Niche Construction – The Neglected Process in Evolution. F. John Olding-Smee, Kevin N. Laland and Marcus W. Feldman. Monographs in Population Biology 37, Princeton University Press, New Jersey 08540, USA. 2003. 472 pp. Price: $39.50.

The bottom line of this review is that this is an unusual book – a must-read for evolutionary biologists and ecologists, and a book to scan through for that breed of engineers, physicists, social anthropologists and management gurus who intend to learn the tricks of the trade from the workings of living systems. I say this because to be able to manufacture a niche product is the ultimate dream of marketing people. But it would be more interesting to alter the market through the dynamics of the usage of the product. Is there something to learn from the 'lowly' leaf-cutter ants, birds, worms and snails as to how the process of construction of the niche itself alters and consequently the evolution of the market? This book does not intend to consider such situations, but it certainly has material worthy of thought for those who think differently in social sciences.

This book is the 37th publication in the Monographs in Population Biology of the Princeton University Press and is already hailed as a pioneering work by many influential biologists as is evidenced from the comments on its back cover. Starting from 'must read' (Robert May), to 'landmark book' (Richard Lewontin) to '...massive reorientation of evolutionary theory' (David Hull) are some of the comments. The book is highly readable and thought provoking besides having the potential to raise controversy – something that keeps the study of evolution intellectually satisfying.

A popular quote from Darwin, often made by the geneticists/evolutionary biologists is – 'Any variation that is not inherited is unimportant'. The standard theory of evolution, in its simplest form, considers that the only vehicle for transmission of variation is through the genes. But are there non-genetic 'information-carrying' inheritance systems? Is it possible that the cultural transmission systems of any environment-modifying human activity, persisting for many generations, can mediate a stable selection pressure and hence may co-direct human genetic

evolution? This book is guided by such ideas embodied in the gene-culture co-evolutionary theory forwarded by the early work of these authors and others for hominid evolution. This is perhaps the first and a fine attempt to present a collection of cases where similar features are shown to exist in organisms as varied as worms to birds. They believe that evolutionary systems are complex systems having multiple processes, with feedbacks between the organism and its environment, that modify each other in the evolutionary scale. They forward an 'Extended evolutionary theory' where an active interaction of environment and organism (both at the individual and population level) may co-direct evolution of the species. What makes the book interesting is that, along with their own research work, the authors refer to the work of a variety of scholars from a wide range of fields such as, biology, physics, computer sciences (artificial intelligence), and social sciences, to forcefully argue their extension of the standard evolutionary theory. Of course, true to any scientific method, they discuss possible experiments for testing their hypothesis and predicting areas in which one should look for evidences including human society.

The very term 'Niche' generally refers to a place or position suitable or appropriate for a person or thing. This is a static concept. The initial definitions of ecological niche meant an organism's position or place in the community, or in the biotic environment. Some ecologists later described niche as a hyper volume in the n-dimensional ecological space, and also distinguished between the fundamental and realized niche. The importance of space and time in the organism's ecological niche also brings it close to studies on resource partitioning which includes factors such as macrohabitat, microhabitat, food type, time of day, and seasonality of activity. The three most important niche dimensions are a subset of – food type, space and time. Studies of resource partitioning and niche had their golden era in the 1970s to the 1980s, but niche theory persists and has a central role in contemporary ecological theory. In this monograph there is a definite and strong attempt at uniting behavioural ecological processes to evolutionary consequences – from taking a static concept to a dynamic process which feeds back to

the environment and changes it radically over multiple generations, thereby altering the forces of selection.

Niche construction refers to the process of organism-driven environmental modification. That this can lead to massive changes, which can have long-term and long-lasting (sometimes even irreversible) effects has been realized over the past decades through indiscriminate human activities in degrading the biotic and abiotic environment. It is understandable that these can feedback into sources of natural selections in the external environment, but the scale in which it does so is not fully understood and hence the process has been sadly underestimated. This book is a result of both experimental and theoretical modelling studies in this area, which makes it more interesting and challenging to readers with widely different backgrounds. The book is thoughtfully laid out in 10 chapters, 5 appendices, glossary of new terms, indexed bibliography and an index along with the list of tables, figures and a short preface. The indexed bibliography is very extensive and useful to readers from different disciplines. Transfer of metaphors from one field to the other entails great risks because metaphors are usually loaded with value judgments that lead to misunderstanding and misuse when transferred across disciplinary boundaries. Therefore, inclusion of the glossary of new terms is a good idea.

