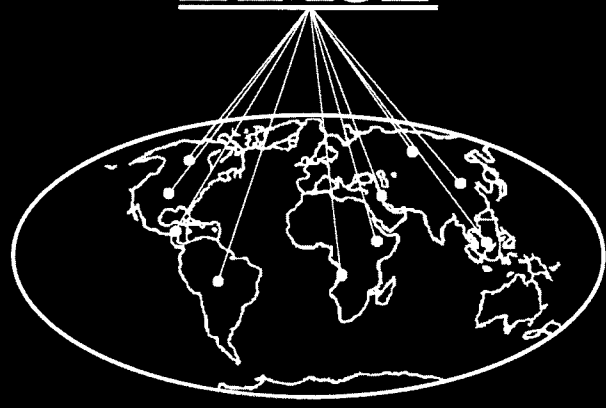
# BASIC SCIENCE EDUCATOR

VOLUME 8 • NUMBERS 1& 2 • 1998

*The Journal of the International Association of Medical Science Educators*

*IAMSE*



*Problem Solving in Molecular Cell Biology*

*The Challenge of Integration*

*In Search of Awe and the Human Spirit*

*Computerized USMLE Testing*

*Medical Science Education in Malaysia*

*Fourth Biennial IAMSE Conference*

*IAMSE on the Web:*
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## MISSION STATEMENT

The mission of the International Association of Medical Science Educators is to promote medical education through faculty development and to ensure that the teaching and learning of medicine in the 21st Century continues to be firmly grounded in science. We strive to achieve this by:

- sharing both current and innovative means to teach the sciences fundamental to the practice of medicine, and
- providing a forum for discussion of issues in medical education which affect the basic sciences and those who teach these subjects.

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# MESSAGE FROM THE PRESIDENT

Roger W. Koment, Ph.D.

During this first year of operation for the International Association of Medical Science Educators (IAMSE), we have successfully completed much of the groundwork that will carry us well into the future. Many of these accomplishments concern the "nuts and bolts" of any beginning organization; and, while most may be of little interest to our members, they are necessary for administrative purposes. Many of these achievements have been inordinately time-consuming for us as volunteer faculty, but they have not detracted from visible progress toward our primary goals. All have provided the foundation to support projects that directly address our mission statement (see inside front cover).

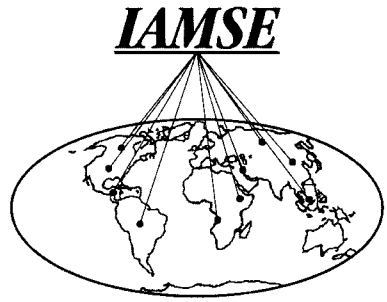
IAMSE is now a bona fide non-profit organization. That means we have successfully negotiated the course to become eligible to receive grants from government and Foundation sources. In this issue of our journal, we gratefully acknowledge Gold Standard Multimedia, Inc., and the National Medical School Review, as the first of our Annual IAMSE Corporate Sponsors (see inside back cover and p.39). The development of both grants and corporate sponsorships is necessary so that we may create useful educational resources while maintaining membership fees at an absolute minimum. The Board of Directors has further addressed the issue of equitable membership fees by creating a rate structure based upon the GNP of each country, as determined by the World Bank (see p.37). The net result of all these actions is that membership in IAMSE has increased to include individuals from the medical institutions of 31 countries.

As the resources and membership of IAMSE grow, so too have the tangible benefits of membership. From its humble beginnings as a simple newsletter, the *Basic Science Educator* has now evolved into an internationally recognized peer-reviewed journal, facilitating communication between teaching faculty across all medical science disciplines. This issue contains contributions from authors in seven countries! Plans for expansion of the Editorial Board are now under way through our search to appoint a Managing Editor and a Production Editor (see p.15), and up to fifteen individuals as additional Manuscript Reviewers (see p.20). This issue also contains the first advertisements for commercial products in medical education. While knowledge of these products is important to each of us as medical educators, fees for such advertising also help to offset the printing and distribution costs of our journal. When speaking with company representatives, remember to thank them for supporting communication between medical science educators with their advertising dollars.

The second tangible product for which our organization has become widely known is a series of biennial international conferences on educational strategies in the medical sciences. Since their inception in 1993, these events continue to grow in reputation, and registrations are always "sold out" weeks before the early deadlines. We continue our policy of selecting one medical school each time to host these events, and for the upcoming Fourth Biennial Conference, July 17-20, 1999 (see p.26) we were pleased that sixteen medical schools from North America had volunteered to take this role. Such demand for both attendance and hosting serves to underscore the important contributions these conferences provide to individual teaching faculty. IAMSE members directly benefit by receiving a 15 to 20% discount on the registration fees, plus priority access.

A third tangible benefit of IAMSE membership involves the creation of new features on our website, some of which will remain available only to members (see p.30). The first change Ms. Julie Hewett, our new Webmistress, Business Manager, and Association Secretariat (see p.33), has made was to relocate the website to a more proper address for a non-profit worldwide organization, <http://www.IAMSE.org>. Projects that involve interaction between individuals through web technology will become a centerpiece of IAMSE's future, and even exceed the growing demands we currently have for both journal and traditional conference access. Faculty development activities over the web are but one idea actively under development. Initially, projects will be led by individuals from the Board of Directors, each of whom has been requested to form working groups of IAMSE members to accomplish their goals. These various projects will provide opportunities to multiple individuals for professional growth and international recognition, as well as opportunities to help guide the role of IAMSE in medical education. We encourage you to become involved (see p.35).

Each of us has been charged with the task of training competent and compassionate physicians for the 21st Century. We are of one voice: science must continue to be the foundation of clinical medicine. We know the challenges which new educational findings and diminishing funds have brought to our professional commitment. However, we also know the benefit of strength in community, common cause, and steadfast adherence to the highest professional standards. IAMSE is the vehicle of this common vision of excellence, and we encourage your continued participation.



# Development of Problem-Solving Teaching and Assessment in a Molecular Cell Biology Course

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## INTRODUCTION

The University Medical School of Pécs has a rather traditional type of curriculum, with students beginning their medical studies after high school, typically at the age of 18. Approximately 180 and 80 students are accepted to our Hungarian and English programs, respectively. The 6-year medical curriculum consists of 2 years of basic sciences, 1 year of preclinical subjects, 2 years of clinical studies and a final year of clerkship. Molecular cell biology is taught during the two semesters of the first year, and for more than two decades the emphasis has been on improving and assessing problem-solving skills. This article will briefly describe three of the most useful techniques developed over the years, Application Tests, Figure Analysis, and Planning of Experiments.

*We have found these three forms of student exercises to be useful educational tools first, because they make the process of teaching and learning more interesting, and therefore, presumably, more efficient.*

## FEATURES OF THE MOLECULAR CELL BIOLOGY COURSE

Forms of teaching in this course include lectures for the whole class, as well as practicals and seminars for groups of 15-20 students. The main topics covered in this course are listed in Table 1.

Student performance is regularly monitored by tri-weekly midterm tests. At the end of both semesters students are required to pass an examination to be allowed to continue their studies. These exams consist of a multiple-choice question-based written test and an oral examination.

**Table 1.** Topics in Molecular Cell Biology

| |
|---|
| Functional Morphology of the Eukaryotic Cell |
| Nucleic Acid and Protein Synthesis |
| Regulation of Gene Expression |
| Tumor Biology |
| Cytogenetics |
| Molecular Medicine |

Techniques of cell biology and molecular biology continue to become integrated within the clinical subjects making these methods increasingly important for diagnostic and therapeutical purposes. Therefore we strongly believe that medical students should develop problem-solving skills to understand novel molecular approaches to medicine. To this end, we try to apply an experimental approach to our subject. In the last 20 years we have developed problem-based educational exercises to improve and test the creativity of medical students. The main principles of three of our problem-oriented exercises are described below, with illustrative examples given for each. For further details and examples, the reader is referred to earlier publications.[1-5]

### *Application Tests*

Such a multiple-choice question-based test is usually prepared from an original paper,[1] and presents the aim of the study, the experimental setting and the results. The student is expected to draw the right conclusions by answering a set of multiple-choice questions. A good application test thus combines problem-solving with objectivity.

EXAMPLE: The consequences of ΔF503 mutation in the cystic fibrosis gene (based on Yang et al.[6] and Pind et al. [7]).

Cystic fibrosis (CF) is the most common autosomal recessive disease in Caucasian populations. It is characterized by increased viscosity of secretions of various exocrine glands, leading to obstruction of the intestine, fibrosis of the pancreas or severe pulmonary infections. Identification and cloning of the CF gene was achieved in 1989, and was found to code for a chloride channel named cystic fibrosis transmembrane conductance regulator (or CFTR). Surprisingly, the most common mutation leading to CF (the ΔF508 mutation) was found to not have much effect on the chloride channel activity of the protein.

The aim of the experiments described in this test was to identify the consequences of the ΔF508 mutation. In the first set of experiments the authors wanted to determine if the cellular lo-

calization of the mutant protein is normal. They infected a pancreatic cell line expressing no endogenous CFTR protein, with recombinant adenovirus vectors coding for wild-type (wt) or ΔF508 CFTR protein, and studied the intracellular distribution of the exogenous proteins in these cells. They found that while the wt-CFTR protein was mainly present in the cell membrane, the ΔF508 CFTR protein accumulated in the rough endoplasmic reticulum and was absent from the cell surface.

To analyze the metabolism of CFTR, protein cells expressing wt or ΔF508 CFTR were labeled with [35S]-methionine. After brief labeling, unlabelled methionine was added to the culture medium (pulse-chase labeling). At different time points of chase, samples were withdrawn from the cultures, cell extracts were prepared and immunoprecipitated with an anti-CFTR antibody. The experiment was performed in cells treated with ammonium chloride, an inhibitor of lysosomal function, as well.

INSTRUCTIONS: How to Solve the Multiple Choice Questions

FIGURE ANALYSIS
The following statements are related to the information presented above. Based on the information given, select
A. if the statement is supported by the information given
B. if the statement is contradicted by the information given
C. if the statement is neither supported nor contradicted by the information given

QUANTITATIVE COMPARISON
In this type of question, paired statements describe two entities that are to be compared in a quantitative sense
A. if A is greater than B
B. if B is greater than A
C. if the two are equal or very nearly equal

FIVE-CHOICE COMPLETION
This type of question consists of a question or incomplete statement followed by five suggested answers or completions. Select the one best answer.

Study the autoradiograph of the immunoprecipitates (Figure 1) and solve the questions that follow.

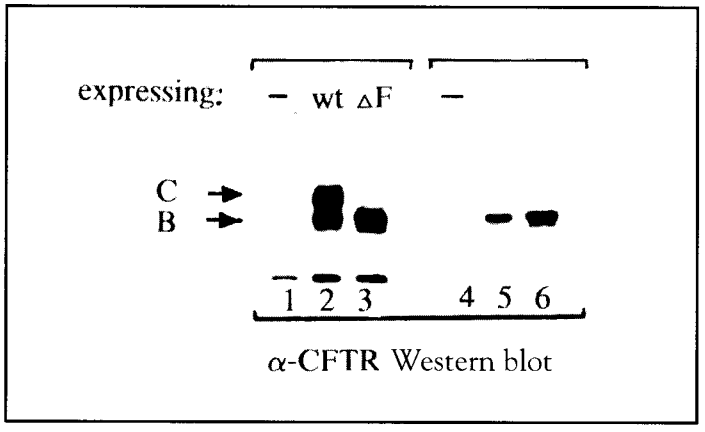


**Figure 1.** Pulse-chase labelling of wild-type (WT) and mutant (ΔF508) CFTR proteins.

FIGURE ANALYSIS
1.__ The mutant gene is not transcribed.
2.__ The mutant mRNA is unable to bind to ribosomes.
3.__ There is a precursor —> product relationship between the proteins in bands B and C.
4.__ Protein C is generated from protein B by a signal peptidase.

QUANTITATIVE COMPARISON
5.__ A. The lifespan of wt-CFTR protein in the cell
B. The lifespan of ΔF508-CFTR protein in the cell

FIVE-CHOICE COMPLETION
6.__ Which of the following statements can explain the difference in electrophoretic mobility between protein B and C?

A. Protein C is a dimer stabilized by ionic bonds
B. Protein C is a dimer stabilized by hydrogen bonds
C. Band C contains an RNP stabilized by ionic bonds
D. Band C contains a RNP stabilized by hydrogen bonds
E. Protein C is a glycoprotein

7.__ Evaluate the effect of ammonium chloride. Which of the following statements best describes the role of lysosomes in CFTR metabolism?

A. Lysosomes are not involved in CFTR degradation
B. Only the glycosylated form of CFTR is degraded in lysosomes
C. Only the non-glycosylated form of CFTR is degraded in lysosomes
D. Both glycosylated and non-glycosylated forms of CFTR are degraded in lysosomes
E. Only the mutant form of CFTR is degraded in lysosomes

In the last part of the experiment the role of calnexin in the metabolism of CFTR was studied. Calnexin is a transmembrane protein of the endoplasmic reticulum that acts as a chaperone. Extracts were prepared from cells not expressing CFTR protein (samples 1 and 4 in Figure 2), and from cells expressing the wt-CFTR (samples 2 and 5) or the mutant CFTR (samples 3 and 6). The extracts were immunoprecipitated with anti-CFTR (samples 1 to 3) or anti-calnexin antibodies (samples 4 to 6). The immunoprecipitates were fractionated by SDS-polyacrylamide gel electrophoresis and Western blotting was performed using an anti-CFTR antibody.

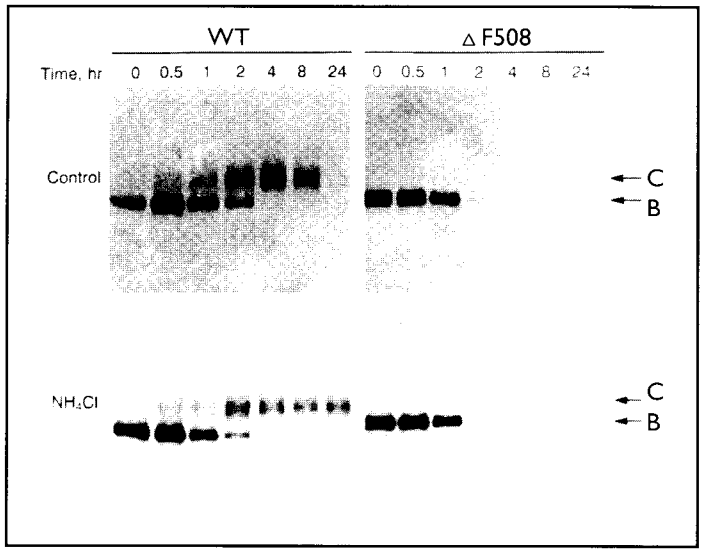


**Figure 2.** Interaction between calnexin and wild-type (WT) or mutant (ΔF) CFTR proteins.

FIVE-CHOICE COMPLETION

8.__ What was the aim of this experimental setting?

A. To determine the exact location of CFTR in the cell
B. To determine the exact location of calnexin in the cell
C. To determine if CFTR and calnexin are complexed in the cell
D. To determine the rate of synthesis of CFTR
E. To determine the rate of synthesis of calnexin

9.__ What is the main conclusion of the immunoprecipitation-Western blot experiment?

A. The wt-CFTR is unable to bind to calnexin
B. The ΔF508-CFTR is unable to bind to calnexin
C. Only the glycosylated forms of CFTR bind to calnexin
D. Only the non-glycosylated forms of CFTR bind to calnexin
E. Calnexin does not bind CFTR

10.__Based on these experiment, what would be the best way to cure CF cells?

A. Expression of the calnexin-binding domain of ΔF508 in these cells
B. Expression of the protein-binding domain of calnexin in these cells
C. Expression of calnexin in these cells
D. Inhibition of N-linked glycosylation in these cells
E. Inhibition of lysosomal function in these cells

CORRECT ANSWERS

1)B, 2)B, 3)A, 4)B, 5)A, 6)E, 7)B, 8)C, 9)D, 10)A

### *Figure Analysis*

In this exercise a figure and its legend is presented to the students. The legend contains all the pertinent information required to understand the experimental situation. After analyzing the figure, students are asked to evaluate its results and draw conclusions by answering open-ended questions.

EXAMPLE: The biochemical activity of SV40 large T antigen (based on reference 8)

A.

5'-CAGCCAAGCTTGGCACTGGCCGTCGTTTTACAACGTCGTGACT-3'
3'-ATGTTGCAGCACTGA-5'

B.

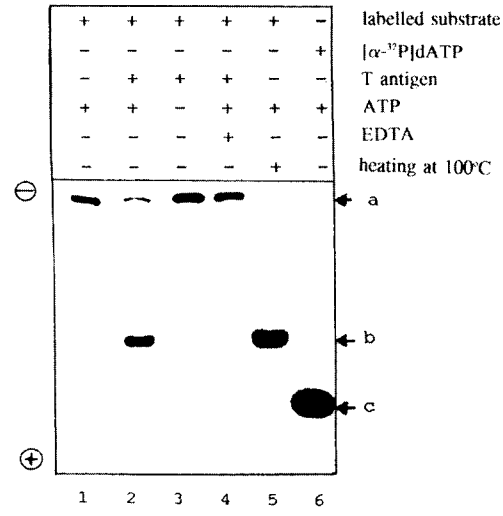


**Figure 3.** Identification of the enzyme activity of SV40 large T antigen.

Figure 3 shows the results of an experiment in which the enzymatic activity of the SV40 virus large T antigen was identified. The substrate was prepared as follows. The synthetic oligonucleotide duplex shown in panel A was incubated in vitro with dCTP, [(-32P]dATP and DNA polymerase I and the labeled DNA was separated from the other components of the mixture. The labeled substrate was then incubated in vitro under the conditions indicated in panel B and the samples were fractionated by polyacrylamide gel electrophoresis and subjected to autoradiography. (- and + indicate the position of electrodes during electrophoresis.) Study the figure and answer the following questions.

