

COMMENTARY

306	Biochemistry
307	Science and Society
308	Molecular Biology
309	Applied Biology
310	Cell Biology
300L-2	Laboratory Course

The inter-academy initiative on a 4-year BSc degree course can easily be structured on either the UGC recommended model or Delhi University model by including two more semesters; one for project work and another for instruction in few more papers to focus on a major sub-discipline within biology like biochemistry, physiology, genetics, biotechnology, etc. Alternatively, a true research project component can take the duration of a semester.

Conclusion

Undergraduate education in science has witnessed a range of structures and subject/disciplines such as honors degrees, pass courses, postgraduate diplomas, general degrees, etc. With regard to biology-related subjects, there are bachelor's degrees given for medicine and surgery as professional degrees; other

disciplines include zoology, botany, biochemistry, biotechnology, microbiology, biomedical science, etc. There are single subject honors courses and 3-subject general BSc courses. Some variations, like 4-subject BSc courses also exist.

However, the philosophical underpinnings both from technical (discipline-based) and from educational perspective has not been seriously enunciated or debated.

Biology is the science of life forms and living processes. Over centuries, biological knowledge has led to many technologies benefiting humans, be it in food security, health sector or national security. One can name sericulture, medical zoology, vaccines against viral, bacterial and parasite diseases, diagnostic methods for infectious diseases, pregnancy, cancer or genetic and nutritional disorders. Possibilities of application to human welfare has driven growth of biological knowledge; be it horticulture, biopharmaceuticals, or emerging technologies in communication.

Biology should be taught as a single natural science domain at the UG level. One can have many models differing in course titles and degrees of integration within biological sciences and among

natural sciences. All that is being proposed here is to integrate the natural sciences, conceptualize biology and incorporate more physical sciences, mathematics and computer applications into biology curriculum and thus present biology as an integrating natural science⁴.

1. Text Books for Class XI and XII Biology, NCERT, Aurobindo Marg, New Delhi, 2006.
2. Restructuring post-school sciences teaching programmes – a position paper, Indian Academy of Sciences, 2008.
3. Kambadur, M., Proceedings of the 9th Indian Science Congress (3–7 January, Annamalai Nagar), Part III, 2007, pp. 3–11.
4. Kambadur, M., *Resonance*, 2008, **13**, 272–276.
5. UGC Model Curriculum (Zoology), University Grants Commission, Bahadur Shah Zafar Marg, New Delhi, 2001, pp. 13–71.

Kambadur Muralidhar is in the Department of Zoology, University of Delhi, Delhi 110 007, India; B. K. Tripathi is in the Department of Education in Science and Mathematics, NCERT, New Delhi 110 016, India.*

**e-mail: kambadurmurali2001@rediffmail.com*

Teaching and research – a lifestyle option and a lifetime experience*

S. C. Dutta Roy

In this article, I shall use the two terms teaching and research together to mean a single profession and for brevity, use only 'he' to indicate both genders. My aim is to (i) share with my senior colleagues the commonalities in our experiences, and debate on the differences; (ii) to advise my younger colleagues to appreciate and enjoy the positive sides of this profession, and provide them some clues and suggestions to overcome the negative sides, if they find any; and (most importantly) (iii) persuade research scholars and other students to consider teaching and research as a career or lifestyle option.

Teaching, it is said, is a noble profession, because it comprises a lot of giving, without expecting any return from the receiver. A teacher gives his best to the student, irrespective of his scope for career advancements and benefits. The teacher–student relationship is a unique one, and is non-reciprocal, because it comprises one way flow, which does not have a parallel in any other type of human relationship.

The freedom of time management is one of the most attractive features of the profession. A rough calculation shows that during any semester, the actual time needed for teaching, including preparation and assessment, hardly ever exceeds 20% of the total time available. You are free to distribute the rest of the time in any manner you like – amongst research,

innovative development, consultancy, conference participation, book writing, hobbies, etc.

A teacher should be active in research. Teaching without research is likely to make you stereotyped, outdated and stale, however good you maybe as a communicator. Updating knowledge for the purpose of teaching is not enough – it must be applied to seek and find undiscovered truths. Being active in research will also help you to innovate on teaching methods, to see and show existing knowledge in new light and inspire your students to think anew and be creative. Various awards and recognitions are available for an outstanding researcher, which are relatively easier to aim for if you are in the teaching and research profession, as compared to others, because

*Extended summary of an 'Institute Lecture' delivered at IIT Kharagpur on 6 April 2009.

of the availability of time, freedom to choose the topic of your research and change it whenever you like, and the availability of fresh and bright minds, in the form of students, to assist you.

