INTERNATIONAL UNION OF PHYSIOLOGICAL SCIENCES TEACHING WORKSHOP, AUGUST 21–24, 2001, LINCOLN UNIVERSITY, LINCOLN, NEW ZEALAND

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Key words: physiology education

A very successful, interactive Workshop on Teaching Physiology was held at Lincoln University, representing the fifth such gathering in association with an International Union of Physiological Sciences (IUPS) International Congress. In total, 70 participants came from 25 countries. Participants were housed comfortably together on the campus of the Lincoln University; local staff were friendly and helpful, and the facilities were good. Fifty-three abstracts were submitted, relating to posters and computer-based learning resources.

Participants joined in a range of activities relating to teaching and learning in physiology and neuroscience. Throughout, 45 colorful posters were displayed, covering a large array of issues from 22 countries around the world and generating a great deal of interest and discussion. Ten related to teaching in different national contexts and a similar number reported aspects of computer-based learning in physiology. Others illustrated assessment and a range of teaching strategies, including problem-based learning; smaller numbers described class experiments, specific topics in teaching, curriculum design, evaluation, or the effectiveness on learning of students’ own research. The poster display was ably summarized in a plenary session by Elaine del bel Guimaeres (Brazil) and Feisal Subhan (Pakistan).

In addition, a range of presenters dealt with important educational issues in plenary debates and in interactive workshops (including assessment, evaluation, active learning, the use of models, teaching in neuroscience, educational planning, learning tools). A stimulating and very well received plenary workshop led by Dr. Neil Fleming (Lincoln University) introduced the issues of learning styles. Other, smaller workshops also included consideration of practical teaching, with some hands-on experiences, and the versatility of the PowerLab system was demonstrated in different contexts. Computer-based learning programs developed by participants were available for exploration and review. Lively discussion groups considered issues from an international perspective, and their reports appear below. The key feature of the workshop was the friendliness of those present, resulting in their active engagement, contribution, and enthusiasm.

Three-fourths of those participating reported some previous experience of workshops or activities related to educational development - local, national, regional, or international - indicating a welcome, increasing trend toward professional educational development of physiologists worldwide. In previous teaching workshops, the majority were new to such activities.

Key issues that emerged included those concerned with curriculum design, assessment, and evaluation, with the focus throughout being on the learners. The use of computers in teaching was an important issue for many - in practicals, in the use of learning packages, and in providing some learning resources for students. There was a wide range of views on the
appropriate place of the different uses of computers within the curriculum but wide agreement on the need for access to some agreed-upon process of review and evaluation of the ever-increasing programs, materials, and resources. Many participants were keen to see “a globalization of teaching resources” in the words of Usha Nayar, many supporting the development of an educational website by IUPS. The role of practicals remains central for educating physiologists, but the emphasis in many countries is moving away from experiments on vertebrate animals.

In the evaluation at the end of the workshop, all present indicated that their expectations had been met or exceeded. Those who attended valued most highly the people, the international flavor, and the opportunities for extensive interaction, as well as the variety of activities available. Obviously, the provision of parallel sessions made it possible to offer a great variety of experiences. All the different types of sessions were very positively rated, although a few participants reported finding it difficult to make choices between the various options.

After the Workshop, the main IUPS Congress was held in Christchurch, New Zealand. For the first time, an educational poster session was included, with a discussion afterwards. About half of those present had not attended the workshop. Again, the discussion was lively, and it is hoped that a similar activity will be included in all future congresses, along with the opportunity for a synesthesium and other educational activities, including displays of educational materials, generated commercially or by enthusiastic teachers themselves.

During the Congress week, the IUPS Council moved to limit the number of specialist Commissions and to offer the former Teaching Commission the opportunity to become the Education Committee of IUPS. When those changes are finalized, the international group will re-form and make plans to develop new initiatives for supporting and enhancing the teaching of physiology worldwide. Comments and ideas can be emailed to Ann Sefton (anns@gmp.usyd.edu.au) or Penny Hansen (phansen@mun.ca).

SUMMARY REPORTS OF DISCUSSION GROUPS

COMPUTERS IN PHYSIOLOGY EDUCATION (A)

We focused our discussion on two broad issues:

- Why do we use, or want to use, the computer in teaching physiology?
- What is needed to facilitate the use of computers in teaching physiology?

