

Teacher to Student, Student to Teacher: The Wonderful Cycle

Linda S. Costanzo Arthur C. Guyton Physiology Teacher of the Year Medical College of Virginia, Richmond

I have spent more time than usual this past year thinking about teaching and students. I wanted to write an article for the VCU community, but the obvious topics—the ones making the rounds at meetings—struck no special chord. Teaching as scholarship? Evaluating and rewarding teaching? Computers instead of teachers? All worthy of discussion. However, in the quiet moments, what I contemplate is what lies at the heart of our motivation as teachers.

I first taught as a postdoctoral fellow at Cornell Medical College in New York City. The Chairman of Physiology approached me about giving a couple of lectures on the microcirculation to first year medical students. Teaching had been something I wanted to try and so I agreed. I started preparing the notes right away, reading and citing original research. The notes of my experienced predecessor seemed good, but I

 planned to raise the microcirculation to new heights.

The date for the lectures approached and the chairman inquired about my progress. At his request, we arranged for a "dress rehearsal" in the lecture hall-amphitheater. The chairman took a seat in the back row, about three miles up. In two agonizing hours, I committed just about every possible offense on good teaching. The verdict was pronounced from the back of the room—"This will never do! We'll do it again tomorrow." I was shaken and embarrassed, but thankful that I hadn't made a fool of myself in front of 100 medical students. While I don't remember the actual lectures well enough to tell any stories, I will never forget the lessons learned on rehearsal day with the booming pronouncement from the back.

There were the minor lessons. Young faculty often commit the sin of overkill, teaching and testing right at the limit of their own knowledge, hoping to dispel any doubt about their qualifications. Young faculty are often so caught up in their own fear of performance, that teaching, caring whether or not the student learns, is secondary. These difficulties will disappear with time and practice, as long as there is humility and the desire to become a good teacher.

The major point of the story is more subtle but far more important. An extremely busy department chairman would not tolerate an inadequate lecture to his students. He cared enough to spend his own time with a green, overzealous young faculty member to insure quality teaching. The lesson taught by his example, never stated or discussed between us, has been with me ever since.

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The Physiologist Published bimonthly and distributed by The American Physiological Society 9650 Rockville Pike Bethesda, Maryland 20814-3991 ISSN 0031-9376

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Publications Committee: Chairman, Leonard R. Johnson; Members, Diana Kunze, Lorne Mendell, Loring R. Rowell, and John A. Williams. Publications Manager, Brenda B. Rauner; Editorial Staff, Laura North and Lorraine Tucker.

Subscriptions: Distributed to members as part of their membership. Nonmembers in the USA: individuals \$25.00; institutions \$37.00. Nonmembers elsewhere: individuals \$35.00; institutions \$48.00. Single copies and back issues when available, \$10.00 each; single copies and back issues of Abstracts issue when available, \$20.00. In 1993, subscribers to The Physiologist will receive it and the abstracts of the Fall Conferences of the American Physiological Society. The American Physiological Society assumes no responsibility for the statements and opinions advanced by contributors to The Physiologist.

Deadline for submission of material for publication: Dec. 15, February issue; Feb. 15, April issue; April 15, June issue; June 15, August issue; Aug. 15, October issue; Oct. 15, December issue. If you change your address or telephone number, please notify the central office as soon as possible. Printed in the USA.

Headquarters phone: 301-530-7118. Fax: 301-571-8305.

G. Edgar Folk, Jr., **Senior Physiologist** Fund

The G. Edgar Folk, Jr., Senior Physiologist Fund has been set up through the generosity of family and former graduate students and postdocs to provide modest but helpful assistance to senior physiologists 70 years or older who no longer have grant funds available to them. The awards might be used for such purposes as attending an APS meeting to present a paper, engaging in a series of modest experiments, or completing a manuscript (paying for typists or perhaps page charges). Recipients will be selected with the assistance of the Senior Physiologists Committee throughout the year. Names of awardees will not be made public. Mary Folk writes that the purpose of the fund is for the Senior Physiologists Committee "to have fun assisting colleagues and for Emeritus APS members to keep in closer touch with APS."

Inquiries concerning the G. Edgar Folk, Jr., Senior Physiologist Fund should be made to Martin Frank, Executive Director, APS.



Physiology and Pharmacology Disciplines for the 21st Century

An APS Symposium Presented at Experimental Biology '93

Organizers: Morton Printz, University of California, San Diego Hiroko Nishimura, University of Tennessee, Memphis

Introduction: Morton Printz

The last 20 years have brought significant advances in all of the sciences and especially in our knowledge of biological systems. Our greater knowledge today of the mechanisms of cell-cell communication helps us understand the genetic basis for eukaryotic cellular function and pathology, the structure and function of receptors and intracellular signal transduction mechanisms, and how cells interact to give rise to coordinated organ system responses, to name but a few of the advances. Many investigators, myself included, believe we are on the threshold of yet another "quantum leap" in the knowledge that comprises our disciplines. Yet, with all this excitement, there has been, over the last five years, a deepening gloom expressed at scientific meetings and conferences. An overwhelming number of physiologists and pharmacologists have indicated, in writing or conversation, that a "crisis" exists in our disciplines. There is a ferment that has entered the disciplines which is driven, possibly in large part, from the rapid introduction of molecular and cellular techniques into pharmacology and physiology. Many believe that grant review study sections have exacerbated this ferment through awarding fundable priority scores more readily when the proposal primarily employs molecular or cellular techniques. The animal rights movement has contributed to this ferment by making it increasingly difficult to undertake studies of the regulation of complex biological systems at the multicellular or whole organ system level. Yet, as disturbing as these outside influences may be, perhaps the most challenging issue is the fact that many pharmacologists and physiologists tend to hide the identification of their discipline and prefer that they be known as molecular biologists (not even molecular pharmacologists), bioengineers, biotechnologists, etc., but not physiologists or pharmacologists. Graduate programs have changed their names and curriculum, ostensibly to reflect a widened faculty base, but also, many faculty will admit, to better attract graduate students.

If indeed there is a crisis, then can solutions be found? Clearly, before one can find answers to the challenges that confront the disciplines of physiology and pharmacology, it is necessary to correctly identify the question(s). Rather than talking about changes in the curriculum, perhaps a more fundamental question is whether physiology and/or pharmacology as distinct disciplines have lost their identification and utility. If the disciplines are to continue, what form should physiology and pharmacology take as disciplines in the 21st century? This symposium is an outgrowth of many conversations between the organizers and our colleagues and seeks not to find answers but to define the questions. Once we know the questions, we will know the answers. The symposium format will have a state-of-the-art research presentation followed by a position paper addressing what the speaker believes are the critical issues that our disciplines must address if we are to continue to train future physiologists and pharmacologists in conducting such cutting-edge research in the 21st century. The issues that confront the disciplines are many and multifactorial. All the speakers have been involved in dealing with this present ferment in our disciplines, and we have asked them to consider what are the challenges that must be dealt with if the disciplines are to survive and grow. We ask that you, the audience, also consider the fundamental questions, and we invite your comments and participation. To begin this thought process, we submit that an underlying question is the following: Does discipline drive research or does research drive (the) discipline?

Organ System Physiology

State-of-the-Art Lecture: Coalescence of "new technology" for an integrative approach for cardiovascular physiology. Allen W. Cowley, Medical College of Wisconsin

In the 21st century, I propose that the term "organ systems physiology" or "integrative physiology" will conjure up a very different image than it has in the waning years of the 20th century. If so-called "integrative physiology" is to survive as a distinct and recognized branch of the life sciences, it will be necessary for physiologists to broaden the meaning of the term "integrative." The revolutionary advances in cell and molecular biology have provided unprecendented opportunities to understand the structure and function of biological systems at levels of detail unimag-

New Awards Available

APS Career Enhancement Awards

The Council is pleased to announce the establishment of the APS Career Enhancement Award Program. This award program is an outgrowth of the Society's Strategic Planning process and is designed to enhance the career potential of our members. The awards will provide up to \$4,000 to allow individuals in the early phases of their careers to obtain special training and in later phases of their careers to develop new skills and to retrain in areas of developing interests.

The Awards can be used to support

 short-term visits to other laboratories to acquire new scientific skills;

 attendance at special courses devoted primarily to methodologies appropriate for both new investigators and more senior investigators entering a new field of research.

Members in good standing interested in applying should submit an application form including a curriculum vitae, justification for requesting an award, description of enhancement activity and current research program, and anticipated budget for the proposed program of enhancement. The applicant must also include a letter of support either from his/her department chair, laboratory host, or other appropriate individual.

For additional information about this new award program, contact Martin Frank, Executive Director, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814. Tel: (301) 530-7118. Fax: (301) 571-8305.



Giles F. Filley Memorial Awards for Excellence in Respiratory Physiology and Medicine The Giles F. Filley Memorial Fund was established in 1993 to recognize excellence in respiratory physiology and medicine. The awards are made to investigators who hold an academic rank no higher than assistant professor and are pursuing research in respiratory physiology and medicine. Each award will be for approximately \$12,000 and is designated for the use of the awardee in their research program. Awards do not include any indirect cost reimbursement.

Awards will be made annually to individuals demonstrating outstanding promise based on their research program in respiratory physiology and medicine. Applications will be accepted from members of the APS working within the United States, reflecting Giles F. Filley's contributions to the national research community through his membership in the American Physiological Society. Because of Giles F. Filley's long association with the University of Colorado, Denver, preference for one award, on a competitive basis, will be given to individuals affiliated with that institution.

The awards will be announced during the APS Business Meeting held at the Experimental Biology meeting and at the Respiration Section dinner. The recipients receive reimbursement for their expenses to attend the meeting and a plaque recognizing their designation as Giles F. Filley Awardees. The recipients are selected by a committee composed of members of the APS Respiration Section. **Deadline for receipt of applications is December 1.**

For information about application procedures, contact Martin Frank, Executive Director, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814. Tel: (301) 530-7118. Fax: (301) 571-8305.

Education

Materials Needed for Education Packets

APS staff are requesting that members who have activities, experiments, or materials that they have found useful during visits to K-12 classrooms send a copy or description to the APS Education Officer.

APS members are often asked to visit K-12 classrooms to talk about physiology, being a scientist, becoming a scientist, and the use of animals in research. Pulling together the resources to address these issues at a level appropriate for the particular age group of students can be time-consuming if not impossible, especially given short notice for a presentation. APS staff in the Education and Public Affairs Offices, with guidance from the corresponding APS committees, are developing packets of resources to assist APS members in their educational outreach activities. Three packets are being developed—one each for elementary, middle, and high school levels. Each packet will contain hands-on physiology activities to do with children, resources on scientific careers and using animals in research, and resources to leave with the teacher. The packets will utilize existing APS resources and those available from other scientific organizations and agencies, as well as newly developed materials. Packets will be available for distribution by summer 1994.

Ideas submitted by APS members will be incorporated into a "how-to" section of each resource packet. Questions about the resource packets and ideas and activities for submission should be directed to the APS Education Officer, Marsha Matyas, via mail, phone: 301-530-7132, or fax: 301-571-8305.

Would You Like to Host a High School Summer Research Teacher?

Application forms for the APS High School Science Teacher Research in Physiology Program are currently being distributed to physiology department chairs, interested teachers, and interested physiologists. This program provides \$5,000 fellowships for teachers to do research in the laboratories of APS members. Often high school teachers are interested in participating in the program but don't know of a physiologist who would be interested in having a teacher work in his/her laboratory. If you would be interested in having a teacher work in your laboratory for the summer, please complete and return the form below. If a teacher in your geographic area expresses interest in the program, we will refer him/her to you to discuss possible research projects.

Yes! I might be interested in having a Summer Research Teacher work in my laboratory!

NAME	
ADDRESS	
TELEPHONE	
FAX	

Return completed form to Marsha Lakes Matyas, APS Education Officer, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814-3991 or fax: 301-571-8305.

TEACHER OF THE YEAR

(continued from p. 163)



L-r: Arthur Guyton, Linda Costanzo, Roger Thies, and Lawrence McGrew (associate editor, W. B. Saunders).

Good teaching is very hard work, harder than it looks. Isn't it ironic that the best teaching appears to be effortless? Good teaching just flows. Point follows point, logically dispensed. Examples illustrate and reinforce, but also make new points, and so excite. Students may leave the classroom drained from the tension of following the story line, so anxious that they not be left behind. Yes, students should leave a good lecture a little weary, but exhilarated and wanting more.

The worst teaching seems labored and to require the greatest effort, as it is riddled with excuses and disclaimers—"they cut my lecture time," "my secretary didn't proofread my syllabus notes," and the most foreboding of all—"I cannot possibly teach you all that I know about this difficult subject in one hour" (the students grumble "50 minutes"). Students leave a poor lecture exhausted from attempting to follow the hodgepodge, but sometimes convinced that this is the best the professor could do with such a challenging topic.

Good teaching is so much a two-way street though. When caring, dedicated teachers meet enthusiastic students—magic! A classroom with several interested faces. An excellent, thoughtful question. Excitement about the subject matter, beyond "what we have to know for the test." The best teachers care whether the students "care back."

A single student can sometimes make a difference. Several years ago, I was teaching acid-base physiology to a burned-out group of first year medical students, hoping to be enthusiastic amidst all that burn-out. A student who I didn't know well came up to me before class to ask questions. Before he took his seat he said, "good luck on your lecture." That simple exchange meant the world, for the student showed that he thought of me as a person, that he understood I would need "luck," and that he understood the give-andtake of teaching. The beginning of our personal relationship ensured that I would be more successful as a teacher and he more successful as a student.

Students' questions provide some of the most rewarding moments in a teaching career. Whenever a student says that he or she needs to see me privately to ask a "stupid question," I know that it will be a good one. We will have an honest exchange and I relish the opportunity. I am touched that the student would trust me enough to dare ask the most basic question. At the same time, realize that my own ignorance may be exposed, since the "stupid questions" are always the tough ones—the ones that textbooks never clarify, that teachers routinely sidestep, and that are more unthinkable to ask the further one gets in a career. These are the most intimate moments in all of teaching, as student and teacher meet on some middle ground. Progress is made, another gap is bridged. The student is changed and so is the teacher.

