

by the impact of an enormous meteorite that had struck right in the very center of the Virginia study area', while the shocked quartz, feldspar, partial melting of other minerals in the basement granite in Toms Canyon area were due to crash of another meteorite at about the same time. Curious to know if there had been more such meteorite impacts elsewhere around this period, he found that the well-known Popigai crater in northern Siberia was also carved at about the same time. Meteorite impacts in the past have been followed by periods of climatic changes and episodes of extinction of life. Geologists have in fact, recognized five such major and a few minor episodes in the earth's history. But this triple impact over the Chesapeake Bay, Toms Canyon and Popigai during Eocene was followed only by climatic changes. The mass extinction of life came about much later, during the succeeding Oligocene period and Poag feels that this was due to delayed 'biotic response to complex combination of triggering mechanisms'. He envisaged the following sequence - a pulse of greenhouse warming after the triple impact in the midst of global cooling trend → dissipation of heat and acceleration of Antarctic ice growth → drop in global temperature → extinction of life or their reduction in distribution during Oligocene.

Poag thereafter examines some of the consequences of the cosmic collision on the geology of the Chesapeake region. The crater produced by the meteorites was instrumental in the preservation of certain clay beds when the Atlantic Ocean receded from Appalachian Mountain flanks during Oligocene. These collisions had uplifted certain beds, which today form a part of the crater rim and had induced differential sinking of land lying over the breccia zone of the crater. They had also influenced the course of rivers in the region and made them converge owing to land subsidence. The quality of ground-water was affected as the crater breccia region served as a brine reservoir. Impact generated subsurface features that can trigger land movements and seismic events exposed residences and installations over the breccia zone to potential risks of collapse and other damaging effects. Though the seismic susceptibility of the region is otherwise negligible, Poag

suggests carrying out close gridded seismic survey to assess such risks. Among the positive aspects of meteorite impacts, he lists a number of economic minerals associated with or influenced by them such as redistribution of already existing minerals, or their concentration by the heat of impact. The craters also served in some cases as water reservoirs or for accumulation of oil, gas, iron and uranium and Poag is optimistic that they can be potential sites for disposal of low level hazardous industrial wastes. This book carries convincing arguments establishing meteorite impacts along the eastern coast of USA and it is hoped that soon data on radioactive dating and characteristic geochemical anomalies associated with meteorite impacts would also be available on suitable samples.

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Interrelationship Between Insects and Plants. Pierre Jolivet. CRC Press, Boca Raton, USA. 1998. pp. 309. Price: US \$59.95/DM 108.

Interrelationships between insects and plants have been extensively studied during the last two decades, particularly in terms of their defence mechanisms. The book under review is different in the sense that it deals with insect food selection and behaviour *vis-à-vis* the plants. The speciality of the book lies particularly in the inclusion of carnivorous and myrmecophilous plants and also the aspects of pollination showing harmonic relations between pollinators and blossoms.

This single-author compilation is a testimony to the expansion of knowledge with respect to plant-feeding insects and arthropods of the geological past and those of the 20th century polyphagous insects.

The first of the 15 chapters reviews simply the plant-arthropod relationships describing sapsuckers, fruit eating,

nectar eating, pollen and spore eating, chewing and carnivorous behaviour of insects. The second and third chapters deal with plant-feeding insects of the past and the present, and also explain the status of mono-, oligo-, poly-, panto- and xenophagy in insects. These chapters also emphasize the mechanisms of plant resistance to insect pests with examples such as the American grapevine and resistant varieties of rice.

The relationship between insects and microbes like fungi makes up the fourth chapter. A close association between ants and termites and their respective fungi has been explained in a very explicit manner to bring forth a more or less perfect symbiotic relationship and how the production of antibiotics helps in the growth of fungi which are useful to the host.

Chapter five on physiology of food selection provides evidence that chemical composition of leaves varies with the age of the plant and variation in plant chemistry. This explains in part at least the local or seasonal behaviour of insects and also the ability of certain plants to resist these insect species. On the whole it is clear that food procurement by insects is related to visual or chemical selection. However, in the case of carnivorous or protocarnivorous plants belonging to 8 families, procurement of food involves the attraction, retention, trapping, killing and digestion of insects with the help of their modified structures or by using excreta and cadavers abandoned by insects (like ants). Such a phenomenon in various species has been comprehensively dealt with in chapter six.

Chapters seven and eight deal with symbiotic association (myrmecophily) between plants and ants or between insects and ants of epizoic symbiosis, i.e. external growth of cryptogam on the backs of insects in a humid environment.

Chapters on galls and mines, insect mimicry and homochrony in relation to plants are interesting. In fact, chemical mimicry can be one of the leading tools in the development of a control method in insect pest management. This phenomenon should have been discussed in more detail.

Pollination and coevolution between insects and plants are good inclusions in this book and the author has done well

to bring forth thought-provoking inferences that will be useful for future research in insect-plant interactions.

