

those aspects. This book serves a major role by merging the two aspects and introduces a coherent picture to those interested in studying or working in this multidisciplinary area.

There are eight chapters in this book, of which two are exclusively devoted to theoretical analysis. Since the book deals with single species only, one of these chapters gives an overview and essential details of the difference and differential equation models representing populations of both non-overlapping and overlapping generations. It also introduces notions of age structure and stage-specific factors regulating density effects on population regulation. Most of the mathematical details are put in boxes for easy reading for those who are less theoretically inclined. This in fact is a major virtue of the book. It does the same when population stability is being assessed, not from the models but from data. The techniques involved can themselves be separate books, but they are introduced in a simple manner for those who may just want to have some basic understanding about the various methods that are used in this area. This book is surely not for those who require in-depth studies on time-series analysis of data.

There is a wealth of literature studying simple to complex models and their behaviour under a variety of ecological and evolutionary conditions. Many models actually predict non-equilibrium behaviour (e.g. simple and higher period oscillations and chaos) to be quite common. Some theoretical studies show that natural factors, such as dispersal and spatial extension (metapopulation) can have considerable influence in stabilizing fluctuating populations. However, how good are these theoretical approaches to describe real population dynamics or to test data? That brings us to the ways by which population data can be collected. Traditionally, field experiments have been the primary mode of assessing population variation – be it direct counting, sample collection or even assessing indirectly through ‘catches’ or ‘fur’ collections. Since a major question confronting ecologists is how population stability is regulated in nature, they spend considerable effort in trying to delineate the contributions of various known and unknown, direct and epistatic environmental and life history-specific factors regulating the population size. Chapter 7 discusses several examples of single popu-

lation studies in nature and the methods adopted. The data gathered indicated much less instability in field populations and it is still an open question as to how different factors can contribute to stability in natural populations. Is stability decided by external spatio-temporal environment, or a product of the life-history evolution of the species? Addressing such questions obviously requires more controlled experiments, even though predicting the ‘past’ could have its own pitfalls.

The three chapters on blowflies (*Lucilia cuprina*), flour beetles (*Tribolium*), and fruit flies (*Drosophila*) are, in my opinion, the most important feature of this book. These three chapters bring together, under one cover, the three most popular laboratory organisms that have been used by ecologists for a very long time. They have been used to address many different types of ecological and evolutionary questions. It is really useful to have them together so that one can easily compare the differences in their behaviour *vis-à-vis* their specific life history. The authors have done a commendable job of reviewing and summarizing a large body of old and recent research papers (both theoretical and experimental) to present a compact and comprehensive account of the studies on population-regulating factors in these three species. The authors’ own long-term research on *Drosophila* has also been reviewed here.

Who are the people who would find this book useful? The book can actually serve many different purposes. First, it is very useful to population ecologists in general. Theoretical modellers looking for both extrinsic and intrinsic nonlinearities in population growth processes would be grateful as the authors have presented the results in such a manner that one can actually start to identify which ecological or life-history phenomenon can give rise to what type of population dynamics. For experimentalists it offers a good introduction to other model systems and comparison among them. The scientific research findings are written in a lucid manner and hence it would be very useful to students of both ecology and evolution. The collection of references at the end of the book is quite comprehensive, and the subject index is reasonably good for quick referencing. Along with the authors, let us also hope that reading this

book would motivate many researchers to take up studies on model laboratory populations to address questions relating to population ecology and life-history evolution. It certainly seems to be a possible way of testing the predictions of the models that theoretical ecologists generate in large amounts.

SOMDATTA SINHA

*Centre for Cellular and Molecular  
Biology,  
Uppal Road,  
Hyderabad 500 007, India  
e-mail: sinha@cceb.ap.nic.in*

---

**The Biotech Century. Harnessing the Gene and Remaking the World.** Jeremy Rifkin. Tarcher/Putnam Publishers. 272 pp. Price: US/\$ 24.95. ISBN-0-87477-909-X.

