tion patterns of the reptiles of the subcontinent using an integrated approach, the merits of this work are offset by crucial errors. Misinterpretations and errors in any specific literature can handicap the progress of the discipline, more so if it is one of the few treatises on that subject (Biogeography of the Indian subcontinent's reptile fauna in this case) and will ultimately have wider negative effects.

Priced at $30, the hard bound covers of the book enclose 87 pages – The biogeography of the subcontinent's reptiles. Of the 87 pages, the species checklist occupies 27 pages. The cover has a good photograph of a montane trinket snake (*Elaphe helena monticollaris*). There are many more photos inside – 36 in all, inserted between the cover and the inner title page. All the photographs are the author's.

The first major problem becomes more than apparent when the map of physiographic zones on p. 5 (chapter 3) is examined. At least four of the 10 zones have been inaccurately delineated – The Trans-Himalayas, Northwest, the Himalayas, and the Deccan. For instance, the region west of the Sutlej river has been designated as 'Trans-Himalayas', including a large portion of Pakistan and all of Kashmir, Himachal Pradesh, and Kumaon (Uttar Pradesh)! Das' Himalayas includes the Terai, 'a swampy belt of maximum width 13 km...'. Apart from such inaccuracies, vegetation types of almost all the zones have been described rather superficially and erroneously. For example, on page 9 (chapter 3), the author writes, 'Subtropical pine forests are recorded where temperature ranges are between 1,500 to 3,000 mm a year, and include *Quercus amellosa* and *Q. lineata, Rhododendron* spp., *Lyonia* spp., *Pinus roxburghii* and *P. insularis*.'! And Das' Trans-himalayas '... include subtropical evergreen and coniferous forests...'!

A physiographic zone represents similar conditions (within itself) which are largely unique to it, thus forming a distinct entity, with characteristic climate, topography and consequently habitat types which influence the faunal distribution within it, and also affect dispersal across it[1]. Any misclassification of zones means that faunal elements will be artificially placed in these zones. For instance, because of Das' zonation, two species of agamids (Family: Agamidae) of the genus *Japalura*, viz. *J. kumaonensis* and *J. major*, neither of which are found west of Eastern Himachal Pradesh, have been absorbed into the Trans-Himalayas, artificially extending the range of the genus, which is the one of the westernmost Tibeto-Yunnanese elements. Similarly, the Indian egg eater *Elachistodon westermanni* is absorbed into the Himalayas, despite evidence to the contrary[2]. Das has calculated similarities between physiographic zones using Jaccard's Index–the proportion of species out of the total species list of the two sites, which is common to both sites. As the index is a purely qualitative one (based on simple presence–absence data), it is sensitive to species richness[3,4]. The wrong zonation and consequently artificial placement of species in them, will thus show wrong similarity values between zones. The similarity values, if recalculated using more appropriate zonation, would be obviously different from those presented in the book. The similarity matrix has been then subjected to cluster analysis, and the results represented by a dendrogram, which has been wrongly labeled an 'area cladogram'. An area cladogram, *sensu stricto*, reflects the relationship between hypothesized phylogenies and the distribution of the clades in question[5,6].

And the blunders go on... writing about Hora's Satpura hypothesis on page 28 (chapter 4), Das writes (Italics mine) '...the dispersal of the Southeast Asian biota to the Western Ghats through the once forested *Siwaliks* that...'. Well Das, the Siwaliks are well forested *today*, and are not the same as the Satpuras, are they?!

There are inconsistencies in the description of faunal characteristics of the physiographic zones too. For instance, according to the author, the extralimital elements in the Himalayas include four Tibeto-Yunnanese and eleven Indo-Malayan elements, with *no* representation of Turkomanian-Central Asian or Afro-Mediterranean genera. However the genus *Laudakia*, which is found in the western Himalayas, *is* considered a Turkomanian-Central Asian element. Similarly, the genus *Vipera*, represented by *V. lebetina* in the Kashmir Himalayas, is an Afro-Mediterranean element.

Before winding up the book, the author then briefly discusses patterns and correlates of diversity, affinities between physiographic zones, affinities with extralimital fauna, barriers and speciation, and disjunct distribution of taxa. All one can say then, is that Krieger Publishing Company definitely hasn't provided (to quote the publishers) '...accurate and authoritative information in regard to the subject matter covered'. Any one who turns to this book as a reliable discourse on the biogeography of the reptiles of this region, is in for bitter disappointment.

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Orientation and Communication in Arthropods. M. Lehrer (ed.). Birkhauser Verlag, P. O. Box 133, CH 4010, Basel. 395 pp. Price: Sfr 178.

