In this issue

Tusk length, sex appeal and health status in elephants: The evolutionary logic of female choice

A fully grown Asian bull elephant with a magnificent pair of tusks is a truly impressive sight (as can be seen from the cover page of this issue). And not just human beings; female elephants too seem to find such tuskers very attractive – a state of affairs infinitely more important from the male elephant's point of view. Why should this be so? More generally, why do peahens prefer peacocks with longer plumage, why are stags with bigger antlers more popular (and so on. . .)? Even more generally, why do some qualities of the males make them more attractive to females?

Natural selection guides the trait of female choice (the way it guides everything else); any trait that leads to a production of better quality offspring is favoured, which, in turn, means that any trait which helps selecting a better quality (stronger, healthier) mate will be favoured. While body size is probably an obvious and a direct indicator of strength, secondary sexual characteristics such as bright plumage in birds have been speculated (and shown) to be reasonable indicators of health. In particular, in taxa as diverse as birds, fishes and reptiles, there is a strong negative correlation between the parasitic load (a possible indicator of health) and the quality of the secondary sexual characteristics; for example, male birds with bright, colourful feathers during breeding season have fewer parasites on them.

On page 885 of this issue, Milind G. Watve and R. Sukumar report the extension of such studies to Asian elephants in the Mudumalai Wildlife Sanctuary. Using dung samples from individually identified elephants, they have been able to obtain an estimate of the number of intestinal parasites harboured by each of the elephants. They have then correlated this parasitic load with tusk length. A detailed analysis, involving data collected over five years from over 150 elephants shows that elephants with long tusks have lower levels of intestinal parastic infection. Female elephants thus do tend to choose healthier males, when they prefer mates with long tusks.

Unfortunately, such male elephants are even more eagerly sought after by ivory poachers! This has, in fact, lead to a rather severe depletion in the number of tuskers in that population. If the smaller parasitic load is because of genetic resistance, then, as Watve and Sukumar point out, poaching is selectively eliminating disease-resistant males as well. For a more detailed discussion of the long-term conservation implications (and also for several alternative explanations of why long tusks are favoured by females), see page 885.

N. V. Joshi

The chemistry–biology divide

Over three decades ago, C. P. Snow while delivering the Rede lectures at Cambridge coined the memorable phrase – 'The Two Cultures'. Snow was addressing the growing gulf between the sciences and the humanities. Over twenty years later, in an address to the American Association for the Advancement of Science (*Biochemistry*, 1987, **26**, 6888–6891), Arthur Kornberg borrowed the phrase to express concern about the increasing divide between the disciplines of chemistry and biology. In Kornberg's words – '*Chemical language has great aesthetic beauty and links the physical sciences to the biological sciences. Unfortunately the full use of this language to understand life processes is hindered by a gulf that separates chemistry from biology. The gulf is not nearly as wide as the one between the humanities and the sciences on which C. P. Snow focussed attention. Yet chemistry and biology are two distinctive cultures and the rift between them is serious, generally unappreciated and counterproductive.*'

In the decade since Kornberg's sharply worded essay, barriers between disciplines have become blurred. Even venerable chemistry departments have changed their names. For example, Harvard's Department of Chemistry has now been rechristened as the Department of Chemistry and Chemical Biology, a clear recognition that chemistry's most important challenges are derived from biology. The revolution in molecular biology has marginalized many classical disciplines under the broad area of biology. It has also profoundly altered the relationship between traditional chemistry and biochemistry. In Kornberg's words, – '*In its rapid and turbulent growth, molecular biology has washed away much of the bridge to chemistry. In the rush and excitement over the new mastery over DNA, attention in biochemistry departments has been sharply shifted to major biological problems of cell growth and development and away from chemistry. . . . Molecular biology falters when it ignores the chemistry of the products of the DNA blueprint – the enzymes and proteins and their products – the integrated machinery and framework of the cell. Molecular biology appears to have broken into the bank of cellular chemistry, but for lack of chemical tools and training, it is still fumbling to unlock the major vaults.*'

Conservative chemists have also jealously guarded their discipline and departments from 'biological contamination', thereby widening the growing gulf. Kornberg has a harsh assessment — '*The problem was that organic chemists placed arbitrary boundaries on their science. Although in their pursuit of natural products, they might still eagerly seek the challenge of an*

Amazonian butterfly pigment, they would not accept nucleic acids, proteins, and enzymes as proper natural products'. Kornberg is also unsparing in his criticism of others —*'Chemists were not alone in ignoring the chemistry of living things. The physicists who during the post World War II period turned their attention to biology, generally focussed on genetics and hoped to avoid chemistry for which they had little patience. Those who applied physical methods to determine the structure of proteins and nucleic acids expected that they could infer biological properties directly from the structures of these molecules and thereby bypass biochemistry. Many biologists were just as eager to remain clear of chemistry. Particularly so were those concerned with systematics evolution and behaviour.'*

Today the realization that biology abounds with immensely challenging chemical problems has largely demolished artificial barriers between the two disciplines, in the scientifically advanced countries. The growing appreciation that many practical and economically beneficial applications of science are facilitated by a fusion of disciplines has contributed in no small measure. Unfortunately, in India tradition is harder to break. Most departments of chemistry and biology (often further fragmented into botany and zoology) are yet to realize that puritanism is hardly a virtue in science. Universities set great store by the basic degrees possessed by prospective recruits to their faculties and pay little attention to promoting interdisciplinary interactions. It is therefore unsurprising that most students emerge poorly equipped intellectually, to comprehend the sweeping changes that are taking place at the interfaces of scientific disciplines.

This issue of *Current Science* presents a special section (**pages 788–845**) focussing on the chemistry–biology interface, as represented by a sampling of research from institutions across India. The articles touch diverse areas – bioinorganic chemistry, model DNA clearing agents, protein folding, antibacterial peptides, the immune response, time resolved fluorescence microscopy as a probe for intracellular dynamics – demonstrating that organic, inorganic and physical chemists have indeed begun to carve a niche for themselves in areas bordering biology.

Promoting research in interdisciplinary areas requires that collaborative interactions between scientists and institutions are facilitated. The tendency of evaluation committees to look askance at collaborative efforts, while assessing individual scientists must be banished. Even more importantly, adequate attention must be paid to the training of research students, such that overspecialization does not cripple them too early in their scientific careers. On this subject it is appropriate that Arthur Kornberg has the last word – *'In the long view, these cultural differences between chemistry and biology are dwarfed by our overall devotion to the larger culture of science. It is the discipline of science that enables ordinary people, whether chemists or biologists, to go about doing ordinary things, which, when assembled, reveal the extraordinary intricacies and awesome beauties of nature. Science not only permits them to contribute to grand enterprises but also offers them a changing and endless frontier for exploration.'*

P. Balaram

Land cover and land-use changes

Land cover and land-use changes have occurred in South and South-East Asia during the last century and earlier past of this century. The major driving forces for the same are population pressure, affluence and technology. The pattern of crops and their consumption have changed, leading to changes in groundwater depletion and pollution, and nutrient deficiency. There is a need to develop indices of unsustainability at the micro-level followed by regional cooperation as emphasized by S. K. Sinha (**page 846**).

T. N. Khoshoo