---

Revolutionary scientific advances in biotechnology are redefining the meaning of life, liberty and equality as the world metamorphoses from the century of physics and chemistry into the ‘biotech century’. The tremendous growth in capacities of the ‘scientific establishment’ and bioengineering MNCs like Du Pont, Novartis, Monsanto, Pfizer, Eri Lilly and Dow Chemical to isolate and recombine genes of plants, animals and humans and ‘Play God’, is being accompanied by a ‘new supporting sociology’, a ‘eugenics civilization’ and a ‘new cosmological narrative’ (p. 10). The essence of these sweeping economic and social forces is a new outlook towards humans, a commodification where ‘the working unit is no longer the organism, but rather the gene’ (p. 14) and respect and dignity shift from the individual to strands of manipulable chromosomal information. ‘Cell by cell, tissue by tissue, organ by organ, we may willingly surrender our personhood in the marketplace’ (p. 173). Ergo, when politicians, scientists and corporate leaders in the developed world sing paeans to the marvels of the biotech century, ‘they are being disingenuous in their public pronouncements’ (p. 36). Jeremy Rifkin’s path-breaking book, although purporting to present data and leave to the reader the choice of deciding which side one is

on, is effectively an exposé of the falsity and inequity of most marvels prophesied by the promoters of unrestricted bio-engineering.

Disingenuity of the possessors of biotech weapons is starkest when it comes to stealing and patenting life and ecosystems from the Third World. 'A battle of historic proportions has emerged between the high-technology nations of the North and the poor developing nations of the South over the ownership of the planet's genetic treasures' (p. 37). Biologically-rich tropical countries of the southern hemisphere, particularly from African and Asian equatorial rainforest regions, are arguing that their biodiversity is a national heritage available in the 'commons pool' and cannot be privatized, monopolized and patented as an 'invention'. But the exploiters are using casuistry and pro-OECD legal instruments like TRIPS to smother these claims. The rosy periwinkle plant of Madagascar enriched the expropriating Eri Lilly company due to its cancer curing traits, but left the impoverished people and cultivators of the variety in Africa as poor as always, and in fact worse off because the patent now requires farmers to pay for using this plant for natural therapy. Another example is the thaumatin plant in West Africa, which is now denied to villagers, thanks to a patent bagged by the University of California. Indian neem, turmeric, amla, karela, etc. have also been expropriated and several more strains are in the process of custodial transfer from the man on the street to the 'inventors' in Western laboratories.

Enclosures were the primary means by which late medieval western Europe bounded common grazing areas and converted shared community land into private property. Plant hunters in colonized Africa, Latin America and Asia also robbed native resources in the garb of 'exploration'. These historical phenomena are being repeated by 'enclosing the last frontier', gene pools, and by proffering specious justifications that do not stand sound scrutiny. In the words of Vandana Shiva, it is nothing short of 'biopiracy' and 'bio-colonialism' to deny prior art and traditional knowledge forms of the South and to convert discoveries into 'inventions' and exclusively-owned private property. Centuries of indigenous research, domestication and preservation of commons are in the process of being hijacked

by the US PTO and TRIPS, the former being so ethnocentric as to derecognize prior art if the product or gene strain were in use outside US territorial boundaries. To put it bluntly, American knowledge forms should be off-limits, but the Third World can be looted without compunction.

In this central clash of the biotech century that, in many ways, will determine the sharing of the global economy, some Southern countries appear satisfied if royalties or other compensatory payments were made to them in return for the bio-pharmacy patents, while many others, especially NGOs, are calling for a 'third position that the gene pool ought not be for sale, at any price' (p. 55) and should remain in the open commons. Compensations are a farce because it is next to impossible trying to valorize and quantify traditional knowledge in monetary terms. Besides, if governments of African, Asian and Latin American countries are given the royalties, there is no guarantee it will reach the intended recipients. When species have been shared from millennia, how can one entity be designated as a legitimate recipient?