A teacher enjoys generous leave facilities. Which job gives you sabbatical leave (with pay) for one year or extraordinary leave (without pay) for a year or more, when you can go abroad on a visiting assignment or take up an appointment with another organization, including industry in the country? Which other job gives you nearly two months of summer vacation and another month of winter vacation, when you can catch up with all pending work?

Teaching and research is perhaps the only profession where there is no clearly identified boss, because the organizational structure is much more democratic than in any other profession, with much more freedom of speech and action. This is particularly true in organizations which follow the rotating headship system; ideally implemented, all major policy decisions in this system are taken by a committee of senior faculty with the Head as the Chairman.

Going back to research, what kind of problems should you choose for investigation? Problems that one can assign to a PhD student are constrained by a time limit and hence they should be potentially solvable. In addition, you should work on one or two outstanding problems, and pursue the same in a relaxed manner over as much time as needed to make a dent.

What kind of journals should you publish in? There are all kinds of journals in every field, some of which are easy to publish in and they survive because of the eagerness of the researchers to increase their publication count. A large number of publications may impress the non-specialist, but not someone knowledgeable in the field. The quality of work, in terms of originality and impact, is more important than the quantity. My

advice, therefore, is that you should submit your work to the most reputed journals in the field. Your work may not be readily acceptable, but usually you get in-depth reviews, which give an expert assessment of your work, and a feel about your standing in the profession.

What about conference publications? Most conference publications, in my experience, are transients, with varying time constants and do not generally have archival value. Conference participation is important for exposure to others working in the same or allied fields, building and renewing professional friendship, exchange of ideas, etc.

It is advisable to expand and change your field of research, at least to related ones. If you pursue the same field throughout your career, you are likely to get stereotyped, stale and repetitive in the long run. On the other hand, if you shift your interests after reasonable periods of time, you have the potential of bringing a fresh approach to the existing problems, enriched by your experience in the earlier field.

The worst thing in a teaching and research career is to isolate yourself from your colleagues. It is a common phenomenon that senior faculty members in the same general area do not collaborate or communicate with each other. This points to lack of family environment in the department and also to an atmosphere of jealousy and apprehension. If two or more faculty members collaborate to make a strong group, then they can take up large projects and achieve much more than what could be achieved through individual efforts.

The ambience in which you work is important for achieving your goal, and much of it depends on how you adapt to the system. The word 'ambience' refers to faculty colleagues, supporting staff and the facilities available to you. Taking the department as the basic unit, you should consider it as a family. No member in a family is perfect, neither are you.

Accept everyone with his positive as well as negative aspects and utilize the best aspects of each for creating and sustaining harmony in the department. Conform to the system when it helps, instead of sticking to your ego. However, when something grossly unfair happens, make a positive effort for rectification through consultation, persuasion and constructive criticisms, rather than waging a war.

Writing a textbook is a worthwhile activity for one engaged in teaching and research. However, writing a good textbook requires in-depth knowledge of the subject and an overview of it, which you get only after teaching it a number of times and carrying out research in the same field for a number of years. It is therefore advisable that you should not think of diverting your energy to this venture in the prime of your career.

I would like to touch upon three more points before I close this article. First, please remember that ideal working conditions is a myth – it does not exist in any system. You have to make the best of what is available and contribute your bit to improve the system. Second, when you encounter a problem and cannot solve it, turn it around and investigate why you cannot solve it. That is, go to the very roots of the problem and you may find some light at the end of the dark tunnel. Third, you must always work on important problems which cannot be solved by routine methods.

Finally, I would like to emphasize that the profession of teaching and research facilitates you to live a life of dignity. A faculty who loses his dignity by his action, including compromising with his principles and beliefs, is guilty to his own conscience, and brings disrepute to himself, the organization and the community in general.

*S. C. Dutta Roy is in the Department of Electrical Engineering, Indian Institute of Technology, New Delhi 110 016, India.
e-mail: scdroy@ee.iitd.ac.in*