1. Describe the substrate produced by labeling.
2. What molecules correspond to bands a, b and c?
3. What enzyme activity is carried by the T antigen? What conditions are required for the enzyme to function?

EXPECTED ANSWERS

1. Under the experimental conditions the synthetic oligonucleotide served as a template-primer complex in the in vitro DNA synthesis reaction. Three labeled A-nucleotides and an unlabeled C-nucleotide were attached to the 3'-end of the lower strand. The substrate thus consisted of an unlabeled longer strand

and a radioactively labeled 19-mer.

2. Band a corresponds to the duplex (it disappears after heat-denaturation; sample 5); band b contains single-stranded 19-mer molecules (band a shifts to b after heat denaturation); band c contains the mononucleotide dATP.

3. The T antigen has the same effect as heating: it has helicase activity (compare samples 2 and 5). It requires ATP and divalent cations to separate complementary DNA strands (compare samples 2, 3 and 4).

### *Planning Experiments*

In this type of exercise the students are presented with a scientific problem and are asked to design an experimental approach to study the problem.

EXAMPLE: Plan an experiment to determine the degree of amplification of the N-myc gene in a human neuroblastoma tumor

EXPECTED ANSWER: (Please note that in most cases more than one correct solution to the problem exists.)

DNA should be prepared from the tumor sample and subjected to Southern blot analysis using probes specific for the N-myc gene and for a gene known to be a single-copy gene. If hybridization conditions – size and specific activity of the probes – are identical for the two genes, copy number of the N-myc gene can be determined by comparing the intensities of the hybridization bands.

## CONCLUSIONS

We have found these three forms of student exercises to be useful educational tools first, because they make the process of teaching and learning more interesting, and therefore, presumably, more efficient. Application Tests are best suited for self-instructed learning, while Figure Analysis and Planning of Experiments are ideal for small-group discussions. Using such exercises in a seminar format allows for a wide range of scientific facts and terms to be presented in a creative, rather than routine way. And secondly, we use such techniques – in combination with methods measuring factual knowledge – for examination purposes to assess higher quality student performance.

Although these educational methods are described for a course on molecular cell biology, similar exercises can be prepared and used in all fields of the natural sciences, including clinical subjects.

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# The Sciences In the Education of Physicians

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## INTRODUCTION

Although there has been much criticism of how the basic sciences are being taught in many medical schools, medical educators remain convinced that medical sciences are essential as the scientific foundation for the practice of medicine, and hence for medical education. The question is how this can best be accomplished. The traditional two plus two curriculum, in U.S. medical schools and most schools worldwide, was based on the German model of the late 19th Century. This was first adopted in the U.S. by (the then new) Johns Hopkins School of Medicine, and later promulgated by Flexner in his influential report[1]. This model of medical school structure and curriculum organization, together with rapidly expanding research activities, has been remarkably stable for nearly a century. In particular, strong medical science departments have provided the foundation for advances in the biomedical sciences and have produced generations of physicians with strong scientific backgrounds and a near plethora of basic scientists. Unfortunately, this overwhelming success may have blinded us to the fact that some of the original assumptions of this model are no longer tenable and consequently, the model is in need of change.

One such assumption was that the scientific research method was prototypical for clinical reasoning used in medical practice, and thus students should master the sciences and the scientific method before beginning clinical training. Medical students were expected to master all the basic medical sciences (originally anatomy, both macroscopic and microscopic, and embryology, physiology, bacteriology, and pathology) prior to the engagement in clinical medicine. The explosion of the knowledge base of these disciplines and the creation of new disciplines, e.g., biochemistry, neuroscience, pharmacology, immunology, information sciences, have made "mastery" unachievable. Moreover, evolving evidence that integration between basic and clinical sciences may be a critical factor in superior diagnostic performance[2] questions the rationale of separating basic science learning from that of clinical medicine. Since the mid-fifties, and with increasing frequency in recent years, deficiencies of the paradigm have become apparent[3] and initiatives for changes in curriculum and instructional design have been instituted[4-8], in some instances supported by novel concepts of faculty engagement and organization[5,7].

Nevertheless, by design or default, there continues to be a tendency of force feeding students with an indigestible overload of facts that drives them to rote memorization of isolated facts instead of learning to understand basic principles supported by facts[9,10]. Evaluation systems, especially those utilizing multiple choice examinations, promote this approach to teaching/learning the basic sciences. Basic sciences are much too valuable to the process of clinical problem solving to be misused in this fashion. It is now accepted that successful clinical problem solving primarily depends on mastery of domain content[11]. Mastery in turn depends not on information quantity, but its organization. The knowledge of experts is organized into schemata (basic science and clinical information integrated into meaningful networks of concepts and facts) useful for both learning (information storage and retrieval) and problem solving. In the following, we will focus on this century old issue. We will explore how basic science teachers should take a different approach to make the basic sciences the road rather than a roadblock to becoming a physician.

## LEARNING AND TEACHING

The goal of education is learning and the demonstration of behavioral changes by students of having acquired cognitive, psychomotor, and professional behavior skills that ultimately are expected of the competent physician. For students to reach that goal, we must define what those skills are, provide experiences that promote acquisition of these skills, and develop assessment tools that provide feedback to students and teachers of what has been accomplished. Hence, objectives, learning experiences, evaluation/feedback are the pillars of education, which must be internally consistent and clear to students and teachers.

### *Objectives*

Objectives must be derived from what the physician is called upon to do and not exclusively from the wealth of factual knowledge of the teacher. They must encompass the skills essential for the physician to solve patient problems or, in other words, make clinical decisions when facing clinical presentations. Physicians, or students, must be able to relate the clinical presentation (its signs and symptoms, investigative findings) to some biomedical and/or psychosocial cause or causes by successfully retrieving from memory and other sources information necessary for problem resolution. The clinical reasoning process used is specific and highly tailored to the complexity of each problem. It is based on the same schemata of integrated basic and clinical science infor-

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mation originally utilized in aid of learning.

The consequence for basic science learning objectives is obvious: the knowledge domain of medicine, construed as one large problem area, is made up of a finite number of problem areas, each representing a clinical presentation. Once these problem areas or clinical presentations are defined, the students must have sufficient knowledge of underlying basic science and clinical principles to understand each problem area. They also must have the skills to search for the facts needed to explore and understand the cause(s) of the patient's presentation. This should lead them to an accurate diagnosis, a prognosis, and a management plan. In collaboration with the clinicians, the basic science teachers must define the biomedical and psychosocial principles (some create one word: biopsychosocial) and knowledge base underlying the clinical reasoning process[1]. While the faculty should be responsible for identifying and helping students learn these principles, students must become proficient in finding independently the information specific to the problem area, ascertaining its validity, and deciding the amount of detail required to render the problem area meaningful for them.

***Evolving evidence that integration between basic and clinical sciences may be a critical factor in superior diagnostic performance questions the rationale of separating basic science learning from that of clinical medicine.***

### *Learning Experiences*

Objectives developed in the above manner require learning experiences different from the traditional teaching of the basic sciences. The teacher will no longer be responsible for presenting students with endless lists of facts but rather with a well-planned set of fundamentals as an introduction to the world of factual knowledge and as a link to clinical medicine. Incidentally, many faculty perceive themselves as providing the framework, while the students and others perceive that little has changed. Further, basic science teachers will serve the students as guides to facts and not as sources of facts. Organizing clinical problem areas into schemata with specific basic science underpinnings combines the learning of the basic sciences and clinical problem solving. The structures created in the first two years of training are revisited in the clerkship and again in residency training. The transition to postgraduate clinical training is facilitated; there is no need to either re-organize knowledge or re-learn basic sciences. As necessary, the schemata can be altered to accommodate new concepts, new information is inserted into existing scaffolding, and schemata are continuously improved to serve the needs of the learner during changing situations and environments.

Such an approach will change the instructional strategy from teacher to student orientation. It will also lead to the acquisition of facts in relationship to patient problems and apply to their teaching implications for learning from cognitive psychology discoveries. According to these findings, recall of learned facts is facilitated if aspects of the recall situation are encoded in memory when learning occurs. The learner develops idiosyncratic memory structures (schemata or semantic networks), that are meaningful sets of connections among abstract concepts or specific experiences[12]. Thus, structuring of knowledge and its encoding environment (both context and process) should become key elements of the instructional strategy. The approach proposed above fulfills this requirement, as it leads to acquisition of facts in the context of clinical presentations (patient problems) and in the process of problem solving. Students should have fewer problems in recalling this factual information in similar situations than having learned it in the traditional context of basic science teaching. This approach has been referred to as "teaching medicine upside down"[13].

The process of storage and retrieval of information from long-term memory together with the acquisition of skills of locating and retrieving information from other sources must become a major component of the students' learning experiences throughout medical school. Time must be provided for students to have repeated relevant practice in retrieving information in this manner. The hypothetico-deductive strategy, most frequently utilized in problem-based learning curricula, supports the acquisition of information retrieval skills and promotes learning for meaning rather that rote memorization[14]. Yet all evidence available in medical education research suggests that there is no universal, generic problem solving process. There is a clinical reasoning process that is specific and highly tailored to the complexity of each clinical domain. Consequently methods for teaching clinical problem solving should not be based on the assumption of a universal, generic process. The alternative consistent with this view is scheme-driven problem solving, a strategy that preserves many of the best features of problem-based learning, but at the same time ensures a specific, more organized approach to problem solving[15]. Information search, its retrieval, and interpretation will be critical skills of practicing physicians for diagnosis and management decisions. The methodology of evidence-based medicine is rapidly becoming a standard approach[16].

### *Evaluation and Feedback*

Evaluation is frequently degraded to the exclusive function of grading students rather than making it a significant component of student and faculty members learning experiences. Feedback from the evaluations should help students to plan further learning and teachers to assess their instructional efforts. In many respects, evaluation drives learning. Unless teachers accept that reality, they will not be willing to accord the necessary time and effort to conducting evaluations.

In the same manner that we now recognize the absence of a single problem solving process, there is no single ideal evaluation method that can assess the complex set of skills that is the basis of physician competence. Consequently, evaluative methods should be chosen from an array of options to satisfy specific evaluation needs. For instance the "triple jump" method[17], the use of standardized patients[18] with appropriate interstation evaluation,

"progress testing"[19], and judiciously selected MCQs should be considered. Recently, methodology has been described to assess personal and professional development by combining student portfolios with faculty interviews. The aim is to foster student self-assessment by means of the portfolio and provide faculty feedback and encouragement in the interview [20]. A combination of this approach with those mentioned above may provide a more comprehensive assessment of the students' progress toward becoming physicians - the ultimate goal.

## CONCLUSIONS

Implementation of an educational program based on sound educational principles, such as those outlined above, is not an easy task and requires that some organizational and resource prerequisites such as those outlined below are met[21].

- Institutional leadership that strongly supports a unified approach and provides the necessary resources both human and material. It must clearly show that faculty members will be rewarded for outstanding performance as educators in terms of salary and tenure and promotion.
- Departmental willingness to abrogate total authority over parts of the educational program that usually were considered undisputed departmental domains.
- Budgetary allocations to the departments based on each department's faculty contribution to the educational program considering quantity and quality of effort[22].
- A sustained interdisciplinary effort of the basic science and clinical faculty members throughout the four years (or more) of medical school combined with the creation of interdisciplinary groups of faculty members[23].
- Effective logistics support for program planning, implemen tation, and evaluation, usually provided by an office or center for medical education.
- An office on medical informatics to provide support to students and faculty members in utilizing information resources.
- A faculty development program to ensure that teachers are able to utilize the available information resources and be knowledgeable about the findings of cognitive psychology to be able to apply them to their teaching assignments.
- A facility and resources to develop a standardized patient program for student learning and assessment.

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# SPECIAL PRESENTATION

## From the Third Biennial International BSEF Conference Charleston, SC, U.S.A., June 24, 1997

*The Biennial International Conferences of the former Basic Science Education Forum (BSEF), and now IAMSE, strive to present issues for discussion which are of importance to a wide range of medical faculty. Information relating to changes in the United States Medical Licensing Examination (USMLE) is always of value to medical science educators, and over the past two years, this has become especially true. The major focus of that current interest has been the plans for conversion by 1999 of this "pencil and paper" examination to a totally computerized form. This change is scheduled to occur for USMLE Steps 1, 2, and 3.*

*The Program Committee therefore considered it most appropriate to invite Dr. Robert Galbraith, Deputy Vice President and Director of the Medical School Liaison Division of the National Board of Medical Examiners, to provide a Special Presentation on this topic at the 1997 Biennial International BSEF Conference. Dr. Galbraith's presentation was attended by virtually all 178 conference participants, and was an excellent introduction and demonstration of the new computerized exam format. Reprinted as the following article are excerpts from the direct transcript of that presentation. The complete transcript, including audience questions and answers, is available in the 1997 Conference Proceedings document.*

*For this issue of the* Basic Science Educator, *Dr. Galbraith has added an Addendum to his transcript that will bring the reader up to date since this Special Presentation of June 24, 1997.*

# Computerized Testing and the United States Medical Licensing Examination

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## INTRODUCTION

The current direction of the United States Medical Licensing Examinations (USMLE), as we see them in relation to Basic Sciences, increasingly is a continuum that extends through the clinical training period and thus is reflected on all three Steps of the exam. To better accomplish this task, in 1999 we will be making the transition from paper and pencil examinations to computerized testing for USMLE Steps 1, 2, and 3. Average testing time will be shortened, and full interactive case simulations will be incorporated into Step 3. However, a number of issues are raised by such a move, and I would like to briefly address some of these.

## WHY COMPUTERIZED TESTING

The answer is first and foremost (Table 1) that we can substantially enhance the examination in terms of what can be asked. Paper is static, but computers allow for simulations; simulations of either patients or experiments in which problem-solving skills must be demonstrated. All senses become involved through computers by capitalizing on the ability to utilize heart sounds, view electrocardiograms, see X-rays, and interact with simulated patients. Cost is another consideration. Images are expensive to print on paper, especially good quality color images, whereas these may readily be generated by computer upon demand. Another consideration is increased flexibility. Computerized exams can be offered throughout the year instead of only twice on set dates. It is also possible to calculate and report scores back to individuals and schools much more quickly.

There is also the issue of "irregular behavior", a polite euphemism for cheating. This occurs in only a minority of cases, but to those involved it has become a serious business. You may have heard about an armored security truck that was hijacked for the purpose of obtaining a shipment of USMLE exams. Obviously, opportunities for theft become numerous when hundreds of thousands of booklets are being physically shipped around the

world every year. Although hackers may attempt to steal information electronically generated, we feel the continually improving defense systems offer much better odds of security. In addition, computerization permits randomizing questions so that every examination booklet is different. Unlike paper test booklets, it would not help an individual student to look at answers on another candidate's computer screen. Because of the increased pool of questions, odds actually dictate that study of material is a more efficient strategy for success than attempting to steal questions!

**Table 1.** Why Computerize USMLE

| |
|---|
| Enhanced simulations |
| Reduced expense |
| Increased exam offerings |
| Faster score reporting |
| Increased exam security |

## HOW WILL COMPUTERIZATION BE ACCOMPLISHED

Currently in excess of 125,000 administrations of the USMLE occur each year, the majority of which in the US are within medical schools. An additional 100,000 subject ("shelf") examinations are also administered within the medical school setting. With each school currently providing testing facilities, proctors, and security, they collectively are in effect, subsidizing partial costs which otherwise the National Board of Medical Examiners (NBME) would pass on to the students. However, in a typical June, there are some 35,000 to 40,000 individual examines. Clearly there are not that many secured computer stations within the 125 medical schools of the United States! Starting with the premise that medical schools are therefore not equipped to administer a computerized USMLE, our solution is to engage a third party.

*All senses become involved through computers by capitalizing on the ability to utilize heart sounds, view electrocardiograms, see X-rays, and interact with simulated patients.*

The Sylvan Testing network currently has an existing network of about 3,000 secure work-stations distributed over multiple centers within the United States, and this number is growing dramatically. Business increases as more organized groups, such as the Graduate Record Examination, Scholastic Aptitude Test, etc., discover the benefits of computerized testing. While expansion of the supply of computer seats available is beneficial to USMLE, the increased demand from other exam programs also creates restrictions.

For that reason, discussions continue with medical schools being involved with developing their own testing centers. Arguments in favor of this include the consistent availability throughout the year of a small number of secure workstations; the "user friendliness" of having a student at least be familiar with the examination environment rather than traveling to an unfamiliar site; issues of maintaining a longstanding relationship between NBME and U.S. medical schools in the testing and medical licensing process; and for students, holding the testing fee at a reasonable level.

In either scenario, numbers of examination candidates is an important issue. All data indicates that June is by far the heaviest demand month, as more than 80% of U.S. medical schools now require passing of USMLE Step 1 for promotion into the third year. This policy therefore provides only a narrow window of time through which pass a huge number of candidates. If adequate work-station capacity can be developed for June, the remainder of the year can easily be accommodated.