Why Do We Use, or Want to Use, Computers in Teaching Physiology?

We came up with two different statements about why we use computers in teaching physiology. First, we decided that we use (or should use) the computer to accomplish what cannot be accomplished without the computer. The computer is a tool, and like all tools, it should be used to accomplish what it does best. The computer is not a cure-all for the problems of teaching physiology, and it should not be thought of as a replacement for the teacher or anything else.

Second, we decided that we want to use the computer to help our students master those parts of physiology that are hard for them to learn or understand. In other words, we want to use the computer to help students when other learning resources cannot accomplish the task, or at least do not do as good a job.

We then discussed some of the things we use computers to do in order to accomplish the two broad goals defined above.

Computers can make it possible for students to visualize concepts or ideas that are otherwise abstract and/or invisible. They also enable students to see the dynamics (temporal and spatial) of important physiological phenomena. For example, the spread of excitation over the heart has both temporal and spatial
components, and seeing each of these can help students to better understand the function of the heart.

Computers are also valuable tools for simulating the behavior (responses) of physiological systems. Such simulations have a myriad of uses, from visualizing system responses (see above) to providing opportunities for problem solving to use as substitutes for laboratory practicals.

Computers also provide students with unlimited (24 hours a day, 7 days a week) opportunities to practice problem solving with appropriate feedback (a necessary experience if students are to understand and not just memorize physiology).

**What is Needed to Facilitate the Use of Computers in Teaching Physiology?**

One of the major problems facing all users and potential users of the computer is the perception that there is no central source of information about available software. If no comprehensive database of available software exists, IUPS ought to attempt to facilitate the creation of such a resource.

Related to the lack of information about available software is the lack of any kind of reviewing mechanism for teaching programs. It was recognized that reviewing software is a difficult and time-consuming process that should involve both teachers of physiology and students. Given the difficulties that are inherent in reviewing software, and the rate at which new programs are appearing, it is unlikely that any appreciable percentage of the available programs will ever be reviewed. Nevertheless, efforts should be made to facilitate and promote such reviews.

The lack of reviews makes it necessary for each teacher to review those programs that he or she thinks might be of use to students. The development of a list of the criteria to be used in reviewing teaching programs would be extremely valuable.

It was proposed that *local* test sites for teaching programs be established across the globe, providing for reviews of software by diverse students and in many different kinds of teaching programs.

It was suggested that IUPS and local physiological societies (particularly the American Physiological Society) could play a role in implementing the suggestions made above.

- Report submitted by Joel Michael, USA

**COMPUTERS IN PHYSIOLOGY EDUCATION**

**(B): COMPUTER-ASSISTED LEARNING (CAL)**

The group had a very active and useful discussion.

**Types of CAL**

We began by attempting to define the types of CAL available and produced the following summary list.

a) Content/Tutorial:

- First Order Interactive (e.g., repurposed textbooks)
- Synthesis Level Interactive (e.g., collection of content from different disciplines integrated into one learning/teaching resource)

b) Computer-Assisted Assessment
c) Problem Solving/Critical Thinking
d) Simulations of Laboratory Experiments
e) Problem-based learning (PBL)/case-based

**Replacing Current Teaching**

Some time was spent discussing whether software should/could be used as an aid to or as a replacement for current teaching methods. It was also felt that some CALs could provide a new opportunity (e.g., distance learning, collaborative learning, alternative to labs for which specific expertise/equipment does not exist, etc.), which could not be achieved by conventional teaching.

**Strategies for Implementation**

From the outset, the group decided to take certain aspects of CAL use as read.

- Teachers had decided that they wanted to use CAL in their teaching.
• They had sourced, evaluated, and acquired a specific piece of CAL.

The discussions then focused on how to convince students that using a CAL was worthwhile and how to enable teachers to successfully integrate the CAL into their courses.

**For students.** The single most important driver was believed to be that the content knowledge derived from the software must be assessed as part of the formal assessment process.

**For teachers.** The software should contain content or provide tools that help achieve objectives that have been designed for the course/curriculum.

Faculty members must take ownership, i.e., tailor software programs to meet educational needs. This could be achieved by customization of the software program by, for example, creating a study guide/workbook to assist learners.

