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Experience on Teaching Biochemistry to the Medical Students at P. Lumumba Peoples' Friendship University

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Teaching of Biochemistry to medical students is primarily based on the concept that subject, i.e. Biological Chemistry, being one of the theoretical basis of medicine, helps to create physiological and biochemical perception of a physician. The outstanding discoveries of the past two decades in biochemistry and molecular biology brought out radical changes in our understanding of fundamental chemical basis of life. In the meantime the method of teaching biochemistry at the medical institutes did not practically change. The process is the same: the lecturer, the blackboard, the examinations, etc. everything is the way it was before. These traditional types of teaching and outdated methods of learning are confronted by the perception and assimilation of increasing stream of scientific information. In order to improve the qualification of a future doctor it is necessary to reorganize the present-day teaching/learning system. Some of the approaches which we employed in this direction are discussed.

Our experience of teaching biochemistry to medical students is based on training foreign students and concerned the following problems: 1) Elaboration of the programme, 2) Organization of the lecture course, 3) Organization of optional courses in medical biochemistry, 4) Conducting the laboratory work, 5) Arrangement of the research work for undergraduate students, 6) Use of textbooks and scientific literature, 7) Role of teacher.

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Symbol System for Manual Operations in Biochemical Procedures.

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A procedure is in this system formulated as a series of sequential additions of reagents to reaction mixtures upon which intermittent operations are performed. The reaction mixtures are listed sequentially according to the vessels in which they are held. All symbol characters are available on an ordinary typewriter. Only four independent symbols are used, namely the symbols for (1) the reaction vessel (parantheses), (2) an operation in the sequence of additions (solidus with specifying subscript), (3) the presence of two phases in the reaction vessel (state of upper phase : state of lower phase), and (4) transfer of material from one vessel to another (dashes between the parantheses). Reagents are written within the parantheses in order of addition and normally separated by commas, or, if operations are performed, by solidi. The amount added may be indicated above each reagent, while conditions applying to the entire content of the vessel may be specified below the line. The reagents are indicated by short names or abbreviations, and fully specified in a separate list. The symbol system produces intelligible and compact formulations which are well suited for surveying and communicating even complex procedures. Transfer of a procedure described in text into the symbol formulation often reveals operational details poorly explained or simply omitted. Hence, the act of formulation gives valuable training in solving practical problems.

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Visual Presentation of Complex Biochemical Pathways.

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One of the major difficulties of teaching biochemistry is that much of the material is complex. Teaching it in small parts overcomes problems of comprehension, yet this must be achieved without losing sight of the overall structure and purpose of the pathways. This difficulty is increased when teaching medical and dental students, who are often reluctant to study topics whose relevance to clinical medicine they cannot immediately see. The integration of prepared overhead projector transparencies can help overcome these problems. Features of these transparencies are:
1) Advance organisers provide an outline into which detailed information taught by progressive parts can subsequently be fitted. The advance organiser is used to locate each part in the greater whole.
2) Progressive parts. The first reaction of a sequence is taught separately. This is then linked to the second reaction and so on.
3) Symbols are used to simplify complex chemical reactions.
4) Integration of pathways is facilitated by combining advance organisers into simple metabolic maps.
5) Relevance to medicine can be illustrated by transparencies relating to clinical problems.

These features will be demonstrated by visual material prepared for lectures on haem synthesis and porphyria; haem degradation, bile pigment metabolism and the differential diagnosis of jaundice.

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A Classical Demonstration of Protein Denaturation, Dye Binding and Indicator Error

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In a footnote to his pioneering paper on pH, Sørensen described a simple experiment which with only slight modification has proved valuable as a class exercise or demonstration for medical students. Attentive observation and clear reasoning are required There is scope for initiative in carrying out simple confirmatory experiments. Students can learn from it about hydrophobic interactions of (one form of) a protein with a dye (relevant to the transport functions of serum albumin and to dye-binding methods for assaying that protein), "indicator error" (relevant to the use of ALBUSTIX to detect protein in urine), the progress of acid denaturation and the heat sensitivity of an enzyme.

Tropaolin 00 (diphenylamino-azo-p-benzene sulphonic acid) is added to a solution containing ovalbumin, which has been acidified with HCl, turning the solution red. Over a period of minutes, the solution becomes yellow, and if pepsin is also present the colour slowly returns to red, in each case without any significant change of pH. Suitable blanks are carried through, including one in which the pepsin has been boiled. If the student is inobservant or if there is undue delay in making up the mixture, the first stage at least may not be appreciated. Serum albumin gives different and less dramatic results.

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The Relationship of Biochemistry to other Preclinical Subjects and the Place of Biochemistry in an Integrated Curriculum

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Physiological, pharmacological and pathological processes are now, to an increasing extent, becoming explained in molecular terms and thus Biochemistry courses in the medical curriculum should make greater contributions in application to these subjects The process has been stimulated in recent years because Biochemists have taken a much greater interest in whole tissue and whole body metabolism than hitherto.

As a consequence of these developments, in many important areas Biochemistry now overlaps with Physiology, for example in the treatment of absorption processes in intestine and kidney, muscle function, erythrocyte metabolism and plasma proteins, with Pharmacology in treatment of neurochemistry and drug metabolism and with Pathology in the treatment of bacterial metabolism and viruses.

Those teaching Biochemistry in medical courses are thus faced with a difficult problem. Should the Biochemistry be retracted into a central small core course or should extensive contributions be made by Biochemists to other conventional preclinical subjects.

These problems and the possibility that Biochemistry should become fully integrated with other preclinical subjects will be discussed in this paper.