Regions of the South with first-nation people, i.e. large ethnic and tribal groups, are especially vulnerable in the biotech century, because of the developments in human genome and cell-line patenting and its attendant eugenic overtones. 'India, with its diverse cultures and inbred populations, is considered to be an ideal setting for gene prospecting' (p. 58). Mutations and genetic disorders which are resistant to climatic and pathological adversity can also be found in tribes all over Africa and several researchers are approaching concerned governments with applications for 'field studies' among indigenous populations, as if they were guinea pigs. The objective of 'genomic' firms and life-science corporations is to extract blood samples and DNA specimens from them and then utilize them for curing diseases of those who can afford expensive treatment. Providing the cures to diseases like AIDS that are consuming indigenous and poorer people all over the South, not as charity but as just payment for poaching upon their living fluid, is never a botheration as long as anti foot-and-mouth, mad cow and anthrax viruses are being 'invented.'

The biotech century is also vitiating the planet with 'genetic pollution', 'destroying habitats, destabilizing ecosys-

tems and diminishing the remaining reservoirs of biological diversity' (p. 70). Although industry spokespersons vehemently deny it, the perils posed by new radical biological technologies on the earth's environment are being highlighted by NGOs. Transferring genes across all natural species barriers can pose greater long-term risks to the biosphere than petrochemicals and CFCs. Each new synthetic introduction into new habitat 'is tantamount to playing ecological roulette' (p. 73). Genetically engineered animals could contribute to deforestation more than human fires. Transgenic 'super fish' could deplete natural ocean zones of all fauna and flora and 'super mice' could spread bubonic plague at will. Genetically engineered 'ice-resistant bacteria' could ruin condensation cycles and harm rainfall and climate patterns far more deleteriously than industrial effluents. Increased use of herbicide-resistant transgenic plants will end up damaging soil fertility and water quality, not to mention the most appalling entry of non-human hormonal traits into human tissue, if the resultant crops are consumed. HIV, for instance, is believed to have entered the human genome from apes in West Africa. The design of 'germ warfare agents' and their employment for biological terrorism and a 'biological arms race' are other spectres. Expectedly, none of the agro-biotech giants are spending enough on risk assessment and 'multiplier effects' of their products.

'Genetic engineering techniques are, by nature, eugenics tools' (p. 116) and, in the words of Theodore Roosevelt, can be harnessed to weeding out 'citizens of the wrong type'. Intolerance for 'feeble-minded persons', 'biologically inferior types' and the poor, corollaries of the first wave of eugenics in the early part of the 20th century show signs of recrudescence in the biotech century. Immigration restrictions on races with 'socially inadequate qualities' (non-Nordics), implemented diligently in inter-war America, are reappearing as reception of the Western world to refugees has taken a downward trajectory. Attribution of genetic disorders to whole communities of ethnic minorities is also taking place, leaving the latter vulnerable to stigmatization. Further, 'what is to preclude a society from deciding that a certain skin colour is a disorder' (p. 140)? Would not Africans and other non-whites be the real sufferers of the eugenics civilisation?

Definitions of terms such as 'defective' and 'abnormal' is highly controversial, and if some categories of people are typecast with such tags, racial hierarchies and intolerance for diversity of humankind are bound to proliferate.

The biotech century could also usher in a phase of governmental inaction and conservatism if the idea that all social and economic problems originate from genetic make-up of individuals and groups, reigns. Instead of aiding and helping develop least developed countries and their peoples, the rich nations could sit back and express helplessness in the face of 'genetic disorders' that have led to African wretchedness. Genetic sociology thus has the potential of legitimizing the North-South divide as natural and foreordained by genes. The shift from 'nurture' to 'nature' as the explanatory force for inequalities of income and status has serious portents for the future of internal and international socio-economic relations. In America, a new group of dispossessed workers, and throughout the world, a new group of dispossessed and inferior countries will be engendered by 'genetic discrimination' and voices calling for a reordering and restructuring will be cowed down by reams of scientific 'evidence', 'Once a new cosmology is widely accepted, the chances of generating a thoughtful debate over the way the economy and society have been reorganized are slim' (p. 198). The genetics-driven immutable 'law of nature' will become insurmountable for activists preaching reform and change in existing divisions of labour across the world. Darwinism suited the rise of industrial capitalism in the 19th century England and neo-Darwinian genetic cosmology could likewise be the perfect fit for globalization today.