The first time a student asked me why the most potent diuretics (those acting in the kidney's loop of Henle) increase urine production, I was stopped dead in my pedagogical tracks. After all, the student had understood from the lectures that this part of the kidney is not permeable to water, and so reasoned that its handling of water would be unaffected by such drugs. After I mumbled something about what a good question it was (!) and raced through some panicked silent reasoning, student and teacher sat together and discussed the complexities of the kidney with its magnificent ability to separate salt and water excretion at some times, to link them together at other times. I'm not sure the student ever realized how grateful I was to finally have an answer to one of these imponderable questions. I have been asked the same question many times since but the answering of it has never been as stressful or as exhilarating as it was that first time.

About seven years ago, when I was just getting my feet wet in the acid-base teaching business, a student caught up with me after class on the landing between floors in Sanger Hall for a "stairwell question." These are urgent, insightful, traffic-blocking questions. The problem was with my textbook level explanation of "volume contraction alkalosis." With all due respect he said, my explanation simply could not be true on physicochemical grounds. I could only admit that I didn't understand either how it could be and promised to get back to him when I resolved it. I called upon all the experts I knew and heard an interesting array of explanations. It seemed that we were all punting this one when teaching beginning medical students. However, I have never again given the textbook explanation, but a modified and more accurate version, at least as far as I understand it. Thanks to Pete Quagliano, wherever he is, for the insight and for the prompting to get the story straight. In short, for being the kind of student who has made me a better teacher.

An article in *Medical Education* (22: 393-397, 1988) entitled "Teaching Basic Science: Dr. Fox in the Physiology

Reprinted with permission from the VCU Voice, January 15, 1993.

Chicken Coop," was the report of an educational specialist's efforts to increase student ratings of teachers at the University of Utah School of Medicine. The plan was as follows: the educational specialist, knowing nothing about physiology, spent five hours training for and preparing a neurophysiology lecture for first year medical students. Then, armed with his minimal knowledge of the subject, and a superior ability to keep attention, to highlight major points and to end on time, gave the lecture without the students' knowledge of the scheme. It was no surprise to read that the students spontaneously applauded at the end of the lecture—after all, the actor had given them a breather with little depth, had entertained with well-placed diversions, and had followed his rules on good teaching.

Good teachers and good students should be infuriated by this trickery! The only suggestions put forth of any value were the obvious ones that successful teachers already know: be organized, be interesting and be mindful of the clock. There is a tendency to place far too much credence in the superficialities of the teaching performance. What really counts is the teacher's depth and clarity of understanding; then, the ability to translate that at an appropriate level with equal clarity and with heart-felt enthusiasm. What could possibly substitute for a scholarly base, experience, and the continuous renewal of scholarship? If you see Dr. Fox . . . run the other way!

What would happen if Dr. Fox were stopped for a "stairwell question?" Would he try to continue the charade or would he confess the scheme to the innocent student? Good teaching only begins in the classroom. If the teacher is lucky it will develop into a close, collegial relationship with the student that could last over years or even decades. If the student is inspired, interested, and senses no barriers, he might dare to ask the "stupid" questions or even the more sophisticated ones. And the teacher, warmed by that interest, will respond with openness and self-revelation. So, good teaching in this broader sense, has nothing to do with the scintillating performance of Dr. Fox.

Years after my ordeal with the microcirculation, I thought back to my own experiences as a student, searching for understanding of this fragile balance which student and teacher must maintain. Had I been the kind of student that I now wished my students to be? I thought of my own great teachers—in particular Drs. Jay and Helen Tepperman, professors of mine when I was a graduate student in Syracuse. The "T's", as we students fondly referred to them, had just finished the fifth edition of their textbook on endocrinology and were retired professors emeriti.

I remembered my contacts with them as a student: lectures from Helen Tepperman which could have set the gold standard for clarity and organization; a tutorial with Jay Tepperman several afternoons a week where I was mostly awed by one of the truly great "big picture" men and a selfdescribed "endocrinology watcher;" their book, which educated legions of medical students world-wide; the advanced endocrinology course, where the Teppermans brought in five or six of the world's leading investigators just to speak to us students and then entertained us at a reception; for me and many others, countless invitations to their home and their place at the lake; and their encouragement and interest in my progress long after I left their institution.

There was more. Simply put, Jay and Helen Tepperman made all the critical differences for me as a student, future investigator and teacher. I had gone to their institution to study kidney physiology and found myself in a bewilderingly apathetic state, unexcited by any of the available projects. What I loved were the afternoons with Jay and Helen Tepperman where they made tea and told stories about the old days in New York and New Haven and at the Medical Research Laboratories of Edgewood Arsenal during World War II with its mind-boggling collection of scientific talent. They talked about the annual June gatherings at the Gordon Research Conference on Hormone Action, which was like a summer camp for endocrinologists and where the Teppermans were major players. Above all, they talked in specifics about their beloved endocrinology with the most uncanny ability to relate the latest findings in a way that made sense. In other words, they ignited a fire in me that wasn't going to go out. Other students who were part of the afternoon tea group felt the same way.

I soon wrote a paper for Jay Tepperman on the effects of aldosterone on the kidney as a final exam for my tutorial with him. Aldosterone was a relatively "new" hormone which was attracting a lot of attention. Three theories of its mechanism of action were being hotly debated: the "metabolism" theory (many supporters), the "active transport" theory (a few supporters), and the "permease" theory (one supporter). I immersed myself in the published work in the area, wrote a review with the auspicious title, "On the Mechanism of Action of Aldosterone," and took sides with the "permease" supporter. What mattered most, however, about the aldosterone review was the suggestion by Jay Tepperman that I write on this subject which linked the kidney and hormones-the former to which I was pledged and the latter with which I was in love. I was off and running and sure that I would find a niche somewhere in the actions of hormones on the kidney, although it was not yet clear which hormone. From my reading of the literature, the aldosterone field already looked too bloodied.

The next pivotal event, again involving the Teppermans, was their invitation of Hector DeLuca to speak in the advanced course. DeLuca, working at the University of Wisconsin, was the hottest item in vitamin D and calcium metabolism. Vitamin D was no simple vitamin, but a fullfledged hormone with all the rights and privileges. I wasn't the only one in the room at the edge of the seat as DeLuca unfolded the story! My mind was already racing ahead, imagining what part I could play in this exciting new area of research. As always, the students were invited afterwards to have dinner at the Teppermans' home and talk with the guest speaker. That evening my thesis was conceived, and I was full speed ahead on vitamin D, calcium and the kidney.

My advisor was enthusiastic about this new area, but warned me that calcium was not his expertise. We reassured ourselves that Jay and Helen Tepperman knew a lot about another important player in calcium metabolism, parathyroid hormone, and had offered to help in any way. In the most incredible move of all, the T's invited Larry Raisz, their friend and calcium expert, to visit so that he could advise me before I embarked on the project. I was not even their thesis student! Raisz came over from Rochester, talked with me for half a day, imparted the inside wisdom on raising vitamin D deficient rats in total darkness, gave me his phone number, and welcomed me to the calcium fold. The Teppermans and my advisor saw me through the rest of the project and sat for my defense. Ultimately I left Syracuse for the fellowship in New York, but I never left calcium.

While many teachers played important roles in my development, none were as comprehensive or pivotal as those of Jay and Helen Tepperman with their old-school caring. What they offered, no strings attached, was a warm welcome into their large extended scientific family, with all the benefits of that membership. But why? What prompted them to give, over and over again? I must surmise that our relationship had that magical element, that elusive mutual give-andtake; the teachers cared and the student, in her own way, must have showed that she "cared back."

The flood of memories seemed incredibly accurate from the perspective of nearly twenty years out. What I could not remember was whether I had ever thanked the Teppermans for . . . well . . . everything. In retrospect, it seemed that I thought to, but never found just the right time. And then I panicked, because for a fleeting moment, I thought it might be too late. A letter to Jay and Helen Tepperman became top priority and it was quickly sent.

I was not to have the last word, though. By return mail, came a long letter and the latest edition of their book with their personal inscription. It said: "For Linda, bless you for writing. . . . At our age, we need all the positive reinforcement we can get! With all good wishes, Jay and Helen T." Two professors, with outstanding careers spanning almost one hundred collective years, with vast networks of associates, friends and admirers, were still touched by the belated thanks of a former student.

No matter where the public discussions at universities turn, whether teaching is redefined, or whether "new" ways are found to reward teaching, nothing will ever replace these simple expressions of interest, of concern, and of gratitude—teacher to student, student to teacher, and back again in a wonderful cycle. These are the driving forces of the student-teacher relationship and the underpinnings of good teaching for all time. ()

1994	
Intersociety Meeting	
Regulation, Integration, Adaptation: A Species Approach Organizers: E. J. Braun, J. R. Hazel, and S. H. Wright	October 29–November 2 San Diego, CA
APS Conferences	
Physiology of the Release and Activity of Cytokines	June 25–28
Organizers: J. T. Stitt, J. G. Cannon, G. W. Duff, M. J. Kluger,	Yale University
A. J. Lewis, and I. G. Otterness	New Haven, CT
Mechanotransduction and the Regulation of Growth and Differentiation	October 5–8
Organizers: H. E. Morgan, P. A. Watson, D. E. Rannels, F. Sachs, M. Schwartz, and H. Vandenburgh	Sarasota, FL
1995	
Understanding the Biological Clock: From Genetics to Physiology	
Organizers: Jay C. Dunlap and Jennifer J. Loros	

Meetings and Conferences

APS Conference

Mechanotransduction and the Regulation of Growth and Differentiation

October 5–8, 1994 Sarasota, Florida

Wednesday, October 5	Thursday, October 6	Friday, October 7	Saturday, October 8
Evening Lecture: Historical Perspective Regarding Studies into Mechanotransduction A. James Hudspeth (U Texas Med. School)	Morning Symposium: Musculoskeletal Responses to Mechanical Stimuli Herman Vandenburgh (Brown U)	Morning Symposium: Cardiovascular Adaptations to Mechanical Stimuli I Peter F. Davies (U Chicago)	Morning Symposium: Mechanisms of Mechan- ochemical Signal Transduction Fred Sachs (SUNY, Buff- alo) and Peter A. Watson (Weis Ctr Res/Geisinger Clin)
	Evening Symposium: Pulmonary Responses to Mechanical Stimuli D. Eugene Rannels (Penn State)	Evening Symposium: Cardiovascular Adaptations to Mechanical Stimuli II Howard E. Morgan (Weis Ctr Res/Geisinger Clin)	Afternoon Symposium: Regulation of Cell Shape and Function by the Extracellular Matrix Martin A. Schwartz (Scripps Res Inst)
			Evening Lecture: Complex Mechanochemical Signal Transduction Involved in the Regulation of Development David R. McClay (Duke U.)

APS Intersociety Meeting

Regulation, Integration, Adaptation:

October 29-November 2, 1994

Sunday, October 29 AM	Sunday, October 29 PM	Monday, October 30 AM	Monday, October 30 PM
8:15-9:15 am	1:00–3:00 pm	8:15-9:15 am	1:00–3:00 pm
Plenary Lecture	Poster Defending and Exhibit	Plenary Lecture	Poster Defending and
J. Diamond	Viewing	B. Block	Exhibit Viewing
9:30 am-12:30 pm	2:00–5:30 pm	9:30 am-12:30 pm	2:00-5:30 pm
Symposium: Excretion of ni- trogen-containing com-	<i>Workshop:</i> Phylogenetic approaches in comparative physi-	Symposium: Comparative respiratory neurobiology I	<i>Workshop:</i> Kinetics and lim- itations of intracellular pH
pounds: comparative aspects	ology	N. Smatresk	regulation
W. H. Dantzler	T. Garland, Jr. and R. Huey		N. Heisler
9:30 am-12:30 pm	5:30-8:00 pm	9:30 am-12:30 pm	5:30–8:00 pm
Symposium: Biomedical ap-	Free Time	Symposium: Anhydrobiosis	Free Time
plications of marine mammal physiology: adaptation to an		J. Crowe	
aquatic world			
M. A. Castellini			
9:30 am-12:30 pm	8:00–9:00 pm	9:30 am-12:30 pm	8:00–9:00 pm
Symposium: Evolution of en-	Plenary Lecture	Symposium: From myxine to	Plenary Lecture
dothermic metabolism	G. Somero	man: the physiology of the blood volume in regulation	C. R. Taylor
A. J. Hulbert		K. Olson	
9:30 am-12:30 pm		9:30 am-12:30 pm	
Symposium: Calcium regula- tion: mechanisms and control I: Calcium regulation in crus- taceans		Symposium: Calcium regula- tion: mechanisms and control II: Calcium regulation in lower vertebrates	
M. Wheatly and		M. Wheatly and	
P. Greenway		P. Greenaway	
9:30 am-12:30 pm		9:30 am-12:30 pm	
Symposium: Advances in rep- tilian and amphibian osmoreg-		Symposium: Neural modulation of muscle properties	
ulation		E. Arbas	
S. Yokota and S. Benyajati			

Poster boards are on display Sunday through Wednesday from 8:00 am to 9:00 pm.

A Species Approach

San Diego, California

This meeting is a collaborative effort of The American Physiological Society, American Society of Zoologists (Comparative Physiology & Biochemistry Division), The Canadian Society of Zoologists (Comparative Physiology & Biochemistry Division), German Society of Zoologists, and Society of Experimental Biology

Tuesday, November 1 AM	Tuesday, November 1 PM	Wednesday, November 2 AM	Wednesday, November 2 PM
8:15–9:15 am	1:00–3:00 pm	8:15-9:15 am	1:00-3:00 pm
Plenary Lecture	Poster Defending and Exhibit	Plenary Lecture	Poster Defending and
M. Koehl	Viewing	A. Bennett	Exhibit Viewing
9:30 am-12:30 pm	2:00–5:30 pm	9:30 am-12:30 pm	2:00–5:30 pm
Symposium: Comparative respiratory neurobiology II	Discussion: Contributions of comparative systemic physiolo-	Symposium: Subzero tempera- ture adaptations of poikilother-	Discussion: Evolutionary de- sign of functional capabili-
N. J. Smatresk	gy to theoretical biology	mic organisms	ties: How much is enough but not too much?
	F. Powell	J. Duman	P. Suarez
9:30 am-12:30 pm	5:30–8:00 pm	9:30–12:30 pm	5:30–8:00 pm
Symposium: Environmental and physiological determi- nants of muscle performance	Free Time	Symposium: Neurohormonal peptides in invertebrates— A model approach	Free Time
capacities H. Guderley		M. C. Thorndyke	
9:30 am–12:30 pm	8:00–9:00 pm	9:30 am–12:30 pm	6:00–8:00 pm
Symposium: Ontogeny of cardiovascular systems I: Mechanisms	Plenary Lecture L. Riddiford	Symposium: Ontogeny of car- diovascular systems II: Diversity in developmental patterns	Banquet, Awards Presentation, and Lecture
W. Burggren		W. Burggren	
9:30 am-12:30 pm		9:30 am-12:30 pm	8:00–9:00 pm
Symposium: New insights into the function of the vertebrate kidney: Lessons from jawless, cartilagenous and bony fish I		Symposium: New insights into the function of the vertebrate kidney: Lessons from jawless, cartilagenous and bony fish II	Scholander Award Lecture P. W. Hochachka
K. Beyenbach		K. Beyenbach	
9:30 am–12:30 pm		9:30 am-12:30 pm	
<i>Symposium:</i> Ecological physiology of endangered animals: Physiological contributions to the preservation of biological diversity		Symposium: Adaptations to hypoxia: Regulatory mechanisms on the systemic and metabolic levels	
M. S. Gordon		M. GHESHADEI	
9:30 am-12:30 pm			
Symposium: Adaptations to ex- treme exvironments			
N. Hazon			

Membership

Council Meets in Bethesda

The APS Council had the opportunity to sample a typical Washington summer when they met in the 90+ heat and humidity of Bethesda from July 9 to 11. The meeting marked the annual gathering of the Council to receive reports of committee activities from the committee chairs. Most of these committee reports were published in the August issue of *The Physiologist*.