Sometimes one wonders what life is all about. Questions like 'what is life' have a tendency to be taken as profound or at least too ponderous. They are also considered to be very much in the human context. I do not know perhaps, but certainly do not want to talk about the 'higher purpose'. The more mundane one seems to be to leave back as many of one's own, in as good or better condition, walking the surface of the earth or wherever one may find such life forms. No one has to point out that to be able to do this successfully, living things need to feed to stay healthy and most certainly find at least one mate of the right disposition to procreate. Perhaps in the meanwhile find shelters for themselves and their young or parent them if that is asked for in some circumstances. This will need them to move about and find amongst a myriad other species and a million other individuals the right kind. In the world of small beings like insects, these occupations make the totality of their living. To do these successfully they need not only to move about but also communicate. Things done randomly given the short life spans, would not make for successful living. In addition, it may be necessary to communicate, not only with one's own species but others as well. One needs to signal and one needs to perceive. Inter and intra-specific communication and orientation are at high levels of sophistication in insects and some of these are amazing to say the least. In some spectacular cases like the monarch butterflies, which travel thousands of kilometers in a matter of a few weeks and specifically reach regular places like the Pacific Grove and even specific few trees, these navigational skills and faculties become really astounding. Do they have anything others do not have? Where is information about landmark coded if no butterfly ever makes the trip again? For this they have developed sophisticated communication skills and homing methods. Of course there is an evolutionary argument for almost anything we do or animals do. How they do what all they do has always been awesome.

Arthropods have occupied every conceivable niche in the biosphere and hence the variety of ways of signaling have also been enormous. More than the actual movement, which itself may be limited to use of physical forces which are not perhaps as diverse, the communicability in different media and niches vary enormously and hence the methods. Arthropods hence have not only used sensory modalities like sight, smell and touch or tactile but also the unusual like magnetic fields, polarized light, etc. When the spider reads vibrations in a two-dimensional net it could be as complicated as it can get if it has to deduce information on size of prey to whether it is another spider or more interestingly a potential mate, etc. It does not stop with only communicating with your own cohorts. An animal needs at least to know the intentions of other species, which might be prey, predator, a competitor for food or nest site or just an interloper in its territory. A large number of arthropods do also need to go back to their nest site or home or food areas and these require a remarkable mixture of communicating abilities (particularly if one lives in groups) and orienting ways.

All these are interesting and worth the while only when one can understand the ways and the basis of such behaviour in concrete terms and this needs as a first step quantification of such behaviours. The present volume deals with some of the most fascinating aspects of sensory performance in arthropods, which comprise insects, crustaceans and spiders. This book in that sense will be a valuable aid. Every author is exhaustive in description of methods of study and analysis. Most books tend to be anecdotal but nothing becomes robust science unless measured quantitatively. Here is where this volume excels. This is different in that it is a collection of wonderful research reviews where attempts to quantitative different behaviours and faculties are shown elegantly. It is amazing to notice how much the editor has spent in organizing the material. Almost all contributors seem to acknowledge her efforts. She has chosen the authors well and done an excellent job. The book is organized in a manner that each chapter seems to follow the previous one naturally.

Campan discusses a variety of tactic components in orientation. Truly these basic, almost reflex, responses to stimuli form the basis of what seem to be more organized behaviour. Taxis towards light effectively becomes an escape response in a threat situation. Similarly a negative phototaxis or positive geotaxis for a larva may lead it towards areas of food and water or shade. But these are necessarily modified by superimposed olfactory or gustatory cues. The study of taxes is all the more important since it will be easily analysed and controlled in an experimental situation. They are perhaps very important in acquiring many if not all forms of orientation behaviours.

Almost all of us must have seen wasps which sting a particular maggot or a grasshopper and drag it either to a hole in the ground that it has excavated in advance as in the case of the digger wasp or to the three-pin socket in the switchboard at home as some of the potters do. They seem to rely much on landmark cues to assist them to zero in on their nest time after time. The chapter by Collett and Zeil analyses the use of landmarks by insects in great detail. Recent experiments have come up with astounding discoveries like bees can actually count, etc. Insects particularly bees, wasps and ants need to make use of such cues extensively to be able to forage and return to their nest sites. Diverse strategies and hence mechanisms are employed for different landmarks. A wasp may use a set of stones near its site or a pattern of contrast at the switchboard but to come close to the site may use trees or housetops or a window pattern. Over and above this here may be cues derived from the sun or the earth's magnetic field.

Flying arthropods have problems. How does the fly land on the ceiling? Visual detection of position and movement of objects are used for course control. But biological movement controls cannot provide a signal proportional to the speed with which objects move on the retina and other image parameters strongly affect detector output. They have developed their own fly by wire systems so as to regulate speed and slow down but not stop till their feet touch. Optomotor system and course control are discussed in detail by Kirschfield. The bees need control of flight as subtle and intricate as supersonic jets. Srinivasan and Zhang discuss visual control of flight in bees. Their remarkable negotiating skills derive from being able to maintain themselves equidistant from flanking walls in a tunnel by balancing speeds of images in both their eyes. In general, balancing inputs to two bilaterally symmetric sensors is a recurrent theme in animal orientation.

The editor herself reviews behavioural studies on free-flying bees' orientation towards food. The results reveal an astounding combination of geometry, symmetry, angular size, absolute size, distance and contours that bees use in this task. More importantly, they demonstrate the bee's remarkable learning capacity and behavioural flexibility. Wasps and ants share such abilities perhaps including colour vision.