The dependence of the biotech century on computer programming and storage has lessons for international relations too. In an era signified by growing information inequalities between rich and poor and developed and underdeveloped parts of the world, 'survival of the best informed' is crystallizing (p. 215). The marriage of computers and biotechnology (bioinformatics) is working to the benefit of Bill Gates and avant-garde Wall Street insiders, who can offer their software reservoir to the bioprospectors as a bank and clearing house of the gargantuan bits of information that are emerging out of dissecting plant and human genes.

Already, the technology for translating DNA units into binary 0s and 1s is underway. But when almost all of Africa has no clean drinking water, it seems redundant to talk of computer access. The biotech century is becoming a vehicle for increasing the fissures between haves and have-nots by driving a wedge between 'Netizen' and Citizen. Like Edward Said's Orientalists who had the power of knowledge to sit in judgement over native societies, Microsoft Corporation and other monopolistic firms have the opportunity as collaborative partners of the 'scientific establishment' to build upon their riches and boss over the under-informed and illiterate parts of the world. Should they be allowed to 'Play God'?

Should the gene be allowed to become a 'cultural icon, a symbol, almost a magical force' (p. 225)? Should Baconian and Newtonian thinking on limitless science aiding man's unceasing conquest of nature be perpetuated? The biggest question on the cusp of the biotech century is not whether one is opposed to science and technology *per se*, but rather to what kind of science and technology, one that abets injustice or one that benefits mankind and the ecosystem in every corner of the globe. For these reasons, 'every human being has a direct and immediate stake in the direction biotechnology will take in the coming century' (p. 236).

This seminal best-selling work, by an author whose ideas have been influential in shaping public policy in the United States, is a must-read for every concerned citizen of the world.

SREERAM SUNDAR CHAULIA

*Maxwell School of Citizenship,  
200 Brookford Road,  
Syracuse, New York 13224, USA*

---

**Environmentalism Unbound: Exploring New Pathways for Change.** Robert Gottlieb. The MIT Press, Five Cambridge Center, Cambridge, MA 02142-1493, USA. 2001. 396 pp. Price: US\$ 29.95.

---

This is a fascinating book in which the author, on the basis of personal research carried out in California, USA, proposes methods of providing space for all stake-

holders in the management of environment and prevention of pollution. He shows that environmental advocacy need not become just a special interest activity. The author's central thesis is that by reconstituting and integrating environmental justice and pollution prevention into a common vision and set of strategies for change, environmentalism could help lay the groundwork for fundamental social change, to make industries more socially responsive and greener, and to make communities more liveable.

The following three research studies have provided the insights articulated with great lucidity in the book.

- A dry-cleaning industry in crisis, the debate over alternative pollution prevention approaches, and whether such alternatives can help establish a new community of interests.
- A set of janitorial cleaning products that may be hazardous to workers and how such hazards can and have been addressed in the context of the search for social and environmental justice.
- The barriers and opportunities in constructing a community or regional food systems approach in the face of a globalizing food system that has changed the very nature of how we grow, make and consume our food.

The first example relates to a small business like dry-cleaning. How can it fit into the environmental policy mode of bringing about 'cleaner, cheaper, smarter environmental change'? The technological and social struggles which small dry-cleaners had to undergo for fulfilling an 'eco-clean' concept are described in detail. For example, in the fifties and sixties, perchloroethylene (perc) was considered to be a safe cleaning agent. However, in mid-seventies, the National Cancer Institute, USA identified perc as a liver carcinogen in mice. Thus, new technologies were being proposed and discarded on considerations of human health and environmental safety. The author summarizes the numerous ecological debates which surrounded the dry-cleaning industry for most part of the latter half of the 20th century and demonstrates the importance of social movements and community action as well as worker and workplace engagement in restructuring the industry. The industry has now seen a transition to wet-cleaning, ending pollution-causing chemical dependencies.