

A PERSPECTIVE FOR RESEARCH IN ANIMAL SCIENCES

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(inputs from K S Krishnan, H A Ranganath, Amitabh Joshi)

Biology started with a description of the living world. The emphasis in the earlier times was on classification and ordering of life forms. Over time, description led to explanations seeking answers to the questions of how and why! Attention then was also paid to the underlying mechanisms that probably cause biological events. Following the understanding of the process of natural selection, life forms and biological events have been analyzed with reference to their phylogenetic background and evolutionary origins. The new science of biology then rapidly developed and questions became increasingly pinpointed. At the same time, there has been a tremendous development in technology and new instruments were designed and developed to probe biological events at more and more micro level. Different areas of biological investigation became highly specialized. Zoology and botany today include seemingly unrelated fields such as taxonomy, ecology, evolution, behavior, physiology, development, biochemistry, microbiology, biotechnology, molecular biology, biophysics, bioinformatics etc. Accordingly, each biologist has become highly specialized in one or the other area of enquiry with little understanding of the related fields. It appears as if the 'organism' is forgotten and only its constituent components are paid attention. Each area of investigation is of tremendous importance for the development of the science of biology. However, at least someone has to keep in mind that an individual organism is a functional entity at a higher level of organization and its total being is not necessarily a simple sum of its component units. Therefore, in addition to the emphasis on more micro levels, research should also concentrate on the study of an organism as an inclusive entity, and indeed this has begun to happen internationally with biological research. The classical zoology which paid great attention to taxonomy now becomes modern classical zoology in which an organism remains the focus of attention. The focus could be given any title e.g. 'Organismal Biology', 'Systems Biology' etc. Natural selection acts on the biological 'systems' and shapes the functionality of organisms over generations. Biological questions regarding the fundamental processes of life – such as metabolism, physiology, behavior and evolution – are, consequently, best posed in the context of an organism embedded in its ecology. The four questions viz. 'function', 'development', 'causation' and 'evolution' raised by Tinbergen regarding animal behavior, or the statement by Jacob that there are only three real questions

in biology - how does it work, how does it develop, and how does it evolve, are equally applicable to 'organisms' or 'organic systems'.

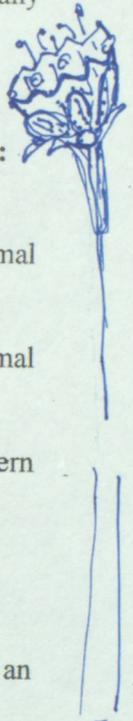
↪ **The PAC Animal Sciences, therefore, could focus on research in the following areas:**

1. Physiology, including endocrinology, biological rhythms.
2. Developmental biology, with a broader emphasis on development as an organismal process rather than mere developmental genetics.
3. Neurobiology, with an emphasis on linking neuronal level explanations to organismal behaviour.
4. Taxonomy, phylogeny and systematics, using both classical and modern (statistical/molecular) approaches.
5. Animal behavior and sociobiology
6. Ecology including wildlife biology, population and community ecology.
7. Evolution, emphasizing the study of the dynamics of the evolutionary process as an interplay of ecology and genetics.
8. Genetics: especially population and quantitative genetics, and cytogenetics]

9. *Antony J. Franklin* 10. *Immunology* 11. *Paleontology*

One mode of operation could be to strengthen research in the above areas by identifying scientists who have carried out successful research projects during the past 10 years. Such scientists could be asked to submit proposals extending up to a period of five years. The intention should be to see that these areas of research get started on solid basis and then continue in the future. A separate budget may be allocated for this purpose.

In general, what ails Indian science, especially biological science, today is the lack of conceptual understanding and focus, be it descriptive natural history or molecular biology. In addition to the development of good research projects, the need of the hour is to prepare our researchers, especially the younger ones, to develop a conceptual grasp over the subject and then raise meaningful questions that advance our understanding of biological phenomena. This is particularly important for organismal biology research in India because such research often does not require very expensive infrastructure and can, hence, be carried out even by researchers in relatively poorly endowed university departments. Unfortunately, however, researchers in such settings, though often keen to do research, lack the broad understanding of the subject necessary to frame meaningful research questions. Consequently, their research often ends up remaining merely descriptive and does not contribute to the growth of



knowledge in the field. An important step that could be taken by PAC Animal Sciences in order to encourage good quality research in organismal biology is the following:

First step: we could organize a national workshop on Organismal Biology in order to make people aware of the broad concepts and issues that need further work. In this workshop, specific sub-fields in which some high-quality research expertise already exists in India could be identified and listed, along with the key scientist(s) in those areas (e.g. life-history evolution, sociobiology, chronobiology, endocrinology, wildlife biology, neurobiology, etc.).

Second step: Separate workshops could be organized in each of the identified sub-fields, again dealing with concepts and issues, in more detail relevant to that sub-field. Promising young scientists could also be identified for further mentoring during these workshops.

Third step: These promising scientists could be asked to spend a few months to get a hands-on experience with established scientists with a track record of good research (not merely completion of previous DST projects!) and the DST could make provision for such an expenditure.

Fourth step: The scientists so further trained can be asked to submit proposals and a mechanism could be developed to put these proposals on fast track for funding.

The above process could serve a dual purpose of good science education and preparation for quality research in the younger faculty of Universities and research institutions. Even if a dozen or so scientists are groomed during a period of five years, this exercise would be worthwhile.

Another aspect that PAC Animal Sciences could consider, given the under-representation in most university curricula of most sub-disciplines that make up modern organismal biology, is to also support the organization of some lecture programmes specifically aimed at undergraduate students. It is important to acquaint students early in their academic progression with the range of exciting research opportunities in organismal biology. These are the people who, after all, are expected to become "promising young researchers" a few years later. When we reach out to post-graduate students, research scholars and young faculty, we have already "lost" a number of potential promising researchers in organismal biology.

Such initiatives that have already been taken up by the DST and need further strengthening include:

Workshops on Methods in Behavioral Ecology – IISc, Bangalore

School on Chronobiology, and Chronobiology Research Unit, University of Lucknow

Unit on Evolution and Genetics – University of Mysore

Other Areas to strengthen:

Developmental Biology, especially its interface with evolution

Neurobiology, especially its interface with behaviour

Wildlife Biology

Population Ecology

Life-history evolution

The regular process of receiving proposals must continue and good projects should be considered for funding.