Editorial

T N C Vidya, Associate Editor

We are happy to bring to you, an issue that celebrates Nikolaas Tinbergen, who along with Konrad Lorenz and Karl von Frisch, laid the foundations of the field of ethology, the study of animal behaviour. In the late 19th and early 20th centuries, animal behaviour was largely approached either through vitalism and purposive psychology (in England and then America), suggesting that behaviour was the outcome of mystical forces within individuals that could, therefore, not be explained through physico-chemical processes, or through comparative psychology (in America) that placed an almost exclusive emphasis on learning as the process responsible for behaviour. Comparative psychologists at that time often anthropomorphised animal behaviour and relied on laboratory experiments to test animals. Ethologists Lorenz, Tinbergen, and von Frisch (in Europe), on the other hand, articulated how animal behaviour itself could be an evolved phenomenon. The behaviour showed by an animal could, therefore, be inherited, have survival value, and be acted upon by natural selection. This was in contrast to the view of comparative psychologists who thought that mental faculties – and not behaviours – evolved and allowed various species to learn appropriate behaviours. Therefore, ethologists tended to focus on animal behaviour in the natural environment and study instinctive behaviours – behaviours that animals displayed in response to specific stimuli even in the absence of prior experience. However, they realized that learning could also be important in some species at least. Lorenz, Tinbergen, and von Frisch carried out careful observations and experiments on insects, fishes, and birds. Their research paved the way for further work on obtaining an evolutionary understanding of behaviours in various animals, including humans, a proximate understanding of critical periods for normal development, and how adverse psychosocial environments can lead to behavioural abnormalities and psychosomatic

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illnesses. The triumvirate was awarded the Nobel Prize in Physiology or Medicine in 1973 “for their discoveries concerning organization and elicitation of individual and social behaviour patterns”, a departure from the norm of awarding the prize to research more directly related to human physiology or disease.

Tinbergen was interested in the specific stimuli eliciting certain behavioural responses of animals and in the adaptive value of behaviour. His life and his work are described in the Article-in-a-Box (Study Nature, Not Just Books) and the General Article (Nikolaas Tinbergen: The Careful Scientist), respectively, by Sindhu Radhakrishna in this issue. Regarding the former, Radhakrishna points out to us that Tinbergen, the man, was even more remarkable than Tinbergen, the ethologist; all of us in academia would do well to strive towards such personal qualities.

Tinbergen is well-known for persistently fine-tuning and carrying out simple, but carefully designed, elegant experiments in the animal’s natural habitat to test hypotheses about a behaviour. It is a pleasure, therefore, to have the first of a series of articles on How to Design Experiments in Animal Behaviour by Raghavendra Gadagkar featuring Tinbergen’s experiments on digger wasps in this issue. This series encourages logical thinking and creativity in setting up experiments to study animal behaviour and describes experiments that can be performed (with some modification if required) by the readers of *Resonance*. I encourage you to write to the *Resonance* Facebook page (@Resonance.IASc.Bng) with your experiences of trying these experiments.

Tinbergen discovered that exaggerated versions of certain stimuli evoked exaggerated responses from animals compared to what normal stimuli achieved. These supernormal stimuli seem to hijack the normal adaptive responses and are seen in a range of taxa – from birds to humans to butterflies. An article on Supernormal Stimuli and Responses appears in this issue. Some aspects of Tinbergen’s work are also illustrated in Science Smiles.

It is far too easy to get lost in the details of one’s work, hardly pausing to step back and examine one’s field of work. However,

Tinbergen did what few do, emphasising the lines of thought and methods used by ethologists rather than emphasising only factual information in his 1963 classic paper ‘On Aims and Methods of Ethology’ and in his 1965 book *Animal Behaviour* (LIFE Nature Library Series). The former was the Classics chosen for this issue and, in lieu of the original paper being reprinted here, we have its essence brilliantly captured in an essay (See Article-in-a-Box) by R Gadagkar that I hope will make you all read the original paper.

Although Tinbergen primarily focussed on instinctive behaviour that was inherited, he attributed his success to his environment – his family, peers, teachers, and the widespread interest in natural history that was part of the social milieu in the Netherlands at the time. Unfortunately, we do not have a widespread interest in natural history, behaviour, organismal or evolutionary biology in India, despite the abundance of biodiversity that can be very rewarding to study. Although ethology and other disciplines in organismal/supra-organismal biology became a ‘testable science’ many decades to about a century ago, most of our school and college syllabi in organismal biology are hopelessly outdated and rarely extend beyond ‘stamp collecting’. An understanding of the theory in various subjects, especially evolutionary biology, is crucial to progressing beyond descriptions and addressing meaningful questions in organismal biology. There is, unfortunately, not a single masters programme on evolutionary biology in the country while there should logically be multiple institutes dedicated to the subject, given its scope of research and ramifications for understanding human society and health (evolutionary medicine, for example) amongst other issues. In this context, it is exciting that the formation of the first society of evolutionary biology in India, the Indian Society of Evolutionary Biologists (ISEB), (<https://www.facebook.com/Indian-Society-of-Evolutionary-Biologists-510429992749285/>) has just been announced. The society has amongst its aims, promoting evolutionary biology in India through outreach in schools and colleges, which might be of interest to readers of *Resonance*. Of course, this is just a beginning and a lot more needs to be done to improve the state of organismal

biology in the country.

This issue also carries the review of a very interesting book, *How to Tame a Fox (and Build a Dog)*. The book describes a long-term experiment, conceived of and initiated by the Russian geneticist, Dmitri Belyaev, in the early 1950s (and continuing to present times) to understand the evolution of animal domestication. Selecting and breeding the tamest silver foxes on fox farms in remote Siberia, Lyudmila Trut, one of the authors of the book, and Belyaev unravelled possible processes that might have enabled the transformation of wolves into domestic dogs. I hope the inviting review by Sujata Deshpande will encourage you to read the book.

Apart from articles relating to ethology and evolution, we have in this issue, another General Article – The Easiest Proof of Fermat's Principle by H Ray (Late) and S Roy, and a Classroom Article intriguingly titled Card Games and Chemistry by A G Samuelson. This issue also carries the second of a three-part lucid and informative series on Breakthroughs in Information and Communication Technologies by V Rajaraman and the last in a long Classroom Series of beautifully demonstrated Experiments in Fluid Dynamics by Chirag Kalelkar. I hope you enjoy the collection of articles.