II—Systems courses

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In traditional medical curricula, anatomy, physiology, pharmacology, and pathology are presented as individual courses, some concurrently and some sequentially, usually by different departments. The student himself is expected to undertake the horizontal integration of such courses and to develop an understanding of the different systems of the body in health and disease. An alternative method that has been adopted in Southampton is to teach all aspects of each system in an integrated manner. Functional anatomy, physiology, pharmacology, pathology, and epidemiology are presented together in a series which deal in turn with each system of the body—for example, the reproductive system, the cardiovascular system, and so on. There are advantages and disadvantages to each of these approaches. In the traditional approach each subject is taught as a complete discipline. Physiology, for example, is presented as a single subject, and the integration of individual systems into the whole is readily appreciated. Concepts such as homoeostasis that span many systems are easily dealt with.

Nevertheless, clinicians often find that students in their early clinical years have an inadequate knowledge of physiology when they come to apply basic principles to the mechanisms of disease. This has led to the view that "clinical relevance" is important in the early stages of a medical curriculum both as a stimulus to learning and in illustrating the emphasis to be placed on items of factual information. To take an example from the respiratory system, the alveolar and arterial Pco_2 is approximately 40 mm Hg (5·3 kPa) in health. This value is rarely remembered by second MB students and would not necessarily need to be, except that ventilatory failure is defined in terms of Pco_2. By not considering disease simultaneously with basic physiology the significance of the Pco_2 as an index of the adequacy of alveolar ventilation is less well appreciated.

The medical student proceeding to clinical medicine needs integrated models in his everyday clinical practice, and a programme of learning which embraces the disordered at the same time as the normal should lead to a better appreciation of both the normal and the abnormal and permit economies in learning and teaching. Introducing students to mechanisms of disease and including clinical teachers from the outset also eases the transition from preclinical studies to clinical medicine which can seem very abrupt for some students. Conversely, there are advantages to be gained by including basic scientists in the later parts of the course that have traditionally been considered strictly "clinical."

But there are disadvantages to the integrated approach. Firstly, teaching in systems fragments each individual discipline so that whatever is gained by seeing the discipline as a whole—for instance, as physiology or pathology—is impaired. Secondly, as individual components of each system may be taught by members of the appropriate discipline the systems course is likely to be presented by many different people, thus removing the continuity obtained when the same person presents the whole of one course.

In the systems course approach there are many ways in which integration may take place. It may be achieved by representatives of two or more disciplines participating in one teaching session or, alternatively, by careful timetabling of individual components within the course. We have adopted the second method with individual disciplines occupying the whole of a session for most teaching and with only a limited number of multi-teacher sessions when they are particularly appropriate.

The problems in a systems course approach vary from system to system and lead to different solutions. There are, however, certain fundamental requirements before an integrated systems course approach can be readily implemented. Firstly, some knowledge of regional anatomy is needed. It would be difficult to discuss the neurology of posture and co-ordinate movement if the basic structure of the limbs and trunk was not known. Secondly, a background in basic pathology is needed before the special pathology of a system may be profitably discussed. Thirdly, a superficial knowledge of all branches of physiology helps with the orientation of the earlier systems courses. These prerequisites are programmed for the first year of our curriculum and therefore the start of the systems courses is delayed. In practice we have found it possible to have only one systems course in the first year, and for this we selected human reproduction. The remainder of our systems courses—cardiovascular, respiratory, neurology, gastrointestinal, renal, endocrinology, and musculoskeletal—occupy most of the second year. A problem encountered in mounting a systems course is the lack of an appropriate structured textbook with a sequence and detail appropriate to the course. We were aware of most of these difficulties from the outset but our experience over the past four to five years has helped to put them in perspective. Despite the problems, the expected advantages of the integrated approach and a cautious enthusiasm for a trial of the approach by staff from all disciplines encouraged us to proceed.

A professorial member of staff was appointed as co-ordinator of each system and charged with assembling a planning team to include representatives of each discipline involved. The constraints were mainly those of fitting a balanced course into an agreed number of hours. This in turn had to be fitted into the number of weeks allocated to the system. Further requirements included a formal assessment of the students' attainment and an assessment of the course and its teachers by the students themselves using a questionnaire. The cardiovascular systems course illustrates the way in which these contraints have been met.

Cardiovascular systems course

A course-planning team included 10 members representing medicine, cardiology, physiology, pharmacology, pathology, microbiology and epidemiology. A draft course-structure was discussed and suitably modified. The course lasts 54 hours. With experience, changes have been made and will continue to be made. This paper describes the present organisation of the course.

AIMS AND OBJECTIVES

The *aim* of the course is to enable the student to develop an understanding of the structure and function of the system, the pathological processes which affect it, and the way in which they result in mechanisms of disease, and also to consider the epidemiological factors which lead to cardiovascular disease.

LECTURES

An introductory lecture by the course co-ordinator explains the objectives of the course and the way in which it is organised. The course

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helps each student to construct for himself a model of the system in health, the nature and origin of the disorders which may affect it, and the effects of such disorders—the mechanisms of disease. A teleological account of the development of the system is given in this first talk to indicate the basic nature and interrelationship of its major components.

Three lectures on events in the cardiac cycle are reinforced by two clinical demonstrations. Ten lectures by physiologists cover the remainder of the circulatory physiology, including cardiac function, regulation of blood pressure and blood flow, microcirculation, and the features of special circulations such as the cerebral and coronary circulations. An introduction to the pathology of the system is presented in four lectures supported by handouts, with a display of relevant museum specimens. The special pharmacology of the system is also covered.