The most likely solution must be to spread the examination period over a longer period of time. But to do this, every test must be unique to prohibit breaches of security. To prepare unique exams, however, raises issues of item difficulty, a unit of measure as perceived by students. At NBME the vast majority of examination questions are first field tested on prior examinations. Although not included in the student's grade, these are nonetheless scored and rated for level of difficulty based upon student response. Extremely easy and extremely difficult questions are discarded and most items retained will have a difficulty level in the range of 20-80%. With a difficulty ranking available for each question, it is apparent how unique individual exams can be created and yet scores can take full account of differences in item difficulty.

## PRINCIPLES OF ADAPTIVE TESTING

Adaptive testing is one means to manage difficulty levels during examinations. Basically, if a difficult item is answered correctly, the next item will be slightly more difficult; and the next, and the next, until the examinee reaches his or her level of performance. This indicates the individual plateau of knowledge has been reached. Likewise, if a question is answered incorrectly, an easier question appears next, followed by an easier question until the examinee answers correctly. This too, identifies a plateau of knowledge. By incorporating adaptive testing, individuals at the extremes of difficulty would be required to answer fewer questions to complete the examination, as compared to those with intermediate ability, whereas more questions would be required from those at the lower end of difficulty. Although there are several technical difficulties to be solved, our intention is to phase in adaptive testing to all three USMLE Steps when it is available.

## ADDITIONAL CONSIDERATIONS

Because of adjustments based upon item difficulty, it is our current plan to shorten USMLE examinations. Steps 1 and 2 will be administered over only one day instead of two, and consist of 350 questions instead of 680-700 as currently. A shorter examination has the added benefits of reducing student stress as well as

reducing charges for computer access time. Fewer questions also means less exposure to possible breaches of exam security.

Of course, reducing the number of test items by half raises the difficult question, are we still adequately testing the knowledge base? We feel reasonably confident because in the existing examinations, there is a level of built in redundancy and the new exams will all conform strictly to pre-determined content specifications. Another reason is that the USMLE is not designed to be totally inclusive, but rather test the minimal competency of a candidate to obtain licensure. The USMLE is designed to focus on the core issues that are taught in all accredited U.S. medical schools.

## AUTHOR'S ADDENDUM

During the time between this oral presentation and its modification for written publication, important decisions have been made. These include the following.

***The Exam***

Computer-based testing (CBT) will begin for Step 1 in April of 1999; for Step 2 in July of 1999; and Step 3 in October of 1999. There will be no immediate change in item content or format, although these will appear in shorter blocks of items (60 minutes as opposed to 180 minutes). There will be opportunities for breaks between blocks. For 1999, there will be no change in price ($280 per examinee for testing within the U.S.).

***Practice Opportunities***

In the fall of 1998, sample questions on CD-ROM will be made available. Similar practice questions will be placed on the web at <www.usmle.org> in early 1999. In addition, hands-on practice sessions will be available at AAMC national and regional meetings. Demonstrations will also be available during medical school visits or via teleconference.

***Application***

Applications for the CBT USMLE will be accepted and processed throughout the year, although it is desirable to submit up to 9 months prior to the desired test date. Candidates will receive a Scheduling Permit verifying the eligibility period granted and enabling the scheduling of a test date and site. This Permit is necessary to start the exam on the day of testing.

***Scheduling***

To schedule a date, a toll-free number will be provided to the Sylvan Testing Center. A customer service representative with special USMLE training will be available to help determine an available date and test site. Candidates may schedule up to 6 months in advance of the desired test date.

***Day of the Test***

Examinees will sign in, show their Scheduling Permit and one ID with photograph and signature. The test will begin with a tutorial, followed by seven 60-minute blocks of questions. Blocks may be completed and exited at any time prior to the allotted time periods. Breaks may be taken at any point between blocks, but cumulatively may total only 45 minutes. However, this may be supplemented with time saved by early exiting of either the tutorial or exam blocks. Partitions between work-stations function as sound barriers, although earplugs will be available.

***Score Reporting***

For accuracy and security, scores will not be reported at the time of testing. At this initial implementation of each Step of CBT, reporting will be delayed up to three months. This interval will be progressively reduced over time to reach the goal of fourteen days. The current score scale (mean of 200 and standard deviation of 20) will continue to be used.

# INNOVATIONS IN BASIC SCIENCE TEACHING AND LEARNING

Associate Editor: Harold Traurig, Ph.D.

## Integration in the Biomedical Science Curriculum

*A major focus for this column in the* Basic Science Educator *is integration of basic science concepts and clinical applications. The first article on this theme was written by Dr. Bruce Maley and appeared in the last issue. He described the integration of surface anatomy with an introduction to physical diagnosis as a teaching and learning strategy in a human anatomy course.*

*In this current issue, Dr. Giulia Bonaminio discusses the rationale for the development of an integrated curriculum. She also describes some of the problems and solutions regarding initiating and maintaining integration in a basic medical science curriculum. Dr. Bonaminio is well qualified to provide her insights, as she has experience working as a biomedical geneticist and basic science faculty member; and more recently, as a coordinator of the integrated curriculum at the University of Kentucky College of Medicine. Her appointment currently is at the University of Kansas School of Medicine, where she has been involved in curriculum revision and the planning and implementation of many new ideas in teaching and learning the basic and clinical medical sciences. The series of articles in this column on developing programs or instructional units relating to integration of the clinical and basic science curriculum will continue. I encourage all colleagues to submit their ideas and experiences for consideration for publication.*

# The Challenge of Integrating the Basic Medical Sciences

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## INTRODUCTION

Integrating the basic medical sciences with one another and with clinical experiences early in the curriculum is an important challenge facing medical schools today. Integration is valuable because it motivates learning and prepares physicians for the "real life" utilization of basic science in medical practice. Basic science is core to understanding current clinical applications and initiating improvements; and it is critical to demonstrate that basic science concepts and information must be retained and applied.[1]

*Integration is valuable because it motivates learning and prepares physicians for the "real life" utilization of basic science in practice.*

## INTEGRATION DEFINED

As medical schools encounter the challenges and opportunities associated with planning curricular integration, they will recognize that integration can take many forms and occur at many levels. Levels of integration range from presenting material in different courses in a coordinated fashion, to a "block" curriculum that crosses departmental boundaries. Integration occurs when "hard-core" basic sciences blend and are synergistic with each other, with relevant behavioral medicine concepts, and with the clinical sciences. In "horizontal" models of integration, items taught within the same year and at the same time are integrated. "Vertical" integration infers a longitudinal coordination of content across the four medical school years.

In addition to integration of content, it is also effective to integrate a variety of teaching and learning methods, including self-learning tasks. More traditional teaching methods, such as lectures, can be combined with small group learning, computer-assisted instruction, and standardized patients to provide a variety of formats, each appropriate to specific learning goals.

Medical school faculties tend to follow a similar pattern in developing new integrated curricula. Curriculum committees typically create task forces or subgroups of faculty members that focus on years of the curriculum, blocks of curriculum time or organ systems, and/or individual courses. These groups review

curricula from other schools, visit other programs, and bring in consultants. These processes are often, but not often enough, facilitated by grants for curricular reform.

## THE CHALLENGES WE FACE

Regardless of the path chosen, challenges to integration will always be encountered. The initial reaction by some faculty members is, "If it isn't broke, why fix it?" Faculty members believe that their students become fine physicians, so why is a change in the educational program needed? One response to this question is to point out that the dynamic nature of medical practice mandates continuous efforts to maintain a responsive education program. Another is in response to surveys in which graduates report deficiencies in their medical education. Additionally, a number of forces are exerting pressure on medical practice for change, such as changes in health care delivery, the information explosion, and the rapid growth of technology. It may be noted that other medical schools have responded to these pressures by integrating basic science concepts and topics such as managed care, introducing clinical experiences earlier in the curriculum, and providing computer skills training. Another effective response is "Why wait until it breaks to strengthen it?" Such responses to faculty members must be delivered in a very positive way to appeal to the critics' prudence, wisdom, and their interests in preventing the development of curriculum deficiencies.

An important factor supporting curricular change is the evolution of the United States Medical Licensing Exam USMLE. Although U.S. faculty members are adamant that they do not, and will not, "teach to the boards", they do want their students to do well on these important exams. As the items on the USMLE have become more interdisciplinary in nature, and as Step 1 becomes more clinically oriented and presenting problem-solving questions, the need for integration among the basic sciences, and between the basic and clinical sciences, has become more obvious.[2]

Another often asked question from faculty members is "How do we know that the new curriculum will be better?" Common indicators that are used to gauge the "success" of curricula, include local and national exam scores, and student and faculty feedback from surveys and focus groups. It is important to realize that many of the benefits of curriculum integration may not be evident or measurable until after graduation and sometimes well into practice. Therefore, a sound curriculum evaluation plan that will provide the resources necessary for tracking graduates to assess curriculum outcomes is essential.[3]

## PERSONAL CONFLICTS

There is usually one faculty member, or a small group, who detests any attempt to integrate the traditional curriculum. The focus of this opposition may come from prominent individuals and may derail the process in a variety of ways, ranging from lack of cooperation to outright obstruction. Strategies to deal with "naysayers" range from excluding those who display a closed mind on curricular revision, to working with those who may be converted with more supportive information. It is important to recognize that including a naysayer on a planning committee might help identify crucial issues and problems overlooked by those in favor of curriculum revision and integration.

Faculty members who display passive-aggressive behavior are another important challenge to the progress of curriculum development. They may not outwardly criticize the move towards a more integrated curriculum, but they can hinder its progress through indifference and misinformation about the goals of curricular integration. As with the group that complains more aggressively, their cooperation can often be obtained by providing peer information from carefully selected schools that have made integration work and providing feedback on the outcomes of curricular changes.

Some faculty members who oppose integration are reacting to a perceived threat to departmental identity. A common fear is that teaching a course without departmental ownership will diminish the role of, or need for, a particular department. A number of schools are working on productivity indices that will help faculty document their departmental and interdepartmental teaching contributions. To obtain cooperation for integrative curriculums, it is critical that administrations develop methods for assigning and rewarding interdepartmental and other integrative teaching contributions.

One of the biggest obstacles to integration is lack of communication. Faculty members, students, and administrators need to increase and improve their avenues of communication. Students frequently complain that they do not receive enough information about the changes in their education, especially those students whose curriculum changes in midstream. Students in a new curriculum often feel empowered, as we evaluate their experiences more closely and they are more attuned to feedback and expect appropriate changes. Schools have responded with a variety of data collection and feedback mechanisms including newsletters, surveys, focus groups, class meetings, and inclusion of students on educational committees. Faculty members and administrators need to disseminate data on the outcomes of curricular revision. Above all, students need to perceive that their feedback is valued and leads to appropriate change.

Last, but not least, a lack of resources can seriously impeded the progress of integration. A resource in great demand, but in short supply, is time. It takes a significant investment of quality time and effort to develop and coordinate an integrated curriculum before its implementation. During, the operational phase, involvement of more faculty members may be necessary; for example, when the new curriculum requires an increase in small group teaching. It must be recognized that this increased demand for educational commitment from faculty members parallels the pressures to obtain grants and see more patients. On the other hand, there may be instances where a reduction in teaching takes place due to elimination of unnecessary content repetition and the introduction of self-learning tasks.

## CONCLUSIONS

The more complex the curriculum integration, the more attention to coordination is needed. The response by some schools is to centralize interdisciplinary course administration. Office of medical education faculty members and staff facilitate course planning, implementation, operation, and evaluation.[4] The need for more time and personnel bring us to another important chal-

lenge, lack of funds. If funds are available, faculty members can be compensated for increased teaching efforts and for innovative approaches to integration. Also, education professionals and staff may be employed to assist with the implementation and operation of an integrated curriculum. Integration can be achieved without increased financial and staff support, but the road is longer and more uncertain.

The challenges of integrating the basic biomedical sciences may seem daunting, but strategies exist to overcome them and the results are well worth it.

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# ANNOUNCEMENT

## Call for Nominations - Managing Editor and Production Editor of the *Basic Science Educator*

The IAMSE Board of Directors is conducting a search for two individuals to join in the leadership of the Editorial Board of the *Basic Science Educator* (BSE). We are pleased to invite applications from qualified individuals for the volunteer positions of BSE Managing Editor and BSE Production Editor. Each appointment will be for a minimum of one-year (two issues). These volunteer positions carry the following responsibilities:

### MANAGING EDITOR

- Receives all manuscripts and other contributions
- Decides to which member of the Editorial Board manuscripts should be sent for peer review
- Evaluates reviewers' comments and relays this information to authors with decision to accept, accept with modification, or reject
- Works with Associate Editors and oversees their submitted manuscripts
- Has responsibility for final edits to all manuscripts to ensure format and proper grammatical English
- Works with the Editor to plan and coordinate the contents of each issue
- Works with the Editor to invite, and to follow up on invited articles
- Assists the Production Editor in overseeing layout

### PRODUCTION EDITOR

- Works with the IAMSE Business Manager and advises the Executive Committee on all issues of journal production costs
- Works with the IAMSE Business Manager on all issues related to corporate advertising
- Acts as the BSE liaison with IAMSE corporate sponsors
- Oversees the layout of each issue
- Oversees the printing of each issue
- Works with the IAMSE Business Manager on all issues of mailing the journal to members
- Works with the IAMSE Webmistress to design and coordinate posting of the journal, in searchable form, on the website
- Handles requests for hardcopy back issues and complimentary copies
- Works with the IAMSE Business Manager to coordinate complimentary copies for membership recruitment

In each case, the successful candidate must possess excellent skills in communication and a proficiency in the English language. Both Managing and Production Editors will also work closely with the Editor in building the BSE Editorial Board and creating other volunteer positions as needed.

The *Basic Science Educator*, published twice each year, is the official journal of the International Association of Medical Science Educators. It is the only peer-reviewed journal in medicine that deals specifically with issues in medical science education across all disciplinary boundaries. Both positions offer unique professional opportunities for creativity, international recognition, and career enhancement. All business for the BSE is conducted electronically, so we ask that you submit your e-mail letter of application to Roger Koment, Ph.D., IAMSE President and BSE Editor, at <rkoment@IAMSE.org>, and include your CV by attachment as Microsoft Word version 7.0 or earlier, Rich Text Format, ASCII, Windows, or DOS text file.

# SOCIAL ISSUES IN THE BASIC SCIENCES

Associate Editor: David Bolender, Ph.D.

*Perhaps you can identify with this scenario. You have just read some exciting new results that pertain to the topic of your upcoming lecture to the medical class. Eager to share these findings with the students, you present this material with great clarity and enthusiasm. However, most of the class appears marginally interested or maybe even unimpressed. What's happened to their awe about scientific discovery? Have they lost their fascination about great new ideas? These questions are central to the themes developed in this Special Invited Essay, "In Search of Awe and the Human Spirit", written by Dr. Allen Neims.*

*After receiving his MD from Johns Hopkins School of Medicine, Dr. Neims remained at the university for a pediatric residency and a short stint on the faculty. Because he had a heart for discovery, he decided to enter graduate school at Hopkins where he earned the Ph.D. in biochemistry. He then went to the Roche Developmental Pharmacology unit at McGill University and studied developmental aspects of drug metabolism, often using caffeine as a model drug to relate molecular, animal, and human experiments. In 1978, Dr. Neims became Chair of Pharmacology at the University of Florida College of Medicine at Gainsville. It was here that he began to develop a serious interest in educational issues, and eventually served for seven years as Dean of the College of Medicine. Recently, he has returned to the professorate to continue teaching in pharmacology and the pediatric clinics. In addition, he is interested in pursuing research into mechanisms behind several alternative-healing methods, a topic of growing social interest.*

*Because of this breadth of experience as basic scientist, clinician, and dean of a major university college of medicine, combined with his passion for medical education, we were pleased to invite Dr. Neims to reflect on what he feels are important issues we as medical educators must consider.*

# *SPECIAL INVITED ESSAY*
# In Search of Awe and the Human Spirit

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Change in the way we understand, teach, and practice medicine seems to be happening at an ever-accelerating pace. It is easy to lose perspective when one is himself or herself deeply enmeshed in such disorienting change. My perspective is that medicine, much like many other facets of our society, has been and continues to be dramatically transformed by science and technology.

It is with some pride that we should remember that median lifespan in the United States has increased in less than a century from about 55 years to nearly 80 years. But anticipated and unanticipated challenges always accompany such striking progress. Our population has a higher fraction of elderly people than ever before, and we do not yet know how to prevent or reverse many age-dependent problems. Death itself has emerged as an enemy to be fought with full resolve. The number of people with chronic disease for which we have inadequate treatment has increased remarkably.

People in general are ambivalent about science and technology, in part because of unmet and unrealistic expectations about the rapidity with which one can expect a "cure", and in part because of confusion with issues pertaining to animal rights, environmental destruction, fraud, greed and abortion. And most of our medical advances have been intellectually and technically sophisticated, a circumstance that has prompted increased specialization among physicians and other providers, and has contributed to the increasing cost of health care. The latter has prompted a massive reorganization of our health care delivery system.

