OPINION

Pitfalls in the syllabus of B Sc (Honours) Microbiology courses proposed under choice-based credit system by University Grants Commission, India*

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Recently, the University Grants Commission, India has provided a structure of the model curriculum for B Sc (Honours) programme in Microbiology. It is based on the choice-based credit system pattern aiming to improve the academic standards and quality of microbiology education in the country. The structure of the programme has been divided into core courses, discipline-centric elective courses, generic electives, ability enhancement compulsory courses and skill enhancement elective courses. Most of the basic papers related to microbiology are well covered under the core courses and care has been taken to include the recently published books as references. However, certain terms that could bring confusion among the teachers and students have been included, and some topics that are important to microbiology are missing. The subject contents offered under the generic electives seem to be mere repetition of the core courses. Here, I provide a few suggestions to improve the standards of the above-mentioned programme.

In the higher education arena, the University Grants Commission (UGC), India has taken a major decision to implement choice-based credit system (CBCS) in both undergraduate and postgraduate programmes. However, several practical difficulties have been highlighted in the implementation of such a model programme in India[1]. On April 2015, under the CBCS pattern, a model syllabus was proposed by UGC for B Sc (Honours) Microbiology course[2]. This was basically suggested to enhance academic standard, quality in higher education, improve the teaching–learning process and impart recent findings and innovations in the subject. Overall, the programme was structured as core courses, discipline-centric elective courses, generic electives, ability enhancement compulsory courses and skill enhancement elective courses. Most of the papers included under the core courses are already well known among microbiologists, for example, basic courses like 'Introduction to microbiology and microbial diversity', 'Bacteriology', 'Microbial physiology and metabolism', 'Medical microbiology', 'Immunology', etc. In all the papers, efforts have been taken to include recently published books as references, which could certainly help the students and teachers to understand recent innovations in the subject and could ultimately help in improving the teaching–learning process.

However, among these papers, a few terms mentioned seem confusing in the microbiology context. For example, in the paper of 'Bacteriology', the term 'mesosomes' has been mentioned under cellular organization. Due to the advent of various electron microscopy techniques, in the mid of 1980s itself, it was clearly proved that 'mesosomes' does not exist in living cells. It should be mentioned as an artifact and not as a cell organelle. Thus, while teaching cell organelles, teachers may decide how to orient the students towards such topics.

Another example is the improper coverage of the bacterial taxa in the seventh unit of the same paper. *Bergey's Manual* classifies identified bacteria in five volumes. In the prescribed syllabus, the fourth volume related to heterogeneous groups of bacteria has been completely neglected. However, it includes important phyla like Bacteriodetes, Acidobacteria and Planctomycetes[3]. In the same paper, the term 'Non-Proteobacteria' has been used to denote the Gram-negative staining members other than Proteobacteria. However, none of the volumes of *Bergey's Manual* or microbiology reference books or websites describing the list of prokaryotic names with standing in nomenclature advocates such a term to describe the Gram-negative staining cells[4]. Usage of such terms will only cause confusion among teachers and students. In my view, the importance of bacterial phyla needs to be studied according to the outline classification of *Bergey's Manual*, with emphasis on molecular aspects. In addition, equal importance may be given for studying bacteria based on Gram-negative or Gram-positive staining characteristics. In the core paper of 'Microbial physiology and metabolism', assimilatory pathways of nutrients like sulphur are lacking and amino acid, nucleic acid biosynthesis has not been included.

Under the topic of generic electives, most of the papers and their contents are similar to those represented in the core courses, a clear delineation for learning level or content coverage under the topics remains unaddressed. However, according to the UGC CBCS guidelines, it should be specific or specialized or advanced or supportive to the discipline/subject of study[5]. Thus most of the courses offered in generic electives may not give any impetus to the Honours programme that requires more specialized and academic standards in microbiology. Thus, it is necessary to modify the contents of the courses so as to fulfil the UGC criteria of CBCS.

However, among the discipline-centric courses, the papers have been structured to accommodate the ever-expanding knowledge in the field of microbiology and its allied fields. An interesting paper

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is 'Advances in microbiology', which includes important findings like horizontal gene transfer and its impact on evolution. Another interesting topic is 'Metagenomics', which is a recently growing field in microbiology[6]. The last unit is entirely devoted to the importance of 'Systems and synthetic biology'. This paper is an appreciative addition to the Honours programme.

The last part of the syllabus is the skill enhancement elective courses. This domain contains many interesting papers like 'Microbial quality control in food and pharmaceutical industries', 'Microbial diagnosis in health clinics', 'Biofertilizers and biopesticides' and 'Microbiological analysis of water'. All these papers have been properly structured; however, none has a practical or hands-on training, or the possibility for competency development or skill development as prescribed by the UGC norms for CBCS.

Generally, for an Honours programme in any subject, the following points need to be considered: the papers should be more specialized with high academic standards compared to those offered in B Sc degree courses. Honours courses help in developing advanced theoretical and research skills among students and in building advanced professional or academic careers. Students in the Honours programme are generally exposed to excellent microbiology laboratory facilities of industrial, hospital and academic institutions, which are included as a part of the curriculum. They are placed in such institutions for a professional training and learning experience, and in some Honours programme, students need to submit a written dissertation for the completion of their course.

The proposed syllabus for the B Sc (Honours) Microbiology by UGC, lacks most of the criteria needed to be fulfilled for an Honours programme. This needs to be revised with the aim to bring excellence, enhance academic standards and quality in microbiology higher education programme in the country.

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5. http://collegesat.du.ac.in/UGC_credit_Guidelines.pdf
6. Jurkowski, A., Reid, A. H. and Labov, J. B., *CBE-Life Sci. Educ.*, 2007, **6**, 260–265.

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