CLINICAL DEMONSTRATIONS

Six two-hour sessions are allocated for clinical demonstrations and whenever possible or appropriate one or more patients attend the demonstration. The demonstrations currently in use are: (*a*) normal and abnormal heart sounds using the phonocardiosimulator and emphasis on the mechanism of their production; (*b*) patients with cardiac arrhythmias such as ectopic beats and atrial fibrillation (records of the other arrhythmias are shown); (*c*) patient with angina pectoris to discuss coronary circulation, mechanism of symptoms, and effects of drugs; (*d*) the embryology of the heart and major blood vessels is introduced by reference to congenital heart disease; (*e*) regulation of heart rate and blood pressure using a patient with carotid sinus sensitivity; and (*f*) oedema and heart failure.

Clinical demonstrations are popular provided that they are well organised. Failure to obtain a suitable patient and merely to talk about one in his absence is ineffective.

PRACTICAL CLASSES

We believe that it is important that students should personally obtain some raw data to incorporate into their model of the system. Although the amount of factual information that may be acquired in the time available is not great, the way it is obtained should place it firmly into their model and should also give some insight into the variability and difficulties of biological measurement. We originally planned six three-hour practicals, but we have reduced these to four two-hour practicals. These are as follows: (*a*) location of peripheral pulses, pulse frequency, how long should one count to have a reliable answer? simple electrocardiography to show heart rate changes with exercise, respiration, Valsalva's manoeuvre, etc; (*b*) blood pressure, Korotkoff sounds, film on blood pressure measurement, effect of posture and exercise; (*c*) 12-lead electrocardiograph recording, Einthoven's triangle; and (*d*) venous-occlusion plethysmography, reactive hyperaemia.

Students dislike writing up their results, so we are experimenting with the completion of a questionnaire on the results, the mounting of any records obtained, and a brief commentary.

SMALL GROUP TUTORIALS

It became apparent after the first course that there was insufficient opportunity for students to manage information acquired from the different parts of the course. We therefore organised twice-weekly, one-hour, small-group tutorials with each group consisting of eight or nine students with a tutor. Tutors are drawn from lecturers in physiology and medicine and informed research fellows and senior registrars. The form of the tutorial is broadly in line with that described in *Small Group Tutorials*,[1] but is more structured in that as a basis for discussion and analysis a carefully selected case record with much physiological information is given to each member of the group. Discussion is generally based on the case record but any other points may be brought up at these discussions. The last session is replaced by one at which a visiting expert who has been given the case record in advance presents his own synthesis of the case to all of the students, followed by discussion.

MAJOR TOPIC

The course ends with a two-hour session on a major topic. It aims to present in some depth a common cardiovascular disorder. Up to now we have chosen ischaemic heart disease. We attempt to integrate epidemiological, nutritional, pathological, pathophysiological, and clinical aspects. This session requires careful "stage managing" with a chairman and four panel members each being restricted to not more than 15 minutes for his contribution before open discussion. The students' response has been generally favourable.

ASSESSMENT

The assessment takes the form of a 25-question, five-part, true or false multiple-choice questionnaire. Regrettably this tends to test recall of detail rather than whether a true understanding of the cardiovascular system has been obtained, but we hope that this will improve with experience.

STUDENT RESPONSE

To test student response each student completes a questionnaire anonymously about the course and its component parts on the last day. This has proved invaluable in improving parts of the course. It has also confirmed that one cannot please all of the students all of the time.

Conclusions

We have reached the following conclusions:

(*a*) a systems-course approach is feasible and is probably more appropriate to a medical student's education than traditional methods;

(*b*) a systems course needs considerably more integrated planning;

(*c*) the objectives of the course need to be defined to restrict the undue emphasis placed by students and some clinical staff on clinical aspects—otherwise the range of study becomes unreasonably open-ended to the detriment of understanding basic principles;

(*d*) the course co-ordinator needs to be concerned personally in all stages of the course to provide the leadership and cohesion needed to give the course an identity; and

(*e*) in the short time available it is not possible for a student to obtain more than a simple model that requires developing during his clinical attachments.

Reference

[1] Walton, H J, *Small Group Tutorials*. Dundee, Association for the Study of Medical Education, 1972.

A previously healthy woman of 70 has developed a labile blood pressure varying between 200 and 80 mm Hg systolic and 170 and 40 diastolic. Despite thorough investigation, no cause can be found for this. What might have caused this change?

Though this patient has been thoroughly investigated, possibly some intermittent change in rate and rhythm of the heart (not present during examination) could still account for the extraordinary blood pressure lability. I assume that the wide pulse pressure with systolic hypertension was not associated with undue slowing of the rate or with any gross irregularity, which might occur with intermittent arterioventricular block or atrial fibrillation respectively. In older patients with inelastic major conducting arteries systolic hypertension and great widening of the pulse pressure may be seen in the beat which follows a long diastolic interval. I assume that there is no appreciable early diastolic aortic regurgitation, which would lower the diastolic pressure to a degree which would vary inversely with the heart rate. I assume also that a fall in blood pressure is not associated with a change in posture due to dysfunction of the baroreceptors, as occurs in diabetic autoneuropathy or in patients taking ganglion-blocking drugs for hypertension.