The joint Council and Committee chairs meeting provides the opportunity to review last year's activities, discuss opportunities for the future, and to develop projects that can be implemented through collaborative efforts. Such a project is the Resource Packet being developed by the Careers in Physiology, Education, and Animal Care and Experimentation Committees to assist our members in their efforts to take physiology and animal research into the pre-college classroom. With the employment of Marsha Matyas and Alice Hellerstein, pre-college education and career information have become a more significant Society activity.

During the meeting, Council also received the report of the Task Force on Awards, which reviewed the status of the Society's prestigious lectureships, the Henry Pickering Bowditch and Walter B. Cannon Award Lectureships. The Task Force received comments from the APS Past Presidents and reviewed procedures used by other basic science societies and recommended that the size of the honorarium and the selection procedures be modified. In the future, the membership will be encouraged to nominate candidates for these Awards, with selection being made by the Executive Cabinet. In addition, the honorarium associated with the Bowditch and Cannon Lectures was increased to \$2,500 and \$4,000, respectively.

The Council also approved the Task Force's recommendation that the Society allocate funds for Career Enhancement Awards for members in good standing. These awards would be for up to \$4,000 and be designed to assist APS members in their efforts to learn new methodologies through a visit to a laboratory or enrollment in a special course. These awards are designed to help our members enhance their skills so they can better compete in the scientific marketplace.

The Membership Committee also presented a series of bylaw changes designed to accommodate the suggestions of a Task Force on Membership that had met earlier in the year. The bylaw changes are designed to recognize the fact that "independence" is not as easily attained in the current funding environment. Individual scientists are spending four to six years in postdoctoral positions, working as research faculty, and/or working in collaborative groups. Recognizing this change, Council approved the Committee's recommendation that the Associate and Associate Corresponding membership categories be eliminated. Students, having completed their doctorates and having published one paper from their thesis, would be able to apply as Regular and Corresponding members, with a reduction in dues for the first several years. Members currently in these categories would be promoted to Regular and Corresponding members. Full details of the pro-



APS Council. Back row (l-r): Martin Frank, Neil Granger, James Schafer, and Franklyn Knox. Middle row (l-r): Leonard Jefferson, Mordecai Blaustein, Frank Powell, Jr., Gabriel Navar, and Heinz Valtin. Front row (l-r): Helen Cooke, Stanley Schultz, Brian Duling, William Dantzler, and Barbara Horwitz.



APS Committee Chairs. Back row (l-r): Joseph Haywood, Franklyn Knox, Gabor Kaley, Frank Powell, Jr., Stephen Flaim, and Diana Marver. Front row (L-r): Donald Jennings, Mary Anne Frey, Hannah Carey, Eleanor Ison-Franklin, and Heinz Valtin.

posed bylaw changes will be published in the December issue of *The Physiologist*.

The Council also approved the establishment of Distinguished Lectureships for each of the 12 sections of the Society. The Lectureships are to be named after physiologists that have made significant contributions to the section's area of physiology and be presented at the spring meeting by an outstanding scientist. In addition to presenting the Distinguished Lecture, the speaker will be asked to participate in other section activities at the meeting, such as chairing a session, attending the section dinner, and/or meeting with graduate or postdoctoral students. The establishment of the Lectureships was proposed by a subcommittee of the Section Advisory Committee.

Council also approved the allocation of funds for an organizational membership in the incurably ill For Animal Research. The Council recognized the importance of this group and expressed the view that the APS should continue to support national groups that promote biomedical research and the use of animals in research. Currently, APS supports the National Association for Biomedical Research and Research!America.

The Council also began planning for its fall retreat scheduled for November 21 and 22, following the APS Conference on "Signal Transduction and Gene Regulation." Council is concerned about the state of physiology education, both at the pre-college level and at the graduate/medical school level. During the retreat, Council hopes to review the Society's programs and identify areas in which APS can influence the educational process. It is hoped that representatives from the LCME and NBME will be able to attend the meeting to discuss the role physiology and other basic science disciplines play in the accreditation process.

Additional details of the Council's actions during the July meeting will be communicated to the membership at the next Business Meeting and in *The Physiologist*. **45**



US Rep. Roscoe G. Bartlett, a physiologist representing the Sixth District of Maryland joined the Council and Committee chairs for lunch. Pictured, 1-r: Stanley Schultz, Bartlett, Brian Duling, and William Dantzler. Mrs. Bartlett is seated in front.

Council Thanks APS Staff

During the meeting, APS President Dantzler and Council hosted a reception to meet the APS staff and thank them for their service to the Society. The APS currently has 51 full- and part-time employees, a small percentage of whom meet with the Council and Committees on a regular basis.

Dantzler expressed the opinion that without the staff, the various programs and publications of the Society could not go forward. He noted that it was through their efforts that the Society has been able to prosper and be of service to the physiological research community and to our membership.

Dantzler then presented certificates to members of the staff who had reached five-year anniversaries. He noted that the average length of employment at APS is 6.24 years, suggesting that it is a pretty good place to work. Dantzler presented certificates to the following staff members: 20 years, Brenda Rauner, Publications Manager; 15 years, Laurie Chambers, Production Manager; 10 years, Ruth Freehling, Copy Editor, *Journal of Applied Physiology*; 5 years, Joanne Acevedo, Subscriptions; 5 years, Kristin Deneau, Membership Services; 5 years, Maria Kuhrmann, Copy Editor, *Physiological Reviews*.



L-r: Karen Cannon (publications), Beth Caseman (publications), and William Dantzler.



L-r: Martin Frank, Brenda Rauner (Publications Manager), and William Dantzler.

APS and Section Awards

Society Awards

Career Enhancement Awards

The APS Career Enhancement Awards are designed to enhance the career potential of APS members. The awards will provide up to \$4,000 to allow individuals in the early phases of their careers to obtain special training and in the later phases of their careers to develop new skills and to retrain in areas of developing interests.

The awards can be used to support short-term visits to other laboratories to acquire new specific skills and to support attendance at special courses devoted primarily to methodolgies appropriate for both new investigators and more senior investigators entering a new field of research.

Members in good standing interested in applying should submit an application form including a curriculum vitae, justification for requesting an award, description of enhancement activity and current research program, and anticipated budget for the proposed enhancement program. The applicant must also include a letter of support from his/her department chair, laboratory host, or other appropriate individual. For additional information about this new award program, contact Martin Frank, Executive Director, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814.

Caroline tum Suden Professional Opportunity Awards

The APS Caroline tum Suden Professional Opportunity Awards (\$500, complimentary registration, and placement service fees) are granted to as many as twelve graduate students or postdoctoral fellows who present a contributed paper at the Experimental Biology meeting. Candidates must be the first author of an abstract submitted to APS. An accompanying letter, signed by the sponsor of the abstract, must contain 1) certification that the author is a student or postdoctoral fellow and 2) the approximate date the nominee will be available for employment. Awardees are notified by the Selection Committee prior to February 15 and presented with their awards during the APS Business Meeting.

Giles F. Filley Memorial Awards for Excellence in Respiratory Physiology and Medicine

The Giles F. Filley Memorial Fund was established in 1993 to recognize excellence in respiratory physiology and medicine. The awards are made to investigators, who hold an academic rank no higher than assistant professor, and are pursuing research in respiratory physiology and medicine. Each award will be for approximately \$12,000 and is designated for the use of the awardee in their research program. Awards do not include any indirect cost reimbursement.

Awards will be made annually to individuals demonstrating outstanding promise based on their research program in respiratory physiology and medicine. Applications will be accepted from members of the APS working within the United States, reflecting Giles F. Filley's contributions to the national research community through his membership in the American Physiological Society. Because of Giles F. Filley's long association with the University of Colorado, Denver, preference for one award, on a competitive basis, will be given to individuals affiliated with that institution.

The awards will be announced during the APS Business Meeting held at the Experimental Biology meeting and at the Respiration Section dinner. The recipients receive reimbursement for their expenses to attend the meeting and a plaque recognizing their designation as Giles F. Filley Awardees. The awardees are selected by a committee composed of members of the APS Respiration Section.

For information about application procedures, contact Martin Frank, Executive Director, American Physiological Society, 9650, Rockville Pike, Bethesda, MD 20814. Tel: (301) 530-7118.

NIDDK Travel Fellowships for Minority Physiologists

NIDDK Travel Fellowships for Minority Physiologists are open to advanced undergraduate, predoctoral, and postdoctoral scientists who have obtained their undergraduate education in Minority Biomedical Research Programs (MBRP) and MARC-eligible institutions, as well as students in the APS Porter Development Program. Applications may also be submitted by minority faculty members at the above institutions. Funds will provide transportation, meals, and lodging to attend the annual spring Experimental Biology meeting. The specific intent of this award is to increase participation of the pre- and postdoctoral minority students in physiological sciences. Applicants need not be members of the APS but should be US citizens or hold permanent resident visas. Applications should include 1) information on academic background and experience; 2) a written statement of interest in research in physiology; 3) a letter of recommendation from the applicant's mentor; 4) a list of publications, if available; 5) a statement indicating the underrepresented minority (Black, Hispanic, American Indian, etc.) with which the applicant identifies himself/herself; and 6) an estimate of required travel and per diem expenses. The deadline for receipt of completed applications is December 8.

John F. Perkins, Jr. Memorial Fellowship

The American Physiological Society invites applications for the John F. Perkins, Jr. Memorial Fellowships. The Perkins Fellowships are designed primarily to provide supplementary support to foreign physiologists who have already arranged for fellowships or sabbatical leave to carry on scientific work in the United States.

The supplementary support is intended to help foreign scientists bring their families to the United States and thus enable them to take fullest advantage of other cultural benefits inherent in international exchange. Preference will be given to physiologists working in the fields of respiratory physiology, neurophysiology, and temperature regulation. Applications from scientists in developing countries will also be given special attention.

Application should be made by both the visiting scientist and his/her host. To qualify, the host must be a member of the American Physiological Society. The application should contain an account of these arrangements with a brief description of the proposed scientific work and an account of how visitors and their families intend to make use of cultural opportunities during their stay. Deadlines for receipt of applications are May 1 and November 1. Applications may be obtained from the Executive Director, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814, USA.

Orr E. Reynolds History Award

The Orr E. Reynolds Award is given annually by the American Physiological Society for the best historical article submitted by a member of the Society.

Articles may deal with any aspect of the history of physiology, including the development of physiological ideas and their application, instrumentation, individual and collective biography, departmental and institutional history, history of societies including APS, and physiology in its public context. Manuscripts submitted for the award should represent original research and be adequately documented. Articles published in APS journals or books during the prior calendar year are also eligible for the award upon request by the author(s). The award is open to all classes of APS membership except for those members who have advanced degrees in the history of science and medicine. A member may receive the award only once.

The awardee will receive \$500 plus expenses to attend the annual spring Experimental Biology meeting. If the awardee wishes, and there is a suitable place on the program, an oral presentation will be made at the Experimental Biology meeting or a subsequent conference at the beginning of an appropriate scientific session. It is hoped that, after appropriate peer review, the article will be published in one of the APS journals.

Manuscripts will be evaluated by a committee consisting of three members of APS appointed annually by Council in consultation with the chair of the History of Physiology Group. At least one member will be a professional historian.

Manuscripts should be typed and double spaced with wide margins on 8.5 x 11 paper and should conform to the style used in APS journals. (Instructions will be sent on request.) Three copies should be submitted for use of the review committee. Manuscripts should be sent to the Orr E. Reynolds Award, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814, by December 1. The recipient of the award will be announced at the Experimental Biology meeting.

Section Awards

Procter & Gamble Professional Opportunity Awards

The Procter & Gamble Professional Opportunity Awards (providing \$500 and complimentary registration for the spring Experimental Biology meeting) are granted to at least 17 predoctoral students who present a contributed paper at the meeting. Candidates must be the first author of an abstract submitted to APS and within 12-18 months of completing his/her PhD degree. All recipients must be US citizens or hold a permanent resident visa. An accompanying letter, signed by the sponsor of the abstract, must contain 1) certification that the author is a predoctoral student and 2) the approximate date of degree completion. Awardees will be notified before February 15. Awardees are selected by the following sections of APS: Cardiovascular, Cell & General Physiology, Comparative Physiology, Endocrinology and Metabolism, Environmental and Exercise Physiology, Gastrointestinal Physiology, Nervous System, Neural Control & Autonomic Regulation, Renal Physiology, Respiratory Physiology, Teaching of Physiology, and Water & Electrolyte Homeostasis.

Cardiovascular

The Cardiovascular Section presents three annual awards—Fellowship, the Lamport Award, and the Carl J. Wiggers Award. Nominations for Fellowship Awards must be made by at least two existing fellows with supporting letters sent to the steering committee for vote. The total number of fellows cannot exceed 5% of the APS regular members who have published meritorious research in cardiovascular physiology. The Lamport Award is presented to a young investigator under the age of 36 showing outstanding promise in his/her field of cardiovascular research. The recipient, who receives a certificate and a \$200 check, is selected by the Wiggers awardee of the previous year. The Carl J. Wiggers Award honors a founder of the section and is presented to a scientist who has made outstanding and lasting contributions to cardiovascular research.