Many of these factors have had a chilling impact on the patient-physician relationship, a deeply human and healing partnership that has always been central to the profession, and a willing, able and equal partner to science and technology. The former deals mainly with whole people, their families and communities and with wellness and self-healing; the latter has focused primarily on the "medical model", which stresses eradication of disease. Even prevention is often thought of as a preemptive strike in this model. Despite the success of science and technology, we see signs of unhappy patients and unsatisfied physicians every-

where. It is shocking to see how many of our current health problems relate to ill-advised human behavior. We must find ways to meet the challenges brought about by our success while at the same time pushing hard for even more from science and technology.

What's all of this to do with teaching basic science to medical students? A lot! Basic science education is pivotal to the attitudes and thought processes of future physicians. Jacob Needleman in a wonderful book titled, *The Way of the Physician*,[1] noted that being a physician was very special because the profession offered both exposure to great new ideas and transformations of the human spirit through relationship. He also noted with dismay that physicians are losing connection with both rich sources of happiness and satisfaction. The medical faculty, and especially the basic science faculty, can help students develop, maintain or recover their passion for great new ideas. We can also encourage personal growth through meaningful relationships with colleagues and faculty.

***I suspect (hope? trust?) that most people want a physician who is excited about great new ideas, who appreciates evidence and discovery, who is wise, and who is deeply aware of and sensitive to, human relationships and the process of healing.***

In my own education, I remember my excitement when Dr. Albert Lehninger presented the experiments that led to our understanding oxidative phosphorylation. The experimental results he presented forced me to the same interpretation despite my own desire to find another one; I had been part of a "great new idea" (new to me because he guided me through the process of discovery). I also remember vividly when Dr. Harold Harrison sat crying at his desk, at the then Baltimore City Hospital, over a child who had died a few hours earlier that day after a brief life of abuse. He was my patient, too, but I had not linked Dr. Harrison's tears with the child. When I saw him crying, I asked if there was anything I could do. He suggested gently, that I sit and cry with him. The science and the art of medicine are partners; to "cure" and to "heal" thrive on each other, each to be emphasized in its own time and place. Great new ideas and the spirit in each of us are synergistic.

Several factors have led to what seems to me to be a decreased emphasis on great new ideas and on the spirit of human beings (as patients, physicians, or scientists) in our teaching. They include 1) the explosive increase in information and the difficulty we have collectively in prioritizing what's to be learned, 2) the need for most successful faculty researchers to be somewhat narrowly focused, 3) the shift to a non-physician basic science faculty and the consequent decrease in the "natural affinity" between teacher and medical student, 4) the explicit desire of students for "certainty" in what they are taught despite the fact that the practice of medicine depends on comfort with uncertainty, probability, complex risk/benefit decisions, and a changing base of knowledge, 5) decreased time in the laboratory, and 6) a faculty necessarily concerned about issues of productivity, grants and tenure, and their future in a growth-constrained academic environment. The shift to more molecular-type research in the basic sciences, with consequent blurring of the boundaries of each discipline, adds even more complexity.

Space does not permit a detailed discussion of each of these issues. Instead, I would like merely to caution us about a system of internal evaluation in which the faculty, the administration and the students evaluate one another and the prime external evaluation comes in the form of tests and reviews by those, just like us, residing at other universities or organizations. We depend on the general public, directly or indirectly, for educational and research funding, and for patients. We must enhance our ability to read their signals as well. I wonder whether or not the railroad industry went through just such internal evaluations before they realized that they were in the business of transportation. I suspect (hope? trust?) that most people want a physician who is excited about great new ideas, who appreciates evidence and discovery, who is wise, and who is deeply aware of and sensitive to, human relationships and the process of healing.

Finally, I will add a few words as an emeritus dean about productivity and accountability in the basic sciences. The financial subtleties of each college of medicine within the United States are unique, but most have depended to an increasing extent since the 1960's on "surplus" clinical revenues to support the size and scope of their educational and research enterprises, as well as their ability to serve the less fortunate and to be involved in certain clinical programs that are not self sufficient. Simply put, we would be wise to plan for a decreased capacity of this source of revenue to do what it has done, albeit good, as our society seeks to control the cost of health care.

I urge you to be courageous in thinking through options. I don't doubt that we can be more effective and efficient. I recommend that we give each other and our students permission to be passionate about great new ideas and how they were discovered, and to embrace the spirit of humanity so deep within the tradition of our greatest scientists and physicians. I am fully aware of the fact that much of modern medicine seems to foster skills and conformity, but I believe the requisite details fit nicely around a foundation of wisdom and caring. Progress in these areas will serve our society well.

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# COMPUTER APPLICATIONS IN BASIC SCIENCE EDUCATION

Associate Editor: W. Marshall Anderson, Ph.D.

*Think back to about fifteen or twenty years ago, a time we will call BC (Before Computers). How did we in the basic medical sciences get along? We had only electric or manual typewriters, grade books, hand held calculators, and a telephone. But our world and our productivity changed dramatically with the appearance of a computer on our desk. Now think back eight or ten years ago, a time we will call BI (Before Internet). Some of us could communicate via fax, and we still used the telephone, but there was no e-mail, and for most of us no worldwide web. Our world changed again, perhaps even more dramatically when our computer became a networking device. We now use computers for almost every aspect of basic medical science education. Wordprocessing has become essential for preparing lectures, cases, exams, manuscripts for publication, student and course evaluations. Spreadsheet applications are used to calculate and keep track of grades and other class data. Plotting and drawing applications are used for diagrams and figures for lectures, cases, and exams. There are a number of teaching applications (both interactive and non-interactive) for most, if not all, the basic medical science disciplines. Computer networks are used for printing, sharing applications and resources, e-mail communication, gaining and retrieving information through the search of literature databases and viewing journals online, and perhaps most useful of all, the worldwide web for obtaining and sharing information and for teaching applications. It may be accurate to say that today the most valuable skill for faculty and students, both now and in the future, is the ability to use a keyboard and a mouse!*

*As the newly appointed Associate Editor of Computer Applications in Basic Science Education for the* Basic Science Educator, *I would like to explore the variety of ways we use computers in our profession of basic science education, including what works and what does not. As the lead-off article in this endeavor, we chronicle the experiences of an international team of basic scientist and clinicians collaborating via the internet. This has resulted in a series of interactive computer assisted learning (CAL) modules which serve to integrate basic science and clinical medicine. To make these CAL modules as widely available as possible, the collaborators converted each exercise to HTML/ Javascript version so it might be run interactively on the worldwide web using a graphic viewing browser.*

*This project is but one example of the focus for this column. I invite all who have "tales to tell" about the application of computers in basic science education to contact me (via e-mail, of course) with their ideas for articles for future issues.* <wanders@meded.iun.indiana.edu>.

# Computer Assisted Learning in Medical Biochemistry on the World Wide Web Accomplished by Electronic Collaboration

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## INTRODUCTION

A small international group of basic medical scientists and clinicians have collaborated to develop computer assisted learning (CAL) tutorials that differ from conventional computer assisted instruction (CAI) materials in that their goal is to advance students' operative knowledge rather than merely providing additional information. By operative knowledge, we mean knowledge gained through an active process that can be utilized in making reasoned decisions. The resulting series of patient-based tutorials feature clinical scenarios that permit students to explore important medical problems in a clinical setting while integrating their recently acquired knowledge of biochemistry. Thus, our emphasis has been on active learning, much as occurs in a student-directed problem-based learning curriculum. This approach is described below and referenced

at <http://www.umanitoba.ca/faculties/medicine/biochem/tutorials/introduction.html>

## ELECTRONIC CASES

In the first tutorial, "George", a patient in unexplained coma, is presented to the students who explore biochemical and physiological aspects of possible causes of coma and apply this new knowledge to interpreting laboratory findings. This exploration leads them to consider the biochemistry and pathophysiology of alcohol consumption and to discover that one of its side effects is causing his coma. Students learn that ethanol is metabolized by more than one pathway in the body. They gain an appreciation for the physiologic consequences of these pathways and ultimately are asked to apply the knowledge gained in this tutorial to suggesting an appropriate treatment for "George".

In the second tutorial another patient, "Frank", presents with abdominal swelling and what first appears to be jaundice. Students can examine present, past, and family medical history, physical examination results and various laboratory results including clinical chemistry, ultrasound, and liver biopsy. After exploring liver function and finally, iron metabolism in detail, students will conclude he is suffering the consequences of long-term iron overload. They are guided to a diagnosis based on the knowledge they have gained, and must then determine the correct treatment for "Frank". Throughout the tutorial, students may review the information they have encountered by clicking on "findings" in a "pull down menu".

*Electronic collaboration also allowed us greater success in joining the forces of basic scientists and clinicians comprising this international group to more completely intregrate basic and clinical science throughout each tutorial.*

"Frank" appears again in the third tutorial, this time with true jaundice. After exploring the causes, signs, symptoms, and lab findings (both blood and urine) of the major types of jaundice, students are invited to apply their new understanding to making a diagnosis based on the clinical scenario and test results. Throughout the tutorial, students are asked to identify components in blood and/or urine, which would be elevated in a particular type of jaundice.

Although there are two names for the patient, "George" and "Frank", this is really the same patient. By following the same individual through a series of clinical problems and scenarios, we have mimicked a technique used in a popular medical biochemistry textbook.[1] Students have the opportunity to follow a patient through a problem while learning basic biochemical facts associated with the clinical problem, much in the same way a paper problem-based learning case would be presented. The major difference however, is that the student is acquiring knowledge and solving the problem on his/her own, rather than through interactions with others in a small group. This is more analogous to a physician in actual private practice.

In all three tutorials, students interact with the tutorial by entering answers via keyboard to questions at various parts of the tutorial. A correct answer is rewarded with positive feedback and the ability to proceed further, while a wrong answer elicits probing questions and encourages students to "backtrack" and review information before attempting another answer. Rhetorical questions are also posed at various stages to help students think about this problem and consolidate their knowledge base.

## THE TUTORIAL DEVELOPMENT PROCESS

The starting points for these tutorials were initially created by Marcel Blanchaer in rough draft form on the Macintosh computer using the SuperCard authoring application. They were then sent electronically to each of the collaborators who, through extensive e-mail dialogue, provided revisions and enhancements to the original concept. Because of computer capabilities and e-mail communication, we were able to assemble a working group, which even ten years ago, would have been virtually impossible because of the geographical distances between individuals. Electronic collaboration also allowed us greater success in joining the forces of basic scientists (biochemists) and clinicians (pathologist) comprising this international group to more completely integrate basic and clinical science throughout each tutorial.

Very often conflicts in opinion occurred during the development process. These conflicts were resolved using the "Delphi technique"[2-3] which was continued iteratively until programming "bugs", and errors in concept and content had essentially been corrected. Each tutorial underwent twenty or more revisions and it was of interest to all collaborators that the "final product" often only vaguely resembled the initial rough draft. Once each tutorial was completed, it was posted on the worldwide web (WWW) for downloading and use at <http://www.umanitoba.ca/faculties/medicine/biochem/tutorials>. Screens in each tutorial display the names, addresses, and e-mail addresses of all collaborators, with an invitation for students and other users to contact them with comments/suggestions for improvements. Comments provided by both students and faculty members guided further revision of the tutorials.

Admittedly, one major problem with CAL/CAI tutorials is that generally they tend to be computer platform specific. This is particularly true with the three tutorials described above, which do run as "stand alone" applications, but only on the Apple Macintosh computer platform. However, it is now possible to construct interactive modules that run on the WWW and which are independent of the end-user's platform. Two of our tutorials have already been converted to HTML/Javascript versions that run interactively on browsers that allow graphic viewing. They are "Frank", available at <http://www.umanitoba.ca/faculties/medicine/biochem/tutorials/frank/titlecd.html>, and Frank during his second episode Jaundice_II, at <http://www.umanitoba.ca/faculties/medicine/biochem/tutorials/frank_II/start.html>. Such conversions compatible with multiple receivers make these case

studies more widely available to students throughout the world and accessible in an interactive manner. This is very similar to the original Macintosh SuperCard versions, which are still available for downloading.

To better monitor usage of these tutorials, we have embedded counters in each of the HTML /Javascript tutorial versions at various selected locations. In this way we can track the number of users progressing through only part of the tutorial versus completing the entire exercise. We are continuing to refine the latest tutorial utilizing the comments provided by our users.

## CONCLUSIONS

Two benefits derived from this type of collaboration are first, the wide variety of expertise of individual collaborators which helped resolve content conflicts; and second, the ability to evaluate the tutorials for compatibility with different Macintosh models and by students in different learning environments. In addition, students on several different continents contributed to the final products by testing and commenting on knowledge they gained from each tutorial and the benefits/drawbacks of this method. These comments were highly valued in the final revision process.

Although electronic collaboration of this type might, at first appear cumbersome, it proved to be a quick and easy way to incorporate suggestions, ideas and corrections into a final usable product. Accomplishing the same goals using conventional techniques, such as mailing the tutorial on disk to each collaborator, or printing each screen and faxing it to all, would have involved much more time and effort. Each collaborator's unique expertise was incorporated and proved invaluable to the design and overall "flow" of the tutorial.

Interestingly, most of us in this collaboration have still never met in person. Yet not only the resultant tutorials, but each of us has also benefited from the shared knowledge used in developing these problem-solving exercises. Electronic collaboration provided the added benefit of opportunities to establish both satisfying professional interactions and personal friendships with colleagues at great geographic distances.

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# ANNOUNCEMENT

## Call for Nominations - BSE Editorial Board

The IAMSE Board of Directors is conducting a search for qualified individuals willing to serve on the Editorial Board as manuscript reviewers for the *Basic Science Educator* (BSE). Approximately fifteen members will be appointed. We seek representatives from a wide range of interests and expertise, consistent with the diversity of materials submitted for publication. The Editorial Board will also represent a diversity of geographical locations having individuals familiar with medical science education in their particular part of the world. All candidates must be proficient in the English language and have computer communication skills. We anticipate that each person will not be asked to review more than three manuscripts per year.

The *Basic Science Educator* is the only peer-reviewed journal in medicine that deals specifically with issues in medical science education across all disciplinary boundaries. Since most all business for the BSE is conducted electronically, we ask that you submit your letter of application by e-mail to Roger Koment, Ph.D., IAMSE President and BSE Editor, at <rkoment@IAMSE.org>, and include your CV by attachment as Microsoft Word version 7.0 or earlier, Rich Text Format, ASCII, Windows, or DOS text file.

# INTERNATIONAL PERSPECTIVE

Roger Koment, Ph.D.

*Undergraduate medical education throughout the various parts of the world often shares more similarities to the systems we know, than differences. Although this revelation may be surprising to some, it only serves to emphasize the commonality of issues we have with our colleagues throughout the world. Such is the case in this edition of* International Perspective, *as we travel far away from North America to view the medical education system as practiced in Malaysia. I first learned about the Universiti Sains Malaysia some years ago while corresponding with Dr. Othman Mansor in preparation for his participation at our 1997 biennial conference. The emphasis that his medical school, and indeed all five medical schools of Malaysia, has involving family and community in the curriculum was intriguing, and certainly consistent with the goals of many medical schools around the world. This was one reason I invited Dr. Mansor to write for us.*

*Dr. Mansor is Professor and Head of the Department of Anatomy at the Universiti Sains Malaysia School of Medical Sciences, and has been instrumental in developing many of the programs there in Anatomy and Histology. In addition to medical students, he teaches a variety of paramedical professional students as well as postgraduates in Surgery, Orthopedics, and Obstetrics and Gynecology. Consistent with an integrated curriculum, he also contributes by teaching in a variety of levels throughout the medical curriculum, including the problem-based learning sessions. He participates extensively in the assessment of student learning, by heading both departmental and external assessment committees. We are pleased to present this brief yet comprehensive look at the medical sciences in Malaysia, which includes an example of objectives for first year medical students, listed by means of an Appendix.*

# The Medical Curriculum and Basic Science Teaching at the Universiti Sains Malaysia School of Medical Sciences

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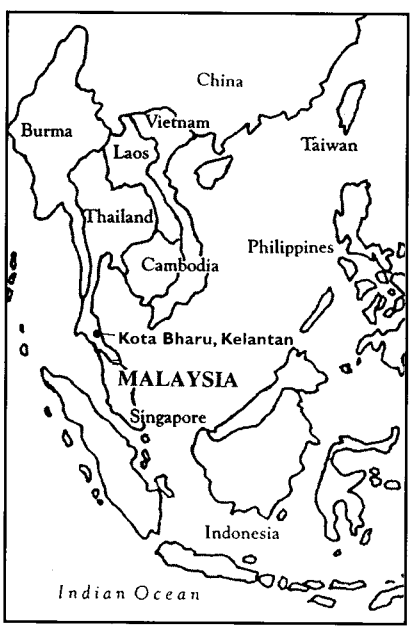
## INTRODUCTION

There are five public medical schools in Malaysia, consisting of University Malaya, National University of Malaysia, University Malaysia Sarawak, University Putra Malaysia, and Universiti Sains Malaysia. The first four schools now do practice some degree of integration in their medical programs, although the first two began only with the traditional system. The Universiti Sains Malaysia School of Medical Sciences (USM), however, has incorporated an integrated, problem-based curriculum since its inception in 1979.

Established in 1969, the Universiti Sains Malaysia was the second university in Malaysia. Its two branches are in Perak where engineering is the major academic focus, and in Kelantan, where the School of Medical Sciences is located and also the Hospital Universiti Sains Malaysia, which functions as a teaching hospital.