I must confess that the chapter on 'Natural weed control in the Holarctic region and in the Tropics' appeared to be out of place, though no information in insect-plant relationships should be considered as unimportant.

In summary, the book has substantial information on insect-plant relationships with a particular stress on various aspects of plant feeding by insects. All the chapters are well referenced up to 1996. The glossary given at the end of the book should be very useful for graduate students. Scientists and professionals interested in insect-plant interactions and their behavioural biology would find this volume immensely valuable.

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Rapid Eye Movement Sleep. B. N. Mallick and D. Inoue (eds). Narosa Publishing House, 6, Community Centre, Panchsheel Park, New Delhi 110 017. 1999. pp. 419. Price: Rs 1500.

Biological rhythms of activity-rest cycles are assumed to be the behavioural reflections of light-darkness cycles of the physical environment of living systems. The rest cycle is known as sleep and its biological manifestation goes by the definition of slow-wave (SW) sleep. With the evolutionary expansion of the brain and the emergence of neocortex, REM (rapid eye movement) state has been juxtaposed within the slow-wave sleep. Therefore, one tends to conjecture that this REM penetration was essential as partial freedom from strict diurnal cycles of environment. The book *Rapid Eye Movement Sleep* is a substantial contribution of eminent scientists. It attempts to throw light on the mysterious state of consciousness, which has been grossly over-interpreted as a dream state. While there are many

hypotheses, there has been no substantial understanding of REM phenomenon. The research is mainly focused on neuronal mapping or collection of correlated cellular events near the Locus Ceruleus, Pontine-tegmentum (Mesencephalic Reticular Formation) or as far as in thalamus, hypothalamus or farthest in the neocortex. However, this high frequency electroencephalographic (EEG) activity along with rhythmic and phasic Electrooculographic (EOG) activity is now accepted as a state of consciousness occurring during normal sleep or in patients with narcolepsy.

It may be reiterated that the REM sleep is emerged during the evolutionary stage of neo-cortical development in mammals. Undoubtedly the sleep mechanism in sub-primates is more hardwired than that in man. The experimental results contained in the book mainly focus on animal sleep. These results, therefore, may not be directly extrapolated to human beings. The REM sleep is still a mere phenomenological description of a state of consciousness. The classical structure-function approach helps us in visualizing and deciphering partial information about REM. It is not yet clear how visual imageries (dreams) are linked to REM. Only in a controlled environment, the REM is identical from night to night, even though there are penetrations of triggers from the environment. But in total isolation, the free-moving biological rhythms tend to become chaotic. This necessitates long duration of recording for several days and some heuristic analytical methods for any understanding of REM. Even though the title of the book is *Rapid Eye Movement Sleep*, it contains more details on SW sleep and EEG rather than on REM physiology. This is well exemplified in the opening note by the celebrated hypnologist Jouvet. However, the book serves as a compiled source of biological information on sleep, which is of interest to researchers in this field.

The sequences of chapters take a reader from one aspect to another with ease. Therefore, this contributory volume has the appeal of an introductory textbook on the subject. There are only a few laboratories working in this field and the editors have achieved a significant and meaningful compilation for the benefits of students and beginners in

sleep research. The first 12 chapters deal with known information on various neural and neurochemical substrates associated with sleep and REM. Even though these have been described in the past, their inclusion in the first part of this book serves the purpose of orienting the beginners to the core issues on the biological role and neural substrates involved in REM. A major paradigm shift is documented in these chapters in which the biology of REM has moved from brainstem to meso-pontine tegmentum. However, strictly speaking, the neural architecture of the central activating axis is dependent on the animal under study. All that we visualize in the new paradigm is a phylogenetic organizational principle of the brain.

There are a few minor difficulties in subsequent chapters as they fail to achieve the desired goal of the objectives of their respective topics. This is apparent so when the researchers consciously interpret the experimental findings of REM to an intrinsic survival mechanism. At both technical and analytical levels, there are some fit-falls in a few of the chapters. These are not serious and may be ignored by a prudent reader. The students of biology may not differentiate the facts from fiction like the terms 'spatio-temporal distribution', when the dipole tracing of multi-channel EEG data itself can be spurious. The locus of the dipole is equation dependent and it should not be interpreted as a localizing source for REM. Similarly, the paraphrasing of 'physiological properties of two population of neurons' is ambiguous. It is unlikely that the membrane properties of cholinergic neurons, that too only present in the brain, are different from other neurons. The concept of 'the possibility of broad spiking' is again an example, which should be understood in relation to integration of cellular conductance and not otherwise. It may be presumed that the terms used in this book may carry different meanings in the context of neurophysiology than that is generally understood in molecular biophysics. A serious look into some chapters like 'function of foetal/neonatal REM sleep', or chapter on 'REM deprivation' may, in fact, confound a reader as to meaning of REM process itself as it associates with a state where it may not occur. In fact, the possibility of REM in neonates