Central Nervous System

The Van Harrevold Memorial Award (\$250) is presented by the Central Nervous System Section to recognize outstanding research in neuroscience by a graduate student or postdoctoral fellow. The recipient must be first author on an abstract presented at the Experimental Biology meeting.

Comparative Physiology

The Comparative Physiology Section Scholander Award is presented annually to recognize an outstanding young investigator presenting a papers as first author in a comparative physiology slide session at the spring Experimental Biology meeting. Candidates must be graduate students or postdoctoral fellows, not more than five years beyond their highest degrees. The recipient receives a cash award of \$100 and a certificate from the APS.

Environmental and Exercise Physiology

The Environmental and Exercise Physiology Section presents two annual awards. The Young Investigator Award (\$150) is for the recognition of excellence in research by a graduate student. The Honor Award (\$200) is given to a member of the section who has had a lifetime of outstanding research. Candidates must be first author on a paper presented at a previous APS meeting. Honoring Harwood S. Beling, the awards are presented at the section dinner.

Gastrointestinal Physiology

The Gastrointestinal Physiology Section Student Prize is designed to challenge and reward students and postdoctoral fellows who are conducting their research efforts in gastrointestinal physiology. Two awards-one for work done while enrolled as a student for a doctoral degree and the other for work performed during the first through third postdoctoral years-are presented at the spring Experimental Biology meeting. Applicants must be first author on abstracts submitted for the Experimental Biology meeting, which are accompanied by a letter from the applicant's advisor indicating whether the applicant is a graduate student or postdoctoral fellow. Each award consists of a certificate and \$300. The Steering Committee chooses a senior physiologist as the recipients of the Smith, Kline and French Prize in Gastrointestinal Physiology. The awardee receives \$500 and presents a lecture at the Section's annual meeting.

Renal Physiology

The Renal Physiology Section Award for Excellence in Renal Research is to promote and develop excellence in research related to molecular, cellular, and organ mechanisms expressed by the kidneys. Annual awards are presented to a graduate and a postdoctoral student, with judging based on abstract submission (25%) and meeting presentation (75%). Papers are evaluated by three judges in renal hemodynamics, epithelial transport, and metabolism. A certificate and prize of \$200 are presented to the recipients at the annual renal dinner.

Teaching of Physiology

The Teaching of Physiology Section of the American Physiological Society sponsors the Arthur C. Guyton Physiology Teacher of the Year Award. The award is sponsored by the W. B. Saunders Company. Nominees must be full-time faculty members of accredited colleges or universities and members of the APS. They must be involved in classroom teaching and not exclusively teaching of graduate students in a research laboratory. Each nominee must be nominated by a member of APS. The nominator is responsible for completing application materials and forwarding three copies to the chairperson of the Award Selection Committee. The deadline for receipt of applications is November 30.

The person selected will receive the award at the banquet of the Teaching of Physiology Section at the spring Experimental Biology meeting. The Teacher of the Year will receive a certificate, an honorarium of \$1,000, and expenses of up to \$900 to attend the meeting.

Water and Electrolyte Homeostasis

The Young Investigator Award in Regulatory and Integrative Physiology was established to encourage young investigators to continue research careers in cardiovascular, renal, and neuroendocrine integration. The award will be presented annually at the business luncheon of the Water and Electrolyte Homeostasis Section of the American Physiological Society to a young investigator (less than 40 years old) who has made important contributions to our understanding of the integrative aspects of cardiovascular, renal, and neuroendocrine physiology in health and/or disease. The award will consist of \$500, a plaque, and free registration to the annual Experimental Biology meeting. The recipient of the award will also be invited to present a short lecture on his/her research work during one of the scientific sessions of the Experimental Biology meeting.

Any member of the APS in good standing may apply or be nominated for the award. Applications will be reviewed by the Awards Committee of the Water and Electrolyte Homeostasis Section and should include a curriculum vitae of the nominee; a brief (one-page) summary and analysis of the research contributions of the nominee; a complete list of publications; and two letters of nomination from members of the APS.

The nomination and supporting documents must be received no late than November 1, 1993.

Nominations for Honorary Membership

Members are invited to submit nominations for honorary membership. Send nominations and documentation of the candidate's contributions to physiology to APS Honorary Membership Committee, 9650 Rockville Pike, Bethesda, MD 20814.

News From Senior Physiologists

Letters to Helen M. Tepperman

Lyle Beck wrote that, like many other physiologists, he was for the last 20 years or so before his retirement a member of the Pharmacology Department of his medical school.

Then, "since February of 1991 some of the attention of health professional in Bloomington and Indianapolis has been focused on improving the activities of my cardiovascular system. I have been exposed to some of the newer as well as older knowledge in Human Physiology, Pharmacology, Anatomy, Biochemistry, etc. For a time I had auricular fibrillation, which an EKG revealed had disappeared. I got acquainted with an Echo machine, with which ultrasound is used to study heart function. In 1992 I twice underwent angioplasty. I have been taking drugs galore. . . . I feel much more learned now, as well as healthier. All of this has not prevented me from reading widely, much of the time about science, exercising, going to plays, etc., and visiting Mrs. Beck's house on Lake Geneva, Wisconsin. While creativity may be weak, life can be interesting long after 80."

In addition, he reported that "a few years ago Indiana University School of Medicine promoted me to the rank of Distinguished Service Professor Emeritus of Pharmacology (without any increase in my Zero salary)."

Carl Bunde characterized himself as ". . . an ancient physiologist turned pharmacologist. In the middle 1940s, I shifted my interests to clinical pharmacology, which was just emerging as a specialty. This resulted in my shifting from academia to the pharmaceutical industry. The move was not difficult because pharmacology is the physiology of drugs.

"After 23 years as Vice President for Research and Director of Medical Research at two pharmaceutical companies, I reached the age of 65 and decided to stop working full time. I became a self-employed Medical Research Consultant, which was sometimes full time.

"At the end of 1992, looking at my 86th birthday, I decided to retire. I even gave up my medical license so I would not be tempted to take on another assignment. I had been Chairman of an Institutional Review Board for 11 years. I may continue to help out there if needed."

Letter to Martin Frank

J.H.U. Brown writes that he is approaching his 50th year of membership in the APS. He retired from the University of Houston some years ago. Since then, he has been working as a consultant to Japanese and American companies, developing an optical card computer memory that is now beginning to grow nicely. "I have managed to write two or three books (I am now up to a total of 32) and to serve on both SCORE (Service Corp of Retired Executives) and the Executive Service Corp as a consultant. I finished my fitieth year of teaching in 1989 but I am still teaching (art, publishing techniques, and on rare occasions, science). As my past graduate students retire I find it harder to keep up with the colleagues, although I maintain emeritus status at the Texas Medical Center and the University of Houston and go to as many meetings as I can.

"It is a real pleasure to read the column in *The Physiologist* and see the names of physiologists I have known during my tenure as department chairman and a director in MIGMS/NIH."

Future Meetings	
1994 Experimental Biology '94	April 24–28, Anaheim, CA
APS Conference Physiology of the Release and Activity of Cytokines	June 25–28 New Haven, CT
APS Conference Mechanotransduction and the Regulation of Growth and Differentiation	October 5–8 Sarasota, FL
Intersociety Meeting Regulation, Integration, Adaptation: A Species Approach	October 29–November 2 San Diego, CA
1995 Experimental Biology '95	April 9–14, Atlanta, GA

APS Outreach to Latin American Colleagues

Despite chronic underfunding and, over the past several years, also a "brain drain," Latin American physiologists have contributed remarkably toward the advance of knowledge in our discipline.

Indeed, physiological research in Latin America has a long and glorious tradition, recognized by two Nobel Prizes since World War II. It flourished in the 1930s, after Latin American scientists trained in Europe and the United States returned home and founded groups that, in turn, offered training opportunities for young, local investigators. It declined somewhat during World War II, when resources became scarce everywhere, than gradually developed again as more Latin Americans went abroad for training and, on their return, introduced to their peers the updated techniques and new perspectives that they had learned.

However, in the last two decades, worsening economic and political conditions have again curtailed the support for research that was heretofore provided by both national public and private institutions. Consequently, basic research activities in Latin America became substantially reduced; many scientists then preferred to leave home and pursue their careers abroad. Those who stayed generally devoted themselves more toward clinical fields, working in basic research whenever an opportunity arose.

Despite these difficulties, active groups gradually have reformed in several countries. Several are linked by joint research programs with centers sharing similar interests in European and North American institutions, their work supported largely by international foundations and only very modestly by national and local university grants. The research currently conducted is modern and of high quality, and the findings are published in prestigious, international journals. Valuable contributions to Latin American physiology are also being made by many of the researchers who left their country earlier and are now on the faculties of foreign universities: they too collaborate in joint research programs, serve as visiting professors, give lectures, transfer technologies, and accept postdoctoral students for further training in their own laboratories.

However, notwithstanding all these efforts, Latin American physiology involves only a minority of the vast, potential talent now in place. Hence, those physiologists not included in such joint programs, lacking the resources to conduct independent research, find themselves at the margins of the field, cut off from the mainstream. The American Physiological Society, concerned with the plight of so many of our Latin American colleagues, has been considering how it might extend a helping hand toward enabling them to participate more fully in the practice of our discipline. Consequently, two years ago, Council charged its International Physiology Committee (IPC), chaired by Don Jennings, to explore means whereby the APS could foster all-around, highquality physiological research in that region.

To gauge the general interest of US physiologists in participating in such an endeavor and to determine the extent of ad hoc interactions already under way, the IPC organized a poster session on "Biomedical Research in Developing Countries." It was held at the FASEB '91 meeting in Atlanta. Gratifyingly, the results of over 20 collaborative research and educational efforts between individual US and overseas groups were reported. More than 75 other participants also signed up, expressing their desire to help, should a plan of cooperation be adopted and

implemented. Thus encouraged, the IPC subsequently sponsored at Experimental Biology '92 a workshop entitled "Fostering Physiology in Latin America." It involved the participation of several invited guests from area countries who reviewed some of the problems they face and suggested means that might help in bringing Latin American physiologists back into the mainstream of our field. One concrete result of that workshop was the formation in December 1992 of an IPC subcommittee on Latin America (CLA), under the chairmanship of Clark Blatteis, with both US and Latin American members; all the US members have interest and extensive experience in research and teaching in Latin America. The CLA soon thereafter developed a proposal for action that, after review and approval by the IPC, was forwarded to Council, which must still act on some of the recommendations before they can be implemented.

Fundamental to the plan is the opening of more, better, and regular communications between Latin American and US physiologists. Initially, this will have to depend mainly on personto-person contacts. In this regard, the CLA will gladly help to put interested investigators from both sides in touch with each other. A network of local, resident coordinators has already been organized in most Latin American countries for this purpose.

There are many ways by which US and Latin American physiologists could assist each other. For example, US physiologists might be interested in developing collaborative projects with Latin American colleagues that take advantage of the unique fauna and geographical features of the region (e.g., the Andes), as well as of special physiopathologies that may affect certain regional populations. APS members may also wish to offer opportunities to Latin American colleagues for advanced training or to explore possibilities for collaboration in their own laboratories in the United States.

At the very least, they may like to be informed about the forthcoming travel to the United States of Latin American physiologists whom they would expressly like to meet, present a seminar, or just come in for an informal visit to get acquainted.

Conversely, US physiologists traveling to Latin America might like to consider visiting, if invited, institutions other than their primary destination, to present seminars, or organize an advance short-course, workshop, or similar activity, summarizing the current state-of-the-art for participants who already have basic competence in physiology and would appreciate the updated information to apply it to their own research. In this regard, it would be helpful to both sides if announcements of national or international meetings, courses, workshops, etc., on any physiological topic to be held in the United States or Latin America were widely publicized.

Other types of cooperative associations could involve US physiologists willing to edit the English style of manuscripts by Latin American colleagues before they are submitted; this would render a great service to those whose work is meritorious but whose English skills are inadequate. Similarly, interested US colleagues might like to help by sending drugs or reagents unavailable to Latin Americans in their own country, or spare parts for instruments, or even used equipment. There is indeed a pressing need for these items in Latin America, as well as for reprints of papers, reviews, and books on recent advances, hard-to-get supplies, general technical information, computer software, audiovisual aids, etc.

The APS is already helping by contributing free APS journal subscriptions to qualified institutional libraries and is considering providing back issues of APS journals, when the value of the journals to a reasonable number of researchers can be documented. Gifts of current and no-so-current physiology textbooks, monographs, and proceedings to the libraries of Latin American institutions would also be most welcome. Oxford University Press has already agreed to offer the new Handbook of Physiology series to all members of the Latin American Association of Physiological Sciences at the same discounted price as to APS members. And to facilitate exchanges among physiologists everywhere, the APS has recently launched its Gopher Information Server that can be accessed through the Internet/NREN. The Server lists the table of contents of the APS journals, employment opportunities in the United States, meetings announcements, and other useful information.

The CLA would like to encourage strongly US physiologists at all levels

of the career—junior, mid-career, and established scientists alike—to become involved in this outreach to Latin American physiologists. Various resources now exist that fund US-Latin American scientific exchanges on an individual basis. APS members who might be interested in developing relationships with Latin American colleagues are invited to communicate their ideas or specific interests to Martin Frank, Executive Director, 9650 Rockville Pike, Bethesda, MD 20814, or directly to the US members of the CLA:

Clark M. Blatteis, Department of Physiology & Biophysics, University of Tennessee–Memphis, 894 Union Avenue, Memphis, TN 38163. Tel: 901-528-5845; fax: 901-528-7126; email: blatteis@physiol.utmem.edu.

Sukhamay Lahiri, Department of Physiology, University of Pennsylvania School of Medicine, 36th and Spruce Streets, Richards Building A210, Philadelphia, PA 19104-6084. Tcl: 215-898-9480; fax: 215-573-5851.

Gerald B. Spurr, Department of Physiology, Medical College of Wisconsin, 8701 Watertown Plank Road, Mailwaukee, WI 53226. Tel: 414-257-8266; Fax: 414-257-8570; email: GSPURR@POST.ITS.MCW.edu.

Guillermo Zeballos, Department of Physiology, New York Medical College, Valhalla, NY 10959-9999. Tel: 914-993-4094; fax: 914-993-4018.



Varmus Selected as NIH Head

After weeks of rumor and speculation, President Clinton announced on August 3 that he would nominate Harold Varmus to become the new head of the National Institutes of Health. Bernadine Healy stepped down from the post on June 30.