At USM, the curriculum is arranged in a multidisciplinary manner. It is integrated, organ or system based, and has a focus on problem solving. Importantly, this curriculum also places great emphasis on patients as subjects within the content of family and community. The aim is to encourage and inculcate the feeling of responsibility towards the community in general, the role as leaders in the health management group, and involvement in continuous medical education. Upon graduation a student would become a competent physician who has been equipped with a spectrum of knowledge and skills which can be utilized in problem solving at both individual and community level.

## THE CURRICULUM

The bachelor (medical) course, which spans five years has been designed as integrated, based on problem-solving, and has orientation towards the community. This program is divided into three phases:

| | |
|---|---|
| Phase I | Year 1 |
| Phase II | Year 2 and Year 3 |
| Phase III | Year 4 and Year 5 |

All three Phases are integrated "spirally" so there is close interaction among the Phases. The teaching and activities in Phase I incorporates the basic sciences, but with an emphasis on behavioral sciences. This forms the first level of the spiral. Phase II and III build on this with students learning epidemiology, biostatistics, and focusing on the community and family health issues. This spiral concept allows the medical school to practice the philosophy of both horizontal and vertical integration. Planning of this innovative curriculum was based on thorough studies on the problems faced by other medical schools worldwide and current developments in medical education. The basic strategy of the education adopted by USM can be summarized by the acronym "SPICES":

S - Student orientated
P - Problem based
I - Integrated
C - Community orientated
E - Electives
S - Spiral and Systemic

## PHASE I (Year 1)

The Phase I program covers all the basic medical science, and focuses learning about the normal human being and responses to injury. Topics in behavioral sciences and exposure to the clinical environment are also included. To further support and complement the basic sciences, students are introduced to aspects of first aid and nursing care. The contents of Phase I can therefore be summarized as

- The Normal Human Being
- Reaction to Injury
- Nursing Care and Bioethics
- First Aid
- Behavioral Science

Complete integration of the subjects is achieved through use of a block system, e.g., the musculoskeletal block. This block presents integrated topics, instead of the presentation of the individual disciplines such as Anatomy and Physiology. The overall curriculum has been integrated such that all the related objectives between disciplines are combined together into definite blocks. Table 1 lists the blocks presented in Phase I.

## PHASE II (Years 2 & 3)

The main teaching and learning strategy of the curriculum in Year 2 and Year 3 is Problem-Based Leaning. Problems that are commonly encountered by patients are given as starting points for these integrated discussions. The Phase II curriculum consists of three parts.

**Table 1.** The Block System of the Phase I Curriculum

| Blocks | Time in weeks |
|---|---|
| Bioethics and Nursing Care | 1 |
| General Block | 6 |
| Haemopoietic system & Lymphatics | 2 |
| Musculoskeletal | 3 |
| Cardiovascular | 2 |
| Endocrine | 2 |
| Reproductive | 1 |
| Nervous System | 4 |
| Gastrointestinal | 3 |
| Nutrition | 1 |
| Respiratory | 2 |
| Urinary | 2 |
| Host and Environment | 4 |
| First Aid | 1 |

### *Clinical Science*

This section involves the integration of subjects that are taught simultaneously by a few disciplines. The aim is to integrate the medical undergraduate teachings horizontally and vertically, thus understanding of the disease processes is followed to the full benefit. The blocks in Phase II are shown in Table 2.

**Table 2.** The Block System of the Phase II Curriculum

| YEAR 2 | WEEKS | YEAR 3 | WEEKS |
|---|---|---|---|
| General block | 4 | Reproductive | 4 |
| Cardiovascular | 4 | Psychological Medicine | 3 |
| Gastrointestinal | 5 | Endocrine | 4 |
| Respiratory | 4 | Hemopoietic & Lymphatics | 4 |
| Nervous System | 5 | Musculoskeletal | 4 |
| Genitourinary | 4 | Infectious Diseases | 5 |

### *Introduction to Clinical Clerkship*

First exposure for students to the clinical setting occurs in the wards at the University Hospital. Through supervised clerkships, students are introduced to the basic principles of learning directly from the patient, and must become confident in taking an appropriate history and doing a simple physical examination of the affected system. Students complete one or two such sessions per week throughout Phase II.

### *Community and Family Case Studies (CFCS) and Electives.*

This CFCS program forms an important component of the undergraduate curriculum at USM, and is fully integrated throughout the five years of the medical course. This program is planned such that there is exposure and learning experience while students are with the patient's family and his community. Through this program, students come to understand that circumstances

existing in the community (and in the family) are important factors in medicine, and how this information relates to what is taught in the lecture rooms, clinics, and hospital.

Students not only improve their skills in communication with the community, but also enhance their self-confidence. In their role as professional medical personnel in actual situations, necessary skills gradually increase as the student progresses through each Phase toward graduation.

## PHASE III (Years 4 & 5)

In Phase III the activities are mainly of the self-study type with specific learning known as "Contract Learning," with emphasis on clinical work.

*The bachelor (medical) course, which spans five years has been designed as integrated, based on problem-solving, and has orientation towards the community.*

## ASSESSMENT

At USM, several modes of assessment are used. These include *Written Assessments*, which incorporate multiple choice questions, short essays, modified essay questions, and also written tests on problem solving. *Practicals* are also given. These make use of the objective structured practical examination (OSPE) as well as the objective structured clinical examination (OSCE). Students must also perform well in seminars and conferences, as well as their achievements in tutorials and small group discussions. *Assessment Reports by tutors and lecturers* constitute a third mode of learning assessment, addressing student progress in problem solving, interpretation of case studies, and performance on elective postings. *Attendance* in specific teaching sessions is also considered in the student's overall progress.

## BASIC SCIENCE INPUT

During the first year of the medical course, seven departments are involved in the curriculum. These are Anatomy, Physiology, Chemical Pathology (Biochemistry), Pharmacology, Hematology, Psychological Medicine, and Community Medicine. The last two departments are involved in behavioral sciences and nutrition, respectively. In Year 1, the input is in the form of lectures and practicals, with a few tutorials or small group discussions. On average, there are three one-hour lectures per day, provided by various departments. However, in blocks such as musculoskeletal and nervous system, a large portion of the input comes from the Anatomy Department. Unlike many traditional medical schools, students at USM do not do cadaver dissections. They depend solely upon prosected specimens consisting of wet and plastinated specimens, and models. As an example, the details of the objectives for the Phase I General Block are provided in the Appendix.

The actual basic science input continues in the second and third years (Phase II), and is taught during discussion of clinical problems. For example, in the cardiovascular block, there is a clinical problem describing a patient with ischemia of a toe. Groups of approximately 20 students meet to discuss the problems encountered and develop methods for solving them. For each group, a lecturer is present as moderator, sometimes referring to his tutor's guide-book. Each group must thoroughly analyze the signs and symptoms and determine what laboratory tests are appropriate and interpret their results. For this case on ischemia of the toe, students must review information concerning the anatomy of the blood supply in the lower limbs, physiological mechanisms regulating peripheral circulation, the metabolic changes that occur in skeletal muscles during ischemia, the mechanisms of thrombosis and embolism, and discuss the modes of action and adverse reactions of drugs used in treating peripheral vascular diseases.

These clinical problems are thus structured to reinforce basic science principles learned previously through both lectures and Fixed Learning Modules (FLM). The FLM is a technique that employs posters displaying information, questions and answers, and exhibits specimens, patient X-rays, and models. These FLM are displayed in the multidiscipline laboratories, and are changed weekly to complement the clinical problems under discussion during that particular week.

## CONCLUSIONS

Thus, it may be seen that the basic medical sciences at the Universiti Sains Malaysia are taught over a period of three years (Phases I and II). They incorporate a variety of learning modes and continually emphasize the importance of the patient in relation to his family and community. Our intent is that students will retain this knowledge as they continue further into their clinical years and beyond into the independent practice of medicine.

## APPENDIX
## PHASE I GENERAL BLOCK - OBJECTIVES
## KNOWLEDGE

1. Describe an overview of anatomy and anatomical terminology.
2. Describe the structure of the cell.
3. Describe the structure and function of cell organelles.
4. Describe the structure of DNA and the different types of RNA.
5. Describe an overview of the biochemical processes that take place at the ultra structural level.

6. Explain the following terms
    6.1. intermediary metabolism
    6.2. anabolism
    6.3. catabolism
7. Describe the mechanism of DNA replication.
8. Outline the process of protein synthesis.
9. Describe the structure and functions of carbohydrate, protein, lipid, and nucleic acids.
10. Define a tissue and list the basic tissues of the body.
11. Describe the structure and function of surface epithelial and gland tissues.
12. Describe the structure and function of connective tissues.
13. Describe the microscopic structure of cartilage and bone.
14. Describe the microscopic structure of muscle tissues.
15. Describe the structure and function of the nervous tissues.
16. Outline the lymphatic circulation of the body and list the lymphoid organs.
17. Classify bones of the skeleton and identify the general features of bones in the body.
18. Describe the functions of the skeleton.
19. Describe the intramembranous and endochondral types of ossification.
20. Outline the general pattern of blood supply of a long bone.
21. Describe cartilage with regard to
    21.1. types
    21.2. growth and nutrition
    21.3. functions
22. Classify joints.
23. Describe the general structure of a synovial joint and list the types of synovial joints.
24. Explain the terms: origin, insertion, prime movers, antagonists, fixators and synergists with regard to the action of skeletal muscle.
25. Describe the structure of the skin.
26. Define epidermis, dermis, and hypodermis.
27. Describe the features of thick and thin skin.
28. Outline the general functions of the skin.
29. Describe the appendages of the skin.
30. Describe the cell cycle.
31. Describe gametogenesis.
32. Describe ovulation, fertilization and implantation.
33. Describe the development of the germ layers and list their derivatives.
34. Describe the development events of the embryonic period and fetal period.
35. Describe the development of the fetal membranes and the placenta.
36. Define the following terms
    36.1. enzyme
    36.2. coenzyme
    36.3. holoenzyine
    36.4. apoenzyme
    36.5. isoenzyme
37. Describe the classification of enzymes, giving examples.
38. Explain with illustrations, how the following factors influence enzyme activity
    38.l. substrate concentration
    38.2. temperature
    38.3. pH
    38.4. enzyme concentration
39. Define the following terms:
    39.1. initial velocity
    39.2. Vmax and Km
    39.3. ES complex
    39.4. turnover number
    39.5. active site
40. Distinguish between competitive and non-competitive inhibition, giving examples.
41. Describe
    41.1. feedback control
    41.2. allosteric effects
    41.3. enzyme regulation by covalent modification
42. Describe the following metabolic pathways and their interrelationship
    42.1. glycolysis
    42.2. glycogenesis
    42.3. glycogenolysis
    42.4. gluconeogenesis
    42.5. hexose monophosphate shunt
43. Give an overview of amino acid metabolism with respect to
    43.1. amino acid pool
    43.2. nitrogenous end products
    43.3. interrelationship of amino acid metabolism with the metabolism of other components.
44. Describe the following aspects of amino acid metabolism:
    44.1. transamination
    44.2. deamination
    44.3. fate of carbon skeleton of amino acids
45. Describe the metabolism of ammonia in the urea cycle.
46. Discuss the utilization of amino acids as precursors for the synthesis of
    46.1. neurotransmitters and hormones
    46.2. creatinine
    46.3. heme
    46.4. purines and pyrimidines
47. Describe the metabolism of triglyceride, cholesterol and fatty acids.
48. Discuss the role of acetyl CoA in the metabolism of triglyceride, phospholipids, cholesterol and ketone bodies.
49. Describe the formation and utilization of ketone bodies.
50. Outline the catabolism of purine and pyriniidines.
51. Give on overview of metabolism of carbohydrate, lipid and protein.
52. Give an overview of energy transformation (bioenergetic) process in the cell.
53. Give an overview of the process involved in biological oxidation and electron transport chain.
54. Describe the Citric Acid Cycle.
55. Describe Beta oxidation.
56. Outline the concepts underlying control of gene expression.
57. Outline the general concepts of inborn errors of metabolism and give examples.
58. Explain briefly the following:
    58.1. restriction endonucleases
    58.2. nucleic acid hybridization
    58.3. polymerase chain reaction (PCR) for DNA amplification
59. Outline the use of recombinant DNA in medicine.
60. Outline the basic concepts of general pharmacology with regard to

60.1. nomenclature of drug
60.2. classification of drug sources
60.3. drug standards
60.4. reference formulary
60.5. the basis of the drug-receptor theory
60.6. the pharmacological basis of drug action (agonists, antagonists, dose-response relationships)

61. Explain the electrophysiological basis of resting membrane potential in nerve cells.
62. Explain the ionic basis of an action potential in excitable cells.
63. Define the following terms
    63.1. all-or-none law
    63.2. threshold potential
    63.3. refractory period
    63.4. hypopolarization/depolarization
    63.5. hyperpolarization
64. Describe the cell membrane (fluid mosaic model and its properties).
65. Outline the basis concepts of transport across cell membrane with regard to
    65.1. osmosis
    65.2. diffusion
    65.3. facilitated diffusion
    65.4. active transport (symport antiport)
    65.5. ionophores
    65.6. exocytosis
    65.7. endocytosis
66. Define behavioral science. Describe with examples, application of behavioral science in medicine.
67. Define personality. Describe the role of heredity and environment in the development of personality.
68. Describe the different approaches used in understanding one's personality.
69. Describe with examples, application of principles of learning in normal habit formation and removal.
70. Describe the development of intellect. Describe important developmental milestones in a normally growing child.
71. Describe the development stages of various emotions.
72. Describe the factors that influence emotion.
73. Describe the basic human drives and motives in understanding one's emotional behavior.
74. Describe the role of thinking and reasoning in problem solving strategies, both in everyday life and in tertiary education.
75. Describe various factors that effect our attention and perception.
76. Describe the ways to improve one's concentration in studies.
77. Describe the fear and misconceptions of uneducated patients from village coming to hospital.
78. Outline the principles of doctor-patient communication in view of dignity and confidentiality of patients.
79. Define attitude and prejudice. Outline the development of attitude and beliefs and the formation of prejudice.
80. Describe how attitude and prejudice influence one's social life.

## SKILLS

1. Develop self-study skills.

## ATTITUDES

1. Appreciate the intricacies of the human body and its function and attribute these to the creation of God.
2. Understand the complexities of human relationships and use these to understand the needs of patients.

# PRELIMINARY REPORT

# Fourth Biennial Conference of the International Association of Medical Science Educators

## *Advances in Medical Science Education: Learning Modes and Teaching Strategies*

**Roger Koment, Ph.D.**
IAMSE President
rkoment@IAMSE.org

**Pamela Champe, Ph.D.**
Chair, Board Conference Committee
atpace@earthlink.net

The International Association of Medical Science Educators (IAMSE) is pleased to announce that preparations are well underway for the Fourth Biennial Conference on educational strategies in the medical sciences. This event will be held in Washington, DC on July 17-20, 1999.

## IAMSE BOARD CONFERENCE COMMITTEE

In January of 1998, four individuals on the IAMSE Board of Directors volunteered to constitute a committee that would make initial decisions pertaining to selection of our host institution, formation of a Program Committee and selection of its Chair, and in general, oversee the development of our 1999 conference. They were:

Pamela Champe, Ph.D.
UMDNJ-RWJ Medical School, U.S.A.
Gönül Peker, Ph.D.
Egé University School of Medicine, Turkey
Gary Rosenfeld, Ph.D.
University of Texas Houston Medical School, U.S.A.
Thomas Viggiano, M.D.
Mayo Clinic and Medical School, U.S.A.

Roger Koment appointed Pamela Champe as the Chair of this Board Conference Committee, and assigned the committee responsibility for making recommendations that would then be carried out by the President. With this committee's help, criteria were established for selecting not only the host school for the 1999 conference, but also a plan to determine host institutions for the 2001 and 2003 biennial conferences. They also reviewed the submitted credentials requested by the President from all individuals who had volunteered to take a leadership role in developing this conference. The recommendations of this committee resulted in the decisions described below.

## HOST SCHOOL

This year, we were exceptionally pleased that a total of sixteen medical schools from across the United States and Canada had volunteered to host this Fourth Biennial Conference. (Eight volunteer schools in any one year had been our previous maximum.) The IAMSE Board Committee approved the host school selection criteria, which included but was not limited to, national and international reputation of the host institution, available conference facilities, accessibility by both domestic and international travelers, and perceived ability of the local Site Director to provide a leadership role at the host institution.

Because of the number of quality institutions that had volunteered, this decision was extremely difficult. In the end Georgetown University School of Medicine in Washington, DC was selected. Located in the heart of our nation's capitol Georgetown University has an international reputation for academic excellence and cultural diversity. The University's Conference Center, a Marriott Hotel Affiliate, is located directly on the campus of this medical center, only a brief distance away from all the historic sights and activities of this capitol city (Figure 1). Our local Host and Site Director will be Aviad Haramati, Ph.D., Professor and Director of Education in the Department of Physiology and Biophysics. He will be responsible for all logistic concerns relating to this conference.

