Original Article

BIOCHEMISTRY IN MEDICAL EDUCATION

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Biochemistry forms the basis of all life sciences including clinical sciences. Physiological functions are indeed the manifestation of the underlying biochemical reactions. The advances in the field of Medical Science is simply overwhelming and obviously, biochemistry occupies the central place in this endeavour. The Profession of clinical chemistry is rapidly merging with other disciplines in laboratory Medicine. In the background of this rapid growth it has become essential that biochemistry is taught in the correct perspective to the students in Medicine. But in reality, biochemistry is taught with total contempt and quite naturally is learnt very casually. Recently there has also been a move by the Medical Council of India (MCI) to cut down the hours of teaching as well as the faculty in biochemistry in Medical colleges. This certainly is a retrograde step.

Biochemistry by definition is the chemistry of life and life is a system of cooperative enzyme catalyzed reactions. Understanding life in molecular terms is quite absorbing. Of course, it is to the credit of a teacher to make the subject come alive and perhaps to inspire the student to devout themselves to an indepth study. In the context of teaching biochemistry in Medical Colleges, the teacher needs to enlighten them with the molecular basis of life processes in normal health and in different disease conditions. The relevance and importance of the subject in Medicine should be clearly identified. Teaching of biochemistry presently followed in Medical Colleges deals, generally with the chemical and structural details of biomolecules and their metabolic fate with very little or no discussion on the physiological or pathological relevance. Further, it has been a classroom teaching. The knowledge gained by this traditional method is hardly retained till the clinical teaching starts in the later years and at this stage there is very little scope for the student to understand the molecular basis of different clinical conditions. Teaching biochemistry with poor clinical exposure does not do any Justice to a medical student and in this way they neither learn the chemistry of life nor the chemical basis of pathology. Exposing the student to less than the whole story is not fair. The beauty of the subject lies not in the fact that something occurs but in why it occurs. Understanding why?, makes the subject lively. Orientation to understand the molecular basis of normal and/or abnormal functioning of an organ system needs to be initiated aggressively. A good following of biochemistry helps a better learning of the other branches of medicine and vice versa. Biochemistry in Health science cannot be taught and learnt in isolation. A thoroughly integrated approach with an emphasis on the recent trends in clinical science and clinical chemistry should be encouraged in medical colleges.

The question of how to reorient the teaching of biochemistry in Medical Colleges has been discussed on several platforms, MCI had also proposed an integrated approach to teaching of biochemistry in its revised curriculum and regulations of 1996. Many stalwarts in the field of Medicine have often discussed this issue in all its sincerity and seriousness. Unfortunately nothing worthwhile has happened except for the superficial claim that biochemistry now has two separate papers for the examination in the first year of the course. An honest and sincere need is that biochemistry should be taught in all the three phases of the course in Medicine.

Biochemistry in phase I shall deal with:

i) the chemical characteristics of biomolecules and how these characteristics can contribute to the physiological functions and

ii) how these biomolecules are metabolised in the body and how a disturbed metabolic profile can contribute to the onset and progress of a pathological condition.

Initially, the student should be encouraged to recognize that biochemistry is a continuum of organic chemistry and how scientists from varied backgrounds have contributed to the understanding of life in molecular terms. Student should be oriented to appreciate some of the simple facts such as:

i) What unique properties of water have allowed life to originate and evolve in it.

ii) During chemical reactions how the electron delocalisations occur and result in simple Organic reactions and how this very same factors play a role in the more complicated enzyme catalysed reactions as well as how the structure of a biomolecule is related to its physiological function and.

iii) How nutritional status of a person is linked to his health and disease etc.

In phase II, biochemistry should be to highlight: how a naturally occurring or a synthetic compound, generally an organic compound, comes to use as a drug. How does it act and how this compound, a prototype drug – the lead compound is chemically modified, in a number of cases, into a better drug. Many examples such as methyl histidine to cimetidine and Ranitidine, Librium to valium, pencillin to many modified pencillins, sulfonamide to tolbutamide, etc. can be cited to convey the message clearly. A little knowledge of basic biochemistry and chemistry such as the stereochemistry becomes very useful in identifying the compound with better efficacy. Remember, nearly half of the commercially available drugs are stereoisomers and not all the stereoisomers of a compound will have the same efficacy. In the case of thalidomide for example, only the d-isomer is useful as drug (Sedative) whereas the l-isomer is terratogenic. This bit of information would have prevented the famous thalidomide tragedy in Japan. Similarly, (+) ibuprofen is a versatile, quick acting analgesic, whereas the l-isomer as well as the racemic mixture (mixture of both the isomers) takes a long time to act. Even with respect to the biomolecules in the body, mind you that only one of the stereoisomers such as D-sugars, L-amino acids, cis-fatty acids, etc., are generally physiologically active. Further understanding the mode of action of drugs or even the drug resistance needs to follow changes at the molecular level. Precisely, pharmacology is better followed with relevant aspects in biochemistry. Certainly, biochemistry is complimentary to pharmacology.

In the final phase of the course, when the student is amidst a variety of cases in almost all the clinical subjects, he is totally at a loss to understand the pathophysiology of the clinical condition that is before him. Let alone an understanding at the molecular level, he will not be in a position to identify a biochemical investigation that is needed for the clinical diagnosis of different cases. If at this stage, imagine, what a great advantage it would be, if the student were to have a discussion on the biochemical basis of the pathology in different cases that he would encounter. Without biochemistry, how would the student follow the metabolic disturbances and the ensuing complications that would develop in some of the common conditions such as diabetes, hypertension, coronary artery diseases, alcoholism, cancer, genetic disorders, etc. Is it not an academic injustice ? We have not given the student a complete story. It is now strongly felt and generally feasible that in addition to the clinics, regular case presentation by a clinician along with relevant discussions by a pathologist/microbiologist and a biochemist should become an essential component of the course. A pharmacologist/a physiologist/an anatomist may also be needed as the situation and the case demands. Such an integrated approach would not only be of immense value for a good understanding, it would also be a genuinely meaningful approach to therapy.

It would not be out of context to conclude by quoting Federick G Hopkins. "The biochemist's data gain their full significance only when he can relate them with the activities of the organism as a whole. . . . His may not be the last word in the description of life but without his help the last word will never be said."

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