Varmus has been the American Cancer Society professor in molecular virology with the department of microbiology and immunology at UCSF. He won the 1989 Nobel Prize in Medicine or Physiology together with J. Michael Bishop for their pioneering work on oncogenes. He is a member of the National Academy of Sciences and the Institute of Medicine and belongs to the American Society for Biochemistry and Molecular Biology and the American Society for Cell Biology. He is expected to transfer his lab to the NIH's Bethesda campus. In an essay published in the January 22, 1993 issue of *Science*, Varmus, Bishop, and Marc Kirschner urged the Clinton administration to "act decisively and soon to revitalize the support of fundamental as well as applied research" by the federal government. They recommended that NIH funding be increased by 15% per year to achieve a doubling in current dollars by 1998, enabling NIH to fund about 30% of approved grants. They advised the new administration to establish the NIH as an independent federal agency and to consolidate the director's authority over the individual institutes. The article also urged that basic research at NIH and NSF be protected by ensuring new funding is provided to cover any new initiatives in research, technology, and education.

APS Member Selected for OSTP Post

President Clinton has also chosen APS member M.R.C. (Marci) Greenwood as Associate Director for Science at the Office of Science and Technology Policy. On August 9 the White House announced Clinton's intention to nominate Greenwood for a new post that combines responsibility for the physical and the life sciences. Greenwood, the dean of graduate studies at the University of California since 1989, has a PhD in physiology, neuroscience, and developmental biology from Rockefeller University. She is also a member of the American Institute of Nutrition and the American Society for Clinical Nutrition. Her research has focused on the genetic bases for obesity.

Torricelli Reintroduces "Research Accountability" Bill

Rep. Robert Torricelli (D-N.J.) has again introduced a bill to require a special review of all animal research to ensure that the project does not duplicate previous experiments. The bill (H.R. 2472) would establish a 20-member National Center for Research Accountability that would have a final say as to whether approved research grants would be funded. The bill also directs the National Library of Medicine to collect and make available at cost to biomedical researchers all the biomedical information acquired by the federal government since 1960. H.R. 2472 is identical to legislation Torricelli sponsored in the 102nd and 103rd Congresses.

APS members should write to their US Representatives urging them to oppose the bill because it will create bureaucracy and cost a lot of money but it won't work. The additional layer of review it mandates is not needed because scientific peer review and the keen competition for federal funding already screen out unnecessary and duplicative animal research. Furthermore, the 20 individuals selected for the National Center for Research Accountability are unlikely to have the expertise to provide serious reviews of the wide range of research proposals involving animal subjects on a timely basis. In addition, the \$38 million cost estimate for providing full-text, on-line access to biomedical information does not take into account the costs of conversion of the current National Library of Medicine system, which now provides only computerized bibliographies and abstracts. H.R. 2472 would have the net result of delaying grant awards and siphoning off scarce dollars without improving how research is conducted.

Misconduct Ruling Overturned on Appeal

The HHS Departmental Appeals Board has reversed the misconduct finding made by the Office of Research Integrity in the case of Cleveland Clinic Foundation researcher Rameshwar Sharma. The Sharma case drew much attention when former clinic administrator Bernadine Healy, then the director of the National Institutes of Health, publicly clashed with House Energy and Commerce Committee Chairman John Dingell over her handling of the Cleveland Clinic's investigation.

The Departmental Appeals Board ruled on August 11 that the government failed to prove its case that Sharma falsified statements on his 1989 application for NIH grant funding. Sharma allegedly wrote that he had performed one kind of experiment when in fact he had performed another. The board reported that "ORI failed to carry its burden of proving scientific misconduct by a preponderance of the evidence." It concluded that Sharma's misstatement was the result of "careless error" rather than misconduct.

Giving NIH Credit

FASEB is urging scientists to make sure that university efforts to publicize their findings acknowledge the role of National Institutes of Health as a funding source for the research. In a guest opinion column published in the June/July issue of the FASEB Newsletter, Federation Vice President Samuel C. Silverstein and John D. Loike argued that a softening of congressional support for NIH appropriations may be due to public ignorance of what the NIH does. Not only the general public but even some members of Congress may not realize how much biomedical research conducted at universities, hospitals, and nonprofit research institutes throughout the country relies on NIH funding, according to Silverstein and Loike.

"Our responsibility is to help assure public demand for increased NIH appropriations by emphasizing the key role that NIH support plays in our work and in weaving the scientific tapestry of the future," Silverstein and Loike wrote.

Foreign Scientist Exception on Hold

Regulations that would have made it easier for foreign-born biological scientists to get jobs in 17 states have been put on hold indefinitely and may be cancelled under legislation approved by the Senate.

The APS sent a letter of comment opposing the pilot labor certification program, which was outlined in a *Federal Register* notice published March 19, 1993. Some 553 individuals and organizations sent comments, most of them opposing the new program to simplify the labor certification process for certain occupations. Labor Secretary Robert Reich subsequently asked Congress to change the law requiring that his department conduct the program.

The Senate on July 1 approved technical amendments to the Immigration and Naturalization Act including a provision to relieve the Labor Department of its obligation to conduct the pilot labor certification program. Similar House action is expected.

A-21 Regulations Finalized

Final revisions to OMB Circular A-21 concerning indirect cost reimbursement were published in the *Federal Register* of July 26. The new rules are almost identical to the ones readied for publication in January during the closing days of the Bush administration.

Meanwhile, on Capitol Hill several bills have been introduced concerning indirect costs. Report language that accompanied the House versions of the VA-HUD-Independent Agencies appropriations bill raised questions about the wide variation among indirect cost rates. Sen. Hank Brown (R-CO) has introduced S. 1184, a bill to place a 50% cap on indirect cost rates. In addition, Senate Minority Leader Robert Dole (R-KS) has introduced a 75-page "neighborhood crimes" bill (S. 1356) that would fund solutions to urban problems in part by a 10% across-theboard reduction in indirect costs. A comparable bill (H.R. 2847) was introduced by Rep. James Sensenbrenner (R-WI) and has 48 cosponsors.

APS Publishes Animal Use Sourcebook

The APS Animal Care and Experimentation Committee recently published a Sourcebook for the Use of Animals in Physiological Research and Teaching, which was sent to all APS members. The Sourcebook recommends steps investigators can take to meet the challenge of animal rights activists who might threaten or harass them because of their use of animals in research. Additional copies are available from Alice Hellerstein at the APS office at a cost of \$5 for one or two copies or \$4.50 for three or more copies.

University of Colorado Wins Suit Over Lab Requirements

A US District Court Judge ruled in favor of the University of Colorado in a case brought by a student who refused to complete a required physiology course because animals were used in the laboratory instruction.

According to court records, entering student Safia Rubaii had signed a standard letter of acceptance to the School of Medicine, which had explained that students are "required to participate in laboratory exercises that use animals, including anesthetized dogs." Rubaii, a practicing Buddhist, did not raise her religious and moral objections to participating in the animal labs until shortly before they were due to begin in March 1992. At that time Rubaii requested an alternative, and the university accepted her suggestion that she take a physiology course not involving an animal lab from another medical school. Rubaii then decided not to take the course and was placed on academic probation. She eventually did take the alternative course and was promoted to secondyear status.

Rubaii filed suit in April 1992, claiming that the university violated her rights to free exercise of religion, freedom of speech and association, due process and equal protection under the US and Colorado Constitutions. US District Court Judge Lynne M. Hufnagel granted the university's request for summary judgment and dismissed all nine of Rubaii's complaints. "The court finds that the University was under no obligation to offer plaintiff (Rubaii) any alternative to the lab requirement but did so in an attempt to accommodate her religious and moral objections." Hufnagel wrote. "Thus, any damages suffered by plaintiff in this action are a direct result of her refusal to timely exercise an option that she herself suggested to the University."

Washington Court to Decide Unfunded Grants Case

The Washington State Supreme Court is reviewing a lower court's ruling that the University of Washington should be forced to release the contents of a grant application to an animal rights group. The Progressive Animal Welfare Society (PAWS) sued the university under the state's public records disclosure statute for access to an NIH grant application written by psychologist Gene P. Sackett, PhD, of the University of Washington and veterinarian Linda Cork, DVM, of Johns Hopkins University. Sackett and Cork proposed to examine a connection between developmental brain abnormalities of monkeys reared in isolation and self-abusing behavior. The grant, which was not funded, was intended to assist in understanding and ultimately in treating similar behavior in children. The lower court found partially in favor of PAWS and ordered that the group be granted access to most but not all of the information in the grant application. Both parties sought the review by the state Supreme Court.

The American Psychological Association and the Washington State Psychological Association filed an *amicus curiae* brief that argued that permitting the disclosure of an unfunded grant application would "(1) compromise the ability to conduct certain research; (2) jeopardize the established intellectual property rights of researchers; and (3) improperly subject scientists who submit applications, and members of scientific review panels, to politically motivated harassment." The brief said distinctions should be made between research that has been funded with public monies and unfunded applications.

ALF Probes Continue

Fugitive Animal Liberation Front (ALF) activist Rodney Adam Coronado was indicted in July on five counts in connection with the February 28, 1992 break-in that caused \$200,000 of damages at a Michigan State University Laboratory. ALF claimed responsibility for the vandalism and a fire set in the office of Richard Aulerich, who heads the MSU's animal nutrition research project involving minks. The fire destroyed 30 years of Aulerich's work.

Meanwhile, in a separate investigation in Washington state, a federal court judge denied the second motion in two months to release a noncooperative grand jury witness from jail. WSU graduate student Rik Scarce was jailed in early May for refusing to answer questions from a grand jury investiating an August 1991 break-in at Washington State University. The grand jury wants to hear evidence from Scarce concerning conversations he may have had with Rodney Coronado and others who allegedly were at Scarce's house at the time of the raid.

US District Court Judge W.

APS Membership

Membership applications may be obtained from APS Membership Services, 9650 Rockville Pike, Bethesda, MD 20814-3991. Applications are reviewed and approved by Council on a regular basis throughout the year. Fremming Nielson dismissed the motion for Scarce's release. "From the evidence presented to this court," Nielson stated, "it appears that Mr. Scarce more probably than not has knowledge of conduct relevant to the criminal investigation and therefore he has a duty as a citizen to testify about this conduct before the grand jury." Scarce could be kept in jail until the grand jury's term expires in December.

PETA Corresponds Further With IACUCs

People for the Ethical Treatment of Animals has sent follow-up letters to Institutional Animal Care and Use Committees that reported to the USDA in 1991 that they had approved research procedures that caused pain or distress and for which pain-relieving drugs could not be administered because they "would have adversely affected the procedures, results or interpretation." IACUCs that did not respond to an initial form letter request from PETA National Director Ingrid Newkirk concerning such experiments are receiving a second form letter stating that it would be "unfortunate if, in our open society, research facilities refused direct communications" with PETA

Research facilities that did respond to the first PETA form letter are receiving individualized follow-up letters informing them that "[a]lternatives to most procedures are available." The letters also ask for copies of the "written narrative description . . . used to determine that alternatives were not available," and for information on any column "E" experiments that are currently being conducted.

A NABR Update published July 26, 1993 stated that NABR was "confident that our members will handle PETA's letters just as they would any other similar communication." However, the Update points out, "Since these letters address research which has been previously reviewed, approved and reported, it is understandable that IACUCs may see no need to respond to the familiar points raised by PETA."

Proposed Standards on Marine Animals

APHIS is considering whether to publish new standards for the humane care and transportation of marine mammals used for exhibition and research purposes. Standards for marine mammals were established in 1979 and amended in 1984. APHIS has decided to review the current standards because of new information developed and new concepts that have been implemented with respect to the housing and care of marine mammals.

Comments on an Advance Notice of Proposed Rule-Making (ANPRM) were due by October 6. For more information, contact R. L. Crawford, Assistant Deputy Administrator for Animal Care, at 301-436-4981.

Internet Primate Resource

The Wisconsin Regional Primate Research Center Library at the University of Wisconsin is coordinating an Internet Gopher information server called Primate Info Net (PIN). The PIN provides access to resources including a taxonomy of the primate, the current issue of Laboratory Primate Newsletter, a list of topical bibliographies from the Primate Information Center, the Primate-Talk Directory, and information about the Primate Supply Clearing House and the Animal Welfare Act and Amendments. PIN can be accessed via Gopher by setting the gopher client to point to "gopher.primate.wisc.edu". PIN can also be reached using Internet telnet with the command "telnet telnet. wiscinfo.wisc.edu" and using the login ID "wiscinfo." No password is required. From the "Wiscinfo" menu select "UW-Madison Information Servers," then select "Wisconsin Primate Regional Center Server," and finally select "Primate Info Net."

For further information about Primate Info Net, contact Larry Jacobsen, Head of Library Services, Primate Center Library, Wisconsin Regional Primate Research Center at 608-263-3512 or by email at jacobsen@primate.wisc.edu.

Final APHIS Regulations

The USDA's Animal Plant and Health Inspection Service (APHIS) has finalized regulations to implement the 1990 pet protection amendments to the Animal Welfare Act. The final regulations, which were published in the *Federal Register* of July 22, 1993, require that most pounds and shelters must hold dogs and cats for at least five days, including one Saturday, before providing them to a dealer or research organization. The new rules took effect August 23, 1993.

Court Orders Report Release

A US District Court ruling in early August cleared the way for the USDA to release information from Carolina Biological Supply's 1987 report. The company had sued the USDA to prevent it from publishing sections of the report covering how many animals it bought and sold and how the transactions take place. The company argued that this information would benefit its competitors. An attorney for the animal rights group the N.C. Network for Animals told the Greensboro, N.C. News and Record that information from the report would assist the group in getting "more of a map of what goes on in the procurement of animals in North Carolina."

21ST CENTURY DISCIPLINES

(continued from p. 165)

ined even a decade ago. Those of us who go beyond merely studying a mechanism at increasingly smaller levels of detail (go beyond pure reductionism) and struggle to obtain and use this information to understand whole organ function will be the "organ systems physiologists" of the 21st century.

Today's frontiers of the chemical, physical, and mathematical sciences provide the physiologist's "technology" of tomorrow. These tools provide extraordinary opportunities to those whose goal it is to understand organ function. Clearly no one person could or should become the master of all these specialized skills. However, individual scientists can understand the basic principles of these techniques and be conversant in the "language" of the needed areas of research from which the data are acquired. I believe this represents a fundamental role of the 21st century physiologist. This is indeed a role not different from the traditional role of the physiologist except we will be equipped with a new bag of tools and skills. Each scientist brings his own interests and strengths to every question addressed. Individual laboratories cannot each contain the expensive instrumentation and trained personnel, so "collaboration" within and between current disciplines, and "shared instrumentation facilities" must serve these needs.