## PROGRAM COMMITTEE

Forty-seven individuals representing forty-one medical schools from five countries had volunteered to serve on the Program Committee for the 1999 conference. A brief outline of interests and credentials was requested of each, and these were reviewed by the IAMSE Board Committee. Selection criteria for the Program Committee included diversity of interests, expertise, and specialty degrees, interest and involvement at prior biennial conferences, and representation from countries outside of North America. The recommendations made to the President resulted in the appointment of the following individuals:

James Amend, D.V.M., Ph.D.
Texas A&M Univ College of Veterinary Medicine - College Station, TX U.S.A.
Nehad El-Sawi, Ph.D.
University of Health Science, College of Osteopathic Medicine - Kansas City, MO U.S.A.
E. Pat Finnerty, Ph.D.
Univ of Osteopathic Medicine & Health Sciences - Des Moines, IA U.S.A.
Henry Mandin, M.D.
University of Calgary Faculty of Medicine - Alberta Canada
Gönül Peker, Ph.D.
Egé University School of Medicine - Izmir, Turkey

Stewart Petersen, Ph.D.
University of Leicester Faculty of Medicine - Leicester, United Kingdom
Thomas Schmidt, Ph.D.
University of Iowa College of Medicine - Iowa City, IA U.S.A.
Roger Koment, Ph.D.
IAMSE President, *Ex Officio* member

Dr. Henry Mandin was appointed to chair this committee.

The first task the Program Committee approached was determination of a conference theme. Working cooperatively by e-mail, these eight individuals, with valuable input from Dr. Haramati, discussed the most important problems facing medical science educators today and ways this conference might address solutions. Equipping faculty members to maximize their effectiveness in any situation was the outcome, and from this was created the theme, *Advances in Medical Science Education: Learning Modes and Teaching Strategies.* The goal is to explore the latest research into how individuals learn, and to translate that into useful techniques for the teaching of the fundamental sciences of medicine.

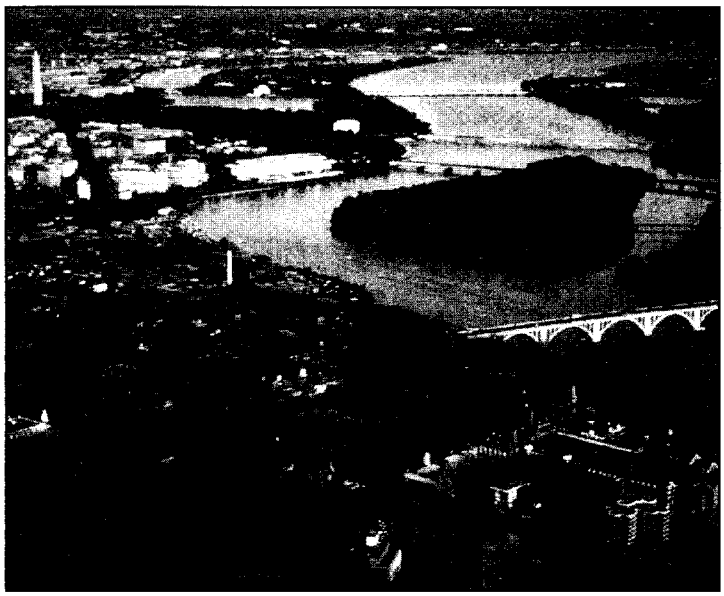


***Figure 1.*** *Georgetown University Medical Center, located in the heart of the nation's capitol, overlooks the Potomac River and is situated close to Georgetown's historic center. Nearby are the John F. Kennedy Center for the Performing Arts, the Lincoln and Jefferson Memorials, and the Washington Monument.*

## LOGISTICAL CONSIDERATIONS

At the business meeting held during the 1997 biennial conference, an overwhelming majority had voted to increase the number of registrants accepted at these biennial conferences. In the past, numbers have purposely been limited between 160 and 200, depending upon the individual conference facility selected in any given year, to retain the collegiality and productivity characteristic of small meetings. Although consensus was that some reasonable limit on the number of participants should still be imposed upon each school (in the past we have had requests to register teams of up to 14 individuals from one school), the total number of registrants should be at least doubled. For the 1999 conference we have therefore set 350 registrants as a provisional limit.

A brochure containing complete information regarding registration, hotels, and abstract submission will soon be mailed to all IAMSE members. Early registration will be until March 1, 1999. The registration fee will vary depending on IAMSE membership status, with Charter Members receiving a 20% discount, new members (those joining after July 1, 1998) receiving a 15% discount, and non members paying full price. A special discounted rate for graduate and medical students, medical house officers and residents, will also be available to encourage those planning to enter careers in academic medicine. As in the past, all conference materials, the opening reception, breakfasts, lunches, all refreshment breaks, and the Monday evening social event, will be included in the registration fee. This conference has been designated by Georgetown University Medical Center's Office of CME for 13.5 credit hours in Category 1 of the Physician's Recognition Award of the AMA.

Additional information concerning the daily program topics, abstract submission, conference registration, a selection of hotels, corporate sponsorship, etc. is or soon will be posted on the IAMSE website as it becomes available. Bookmark and follow our progress at <www.IAMSE.org/4bicmenu.htm>.

*One of the first tasks undertaken by the newly formed IAMSE Board of Directors was the creation of Association Bylaws that would guide our organization. Such a document was also a requirement of the United States Internal Revenue Service for recognition of IAMSE as a non-profit tax-exempt organization, eligible to receive grant funding. To accomplish this, a Board subcommittee was formed which created the basic document that was then edited and polished by the entire Board. The Board of Directors approved this final version at their February 1998 quarterly meeting.*

# BYLAWS
## International Association of Medical Science Educators

February, 1998

### ARTICLE I. Name

The name of the Association shall be the International Association of Medical Science Educators, and it shall be incorporated as a nonprofit corporation in the Commonwealth of Virginia.

### ARTICLE II. Purpose

The purpose of the Association shall be to promote medical education through faculty development and to encourage that the teaching and learning of medicine continue to be firmly grounded in science.

### ARTICLE III. Restrictions on Activities

Section 1. No part of the earnings of the Association shall inure to its members, officers, or other private persons, except that the Association shall be authorized and empowered to pay reasonable compensation for services rendered in direct support of its purpose.

Section 2. No part of the activities of the Association shall be directed towards influencing legislation or intervening in political campaigns.

### ARTICLE IV. Members

Section 1. The Board may establish and/or change the membership classes. The Board of Directors shall set the dues amount and the criteria for each class of membership.

Section 2. All individuals who are members shall have the right to vote, hold office, and serve on committees. A member must not be more than three months in arrears in their dues and financial obligations to the Association prior to the mailing of ballots by the Secretary.

### ARTICLE V. Board of Directors

Section 1. The Board of Directors shall be the principal governing body of the Association, and its Chairman shall be the President. It shall consist of the Officers and nine Directors. The first Board shall be appointed by the President and shall serve until the first election in the year 2000. To promote stability through staggered terms, the terms of office for the first elected Directors shall be determined by the number of votes cast for each candidate: the top one-third of the candidates receiving the most votes shall serve a three-year term, the middle-third of the candidates shall serve two year terms, and the lowest one-third of the candidates receiving the fewest votes shall serve one-year terms. In the event of a tie vote that would make it impossible to divide the candidates into three equal groups for the purpose of determining the terms of office, the President shall decide the terms for the tied candidates.

Section 2. The term of office for all Directors elected annually after the year 2000 shall be three years. Directors may be re-elected for one additional term.

Section 3. Members of the Board shall be elected by mail ballot. A Nominating Committee of five members, appointed by the President and approved by the Board, shall post a list that contains at least one or more candidates for each position to be filled on the Association's website by no later than April 1. Members who do not have Internet access may request the Secretary to mail or fax a copy to them. Additional nominations may be made by members to the Secretary by either petition or letter. Nomination petitions bearing 15 or more signatures of members or at least 15 individual letters of nomination for a candidate or candidates must be received by the Secretary by May 1. The Secretary shall then prepare and mail a ballot to all members by May 15. Ballots must be returned to the Secretary by June 15 in order to be counted. The Secretary shall tally the votes and post the results on the Association's website by July 1.

Section 4. The Board shall meet quarterly or more often if the need arises, at the call of the President or at least three members of the Board. The President shall chair the Board. Board meetings may be held by teleconferencing or other electronic means. A proposed agenda and supporting materials shall be sent to all Board members at least 15 days prior to a Board meeting.

Section 5. A quorum of the Board shall consist of seven Board members.

Section 6. The President shall appoint, with the approval of the Board, Officers and Directors to vacancies that occur between elections. Appointed individuals shall serve out the term of the individual they replace on the Board. In the event of a vacancy in office of the President, the Senior Vice-President shall succeed and assume the role of President.

Section 7. Officers and Directors may be removed by two-thirds vote of the Board present and voting, after being given at least two weeks notice and afforded the opportunity to represent themselves at a meeting of the Board.

## ARTICLE VI. Officers

Section 1. The officers of the Association shall be a President, one or more Vice Presidents one of whom shall be designated the Senior Vice President if there is more than one, Secretary, and Treasurer, and the Immediate Past President, when applicable.

Section 2. The officers shall be elected in the same manner as specified for Directors in Article V, Section 3, and shall take office on July 1. Officers shall serve a two-year term and may be re-elected for unlimited additional terms.

Section 3. The duties of the officers are the usual functions spelled out in *Robert's Rules of Order*, as revised.

## ARTICLE VII. Executive Committee

The Executive Committee, consisting of the officers, shall make decisions and take actions on behalf of the Board in-between Board meetings. The President shall call and preside at meetings of the Executive Committee.

## ARTICLE VIII. Indemnification

The Association shall defend and indemnify any qualified person against any threatened, pending or completed legal action resulting from actions taken in good faith on behalf of the Association. Qualified persons shall be present and former officers, employees, and officially elected or appointed members of boards, councils, committees, and other components of the Association.

Indemnification will not be provided to any person who shall be adjudged in a legal action to be liable for negligence or willful misconduct in the performance of duty, or when such person did not reasonably believe that the action was within the law and in the best interests of the Association.

Indemnification shall cover cost of defense and any judgments, fines, and amounts paid in settlement actually and reasonably incurred by a qualified person, up to a limit of one million dollars in any single case except in circumstances expressly prohibiting such limitation under the law. Such indemnification shall be in accordance with the established policy of the Association.

## ARTICLE IX. Other Provisions

Section 1. The fiscal year of the Association shall be on a calendar year basis (January 1 - December 31).

Section 2. The Association shall be governed by *Robert's Rules of Order*, as revised. In case of a conflict between *Robert's Rules of Order* and these Bylaws, the Bylaws shall take precedence.

Section 3. The Board may hire staff or contract services, as desired.

## ARTICLE X. Dissolution of the Association

In the event of the dissolution of the Association, the Board shall give all its assets to one or more nonprofit, tax-exempt organizations. If the Board cannot decide, the decision shall be made by the applicable Court in the Commonwealth of Virginia.

## ARTICLE XI. Amendments

Section 1. Amendments of the Bylaws may be proposed by a majority of the Board of Directors or by a petition, sent to the Secretary, which bears the signatures of at least 15 members.

Section 2. Amendments of the Bylaws require a two-thirds vote of the members voting on the issue. Notice of proposed amendments, together with pro and con statements shall be posted on the Association's website by April 1. Members who do not have Internet access may request that the Secretary mail or fax them a copy of the proposed amendments. Amendment ballots shall be mailed to the members together with the ballots for Officers and Directors by May 15. The Secretary must receive all ballots by June 15 in order to be counted.

Section 3. In the event of an urgent requirement for an amendment, the Board of Directors, by a two-thirds vote, may authorize posting a proposed amendment to the members at any time.

# IAMSE WEB-SIGHT

**James Swierkosz, Ph.D.**
Past IAMSE Webmaster
Department of Molecular Microbiology & Immunology
St. Louis University School of Medicine
St. Louis, MO 63104

Insight! Oversight! Hindsight! Out of Sight! Welcome now to WebSight! Actually, all these terms apply to the Web. The worldwide web has come to represent the good, the bad, and the ugly. It also represents the future – a means of information and communication exchange that would make Gutenberg drool on his presses! We hope this new column will help keep you informed about what's currently available, and what you may look forward to seeing, on the many informative webpages of the International Association of Medical Science Educators (IAMSE). Check it out at <http://www.IAMSE.org>, and consider this ongoing feature essentially a view from the Website. Or WebSight!

In politics they say vote, and vote often. Here we say, visit, and visit often. Someone must be listening, since we currently record, on average, some 85 "hits" per month. Our goal is to make it a very useful and user-friendly site for medical educators, so your comments, suggestions, and ideas are always welcome. Currently, the homepage features convenient links to our Mission Statement, Bylaws, information on the benefits of joining IAMSE, direct access to the Officers and Directors, and to the Editorial Board of our semi-annual journal. Six prominent icons provide access to our major categories of information. And that's not to mention a "Hot Stuff" page which gives the repeat visitor opportunity to see what was added since their last visit!

Navigating off from the **PUBLICATIONS** icon, one discovers information on how to obtain proceedings of previous biennial conferences (and soon, other IAMSE publications), and the *Basic Science Educator* (BSE). Tables of contents for recent issues of the BSE, listings of Columns and Features, as well as information on how to submit articles and contact Associate Editors are all only a "click" away. **CONFERENCES** contains complete information on these past biennial events, with links to individual conference descriptions, their daily programs, information both for and about our financial sponsors, etc. Importantly, this is also where up-to-the-minute information regarding upcoming conferences can be found. Make certain to bookmark the link to our Fourth Biennial International IAMSE Conference <www.IAMSE.org/4bicmenu.htm> coming this July 17-20, 1999, and follow progress as it develops. Included for your convenience are links to travel related sites, where one can obtain information on world currency exchange, maps, weather, and even language; useful information for those attending IAMSE (or other) international events.

**MEMBERSHIP** provides links to IAMSE participating medical colleges and universities throughout the world, while **PROJECTS** contains a listing of current and future IAMSE endeavors. The **SPONSORS** icon takes you to a listing of our current Annual Corporate Sponsors. It also leads to information on the benefits provided to commercial companies for IAMSE sponsorship and how to apply. Our **LINKS** page will quickly connect you with search engines, and an ever-expanding list of educational and medical discipline-related websites. As these expand, appropriate link sub-categories will be developed.

Soon we will be adding a "Calendar of Events" page with notices of other upcoming meetings, workshops, or similar events of interest to IAMSE members. Also under development are plans to more fully capitalize on the interactive potentials of the web. Features likely to be developed first will be "discussion groups" threaded around topics of major interest and both real-time and delayed on-line offerings of faculty development workshops.

The "distance learning" aspects of using the web are enormous. And with the diversity of backgrounds and expertise in our organization, the web becomes a natural means by which to collaborate and learn from one another (see article on page 18 of this issue of the BSE as example). At my institution (St. Louis University) we have adopted the WebCT (Web Course Tools) program developed at the University of British Columbia <http://homebrew.cs.ubc.ca/webct/> as our platform for creating web-based courseware and distance learning courses. This is a tool that facilitates the creation of sophisticated worldwide web-based educational environments by non-technical users. Evaluation of the usefulness of programs such as these to deliver course materials to students, as well as to faculty, would certainly be useful as we all struggle to get the most out of the technologies available.

Please let us know how you feel about such issues and how best we may develop the IAMSE website to accomodate your interests and needs. Although I am stepping down as Webmaster, my replacement, Ms. Julie Hewett, has already hit the ground running! Her first contribution was to secure the domain site, which now makes us <http://www.IAMSE.org>; and by the time you read this, she will have the logistics conquered for that Calendar of Events I mentioned above. You can reach our new "Webmistress" with your comments and suggestions at <Julie@IAMSE.org>

As the motto from my favorite television program says, "The Truth Is Out There!" So let's put it on our website!

# AAMC Group on Educational Affairs
# Basic Science Education Special Interest Group

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# 1997 ANNUAL REPORT

## AAMC NATIONAL SIG MEETING

The November 1997 Annual Meeting of the Association of American Medical Colleges (AAMC) in Washington, D.C. marked the 10th anniversary of the founding of our Basic Science Education Special Interest Group (BSE-SIG), the first recognized SIG of the AAMC's Group on Educational Affairs (GEA). **Roger Koment, Ph.D.** who was singly responsible for its creation, chose this auspicious time to step down as our National Convener, a position he had held since its inception. Roger now plans to devote more time to his role as President of the International Association of Medical Science Educators (IAMSE), the global organization which, through him, can trace its roots to ideas forged within this special interest group. To honor the occasion, the BSE-SIG membership, of whom about 45 were in attendance, presented Roger a commemorative plaque in recognition of his vision, dedication and decade-long devoted service to this effort. His last official act was to formally turn over leadership of this National SIG to Gary Rosenfeld.

As the new National Convener of the BSE-SIG, my immediate goals for this Special Interest Group are:

- **To continue to meet annually at the AAMC conferences** to share information and to discuss issues that are important to basic science education AND to all basic science educators.

- **To increase communication among basic science educators,** particularly those who cannot routinely attend the AAMC meetings.

- **To strengthen the role of the BSE-SIG at the four annual regional GEA meetings.** To this end, **Aviad Haramati, Ph.D.** (Department of Physiology & Biophysics, Georgetown University School of Medicine) has accepted the appointment of Convener of the Northeast Regional Chapter of the BSE-SIG, and **Rex Stith, Ph.D.** (Department of Physiology & Biophysics, University of Oklahoma Health Sciences Center) has accepted appointment as the Convener of the Central Regional Chapter of the BSE-SIG. We welcome them both and look forward to their leadership in the respective regional sections of the GEA. Convener positions have also become available for the Western and Southern Regions, and I encourage GEA members in those regions to contact me if they have leadership interests. As in the past, all Regional Conveners will continue to serve as the Advisory Committee to maintain a unified national system of GEA Basic Science Education SIGs.