Once incorporated into the program or unit of study, computer-aided learning must be evaluated to assess its impact and effectiveness.

- Report submitted by David Dewhurst, UK

### PRIORITIES OF TEACHING OF PHYSIOLOGY IN UNDERRESOURCED COUNTRIES

Physiology faculty in the developing world are faced with many odds in their efforts to establish their departments and contribute to the development of competence in the discipline of physiology. A general assessment of the situation by the discussion group required a pragmatic approach. Thus they considered the issues of all the three segments (institution, faculty, and students) concerned in the teaching of physiology and discussed possible solutions.

### Institutions

**Curriculum.** In line with the changing world trends and local community needs, there is required a periodic review of the curriculum. Both faculty and students should be involved in the process so that ownership of the identified needs will remain evident.

**Faculty development/research programs.** There is a pressing need to ensure that the capacities of the faculty are developed. Institutions are expected to have in place ongoing programs of training workshops and programs. Despite often heavy teaching loads, faculty always indicate their keenness to carry out research. Degree-oriented research programs will ensure sustained motivation and commitment. Modest and achievable research programs and collaborations with local relevance can be developed with the help of colleagues in developed countries.

**Learning (textbooks/websites/Internet).** It is to the advantage of the world community to participate in the transfer of knowledge and technology needed for the improvement of living conditions in the Third World. Key learning resources such as textbooks, computers, and accessibility to websites and the Internet are grossly deficient in many institutions of the developing world. It was suggested that national professional societies with the help of their colleagues in developed countries can be instrumental in collecting (at least) used textbooks and organizing their transportation with sponsors such as UNESCO, Third World Academy of Sciences (TWAS), COMSTECH, and the Asia Foundation. In countries where the language used is other than English, arrangements may be made to translate important titles into the local languages. Organizations such as those listed above may be persuaded to sponsor such ventures.

### Faculty

**Brain drain.** Already-depleted departments of physiology in developing countries are facing the chronic problem of the brain drain. Besides improving working environments, faculty serving in the basic sciences need to be attracted by offering attractive incentives so that the dedicated faculty can sustain a respectable living.

**Faculty development.** Faculty linkages and exchanges at the regional level could be one way to fill the gaps. Opportunities of visiting professorships from both the developed and the developing world
should be created. The organization of workshops by such staff could be a useful resource to meet both short-term and long-term needs.

Well established and resourced professional societies by organizing workshops and training programs could play a more effective role in enhancing cooperation and professional development. International sponsoring needs to be organized to have a permanent program in place.

Students

Students play a pivotal role in shaping the future of the discipline of physiology. Students entering medical schools must be competent and motivated to accept the challenge of dealing with human lives. Appropriate entry requisites therefore must be adopted. Measures must also be taken to ensure diversity in the student population. This will help them to work in varied community environments.

Occasionally, highly motivated and brilliant candidates fall short of meeting the entry prerequisites. Inadequate proficiency in English is usually the cause. Such students should be identified and assisted to overcome this particular deficiency.

Future faculty are to emerge from among the students. Their induction into ongoing research programs in the department could motivate them to become research oriented, to promote creative thinking, and to sharpen their analytical skills, thereby resulting in their possibly assuming physiological research as a career.

Institutions in the developing countries are usually faced with disruptive activities among the student body leading to disruption in academic activities. Besides counseling and mentoring, one way to alleviate this problem could be to assign them a role in curriculum development and review. Such an approach is likely to persuade them to refrain from indulging in disruptive activities.

- Submitted by Arif Siddiqui, Pakistan

RETAINTING THE IDENTITY OF PHYSIOLOGY AND NEUROSCIENCE IN AN INTEGRATED CURRICULUM

Physiology is a central discipline, related to many others (e.g., anatomy/histology, clinical medicine). Historically, from it has grown a range of newer disciplines including biochemistry and pharmacology. It can thus be seen as a core discipline for many professional and scientific programs.

Why Retain an Identity?

- Concepts in physiology are central to normal function and the maintenance of homeostasis
- Subject experts in physiology are needed to design cases, act as resource persons, and assess content

Self-Survival?

How?