This view of the future leads directly to the question of how the physiologist of tomorrow must be trained. It seems evident that a strong background of organ systems physiology will be necessary (an integrated view of function spanning from the gene to the whole animal). A variety of focused skills which may be required to make original contributions to the understanding of biological systems will evolve as needed and must be encouraged. Perhaps the most important characteristic of a student of physiology and his mentor has been and will continue to be an attitude which will enable them to learn and incorporate the new technology required to answer questions at all levels of structure and function of the living system.

It is also increasingly evident that "Physiology Departments" cannot remain isolated units any more than can individual investigators. A rapidly emerging interdisciplinary research structure is emerging within institutions since no single department can encompass the equipment and skills required to address questions at the multiple levels at which they can now be examined. Such changes, however, will provide enormous opportunities and open the world of physiology to previously unimagined or unobtainable tools to explore the integrated functions of the living systems.

There exists perhaps an overemphasis on new technology at the moment, and it often overshadows the basic questions that we must address; but I believe this will change soon. The biological sciences will again begin to look outward as well as inward. The world will demand that we study important problems and make sense of the enormous inforI believe that systems and integrative physiology, which has currently ceased to exist in some institutions, is presently undergoing a quiet renaissance. I predict that as we enter the 21st century, our discipline will reemerge as an important and central component of the research enterprise. Physiology will survive as a discipline because the goal of the biological sciences has been and always will be to understand the mechanisms that make the whole animal tick. We will learn to integrate information from the microscopic to the macroscopic. Physiology will emerge in a form that a true systems physiologist of the 19th and 20th century would be proud to see.

Position Paper: Training physiology students for the 21st century. M. Ian Phillips, University of Florida

It is said that "the best predictor of the future is the past." Therefore, faced with the daunting task of predicting the future, let us consider how we would be training physiology students for the next 100 years if we lived in 1693, 1793, 1893, and 1993.

1693: Experimental physiology and the cautious interpretation of results from animal experiments began with William Harvey. His famous book of 1628, *De Motu Cordis—The Motions of the Heart and Blood*, is one of the great classics of the physiology experimental method. However, the 17th century really belonged to the astronomers, like Galileo, and the mathematicians, like Newton. Therefore, if this were 1693 and we were training physiology students, we would predict that they should have solid backgrounds in math and physics and be able to use a Hooke microscope. They should conduct experiments as Harvey did.

1793: In the 18th century Lavoisier gave us animal combustion, Galvani gave us animal electricity, and Priestly discovered oxygen. So in 1793 we would insist that our students preparing for the next century should study animal electricity, have a good knowledge of gas laws, i.e., physical chemistry, and grasp the physiological concepts of cell oxidation. Armed with such training, the student would have been ready for the 19th century, which began with the discovery of electric current (Volta, 1800) and, later, Charles Bells' work on nerves and brain anatomy, which opened up neurophysiology.

1893: By 1893 our students would have to know a lot of physics, have read Darwin's *The Origin of the Species* and have looked down the Helmholtz ophthalmoscope. But the real influence on them would be Claude Bernard, who combined experimental skill with theory and gave to physiology its central theme of homeostasis. Those trained in Claude Bernard's tradition would have been the best equipped for the

20th century. Although his technical skill was in animal surgery, he was open to any technique that could be used to answer the problem he was studying. He studied the nervous system, gastric secretion, and the role of bile and pancreatic juice in the digestion of fats, discovered glycogen, and showed that oxidation occurs in all tissues, not just the lungs as Lavoisier had assumed. The graduate student of that time would also have picked up tools for future research from the discovery of x-rays in 1896 and the discovery of radium in 1898. Walter Cannon represents a student of physiology training in 1893. Roentgen discovered x-rays in 1895, and the very next year Cannon was embracing this high-tech state-of-the-art equipment to study digestion.

1993: The 20th century advances are too numerous to list completely and also are not distant enough for us to know what is truly outstanding. Depending on our field of interest, we would pick different discoveries from this century. A neurophysiologist might pick Dale, Hodgkin, and Huxley; a cardiovascular physiologist—Bayliss, his brother-in-law, Starling, and Krogh; an endocrinologist might choose Banting and Best, and Yallow; while a muscle physiologist, Krebs and Huxley. But all would probably agree that the greatest impact from this century would come from the elegant, precise, and short note that appeared in *Nature* in 1953, authored by Watson and Crick.

So what do we teach our students in 1993, and what can we learn from previous centuries? In 1993 the modern student is faced with more choices and more tools than at any previous time. Each student will have a natural affinity for one area of research over another. I don't know if there is a gene for physiologists, but we all have our preferences for certain subdisciplines. Many physiologists are concerned today about maintaining integrative physiology as if it were a religion. But what could be more integrative than DNA? It is at the beginning of every event in every cell of every organ of every organism. As physiologists, we talk about coming "down" to the DNA level or "down" to the cellular level, but actually we start with the organ or organism and work our way "up" to the most integrative features of that organ: the membrane, the channels, the transport systems, the enzymes, the metabolic processes, the mRNA, and the DNA. Our real creed as physiologists is to understand "how homeostasis regulates the fundamental cellular, molecular processes." How does an increase of 5 mEq/l of Na+ produce changes in angiotensinogen mRNA? How does the long interval between Q and T waves in a patient's EKG relate to the RAS gene and ATPases? We can study such questions with the techniques of Northern blots, point mutations, and gene targeting. But we do not expect our students to be geneticists nor molecular biologists. In each field there is too much depth. What we must give our students is the philosophy of Claude Bernard and William Harvey so that, like Walter Cannon, they can embrace the new techniques available to answer physiological problems.

21st Century: Today, in 1993, students already have three new, enormously powerful new techniques available that should revolutionize physiology. First, is MRI, which can be used to study blood flow and metabolism in any organ of the body of man or animal noninvasively and at mm2 resolution. Second is the power of the computer and computational methods. Third, we cannot ignore the fact that in 1993 we will graduate trainees into a world where, ultimately, every nucleotide of the human genome will be mapped. When we train physiologists, we have to give them the physiology overview of the workings of organs and also give them the tools they need to answer physiological questions. Every established professor I know was trained in one technique in some depth. But at some time in their careers they had to learn another technique. This is because techniques change, and none will be appropriate forever. It is the question that determines which technique to use.

The lessons of history are clear. Physiology is a strong discipline rooted in 365 years of experimentation that has borrowed the practical side of discoveries in math, physics, chemistry, immunology, and molecular biology. It is, and will remain an integrative discipline. Now it is integrating the molecular into the whole organ system. Future physiologists, like those of the past, will have questions to ask nature, and they will choose their techniques from any discipline to get the answer. The future has never been brighter or more exciting for students in physiology.

Cell Physiology

State-of-the-Art Lecture: Inhibition of acid secretion: drug mechanisms by design. George Sachs, UCLA and Wadsworth VA Medical Center, Los Angeles

The etiology of peptic ulcer disease is not well understood. For most of this century it has been known that the presence of acid is essential for the development of duodenal and gastric ulcers. Only recently has the possible connection between H. pylori infection and duodenal and gastric ulcers become recognized. The majority of currently approved therapies therefore have as their goal reduction of acid secretion. The differing efficacies and tolerability of the different drugs depend on the physiology and biochemistry of acid secretion. The approach to the elucidation of new antiulcer therapy provides a lesson applicable to the theme of this symposium.

Stimulation of acid secretion is both centrally and peripherally mediated, centrally via vagal activity and acetylcholine release within the fundic mucosa, which directly stimulates acid secretion from the parietal cell via muscarinic M3 receptors and indirectly via M1 receptors, causing histamine secretion from enterochromaffin-like (ECL) cells. Peripheral stimulation depends on the release of gastrin, which stimulates histamine release from ECL cells to act on H2-specific histamine receptors on the parietal cell.

Belladonna alkaloids provided the first type of peptic ulcer therapy, namely atropine and hyoscine, which block the M1 and M3 receptors. While side effects such as dry mouth and pupillary dilatation severely limited their use, their efficacy is also less than optimal. A major advance was the development of H2 receptor-specific antagonists in the 1970s by Black and his colleagues. While their side effects are few, because the parietal cell can be stimulated directly by acetylcholine and by histamine, even these drugs cannot fully inhibit acid secretion during the day. They nevertheless are generally quite effective against nighttime acid secretion. There is, then, no single common pathway for stimulation of the parietal cell. Using metaanalysis, Hunt and his collaborators showed that optimal healing for duodenal ulcers requires elevation of intragastric pH to greater than 3 for at least 16 h per day, and for reflux disease elevation of intragastric pH to greater than 4 for the same period of time.

The gastric acid pump, the H+ K+ ATPase, is however, the final step in acid secretion; and inhibition of the pump would control acid secretion effectively, no matter what the stimulus. The pump is composed of two subunits. A large catalytic subunit consisting of 1,033 amino acids is folded such that it forms a large cytoplasmic domain, eight membrane spanning segments, and a small extracytoplasmic domain. The smaller subunit has one membrane spanning segment, and most of it is on the outside surface of the membrane and is heavily glycosylated.

The parietal cell ATPase exists in a resting, non-acid-secreting form in cytoplasmic membranes, and when activated is present in the membrane of the secretory canaliculus where it generates a very large pH gradient, causing pH to fall to 1.0 or below. In designing a drug specific for inhibition of the acid pump, namely, one with the ability to concentrate selectively in the acid space generated by the H+ K+ ATPase and with a finite membrane permeability of the unprotonated form, two types of inhibitor may be visualized: covalent or reversible. The only class of clinically useful drugs is of the covalent type, such as omeprazole. Omeprazole accumulates selectively in the acid space of the secreting parietal cell and undergoes acid-catalyzed conversion to a cationic sulfonamide, which, being a permanent cation, remains trapped in the acid space. The sulfonamide undergoes rapid covalent reaction with available cysteines to form a stable disulfide. The reactive cysteines are cysteine 892, between the 7th and 8th membrane spanning segment, and either cysteine 813 or 822, which are in or near the 5th and 6th membrane spanning segments. Another substituted benzimidazole-pantoprazole, which also inhibits the proton pump-reacts only with cysteine 813 and cysteine 822, indicating that reaction in the 5th and 6th membrane sectors is important for drug action. This class of drug therefore gives effective, long-lasting inhibition of acid secretion, since a covalent derivative of the acid

pump is formed, and yields a significant improvement in therapeutic results in acid-related diseases as compared with receptor antagonists.

Position Paper: Educational needs and goals for cell physiology. William H. Dantzler, University of Arizona, Tucson

Physiology is the science dealing with mechanisms of normal function and their regulation at all levels of biological organization from molecules to intact animals, including humans. For the 21st century, cell physiologists must be able to 1) integrate information obtained at the molecular (and even submolecular) level into the function of the intact cell and 2) contribute to the integration of cellular functions into the function of epithelia, organs, and multicellular organisms, including humans. Although progress will continue to be made via the reductionist approach, the integrative approach will be the real challenge for the rest of this century and well into the next. Moreover, this integration cannot be accomplished with the old methods and old approaches. It will be absolutely necessary to find new methods and new approaches. I cannot predict what some of these approaches may be. Under these circumstances, what can be done about preparing students for the future? First, graduate programs must require that all students be exposed to both cell physiology and systems physiology. Students exposed to higher levels of biological organization can move to the molecular (or submolecular) level and will still be able to appreciate the need for integration. Those who are only exposed to the molecular (or submolecular) levels of organization rarely can appreciate or work at the higher levels of organization. Second, to help students find new approaches to integration, graduate programs must make certain that students have major interactions with individuals working in diverse fields-not just the biological sciences, but the physical sciences and engineering. These interactive pathways between students and faculty (and other students) in diverse fields must be established early in the graduate students' careers so that they will always be used to looking for new approaches to scientific problems and to searching for them in other areas of science. One educational mechanism to accomplish this is to eliminate departmentally based graduate programs and to establish interdepartmental, interdisciplinary graduate programs. These can bring together faculty with interests in physiology from many departments (physiology, biochemistry, molecular biology, genetics, cell biology, anatomy, physical sciences, and engineering). There are a number of obstacles to developing these types of programs, including 1) rigid departmental structure (although this does not require doing away with departments, and my definition of physiology is independent of academic department); 2) rigid university superstructure that interferes with budgeting; 3) lack of rewards for faculty working in nondepartmental settings; and 4) difficulties in supervising students and maintaining quality and cohesiveness. These problems can be overcome, and this is only one suggested approach to helping graduate students to be prepared to make significant contributions to physiological integration.

Audience Guestions and Comments: Issues on Physiology Disciplines

Audience: To promote interdisciplinary collaborations, the use of the National DNA Sequence Data Base and a national computer network for molecular biology may be helpful. NSF is sponsoring this INTERNET and will provide you with a free service. Vice President Gore is trying to get high schools and other educational institutions around the nation connected to the INTERNET, and they really would encourage you to participate.

Audience: The technique of systems analysis is crucial for implementing integration from the cellular to the molecular level and should not be overlooked. Dr. Cowley mentioned the concept of pressure natriuresis and gave us an impressive list of technologies that were used to investigate this concept. I would like him to tell us whether the concept emerged basically from the systems analysis approach.

Panelist: I fully agree with you. I tried to convey the use of computers tying all of this together in a general sense. Indeed, a systems analysis was used to investigate the jux-tamedullary circulation and understand how these systems interacted.

Audience: I disagree with the previous comment. I don't think the systems analysis that we talked about and that we learned about is a technique. What we need to do in training our graduate students is to think about "processes" and "how to view the world" and "how to approach systems." To think of the world as a group of systems gives us a viewpoint that allows an investigator to start with the animal and to seek whatever techniques he needs to answer questions as he moves to smaller and smaller systems that are all part of the larger system. So I argue that we need to think more in our graduate programs about "processes" and less about "specific techniques" at the beginning.

Panelist: I agree. I think that this is a very important aspect of education. We clearly need to think about the overall process. In fact, that is the sort of thing that people would develop if we encouraged them to develop a broad attitude of mind and interact with people at all levels. I don't expect a single technique to solve all problems, and I don't think one should get focused on a technique.