- **To increase our collective voice in the GEA/AAMC.** I believe it is important that we establish formal lines of open communication with the leadership of the GEA and AAMC to articulate concerns of basic scientists. We must also begin to participate actively in the formulation of policy that directly or indirectly has an impact on the basic science education mission of our medical schools here in the U.S. and Canada.

The formal program for this BSE-SIG meeting began with an opening statement to the membership by the newly elected Chair of the GEA, **Ruth-Marie Fincher, M.D.** (Medical College of Georgia School of Medicine). In her address titled, ***The 'New GEA' and the BSE-SIG***, Dr. Fincher outlined recent changes in the organization of the GEA. She proposed to foster stronger linkages between our SIG and other GEA SIGs, and with the four Sections of the GEA (Undergraduate Medical Education, Graduate Medical Education, Continuing Medical Education, and Research in Medical Education). She also challenged the BSE-SIG membership to become involved in the four new sponsored projects of the GEA: 1) Teaching strategies in ambulatory settings, 2) Recognition of educational research and scholarship as career pathway development, 3) Evaluation strategies, and 4) Impact of changes in health care on medical education.

The second part of the formal program was devoted to ***Determining Core Objectives in Basic Science Education***, a topic chosen to provide our membership the chance to further consider the AAMC Medical School Objectives Project (MSOP). A near-final draft of this document had been presented and discussed at an earlier AAMC session. **Donna Waechter, Ph.D.** (Uniformed Services University of the Health Sciences) and **Allen Rawitch, Ph.D.** (University of Kansas Medical Center) provided our group with excellent overviews of MSOP and its implications for basic science education, pointing out that it was not the

intent of the AAMC to create a national curriculum, but rather to provide a general guide to help faculty identify the specific "knowledge, skills, attitudes and values that each student should possess at the time of graduation from medical school". **Todd Olson, Ph.D.** (Albert Einstein College of Medicine) and **Gary Rosenfeld, Ph.D.** (University of Texas-Houston Medical School) followed with discussions of recent progress by certain professional organizations to define, respectively, ***Learning Objectives in the Anatomical Sciences*** and ***Knowledge Objectives in Medical Pharmacology.*** It was suggested that such documents could serve as templates for medical school development of specific disciplinary objectives in the basic sciences.

The 1998 Annual Meeting of the AAMC will be in New Orleans, October 30-November 5, and the topic for the BSE-SIG session is ***The Dollars and Sense of Basic Science Education.*** I know many U.S. and Canadian members of IAMSE are already members of the BSE-SIG, and I hope others will also join us. I look forward to seeing you all in New Orleans.

## SOUTHERN REGIONAL BSE-SIG MEETING

The GEA Southern Regional BSE-SIG met on March of 1997 in Augusta, Georgia, and was attended by about 20 members. The topic for discussion was ***Downsizing and Mergers of Basic Science Departments: Impact on Medical Education***, chaired by **Gary Rosenfeld, Ph.D.** (University of Texas-Houston Medical School). After the formal presentation, a lively discussion continued concerning strategies to increase the representation of basic science educators in the GEA and AAMC so that their specific concerns might be heard.

# QUOTABLE QUOTES...

Submitted by
**Ruth-Marie Fincher, M.D.**
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## Knots![1]

There is something I don't know that I am supposed to know. I don't know what it is that I don't know, and yet feel I am supposed to know. And I feel stupid if I seem both not to know it, and not to know what it is that I don't know. Therefore, I pretend to know it. This is nerve-racking, since I don't know what I must pretend to know. Therefore, I must pretend to know everything. I feel you know what I am supposed to know but you can't tell me what it is, because you don't know that I don't know what it is. You may know what I don't know, but not that I don't know it. And, I can't tell you, so you will have to tell me everything!

1. Laing, R.D. Knots. Pantheon Books, New York. 1970

## EDITOR'S NOTE

*Ronald D. Laing was an eminent British psychiatrist who lived from 1927-1989. He rebelled against the orthodox psychotherapy of his day in his quest to develop new approaches to our understanding and treatment of "madness". He espoused the theory that insanity might just be a relatively sane response to an insane life situation. It's not difficult to assume that many of our medical students would agree!*

# TRANSITIONS

**John R. Cotter, Ph.D.**, Associate Professor of Anatomy and Cell Biology, State University of New York, The University of Buffalo School of Medicine and Biomedical Sciences, has been appointed to the Editorial Board of the *Basic Science Educator* as Associate Editor for the column *The Medical Educator's Resource Guide.* In the next issue, John will debut his significant upgrade of this column that will now feature an ongoing series of personal and invited reviews of educational websites. Once published, these will be archived, searchable, and accessible to all on the IAMSE website.

**Aviad Haramati, Ph.D.**, Professor and Director of Education in the Department of Physiology and Biophysics at Georgetown University School of Medicine has been appointed as the Regional Convener for the Northeast Chapter of the AAMC Group on Educational Affairs Special Interest Group on Basic Science Education.

**Julie K. Hewett** has been appointed Secretariat and Business Manager for the International Association of Medical Science Educators. Her expertise in distance learning, website design and marketing, plus all aspects of computer technology will carry IAMSE forward on the cutting edge of technology in our global mission of communication and providing educational resources. She has also assumed the role of Webmistress of our website, and has established our new address at <http://www.IAMSE.org>. Julie brings an aggressive and dynamic management style to our organization, and we are pleased to welcome her onboard.

**Gary C. Rosenfeld, Ph.D.**, Professor of Pharmacology and Assistant Dean of Educational Programs at the University of Texas Houston Medical School was installed in November 1997 as National Convener of the Special Interest Group on Basic Science Education of the AAMC Group on Educational Affairs. He replaces Roger Koment, Ph.D. who created this SIG and served in that capacity since its inception in 1988. Since the spring of 1994, Gary has served as the elected Regional Convener for the Southern Chapter of the SIG on Basic Science Education.

**Rex D. Stith, Ph.D.**, Professor of Physiology and Biophysics at the University of Oklahoma Health Sciences Center has been appointed as the Regional Convener for the Central Chapter of the AAMC Group on Educational Affairs Special Interest Group on Basic Science Education.

**James E. Swierkosz, Ph.D.**, Associate Professor of Microbiology at St. Louis University School of Medicine has resigned as IAMSE Webmaster. Together with Roger Koment, Jim has continued since 1996 to design and construct this website, and is personally responsible for synthesizing and translating into electronic reality many of our collective ideas. Inherent in theses visual designs were Jim's personal stamp of unique and wry humor, and his exceptional craft with words and images. We thank him for his creativity and flair that has resulted in a world-class website.

### IAMSE Board of Directors

The following individuals have resigned from the IAMSE Board of Directors effective June 30, 1998. We are grateful for their help during our first and formative year and look forward to their additional contributions as each now moves into a different leadership role within IAMSE.

**Margarita Baron, M.D., Ph.D.**
Departmento de Fisiologia y Farmacologia
Universidad de Alcala de Henares
Madrid, Spain

**Ms. Frances Maitland**
Executive Director (retired)
Alliance for Continuing Medical Education
Boulder, CO U.S.A.

**Thomas R. Viggiano, M.D.**
Department of Internal Medicine
Mayo Clinic and Medical School
Rochester, MN U.S.A.

We are also pleased and excited to welcome our newly appointed members to the IAMSE Board of Directors. These individuals assumed their office on July 1, 1998.

**Sergio Curtoni, M.D., Ph.D.**
Department of Genetics, Biology & Clinical Chemisty
Universitá di Torino
Torino, Italy

**Nehad El-Sawi, Ph.D.**
University of Health Sciences
College of Osteopathic Medicine
Kansas City, MO U.S.A.

**Henry Mandin, M.D.**
Department of Medicine
University of Calgary Faculty of Medicine
Calgary, Alberta Canada

**Allen H. Neims, M.D., Ph.D.**
Department of Pharmacology & Therapeutics
University of Florida College of Medicine
Gainesville, FL U.S.A.

Another change occurring within the IAMSE Board of Directors, as a result of our acceptance of the newly drafted Bylaws (see page 28) was the appointment of Officers within the Board. These two Officers, along with the President, constitute the IAMSE Executive Committee. Appointments became effective in May of 1998 following the Board of Directors quarterly meeting.

### OFFICE of SECRETARY

**Robert G. Carroll, Ph.D.**
Department of Physiology
East Carolina University School of Medicine
Greenville, NC U.S.A.

### OFFICE of TREASURER

**Todd R. Olson, Ph.D.**
Department of Anatomy & Structural Biology
Albert Einstein College of Medicine
Bronx, NY U.S.A.

# CALENDAR OF EVENTS

## 1998

***Current Issues in Medical Education***
**Association for Medical Education in Europe Annual Conference**
**August 30-September 2, 1998 - Prague, Czech Republic**
Penaries, Workshops, Short Communications, and Poster Sessions relating to many different aspects of current issues. Directed toward teachers, educators, practitioners, students, and administrators.
*CONTACT*: Ms. Pat Lilley, AMEE Office, Centre for Medical Education, University of Dundee, Tay Park House, 484 Perth Road, Dundee DD2 1LR, Scotland, UK
TEL: (+)44-1382-631 967; FAX: (+)44-1382-645 748; E-MAIL: p.m.lilley@dundee.ac.uk (http://www.dundee.ac.uk/MedEd/AMEE/conf98.htm)

***Faculty Development in the 21st Century***
**WHO/AMEWPR Fifth Conference**
**September 21-23, 1998 - Manila, Philippines**
This conference is being arranged in collaboration with the Philippine Society of Medical Education.
*CONTACT*: Mrs. Loraine Kerse, Acting Regional Adviser, Human Resources for Health, World Health organization Regional Office for the Western Pacific, United Nations Avenue, P.O. Box 2932 1000 Manila, Philippines

***Higher Education in the Twenty-First Century***
**UNESCO World Conference on Higher Education**
**October 5-9, 1998 - Paris, France**
*CONTACT*: UNESCO, 7 place de Fontenoy, 75352 Paris, 07 SP France
TEL: (+)33-1-45681095/45681126; FAX: (+)33-1-45685626/27/28; E-MAIL: ml.kearney@unesco.org (http.www.education.unesco.org)

***The Dollars and Sense of Basic Science Education***
**Eleventh Annual Meeting of the AAMC-GEA Special Interest Group on Basic Science Education**
**October 30-November 5, 1998 - New Orleans, Louisiana, U.S.A.**
This Special Interest Group on Basic Science Education will meet for a two-hour program as an integral part of the Group on Educational Affairs during the Annual Meeting of the Association of American Medical Colleges.
*CONTACT*: Gary Rosenfeld, Ph.D., AAMC-GEA National SIG Convener, Department of Pharmacology, UT-Houston Medical School, 6431 Fannin, P.O. Box 20708, Houston, TX 77030; TEL: (+)1-713-500-7435; FAX: (+)1-713-500-7455; E-MAIL: grosen@farmr1.med.uth.tmc.edu

***First National Congress on Medical Education***
**Ankara University School of Medicine**
**November 12-15, 1998 - Ankara, Turkey**
Ankara University School of Medicine, the first medical school of modern Turkey, presents this First National Congress on Medical Education in commemoration of the 75th Anniversary of the Turkish Republic. Distinguished International Speakers, Panel Discussions, Workshops, and Poster Presentations will address issues relating to teaching strategies, innovative curricula, faculty development, assessment and accreditation. The goal is to focus on issues relating to producing physicians in Turkey.
*CONTACT*: Prof. Dr. Ozden Palaoglu, First National Congress on Medical Education, Ankara University School of Medicine, Department of Pharmacology and Clinical Pharmacology, 02100 Sihhiye, Ankara, Turkey
TEL /FAX: (+)90 -312-310 6268, E-MAIL: skemahli@ato.org.tr

***Visitor's Workshop - An Overview***
**McMaster University**
**November 16-18, 1998 - Hamilton, Ontario, Canada**
This interdisciplinary, interprofessional workshop is offered to provide an overview of the approach to health sciences education at McMaster University. Opportunities are provided for practicing the development of learning objectives and health problems/situations, and for discussing the implementation of problem-based learning, evaluation of student and faculty performance, the role of the tutor, and follow-up studies.
*CONTACT*: Ms. Annette Sciarra, Program Administrator, Programs for Faculty & Leadership Development, McMaster University Faculty of Health Sciences, 1200 Main Street West, Hamilton, Ontario, Canada L8N 3Z5
TEL: (+)1-905-525-9140, ext. 22714; FAX: (+)1-905-528-6552; E-MAIL: sciarra@fhs.csu.mcmaster.ca

## 1999

***Problem Design and Curriculum Development in Problem-Based Learning***
**January 3-8, 1999 - Santa Barbara, California, U.S.A.**
This is an intensive "hands-on" workshop designed for all teachers interested in creating problems to facilitate the use of problem-based learning (PBL) in their teaching. Course Directors: Howard Barrows, M.D., and Ann Kelson, M.D.
*CONTACT*: Ms. Rosemary Beiermann, Department of Medical Education, Southern Illinois University School of Medicine, P.O. Box 19230, Springfield, IL 62794-1217 U.S.A.
TEL: (+)1-217-782-0795; FAX: (+)1-217-524-0192

***Advances in Medical Science Education: Learning Modes and Teaching Strategies***
**Fourth Biennial Conference of the International Association of Medical Science Educators**
**July 17-20, 1999 - Washington, DC, U.S.A.**
This conference, which is being hosted by Georgetown University School of Medicine, will examine the theoretical research into how humans learn, and translate that conceptual information into understandable and useful strategies for improving the way we teach the fundamental sciences of medicine.
*CONTACT*: Roger Koment, Ph.D., IAMSE President, University of South Dakota School of Medicine, Vermillion, SD 57069, U.S.A. TEL: (+)1-605-677-5174; FAX: (+)1-605-677-6299; E-MAIL: rkoment@IAMSE.org (http://www.IAMSE.org/4bicmenu.htm)

***A Critical Appraisal of Medical Education***
**Association for Medical Education in Europe Annual Conference**
**August 29-September 1, 1999 - Linkoping, Sweden**
Penaries, Workshops, Short Communications, and Poster Sessions relating to many different aspects of current issues. Directed toward teachers, educators, practitioners, students, and administrators.
*CONTACT*: Ms. Pat Lilley, AMEE Office, Centre for Medical Education, University of Dundee, Tay Park House, 484 Perth Road, Dundee DD2 ILR, Scotland, UK
TEL: (+)44-1382-631 967; FAX: (+)44-1382-645 748; E-MAIL: p.m.lilley@dundee.ac.uk

# 2000

***Ninth Ottawa International Conference***
**March 1-3, 2000 - Cape Town, South Africa**
This conference is a forum for professionals from around the world who are concerned with teaching and assessing health care professionals.
*CONTACT*: Dr. Athol Kent, Postgraduate Conference Centre, Medical School, Anzio Road, Observatory 7925, Cape Town, South Africa; TEL: (+)27-21-406 6381; FAX: (+)27-21-448 6263; E-MAIL: hero@ct.lia.net

# ANNOUNCEMENT

## IAMSE Projects — Call for Volunteers

The IAMSE Board of Directors is in the process of developing several projects to create products and services in medical science education. These will become more defined over time, but we are issuing this initial call for volunteers to establish a resource list of individuals interested in providing their expertise. Examples of projects under development include:

- Faculty development workshops on the IAMSE website
- National and international exchange programs for individual teaching faculty
- Developing teams of experts for departmental or institutional site visits
- Developing our global electronic network of information exchange
- Establishing IAMSE regional offices in all countries

Contributors to these projects will have several opportunities for local, national, and international recognition in the field of medical science education, including publications, plus the opportunity to work with colleagues with similar interests from around the world. They will also have opportunities to work closely with the officers and directors of IAMSE and help us determine the direction of individual projects. Progress toward these and other projects will be posted on the website at <www.IAMSE.org/projects.htm>.

Please respond by sending a brief statement of your interests and expertise to Dr. Todd Olson, Coordinator of IAMSE Volunteers, Department of Anatomy & Structural Biology, Yeshiva University, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Bronx, NY U.S.A.; TEL: (+)1-718-430-2847; FAX: (+)1-718-430-8997; <tolson@IAMSE.org>.

# INSTRUCTIONS FOR CONTRIBUTORS

## GENERAL

Contributions to the *Basic Science Educator* are encouraged from all who seek to have their information reach an audience of basic science course directors, members of the basic science faculty, clerkship directors, attending physicians, curriculum planners, residency directors, and all those involved with the teaching or administration of the medical sciences throughout the continuum of health professional training. With the exception of Letters and Commentaries, all articles will begin with an "Introduction", end with a "Conclusions", and incorporate citation of appropriate "References". Each article will be reviewed by the Editor and two other members of the Editorial Board. Unless otherwise noted, send all submissions to Roger W. Koment, Ph.D., BSE Editor. This may be by e-mail to <rkoment@IAMSE.org> (Microsoft Word 7.0 or earlier, Rich Text Format, ASCII, Windows, or DOS text file attachment), or if by mail, send three hardcopies to: University of South Dakota School of Medicine, Vermillion, South Dakota 57069, U.S.A. If the submission contains photographs, three complete copies must be submitted by mail. See inside front cover for contact information on all Associate Editors.

## ARTICLES

Submission is encouraged of articles relating to all aspects of teaching and learning in the medical sciences throughout undergraduate and graduate medical education, continuing medical education, and all aspects of faculty development. Examples include, but are not limited to, integration of science throughout the continuum of medical training; experiments in individual course or curriculum design; creation of methods which stimulate thinking, problem-solving skills, and foster independent student learning; methods to encourage student integrity, humaneness, and team-building characteristics; and programs directed toward medical science faculty development.

