

Book review

Adaptive Radiation of Blind Subterranean Mole Rats

E Nevo, E Ivanitskaya and A Beiles
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Evolutionary message from the underground

The East Mediterranean blind mole-rat is one of about 300 species of mammals that have occupied the unique underground ecotope where they are safe but have to cope with a dark, moist, oxygen-poor and carbon-dioxide-rich atmosphere, where movement is costly, and partners and food are not so easy to be found. Although the mole-rat rarely ventures above ground, its mounds cannot be overlooked, and so no wonder that this animal has already been mentioned in the Bible. However, the animal has remained enigmatic and virtually unknown for millennia.

Some 50 years ago, Eviatar (Eibi) Nevo, then still a student at the University of Jerusalem, developed a fascination and scientific curiosity for the mole-hills, and discovered and described, for the first time, these distinct breeding mounds. In the meantime, he developed into a leading international evolutionary biologist whose research has ranged from genes to ecosystems, and from algae to humans. Still, the primary fascination for the cryptic life of mole-rats has had a great impact on his scientific career. In 1969, two seminal papers were published in *Science* on the blind mole-rat, both authored or co-authored by Nevo. In 1979, a review article by Nevo (which has since become a citation classic) stimulated considerable research into the physiology, sensory biology, communication, temporal and spatial orientation, ecology, taxonomy and phylogeny of subterranean rodents. In 1989, the International Symposium on the Evolution of Subterranean Mammals at the Organismal and Molecular Levels was organised within the International Theriological Congress in Rome by Eibi Nevo and the late Osvaldo A Reig, and an influential book (actually the proceedings of the symposium) edited by both conveners was published in 1990. Three years ago, in 1999, Nevo has published an opus magnum on the *Mosaic Evolution of Subterranean Mammals* (Oxford University Press). Eibi Nevo's contribution to the growth of knowledge of subterranean mammals has been thoroughly inspiring, stimulating, and a motivating force for others; it should also be pointed out that about 250 scientific publications (at least 20% of all the articles published on subterranean mammals so far) have been authored or co-authored by him. Most of these studies deal with the Israeli blind mole-rat, *Spalax ehrenbergi*.

Hence, Professor Nevo has also been undoubtedly the most competent person to write a monograph summarising the knowledge of the blind mole-rat, which has –

thanks to him – become a model organism studied by many researchers and teams, and has become one of the best-known wild mammals. Actually, in times when many scientists feel free to write books after much shorter and less intensive research, one has to wonder why it took so long for a book on this subject to appear. Well, those of us who know Eibi Nevo, one of the last polyhistorians of our time, do not wonder – he is so productive, in so many fields of research (cf, the laudatio in the recently published Festschrift in honour of his 70th birthday, edited by SP Wasser, 1999) that he has just been too occupied with making, describing, and planning new discoveries to find time, apart from publishing some major review articles, to slow down and write a book. However, finally, he and his close collaborators have accomplished what had been promised to us for at least 20 years.

The book summarises the results of several decades of an intensive research programme on the evolutionary biology, ecology, systematics, speciation and adaptive radiation of the blind mole-rat, *Spalax ehrenbergi*, in Israel. For taxonomists, it is of importance in that it definitely shows that *Spalax ehrenbergi* is a superspecies consisting of several good species, of which four are named and described here, following the formal rules of taxonomy. All the data and results concerning eg cytogenetics, population genetics, morphology, physiology, behavioural ecology and sensory biology published in numerous articles scattered over various specialised journals are summarised here, in a well-arranged, synoptical form. Using the blind mole-rat as a potent model, Nevo and co-authors show convincingly how life adapts and diversifies under the unique stresses in the underground ecotope. It is shown how phenotypes and genotypes regress, progress, converge and diverge through molecular and organismal tinkering by natural selection. The authors use the case of the blind mole-rat as a fundamental case study of evolutionary theory to highlight some of the important patterns of adaptive speciation. This case provides solid evidence to support and enlighten Darwinian gradualism, speciation with little genomic change, the adaptationist programme, peripatric speciation, evolution of reproductive isolation as by-products of adaptive evolution, and coadapted molecular and organismal complexes adapted to environmental stresses.

The book is organised into four parts. Chapter 1 called 'Biodiversity evolution: Problems and objectives' is dedicated to the species concept, overview of evolutionary history (including palaeontology and chromosomal evolution) and population biology of the spalacid mole-rats in general and the *Spalax ehrenbergi* superspecies in Israel in particular. In the second chapter, the four new species of the *Spalax ehrenbergi* superspecies are formally named and described.

Part 3 of the book deals with diversity within and between the four named species, comparing and analysing their genetic, morphological, physiological, population and behavioural patterns, as well as DNA poly-

morphism and parasitological aspects. Further on, phylogenetic analysis is presented.

The fourth part concerns theoretical perspectives and the theoretical framework of speciation and adaptation in the *Spalax ehrenbergi* complex.

Finally, conclusions and prospects, bibliography and index arranged by authors, species and subjects are provided.

The book is filled with information and richly illustrated, with much graphics and many tables. The book is a must, not only for the growing community of zoologists interested in subterranean mammals in particular, but also for mammalogists in general. Indeed, anyone interested in general aspects of evolution, especially speciation and adaptation, should read this book. For a moderate price of £35 the reader gets an excellent up-to-date

overview of data, facts, and ideas based on 50 years of Nevo's and his teams's own study and experience, and on careful, critical and thoughtful study of a variety of other sources. The book provides ideas and excellent reading texts for seminars in organismal and molecular evolution and ecology.

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