Audience: An integrative program to look at problems involving both experimental approaches and applied mathematics often requires interinstitutional collaboration in addition to interaction within the university, and what makes this increasingly possible is INTERNET. I would like to point out, however, the difficulty in getting extramural funding for such efforts approved by initial review groups. A more consistent funding base for integrative and interdisciplinary approaches is necessary.

Panelist: I agree that integrative systems approaches are not getting a fair shake in review. I think this is due, in part, to the tendency toward narrowness of some of the reductionists that are frequently on study sections. Physiologists tend to accept the work of molecular biologists, and their grants sail all the way through with no trouble. However, other reviewers tend to be more narrow and don't feel money should be given to "integration" efforts in research projects. Perhaps we need an integrative study section, and I would propose that the American Physiology Society push the NIH toward putting together an integrative-type study section that can deal with these grants.

Molecular Pharmacology

State-of-the-Art Lecture: Making the transition from molecular mechanisms to an understanding of in vivo functions as a prelude to novel therapeutic design. Lee E. Limbird, Vanderbilt University

Pharmacology is by its very nature a hybrid discipline. Even at the inception of this discipline, it was not possible to understand drug action and mechanism without employing all of the elements of other existing scientific disciplines. The same is true today. Thus, although some investigators may choose to focus on molecular issues and others may engage in understanding the effects of a given drug or endogneous regulator in the in vivo situation, each investigator needs the insights gained by the other to foster our understanding of how the body works, and how drugs influence physiological processes. It has been my own personal experience, both in the laboratory and observing the career progression of others, that scientists proceed to a new understanding by following up on each answer with a new level of questioning in the laboratory, a process that often requires implementing new technologies most appropriate for elucidating the question at hand. It is for this reason that I have been unable to understand what I perceive to be a polarization of the discipline of pharmacology between so-called molecular versus organismal pharmacologists, perhaps heightened by the accelerated implementation of recombinant DNA strategies and other molecular techniques in the discipline, as if utilization of

these new technologies weren't "real pharmacology", whatever that should be. It seems, at least to me, that to answer an important biological question with sufficient lack of ambiguity will likely require, during the lifetime of that question-answering enterprise, the involvement of a variety of complementary experimental strategies. In our own studies for example, we have sought to elucidate the various signal transduction pathways elicited by a2-adrenergic receptors and determine which are involved in metabolic effects versus regulation of hormone and neurotransmitter release versus modulation of excitation-contraction coupling, with the hope that novel therapeutic strategies might offer specificity by perturbing receptor coupling to discrete signalling pathways in particular cellular settings. Following up on an observation that a2-receptor activation of human platelet secretion utilizes a pathway involving Na+/H+ exchange, we made the unexpected observation that the isolated receptor itself is allosterically regulated by cations. Biochemical mapping and site-directed mutagenesis studies indicated that a membraneembedded aspartate residue highly conserved among G-protein coupled 7-transmembrane-spanning receptors was critical for cation regulation of adrenergic ligand binding to the a2-receptor. Introduction of a Na+-insensitive mutant of a2receptor (D79N a2-AR) into cultured AtT20 anterior pituitary cells revealed that the mutant receptor was able to activate two known a2-adrenergic receptor pathways, i.e. suppression of cyclic AMP production and voltage-sensitive Ca++ currents, but could no longer activate receptor-operated K+ channels. This unanticipated finding suggests the exciting possiblity that introduction of the mutant a2-receptor in vivo could provide an exquisite tool for understanding which electrical consequence of a2-receptor activation, i.e. Ca++ current suppression or K+ current activation, mediates integrated physiological responses, such as central control of blood pressure, modulation of pain perception or suppression of epileptogenesis. Thus, we currently are undertaking homologous recombination to substitute this Na+-insensitive a2-receptor into the mouse genome, giving rise to animals homozygous for the mutant a2-receptor as a first step toward bringing in vitro molecular insight regarding a2-receptor-effector coupling to an in vivo setting. Thus, even in this limited example from our own laboratory, it is clear that efforts to understand how the "whole animal ticks", to borrow a statement made by Dr. Cowley (above), will naturally involve a continuum of studies from the molecular to the organismal.

If one makes the assumption that during an investigative career, a scientist will need to employ strategies at the molecular and cellular and in vivo level to finally resolve a biological question, how can one purport to design a training program that prepares a graduate student for such an anticipated adventure of inquiry? For pharmacology as well as for other disciplines, there is no doubt that a graduate student cannot attain experimental proficiency with every available experimental approach. This is an unattainable goal even for senior investigators, and making the transition from molecular to in

vivo studies and vice versa will likely involve fruitful collaborations as well as implementation of new technology in a single lab. Furthermore, in terms of training, it may be that the faculty participating in a given training program have strength in molecular, but not in vivo pharmacology, or vice versa. Naturally, the strengths of the faculty will influence the emphasis of the graduate training program. However, what can and should be taught in any environment is an appreciation for what can be learned at the molecular, cellular and in vivo levels of investigation. Passing on a sense of appreciation for diverse experimental approaches can be accomplished by any number of means, such as the judicious selection of faculty invited to present research seminars in an institution, requiring students to select topics outside their dissertation research area for presentation at student seminars, specifically introducing students to diverse experimental strategies in a course that focuses on experimental design, logic interpretation, etc. or any other intentional enrichment of the graduate training program appropriate for a given institution. Because powerful technology is being introduced not only at the molecular, but also at the in vivo level of investigation, perhaps the best that we can do during the course of graduate student training is to teach students how to teach themselves, as it is quite certain that what they learn during their dissertation research will be eclipsed by new technology, questions, and "dogma" shortly following the graduation period. If graduates of our training program are to continue to be at the forefront of their research area, they not only must be intellectually flexible, but also must be capable of continuous learning on their own. And if pharmacology, or any other biomedical discipline, is to contribute in a pioneering way to the rapidly accelerating advancement of our understanding of "how we tick" in health and disease, its students and teachers alike must exploit the opportunities for perpetual intellectual and technological growth and participation in fruitful collaborations to link molecules to man, a first step into providing insights for development of novel therapeutic interventions, a classic hallmark of pharmacological research.

Position Paper: Educational needs and goals for molecular pharmacology. James C. Garrison, University of Virginia

My presentation made five major points as follows. 1. By its nature, pharmacology is a broad discipline that draws from and gives to most other medically related disciplines. 2. Accordingly, education for the PhD in pharmacology needs to be broad. The entrance requirements for the University of Virginia pharmacology program were discussed. An ideal background for entrance into graduate education in today's pharmacology is a BS degree in chemistry. The graduate courses leading to the PhD were presented and discussed. 3. Areas of future emphasis in pharmacology were pointed out and discussed. The areas included biochemistry, molecular biology, cell signaling, electrophysiology/biophysics, molecular modeling, crystal structure of proteins, protein-protein interactions, stem cell technology/transgenic animals, and gene therapy. 4. It was discussed that pharmacology was always evolving and new areas of science were becoming important to the discipline. Therefore, it was important to work at the leading edge of some field and understand the role of cutting-edge research. It was noted that the actual field of training did not have to be pharmacology as long as the basic tenants of the discipline were understood. 5. Finally, it was pointed out that success in the field of pharmacology required a broad view of modern biology and the ability choose the correct approaches to solve research problems and to communicate the results to other scientists.

Physiological Pharmacology

State-of-the-Art Lecture: Renal eicosanoids: tissue-specific pathways and functional effects. John C. McGiff, New York Medical College

The generation of biological mediators from arachidonic acid depends on oxygenases that are region-specific and stereospecific and involve three major enzyme systems: cyclooxygenase, lipoxygenases, and cytochrome P450-dependent monooxygenases. The cytochrome P450 isoforms have a wide distribution including the nephron and renal vasculature. In the vasculature, cytochrome P450 monooxygenase activity is stratified, the highest activity being present in the intima. These monooxygenase (M) products are endowed with biological properties-vasoactivity and the ability to affect ion movement-that identify them as potentially important to the regulation of the circulation and extracellular fluid volume and composition. Synthesis of P450-M products can be altered by pharmacologic probes. Quantitative and qualitative alterations of these products occur in response to hormones, elevation of blood pressure, dietary factors, and age.

In considering the theme of this symposium and the challenge, we must recognize that the pharmacologist has always been a "jack of all trades" and, I would add, master of some. The solution to "Big Questions" requires the use of tools borrowed from many disciplines. In the future, as in the past, novel research approaches will arise from the convergence of two or more disciplines, as seen in the development of renal micropuncture studies when a pharmacologist (for example, A. N. Richards, University of Pennyslvania) encountered a cell biologist-anatomist (for example, Robert Chambers). Nevertheless, pharmacology is the study of agents in integrated systems. Therefore, classical pharmacology must be maintained, for it provides the essential testing ground. Still, we can look to molecular biology to provide specific probes for functional studies and the conceptual basis for novel drug development.

Position Paper: Educational needs and goals for physiological pharmacology. Edward H. Blaine, John M. Dalton Cardiovascular Research Center and University of Missouri-Columbia

Physiological pharmacology is a key element in the process of discovering and developing new drugs. In the context of this symposium, I define physiological pharmacology as the practice of applying physiological principles to pharmacological investigations. The power of this approach is that it focuses our understanding on the mechanisms underlying drug therapy. Physiological pharmacology relies on the development of a hypothesis for a particular therapeutic approach. Testing that hypothesis to determine if a therapeutic possibility exists is the role of the physiology component of this partnership. Pharmacology takes over when the therapeutic target is clear. Chemists invent new molecular entities, which are tested in standard test schemes to characterize the compounds for efficacy and safety. If successful, the drug candidate moves into the development pipeline where additional long-term animal testing occurs to ensure complete safety assessment. If not successful, which is the case for the vast majority of new chemical entities, the process recycles back to the chemist to make new and, one hopes, better compounds.

Physiological pharmacology flourishes in the pharmaceutical industry, and many young scientists can find rewarding careers in this discipline. What is disappearing in our training system is the broad-based, systems-level integration that characterizes the thinking of the physiological pharmacologist. As training becomes more reductionist, fewer individuals choose to view the broad implications of a systems approach to understanding biological problems. There is a real possibility of overspecialization if the goal is a practical outcome like a drug. What is needed is greater integration of molecular and systems-level approaches and everything in between. If this cannot be done in individuals, our educational system must provide mechanisms to support collaborative interactions at all levels of research. Drug discovery is not a reductionist enterprise; it is an integrative undertaking. Improving human health is a practical endeavor.

Discussion Paper: Future direction of graduate training. William Spielman, Michigan State University

I reiterated a number of fundamental points made by the previous speakers. First, I mentioned the "polarization" of physiologists and pharmacologists into "reductionists and integrative biologists," a situation that has led to an adversarial relationship rather than an opportunity. Additionally, I pointed out the unfortunate but real trend toward a decreased emphasis on in vivo investigation in some of the contributing factors. I then went on to mention training needs for physiologists and pharmacologists in academia and industry and the perceived strengths and weaknesses of recent trainees. Finally, I made some recommendations for a general curriculum that might serve as an example for physiology and pharmacology PhD programs.

Discussion Paper: Importance of organ system approaches for understanding biological perspectives. Hiroko Nishimura, University of Tennessee, Memphis

The physiology/pharmacology discipline represented in this symposium by four subdisciplines should remain for the 21st century. Organ system physiology/pharmacology is important not only for integration of the information derived from cellular and molecular studies, but also for its indispensable values. First, important questions and hypotheses relevant to biomedical science arise from observation of intact organs and living animals. Imaginative research begins by imposing questions on complex systems and by intending to grasp overall views and processes. Second, information obtained at cellular/molecular levels becomes more valuable when it is interpreted and integrated into in vivo living systems. Third, although organs are composed of cells, simple collections of cells and molecules do not function as organs or living creatures. Whole animal studies and organ system approaches are necessary to understand regulation of biological systems and interactions among cells and organs. Fourth, to elucidate biological evolution and evolutionary perspectives, it is necessary to understand adaptation of animals to changing environments and modulation and selection of gene messages and gene expressions through their interactions with diverse environments. Fifth, it is prerequisite for medical students to learn organ system physiology/pharmacology as a basis for understanding the pathophysiology of diseases. Last, but not less important, organ system physiology/pharmacology is indispensable for industrial designing and development of new drugs and chemicals, biological instruments, and apparatus.

It is the role of current physiologists, particularly that of senior investigators, to teach to students and young scientists the principles of organ system physiology/pharmacology and the proper methodology to study them so that these important concepts and approaches are retained in science in the future. It is our responsibility to transmit to the next generation the excitement of working on living models that provide us with numerous puzzles and questions. It is our role to propagate as a group the importance of the organ system approach at local and national levels to obtain institutional and federal support. In this context, channeling through appropriate professional societies such as the American Physiological Society is effective and should be more utilized. Furthermore, the importance and necessity of whole animal and organ studies in industrial tests and research should be more widely propagated to investigators and public communities.

Discussion paper: Does research drive discipline or does discipline drive research? Morton Printz University of California-San Diego

Is there a future for physiology and pharmacology as identifiable disciplines in the 21st century? I posed the following question at the beginning: does discipline drive research or does research drive discipline? The dictionary provides several definitions for DISCIPLINE, including the following: instruction and exercise designed to train to proper conduct or action; the training effect of experience, adversity, etc.; behavior in accord with rules of conduct; a set or system of rules and regulations; a branch of instruction and learning. Likewise, RESEARCH is defined as diligent and systematic inquiry or investigation into a subject in order to discover or revise facts, theories, applications, etc. It has long been recognized that the application of the principles of a "Discipline" should lead one to systematic investigation for, in the final analysis, that is what should come from a true scientific discipline. If research drives "Discipline," will systematic investigation lead to a "Discipline?"

Posturing appears to have assumed a much greater role in the biomedical disciplines over the past 10 years than previously. Integrative physiology and pharmacology appear to have lost favor with many of our colleagues, who seek identification as "molecular" or "cellular" scientists. But is there a confusion between "methodology" and "principles?" Are our disciplines truly in a crisis; or, rather, is it evolution? Ian Phillips indicated that every established professor trained in one "technique" (I prefer to use the term "disciplinary area") in some depth. In my opinion, a discipline is not merely a branch of instruction and learning, but also instruction and exercise designed to train to proper conduct or action. A discipline should do more than simply teach a technique or a set of rules; more important, it should develop a way of thinking about problems necessary to conduct research in the discipline. This requires, however, in-depth teaching of a body of facts and principles to the trainee. Can a physiology or pharmacology curriculum really teach molecular biology? Can a molecular biology curriculum really teach electronic principles and computer neural networks or the biochemistry of signal transduction mechanisms?