## INNOVATIONS IN BASIC SCIENCE TEACHING AND LEARNING

The purpose of this column is to share new approaches to the teaching of medical sciences that will enhance the student's ability to learn. Submissions to Harold Traurig, Associate Editor.

## COMPUTER APPLICATIONS IN BASIC SCIENCE EDUCATION

The purpose of this column is to explore means by which computer technology may be used to aid both faculty and students in the teaching and learning of medicine. Submissions to W. Marshall Anderson, Associate Editor.

## SOCIAL ISSUES IN THE BASIC SCIENCES

The purpose of this column is to present articles that stimulate medical science faculty to consider their role in all aspects of medicine and society. Submissions to David Bolender, Associate Editor.

## INTERNATIONAL PERSPECTIVE

The purpose of this column is to demonstrate both the diversity and yet commonality of how the fundamental medical sciences are taught throughout the world. Submissions to Roger Koment.

## THE EDUCATOR'S PORTFOLIO

The purpose of this column is to disseminate techniques currently in use, or under development, for the documentation of the educational activities of medical school faculty. Submissions to Jay Menna, Associate Editor.

## THE MEDICAL EDUCATOR'S RESOURCE GUIDE

The purpose of this column is to present critical reviews of educational materials on the worldwide web. Submissions to John Cotter, Associate Editor

## IN MY OPINION... (Debates)

Debates on issues of timely interest to medical science educators are welcome, and may actually be arranged with help from the Editorial Board. The purpose is to present readers with common arguments on each side of an issue to help us better understand different views. To discuss your ideas, to volunteer as one side of a debate, or to suggest a topic you would like to see debated, please contact Roger Koment. Format and length are negotiable.

## COMMENTARY

The Editorial Board encourages submission by individuals of their views on timely topics in medical education, especially those which relate to teaching and learning of the medical sciences. These essays may be up to 1,500 words in length.

## IN THE LITERATURE...

This column features reference citations and brief excerpts from articles in medical science education, which are published in other journals or sources. Your submissions are encouraged.

## QUOTABLE QUOTES...

These are anecdotal phrases of either serious or humorous (sometimes the reader must decide!) interest to medical science educators. Your submissions are encouraged.

## LETTERS TO THE EDITOR

Reader response to articles in the *Basic Science Educator* is encouraged in the spirit of dialogue, and will be published as space permits. Letters may be up to 500 words.

## ANNOUNCEMENTS

Announcements and news of interest to medical science educators are published in each issue. All topics may be considered.

## CALENDAR OF EVENTS

Notices of upcoming conferences, workshops, and other events of interest to medical science faculty are listed chronologically in each issue. Please send information regarding your event as soon as possible to ensure inclusion in the next available issue.

# MEMBERSHIP BENEFITS

## International Association of Medical Science Educators

- Subscription to the newly revised *Basic Science Educator* (two issues per year). Written specifically *for* medical science educators *by* medical science educators, this peer-reviewed journal contains first released articles describing current trends in basic medical science education, reports, critiques, and commmentaries on innovative teaching methods, debuts of educational software, and candid editorials.
- 15% discount on registration, plus priority admission to limited access IAMSE conferences on educational strategies in the medical sciences. Charter members who continue without lapse of membership will receive a 20% discount.
- 10% discount on IAMSE Conference Proceedings and other IAMSE publications. Charter members who continue without lapse of membership will receive a 15% discount.
- Complimentary copy of the IAMSE Directory of Colleagues, containing each member's discipline, mailing address, phone, fax, and e-mail.
- Mailings of IAMSE conference announcements, brochures, calls for abstracts, and announcements of Conference Proceedings availability
- Professional advancement opportunities to network with colleagues at other medical facilities, establish collaboration and exchange programs, publish in the *Basic Science Educator*, conduct and/or attend workshops on educational methods, present projects from your school, and develop the credentials of a truly effective medical educator.

### Membership Fees (in U.S. Dollars)

In an effort to equitably assess membership fees, the IAMSE Board of Directors has implemented the following three-tiered structure based upon each country's GNP per capita, as determined by the World Bank. A complete listing of countries may be found at: http://www.worldbank.org/depweb/gnp/data.htm

| | |
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| Category 3 – High Income Countries | annual earnings greater than 9,386 U.S. Dollars |
| Category 2 – Middle Income Countries | annual earnings between 765 and 9,385 U.S. Dollars |
| Category 1 – Low Income Countries | annual earnings less than 765 U.S. Dollars |

| | One-Year | | | Two-Year | |
|---|---|---|---|---|---|
| | Individual | Institutional† | Student†† | Individual | Institutional† |
| Category 3 | $45 | $160 | $25 | $85 | $310 |
| Category 2 | $30 | $100 | $15 | $55 | $190 |
| Category 1 | $15 | $50 | $8 | $25 | $90 |

† Deans, Departmental Chairs, or equivalents may purchase Institutional Memberships which each provide 4 Individual Memberships. Those 4 individuals designated by the purchasing body will be listed in the Directory. Limit one per department or unit, although more than one department or unit in a school may become Institutional Members.

†† Applications for Student Membership must be accompanied by a letter verifying this status from either your Professor (Graduate Students & Post-Docs) or Office of Student Affairs (Medical Students & Residents). Renewal must be verified annually.

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$_____ Membership Fee

$_____ Additional U.S. Tax-Deductible Contribution to IAMSE

$_____ Total Amount

Account Holder's Name: _____

Account Number: _____

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Signature: _____

8-12

***PLEASE RETURN TO:***

International Association of
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One Crested Butte Drive
Suite 100
Huntington, WV 25705
U.S.A.

TEL: (+)1-304-733-1270
FAX: (+)1-304-733-3549
E-MAIL: Julie@IAMSE.org

***NOTE: If using a credit card, you can become an IAMSE member in less than five minutes by simply dialing the telephone number listed above.***

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*Cloutier, M.M.:*
*"The Body of Knowledge",*
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Gold Standard Multimedia is a publisher of innovative medical education and reference software and online services. Acclaimed for their unique interactive interfaces, value-added features, and informational content, these multimedia programs are designed to provide healthcare professionals and educators with complete and clinically relevant reference guides and teaching tools. A selection of the programs offer Continuing Education credit, and data licensing opportunities are also available. Gold Standard Multimedia's commitment to quality can be found in the authenticity, comprehensive, and useful presentation of the information in these products.

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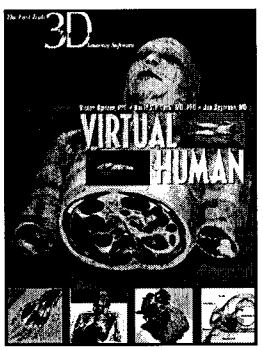
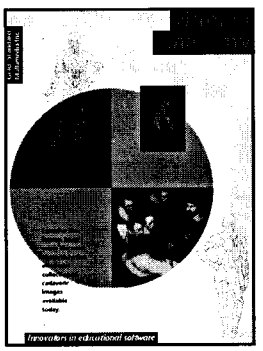
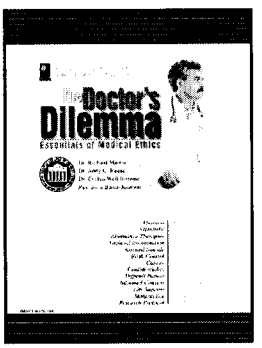


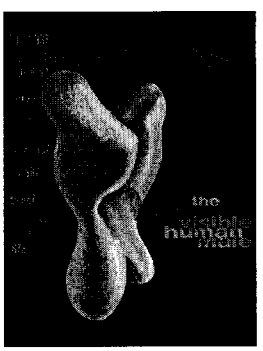

**Virtual Human**



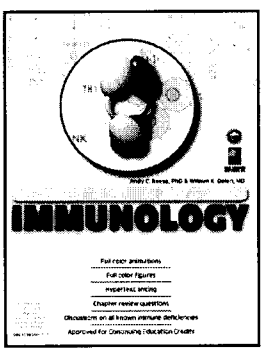
**Human Anatomy**



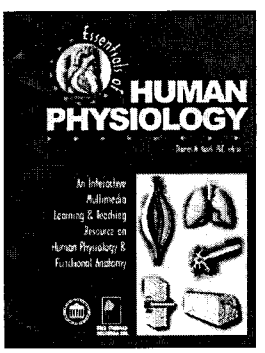

**The Doctor's Dilemma**



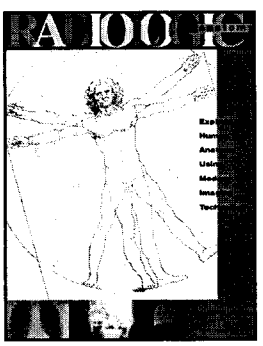

**The Complete Visible Human Male**



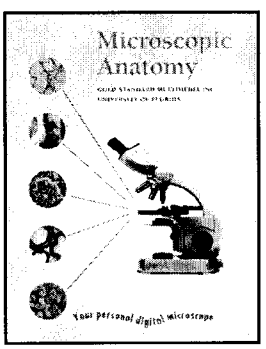

**Essentials of Immunology**



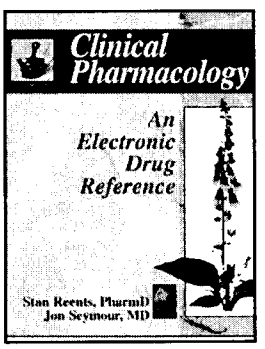

**Essentials of Human Physiology**




**Radiologic Anatomy**




**Microscopic Anatomy**




**Clinical Pharmacology**

# IAMSE CORPORATE SPONSORSHIP BENEFITS

As an academic organization, the International Association of Medical Science Educators (IAMSE) offers membership to all individual faculty members and staff of medical universities, schools, and health professions related institutions worldwide. Graduate and medical students, postdoctoral fellows, medical house officers, and residents are also invited to become full participating members of IAMSE at a special discounted rate.

As medical educators on the forefront of both excellence and innovation, we also share a special relationship with those in the corporate world who publish the textbooks, computer software, anatomical models, and other educational tools that help us in our vital task of training future generations of physicians. Indeed, many of us have actually created or authored these educational tools in collaboration with our corporate colleagues.

It is therefore with great pleasure that IAMSE now offers a means for corporate entities to become formally involved with our organization by becoming Annual Corporate Sponsors. We cordially invite all companies concerned with the production of educational tools or products to participate with us in support of medical faculty throughout the world. For further information, please contact Ms. Julie Hewett, IAMSE Business Manager, at TEL: 304-733-1270, FAX: 304-733-3549, or E-MAIL: <Julie@IAMSE.org>.

## PLATINUM LEVEL – $4,500

- Five copies of the *Basic Science Educator*
- Company listing as Platinum Corporate Sponsor in the *Basic Science Educator*
- Company listing as Platinum Corporate Sponsor on the IAMSE Website (with hyperlink)
- Two free registration fees at the IAMSE Conference ($700-800 value)
- Free Exhibit privileges at the IAMSE Conference ($1,000 value)
- One free use of IAMSE mailing list
- Two free full-page advertisements in the *Basic Science Educator* ($800 value)
- 25% discount on all advertising in the *Basic Science Educator*
- Member rates on all IAMSE products

## GOLD LEVEL – $3,000

- Four copies of the *Basic Science Educator*
- Company listing as Gold Corporate Sponsor in the *Basic Science Educator*
- Company listing as Gold Corporate Sponsor on the IAMSE Website (with hyperlink)
- One free registration at the IAMSE Conference with payment of exhibit fee ($350-400 value)
- 80% discount on Exhibit Fees at the IAMSE Conference ($800 value)
- 50% discount on one-time use of IAMSE mailing list
- One free half-page advertisement in the *Basic Science Educator* ($250 value)
- 25% discount on all advertising in the *Basic Science Educator*
- Member rates on all IAMSE products

## SILVER LEVEL – $1,500

- Three copies of the *Basic Science Educator*
- Company listing as Silver Corporate Sponsor in the *Basic Science Educator*
- Company listing as Silver Corporate Sponsor on the IAMSE Website (without hyperlink)
- Up to two $100 discounts on registration fees at the IAMSE Conference with payment of exhibit fee
- 25% discount on Exhibit Fees at the IAMSE Conference ($250 value)
- 25% discount on one-time use of IAMSE mailing list
- One free quarter-page advertisement in the *Basic Science Educator* ($150 value)

## BRONZE LEVEL – $750

- Two copies of the *Basic Science Educator*
- Company listing as Bronze Corporate Sponsor in the *Basic Science Educator*
- Company listing as Bronze Corporate Sponsor on the IAMSE Website (without hyperlink)
- One $100 discount on registration at the IAMSE Conference with payment of exhibit fee
- One free eighth-page advertisement in the *Basic Science Educator* ($100 value)

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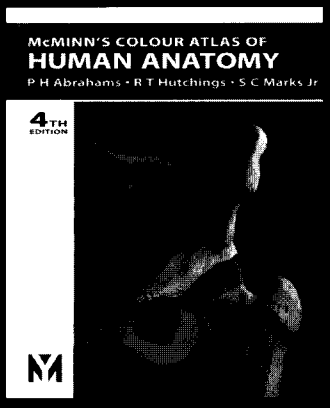


The world's premier photographic anatomy atlas presents crystal-clear photographs of dissections of all areas of the human body. Clinical notes are integrated throughout the text for thorough and clinically relevant understanding of anatomy, its normal structure and function, and how these are related to disease processes.

Peter H Abrahams,
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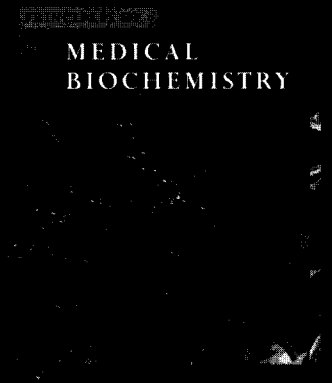
Mosby is proud to present the finest collection of histologic images ever published for medical students. Every single histology and electron micrograph has been painstakingly prepared by the author to provide your students with images that reflect exactly the images they'll see under the microscope. Clinical correlations are integrated throughout the text.

Jeffrey B Kerr

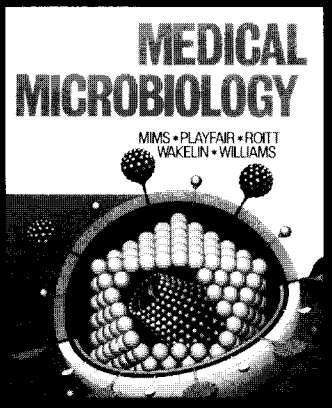

The new edition of this best-selling textbook combines concise text with full-color illustrations. In addition to the basic science, this text considers immunology in relation to histology and pathology. Clinical aspects of immunology are illustrated with color photographs. Immunology Interactive CD-ROM 2.0 and Case Studies supplement this major text.

Ivan Roitt, Jonathan Brostoff &
David Male



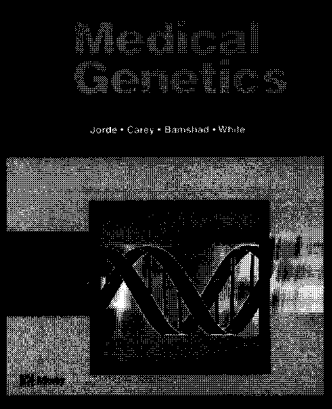

Throughout this text, aspects of human biochemistry are presented in the context of their function rather than as abstract chemical entities. These are followed by descriptions of how functions are disrupted in the presence of disease. Crisp illustrations depict important mechanisms as well as key chemical structures.

Gerhard Meisenberg &
William H Simmons




The second edition of this outstanding text takes an approach that is unique amongst microbiology textbooks, keeping in line with modern curricula. It gives a systems-based treatment, looking at the microbiology of the agents causing disease and the diseases affecting organ systems. Over 450 color illustrations explain difficult concepts clearly.

Cedric Mims, John Playfair,
Ivan Roitt, Derek Wakelin &
Rosamund Williams




This text provides students with a balanced, comprehensive introduction to genetics and clinical practice. New to this edition is an entire chapter on biochemistry and expanded coverage of genetic counseling and gene therapy. There are more of the popular clinical commentary boxes that emphasize the link between genetic principles and clinical practice.

Lynn B Jorde, John C Carey,
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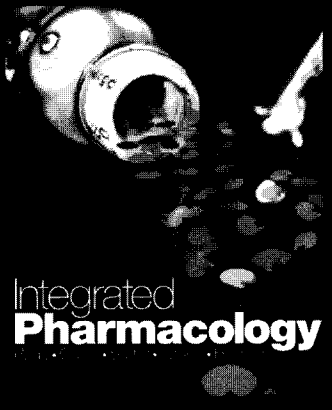


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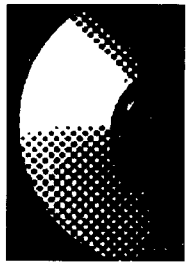

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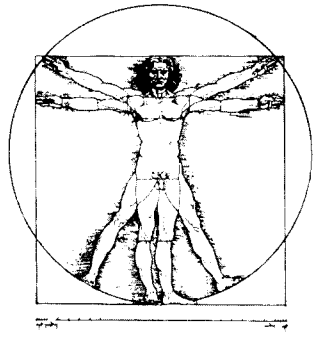

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