- Curricula can be (and often are) organized on the basis of physiological systems (a good organizing principle)
- The final curriculum needs to be reviewed constantly for balance and content
- Physiology staff can become involved in case design
- Assessment of physiology and neuroscience concepts has to be undertaken by experts
- Staff can stimulate student motivation
- Evaluation by staff and students is crucial to ensure a continuing contribution.

Integration

- Problem-based learning (PBL) is an example in many medical programs
- The principles can be adopted in medical biosciences more generally (e.g., science, veterinary science, dentistry, other health sciences).
In PBL

- Students can be encouraged to identify relevant learning issues, and physiology/neuroscience must be adequately tested
- International website is needed for PBL resources and ideas.

Assessment

- Physiology/neuroscience concepts need to be tested
- Newer assessments are starting to be used to test reasoning skills as well as knowledge
- It has been shown that students in PBL use their basic science understanding in problem-solving.

Evaluation

- Guides faculty in teaching methods
- Establishes whether broader curriculum goals (knowledge, skills, behaviors) have been met.

It was also noted that student opinions vary: some favor more discussion; some want more didactic classes.

- Submitted by Usha Singhal, India

IMPROVING STUDENT LEARNING

The group began by brainstorming ideas for improving student learning. After discussion of each suggestion, the ideas were roughly categorized into various areas, and the final structure was then refined, discussed, and approved by the entire group.

The key emphasis (goal) was to assist in producing students who are motivated to learn by fine-tuning various aspects of both the learning environment and assessment. Goals and characteristics of both assessment and the learning environment have been listed, along with specific responsibilities of the faculty member for improving the learning environment. Some of the various techniques that can be chosen to facilitate the goals of either assessment or the learning environment (or both) are also listed. Thus this summary represents the combined contributions of 22 physiology faculty members from 10 different countries.

Students Who Are Motivated to Learn

- feel that they can accomplish the expected learning
- know what they don’t know/can’t do
- are aware of their lack of knowledge and the need to know/understand
- realize what their knowledge will do for them

Assessment: Goals and Characteristics

The goals of assessment include

- providing feedback to students
- aligning teaching, learning, and assessment
- providing feedback to faculty.

Characteristics include

- applying both formative and summative assessment
- using assessment to develop skills of self assessment

Opportunities available include

- individual and group assessment
- innovative kinds of assessment
- assessing the development of skills, knowledge, attitudes, and behaviors

Techniques that can be used for either assessment or learning include having the students

- predict, observe, explain activities
- think about open-ended questions
● think—in pairs—share activities and discuss
● engage in small group activities
● undertake peer teaching/learning
● ask questions
● do the lab/hands-on activity first
● take group tests
● repeat tests
● use multi-media and technology

Learning Environment: Goals and Characteristics
Goals: the students should be able to
● link learning to previous knowledge
● know what learning is
● understand how they learn as an individual
● learn to become self-directed lifelong learners.

Characteristics: a good learning environment
● is safe, supportive
● is personal
● encourages collaboration
● is structured to provide time to meet the goals
● ensures activity (learning is what the students do)
● incorporates activities for multiple modes of learning
● accommodates different learning styles
● makes available adequate computer, library and other resources
● is fun.

Faculty’s contribution to a good learning environment includes

● recognizing the need to be educated about teaching and learning
● providing an appropriate context/relevance
● offering feedback to students
● being motivated to support the goals of the course/program/unit
● having clearly defined, realistic expectations of student learning

- Submitted by Barbara Goodman, USA

Our thanks are due to members of the Commission for Teaching Physiology (some of whom have authored sections above), particularly Dee Silverthorn (USA) for help throughout, Rob Kemm (Australia) particularly for the website development, and Adrianta (Indonesia) for the development of a list-serve to help organize and follow up the workshop, as well as many others who contributed to the design and delivery of the workshop activities.

The workshop was supported by the IUPS Council, International Brain Research Organization, A.D. Instruments (who also provided hands-on sessions throughout the workshop), American Physiological Society (whose contribution supported the attendance of nearly 30 participants from developing countries), Prentice-Hall Publishers and NZ Renaissance (Apple Computers). Without such assistance, the workshop would not have been possible.

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Received 6 December 2001; accepted in final form 6 December 2001