Ants as well as bees derive compass information from polarized light. The experiments of the Swiss physician Felix Santschi that Wehner reports took nearly a half-century before interpretation. Sanstchi noticed that harvester ants *Messor barabarus* always walked directly back home after a successful trip of foraging. Surprisingly an ant maintained its homeward course even after he had surrounded it with a cardboard cylinder screening off the sun and providing the ant with only a small patch of the sky. Only when he covered the opening with a ground glass plate did the ant walk in random directions. It took over forty years and Von Frisch's experiments (done without knowing about Sanstchi's classic work) to clarify that arthropods use polarization gradients to navigate. Wehner's article is a marvelous piece of exposition. It ends with the description of a robot that can navigate with polarized light.

Past work has revealed magnetic cues. From Walker's review one learns that insect magnetic compass responds to polarity rather than inclination of magnetic field. How insects detect magnetic polarity and fields needs yet to be resolved but the experiments are remarkable lucid. Insects possibly use these when they migrate, e.g. locusts, the dragonflies that move in large clouds some time or monarch butterflies.

Crustaceans have evolved to use fluid mechanical cues to extract information from their environment. These cues enable them to find resources, orient to water currents or escape predators. Since a fluid environment affects transmission and structure of relevant signals, a better understanding of the hydrodynamic context of mechanosensory and chemosensory behaviours becomes very important. Weissburg details the important properties of mechano and chemosensory signals in fluid media.

How does the mosquito get you? From CO_2 gradients to fungal infested feet, all have one common aspect namely chemosensory cues. Chemosensation as a mode of communication and orientation in insects is universal. It is ideal in fluid media. The most studied is pheromone-controlled anemotaxis. Kaissling discusses the prospects of combining precise behavioural experiments with neurophysiological studies in a truly expository manner.

How does the spider say walk into my parlour? It looks like with a guitar of sorts. For spiders vibratory signals are overwhelming behavioural cues. The vibratory world both in its richness and adaptations may provide us some very useful new insights. In their world they are exposed to all sorts of vibrations which they need to distinguish. Background vibrations include those from wind, prey vibrations and courtship vibrations, to name a few. The distinguishing features that have been identified in these are a conspicuously narrow frequency spectrum; low frequency for wind, high frequencies from prey insects and a high temporal order from courting male. Electrophysiological recordings and behavioural experiments have indeed shown spiders do use these clues. Barth's essay documents carefully a large body of results in this area.

Much has always been said about acoustical communication in insects. Possibly the largest fraction of biological noise (the sound variety) comes from insects and they use sound in a variety of ways. Some of the best examples studied are the cricket's courtship songs or the audio signals mantis uses to fool bats. Ants, bees and termites also use sound to communicate. These are part of the discussion by Kirchner. Phonotactic orientation in grasshoppers is the subject of a thorough study recorded by Von Helversen. Behavioural, electrophysiological and anatomical studies are combined to reveal neural pathways of acoustic information processing and mechanisms involved in acoustic communication and orientation.

Gadagkar crowns this volume with a very apt and erudite discussion of possibilities of evolution of communication and communication of evolution. I do not know what that second part of the title means but it rings well and he certainly has done a good job of communicating evolutionary thoughts. All in all this is a wonderful book to have in an institutional library.

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Trends in Microbial Exploitation. Bharat Rai, R. S., Upadhyay and N. K. Dubey (eds). International Society for Conservation of Natural Resources, Department of Botany, BHU, Varanasi 221 004. 258 pp. Price: India Rs 900 other countries US $40.

Microbiology deals with the microscopic forms of life. We are surrounded by a world of microorganisms. They are found in the air we breathe, the food we eat, the water we drink, within our bodies and our surroundings. The adage, 'What you cannot see won't hurt you' does not hold good for microorganisms. Having appeared first on this planet, microbes influence the life processes of all other living systems. They can thrive in habitats extremely hostile to human life and are more skilled than any scientist in their synthetic activities. They represent a richly diversed resource for obtaining several materials required for human welfare. The founder of microbiology Louis Pasteur said 'The role of the infinitely small is infinitely large'. The goal of microbiologists is to understand how microorganisms work and to develop techniques and technologies to use them for the benefit of man.

An international symposium was organized in 1996 at Banaras Hindu University, Varanasi, India to discuss the trends in microbial exploitation for the service of mankind. The above book is the compilation of various papers presented in this symposium by eminent scientists working in this area. The book contains 25 review articles highlighting major issues on exploitation of microorganisms for human welfare. The topics covered include microorganisms used for crop production, crop protection, bioremediation of environmental pollution, large-scale biodegradation, prevention of microbial corrosion and microorganisms as sources of food, enzymes and energy. Out of 25 review articles, 15 deal with the use of microorganisms in increasing crop production and include plant growth promoting rhizomicroorganisms, biofertilizers, mycorrhiza and biocontrol. There are four chapters dealing with the role of microorganisms in food, three on bioremediation of organic wastes, two on the recent advances in the production of microbial enzymes and one on mi-