
Princeton University Press: 2003. 296 pp. $75, £52 (hbk); $35, £24.95 (pbk)

Alan Hastings

A mathematical and conceptual approach to population ecology — the study of the dynamics of animals and plants in nature — can be traced back to work early in the twentieth century. The fundamentals were developed by a number of scientists: Alfred J. Lotka, Vito Volterra and G. F. Gause worked on the dynamics of single and interacting populations; A. J. Nicholson and V. A. Bailey studied host–parasitoid dynamics; Lotka and P. H. Leslie did the early work on age-structured populations; J. G. Skellam did the same for spatial dynamics; and W. O. Kermack and A. G. McKendrick, and then Norman T. J. Bailey and others, worked on the dynamics of diseases and epidemics.

These innovators set the stage for recent advances in the understanding of the dynamics of ecological populations, and in applied areas such as the management of renewable resources, conservation biology and understanding the population dynamics of diseases. Progress in all these areas has come from a tight coupling of mathematical theory with biology, and students and ecologists need a good grounding in these areas. How well does the book *Population Ecology* succeed in developing the field from a set of first principles, and who is most likely to profit from reading it?

Research based on first principles in population ecology depends, at the very least, on a thorough understanding of basic calculus and linear algebra, and arguably needs more advanced techniques as well, such as stochastic processes and partial differential equations. So it is important how the book treats these areas, and what knowledge it assumes on the part of the reader. The stated assumption is that readers are familiar with calculus but may not have seen the required results in linear algebra — there is a brief appendix summarizing the major results for linear algebra, but not for calculus. I think that to follow the mathematical development, readers will need a good to outstanding working knowledge of calculus and be comfortable with mathematical manipulations.

In some respects, the chapter on dynamics emerges as one of the strongest parts of the book; in others, it is the weakest. It is a truly beautiful exposition of nonlinear dynamics at a relatively elementary level, but unfortunately it is almost devoid of biology. And in population ecology, where mathematics and biology are intimately connected, it is important that these disciplines are well integrated. The rest of the book does this much better, helping readers to understand how both need to be used to get at the heart of population ecology. The chapter on space and metapopulations goes further, by explaining the importance of a statistical approach to understanding spatial pattern, and in so doing it emphasizes the role of model formulation.

As is typical in ecology, many mathematical arguments are presented graphically. Some of these are well done, for example in the chapter on competition models, but some are confusing, such as those illustrating the components of predator–prey interactions. In a few places, such as the chapter on life histories, a more graphical development would have been welcomed.

Overall, the book provides a solid foundation for further study in population ecology, and provides good coverage of all the fundamental areas of population ecology outlined above. But as a textbook, or for individual study, there is room for improvement. The lack of problems to solve is a big shortcoming, as mathematical developments are best understood by doing, rather than by merely reading. And readers who are not advanced mathematically might find several places where the mathematical development is too terse, for example in the chapter on projection matrices. Also, the book doesn't use many different biological examples to bolster an argument, just a few choice studies (very few in the chapter on competition). Yet the overall concept of emphasizing first principles in population ecology is very appealing, and readers who understand the material presented will be able to cope with most current research in population ecology. ■

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Petal power

Illustrations of orchids, such as those of *Eriochilus cucullatus* shown here, are normally found in historic texts predating modern photography. But Princeton University Press has just published the first in a series of books on the *Orchids of Australia*, each containing new illustrations of some 150 species by artist John J. Riley. Accompanied by descriptive text by Riley and David P. Banks, these books are intended to provide a visual diagnostic reference for orchid enthusiasts, as well as a feast for admirers of botanical illustration as art.