The lucidly written 35-page introduction beautifully lays out the issues dealt in the book. It provides a constructive guide to the reader about what the authors plan to say in the book. They clearly delineate the two roles that organisms play in evolution – that of inheriting and transmitting genes to the next generation (genetic inheritance), and their interaction with the environment and the consequences thereof (termed as ecological inheritance). It may be worth noting that it was the last (and probably less known) work of Charles Darwin in 1881, where he studied the formation of vegetable mould through the action of worms and noted his observations on their habits, which had the ideas of modification of selection pressures through organism-actions over the evolutionary scale. These organisms have been termed as 'ecosystem engineers' as they modify their own and other's environment through their activities and consequently the 'local'

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selection pressures on the organisms. Interestingly, the authors give credit to a physicist, E. Schrödinger, for being the first to indicate (in the book *Mind and Matter*) that the organism–environment is a coupled system and organisms stay alive at the expense of the biotic and abiotic environment. This 'feedback' process has been gaining considerable ground over the years and the organism and environment are considered to co-evolve where they act as both causes and effects. This has grown more important since the role of learning and cultural transmission of information and the large scale alteration of environment by human actions have been major areas of study in social anthropology and 'memetics' – an area where all three authors have contributed significantly. The chapter on culturally transmitted niche construction in hominid evolution is particularly interesting and potentially controversial as there are strong critics of these ideas among both biologists and anthropologists.

The appendices consider several increasingly complex population genetic models of diploid individuals with two di-allelic loci where the consequence of the niche construction activity in resource depletion or creation are included as functions of the allelic frequencies. There is an interesting model of the altruistic behaviour in niche constructing activities (such as, nest building and maintenance) in social insects (Hymenoptera species), which predicts a more female-biased sex ratio as is seen in nature. There is much material for interested persons here to work on. The book concludes with chapter 10 in which an assessment of the contributors' arguments and a clear description of what are the compelling reasons for considering an alternative to the standard evolutionary theory are given. They discuss the different positions taken by other evolutionary theorists in describing different types of change and clearly state why they 'seek to describe evolutionary change in terms of both of the properties of environments that affect organisms and of the properties of organisms that affect environments'. The discussions on adaptation, environmentally-mediated genotypic associations, phenotypic plasticity, and, of course, the uniquely powerful human cultural niche construction provides much food for thought. The book under review clearly has made a serious and powerful attempt

to include niche construction and ecological inheritance as important processes in evolution along with natural selection and genetic inheritance.

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Bioinformatics – A Practical Approach. K. Mani and N. Vijayaraj. Aparnaa Publication, Coimbatore 641 015. 2004. 112 pp. Price: Rs 165.

This book is apparently a follow-up to the authors' previous effort titled *Bioinformatics for Beginners* which was an attempt to address the shortage of affordable books on the subject that existed then. Since then, several very good, low-priced Indian editions of American and European books have been published and price alone cannot be an USP anymore. The authors evidently realized this, and the book under review is therefore an effort to go beyond being just a cheaper version of some expensive publication.

The entire book is written in the style of a tutorial, or rather several tutorials. The topics addressed include searching for information on the Internet, bioinformatics databases, molecular graphics, analyses of nucleic acid and protein sequences and structures, and phylogenetic trees. For each of these topics, the book chooses a simple example and demonstrates the use of a program or a server. For instance, the first chapter demonstrates the use of the Internet to obtain all types of information regarding a given topic. This is illustrated using the word 'Cortisol'. This chapter shows how it is possible to download reports, slides, papers and even books pertaining to the topic. The chapter, however, does not discuss a major problem that accompanies such easy access to information. All the downloaded material is completely useless unless one *actually* reads it. I know students who spend hours of Internet time and gigabytes of disk space, obtaining and storing stuff they will never use. I wish the authors had spent some time

explaining that clicking on the mouse is no substitute to actually reading the downloaded information.

This somewhat superficial approach is seen throughout the book. In one of the later chapters, the authors discuss the use of the SWISS-MODEL server to build a 'homology' model structure for a protein. Too few cautionary notes have been added, and the impression is created that if one knows the sequence of a protein, it is not too difficult to know its structure. In a recent seminar, a fairly senior scientist in the audience asked me about the need for X-ray crystallography and other expensive experimental structure determination techniques when programs such as SWISS-MODEL were available. I had to explain that the state-of-the-art in structure prediction and modelling was far, far away from being able to replace experiment. Chapters such as the one I have just discussed may only add to this kind of confusion, particularly in the impressionable minds of young students.

The book is full of annotated screen shots, which is good, but it also has many spelling and grammatical errors, which is bad. There are a few colour plates that add to the overall 'look and feel' of the book (and perhaps to its price), but do not really contribute to the substance. Though the authors have not specifically stated this, and though the style of writing is informal, they probably intend their effort to serve as a reference book in a 'Bioinformatics practicals' course as part of a M Sc or B Sc (Biological Sciences) programme. In my opinion this is where the book will be most useful. Finally, a CD containing some of the programs and data, similar to the one distributed by the Bioinformatics Centre, Pondicherry University, would be a useful accompaniment to the book.

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