I entered pharmacology from doctoral training in biophysics and the physical chemistry of macromolecules. While I clearly recognize the importance of the "molecular" approach, it seems to me that the "integrative" aspects of both disciplines are crucial to understanding and answering the questions that we as physiologists and pharmacologists should be increasingly asking. Yet there are fewer "integrative" physiologists and pharmacologists being trained. There is, whether our societies want to admit it or not, a "flight from identification." There are many potential reasons for this posturing, and the speakers today have already alluded to several. I submit that among these reasons are the following: 1) funding decisions by NIH study sections have over-emphasized molecular and cellular approaches in granting fundable priority scores; 2) the rapid expansion of biotechnology and the impact this has had on venture capitalizations in academics; 3) the antiintellectual impact of political movements, including the animal-rights, on research; 4) the belief of many academics that to compete for graduate students one must emulate molecular or cellular biology; and 5) molecular biology research methods are easier.

However, I am an optimist; and I submit what is happening is really an evolution of the methodological approach. The experimental methods of integrative physiology and physiological pharmacology are coming of age. We now have available instrumentation, including computers and computational methods, physical-chemical techniques, including MRI (for organisms) and NMR (for molecules), modelling miniaturized electronics, etc. The problem, I submit, is that our disciplines have failed to integrate many of these methodological advances into our educational curriculum in a rigorous manner; and young, bright undergraduates recognize this and find many of our curricula boring. The APS should be congratulated in taking a proactive stance in recognizing that a crisis exists and that questions must be asked so as to find answers. Unfortunately, my society, ASPET, felt the questions posed by this symposium and the faculty that were to be invited constituted "too controversial" a topic to support and would not cosponsor this symposium. Nevertheless, as a pharmacologist by choice, I believe that our disciplines are too crucial to advances in the 21st century to let them whither and disappear. From the size of the audience that we have had for the "education" symposium, I believe that there are many who agree with this position and want to preserve the future of our disciplines. In this regard, I want to thank the symposium speakers and participants for dealing so directly with the issues that we must discuss if our disciplines are to evolve and be strengthened.

Panel Discussion

Chairs: The basic questions asked in this symposium are "Do we want physiology and pharmacology disciplines in the 21st century?" and if yes, "what must we do to maintain the structures of disciplines as well as to meet the demand from rapidly growing biotechnology?" First, what would be the roles of individual investigators in terms of integration of molecular and cellular techniques to traditional organ system approaches in research and teaching, and development of interinstitutional network and communication? Second, does the university administration adequately back-up faculty's goal in research and teaching? Third, do grant review groups for funding agencies adequately represent all areas of desciplines? Fouth, do graduate students recognize importance of integrative approaches and put sufficient effor to learn organ system approaches as well as newer molecular anc cellular technology? Fifth, what would be the role of industry in physiology and pharmacology disciplines in the 21st century? Many of these issues were already raised; and we invite the audience and the panel to expand on any of these or other related subjects.

Audience: It has been implied that we were uncomfortable or felt inadequate with our own knowledge base and with our own research tools because in the minds of both administrators, including those at NIH, and the public-at-large what was considered to be physiology has changed because it was felt it wasn't up-to-date. The real issue is how to tell everybody what physiology and pharmacology is all about without new adjectives and without new modifiers. Another problem would be the fact that there is an increasing gap between what we teach the students in the core medical school curriculum and what our laboratories stress.

Panelist: If you define physiology as the study of normal function and its regulation at all levels, you're obviously going to use all sorts of techniques and new approaches; but you don't necessarily change the name for that purpose. The other issue you raise in terms of the teaching is a real one; but if one is broadly trained as a physiologist, one should be able to teach one type of student in terms of broader areas and another type of student in a differently focused approach. It is certainly true that perhaps in terms of the teaching, we are being caught by administrators pushing one way or another. If a person is well enough trained in physiology and pharmacology and has the appropriate breadth, one can deal with these challenges and will not be intimidated.

Panelist: I don't think that we should be changing the name or perception of physiology/pharmacology just because of some current trend. But I do know that, in reality, sales-manship does affect us, since many very qualified students target cell and molecular biology because that's what they hear is a good area of biology. The salesmanship issue may be critical to the recruitment of young faculty.

Chair: I think that most of the audience are associated with medical schools; and, since identification of physiology and pharmacology in the minds of future graduate students really has to take place prior to commencing graduate education, i.e., at the undergraduate level and even in high school, what is being done to (a) educate our colleagues on the general campus in biology and chemistry to acquaint undergraduates with the disciplines of physiology and pharmacology, and (b) educate high school science teachers that there are such disciplines as physiology and pharmacology? Finally, I would ask how many of us here today are or have been involved with undergraduate education so that undergraduates can get a "vision" of who we are and how we function before they make their decision on graduate education?

Panelist: At our own institution, we are located in the medical school on the main campus; and we do teach at least two undergraduate courses, a systems levels course as well as a course designed strictly for engineers. In our institution, the biology departments want to interact with each other so that all the heads of the departments, including the heads of the basic departments in the medical school and on the main campus, the college of agriculture, the cancer center, etc., all meet once a month to have planning sessions on the needs for biology. We have formed a committee (including medical school faculty) that is going to begin looking at undergraduate teaching at the early levels and also at courses for nonmajors. Furthermore, the APS is beginning to take steps in this direction. We now have a full-time educational officer. and we are going to emphasize programs at the preprofessional level, actually the precollege level, (K-12). I think this is all very important, and it's an area that we all must be involved in not just for physiology and pharmacology but for the future of science and the future of biology in general.

Audience: When I look at physiology today, including the American Physiological Society, I have a feeling of a group of people anxious to sell the birthright for a plate of lentils. The birthright that they are selling is the fact that they are the only scientists, biologists, who are really integrative. The physiologists are the only integrative biologists at the organismal level; and if physiologists give up that dimension of their calling, nothing will be left. For the first time in history, we have a fine scalpel so we can go down to the molecular level, and every day we are discovering a new molecule, which is wonderful and good, but let's not confuse molecular anatomy with the integrative function of physiology.

Panelist: The molecular discoveries are truly exciting. I think, however, one of the most exciting areas in the coming years in physiology, and for many aspects of pharmacology as well, is new ways of integration. Integration will have to be accomplished through techniques and approaches that many of us don't recognize now.

Panelist: I also think that we can't possibly anticipate the breadth of technology a decade from now. We thus need to prepare ourselves to continually train and teach our students how to think well and how to set aside a time of day to always read something new, for example, a new primary research paper outside their field or an integrative review article in an area outside their own, and try to integrate these concepts, if appropriate, into how they think about their own research problem.

Audience: Coming originally to physiology and medicine from physics, I was always struck with what I regarded as a lack of theoretical underpinning in physiology and particularly of any mathematical underpinning. One of the main reasons for this would be that many physiological problems have been computationally too difficult to approach within the computation framework that has been available. With advances in parallel computing, you can now get a gigaflop of computing power, and this should only increase. One issue that the Society might look at is the way that this computational power can be made available to physiologists in general.

Chair: How many graduate programs in physiology and pharmacology require a computer course, computer programming, or some course that introduces students to advanced technqiues in the use of computers? This is critical for physiology and also for pharmacology. Certainly in the area of molecular pharmacology, the power and availability of the computer was the limiting factor in molecular modelling. However, with existing and evolving supercomputers, that limitation is disappearing. Has any graduate program implemented formalized computer training for graduate students?

Panelist: Students don't take a separate course at Vanderbilt University, but molecular modeling and computational chemistry are part of a course termed "Fundamentals in Pharmacology", Computer-assisted analysis for statistics and for other data handling are part of a short-course taught in alternative summers and are dealt with in several courses as appropriate for experimental design, data analysis, and interpretation.

Audience: The issue of attracting students is key for many faculty members. One thing that students are using more and more these days is computer networks, like Prodigy, Compuserve, etc.; but the senior people in molecular biology are often reluctant to get involved with computers. Thus, I wish that the American Physiological Society could be one of the first societies to actually take the initiative and get on-line and start using the network. Lots of individual molecular biologists and cell biologists are out there nowadays using the networks. NSF has the Arabidobsis-Xenon project, which is using the network and uniting scientists from the United Kingdom to the U.S., Canada, Australia and the rest. But so far, all attempts I have made to try to get professional societies on-line are still languishing to some extent.

Panelist: This is obviously very important. The American Physiological Society established recently a bulletin board system on INTERNET through the Gopher Network, and that's just the beginning of what we hope will be more and more information flow in this manner. It is a start, and obviously there's a long way to go; but we are moving in that direction.

Chair: If integrative physiology and pharmacology involve the INTERNET or an interdepartmental or interinstitutional network and communication, how will this research or

education be funded? Does this require more institutional commitment, more departmental support, or more federal research support?

Panelist: We have several department chairs here today who can speak to the problem of how to get funds out of their deans! However, my impression is that it's always a hassle getting funded for INTERNET. It's not all that cheap, so I think it's going to become absolutely essential to seek sources of funds to get on-line. It's not an easy question to answer, but I think this is something that the Society might be more successful in trying to address than individuals.

Audience: My point is that if physiology and pharmacology are going to survive to the next century, we are going to need graduate students. Let's take that as a given. And, I think the comments made indicate that we need to train students how to think because there is an information overload issue. But what I think we really lack is how to do that. I really don't know if we have good methods or curricular ideas or if you can really demonstrate, in fact, that you can teach people how to think and continually retrain themselves. I think we don't know how to train people, short of just doubling or tripling the length of graduate programs, to try and make people well-versed in all the techniques of the day. That's the big educational challenge that I see.

Panelist: I agree with those views. You can't have a course in what I think is essentially an attitude. Part of that training has to come from the faculty members themselves and from the departments fostering that attitude. If all the people around you think like that and that's the valued approach to the problem when you're learning it, you're more likely to think that way.

Panelist: I also think this is a major problem, and I agree that it has to be something that you learn from example and from interaction with people. But I believe it has to start well before graduate school. We have a major undergraduate research program that is expanding every year, and it gets students involved early on. I think it's really important that we figure out ways of getting these attitudes of thought into students at a much, much earlier age. You certainly can't suddenly do it with a course later on.

Chair: An early start in training how to approach science would be a key issue. In our department, we have established a local educational network. We periodically invite chairmen, faculty members, and students of local colleges to our department, show our laboratories, and discuss. We have federal and local programs that financially support college

and high school science teachers and students who want to work in laboratories during the summer. These programs will help in cultivating future graduate students.

Panelist: There are many aspects of your scientific environment that you could make more didactic. We've tried to do this to make issues related to how to approach science more explicit. When we invite speakers from off campus for the seminar series, we ask them before they come to construct their seminar not just to showcase their research but to emphasize their thinking processes. And, when they meet with students the next day, we ask them, to be prepared to discuss what influenced making their career choice as well as experimental choices, and what criteria they use in a change of direction, scientifically.

Panelist: In some medical schools, problem-based learning is becoming a mode that will actually eliminate a tradition of courses that we have used to train graduate students and will necessitate a revision of how this whole process occurs. I don't know how pervasive problem-based learning will be or exactly the structure it will take ultimately, but this is certainly a trial balloon that is getting very serious consideration. If it does occur, than the traditional format needs to be revised. I think that the possibility of expanding physiology and pharmacology out of the graduate disciplines and into the undergraduate schools is very strong, and I think that's where we ought to be looking right now.

Panelist: We implemented problem-based learning in pharmacology, not as a replacement for didactic lectures, but in place of discussion sections. I can tell you that problem-based learning, when it supplements formal lectures, is phenomenally successful. It facilitates an understanding by medical students of the formal didactic lecture material. I think we shouldn't shrink from problem-based learning, but clearly problem-based learning should not replace the formal didactic instructions.

Audience: Following up the discussion on problembased learning, the "technology," if you want to use that term, is available in the College of Education. There are methods and techniques to teach students how to think. Problem-based learning is thrilling to be involved with, and it's a way to teach students to think. Graduate students faced with "cases" can think how to solve research problems. There's another technique called "guided discovery" that's also as powerful as problem-based learning.

Chairs: We think it was a great symposium and panel discussion and thank all speakers, discussants and audience.

APS Members Elected to the National Academy of Sciences

APS members Henry Friesen and Bert Sakmann were among the 15 new foreign associate members elected to the National Academy of Sciences. Foreign associate member status is an honorary position awarded in recognition of outstanding accomplishments.



Henry Friesen received his MD from the University of Manitoba in 1958 and obtained his FRCPC in Internal Medicine in 1963. He has directed research and clinical trials on the effectiveness of human growth hormone (HGH) to stimulate the growth of children who are HGH deficient. He is also known for his discovery of the human hormone prolactin and the subsequent development of a simple blood test to identify patients with tumors that secrete excessive amounts of prolactin.

Friesen has received many honors for his research, including the 1982 G. Malcolm Brown Memorial Award from the Canadian Society for Clinical Investigation and its 1987 Distinguished Scientist Award. In 1987 he was also made an Officer of the Order of Canada and received the Koch Medal, which is the highest award of the Endocrine Society. Since 1991 Friesen has been President of the Medical Research Council of Canada.

Bert Sakmann, an honorary member of APS, is director of the Department of Cell Physiology at the Max Planck Institute for Medical Research in Heidelberg, as well as acting director of the Institute. He received his MD from the University of Munich in 1967 and then began working with Otto Creutzfeldt at the Kreupelin Institute in Munich on the electrophysiological basis of pattern



recognition. He took a three-year postdoctoral fellowship with Bernard Katz at University College, London, where he was trained in cellular biophysics.

Sakmann's research interests are in neurobiology, where he has focused on the molecular basis of long-term changes in synaptic transmission at the neuromuscular junction and the establishment of structure-function relationships of synaptic membrane channels, especially the acetylcholine receptor channel. His honors and awards include the 1991 Nobel Prize in physiology or medicine, which he shared with Erwin Neher.



Klabunde Appointed Associate Director



Richard E. Klabunde has been appointed Associate Director of the Deborah Research Institute, a nonprofit research organization. He moves from Abbott Laboratories, where he was senior cardiovascular group leader and a research fellow in the Department of Physiology. He is a member of APS, the Microcirculatory Society, and the American Heart Association.

Bishop Named to SCAW Board of Trustees

Vernon S. Bishop is one of two new members of the SCAW (Scientists Center for Animal Welfare) Board of Trustees. Bishop, a past president of APS, is chair and professor of the Department of Physiology at The University of Texas Health Science Center at San Antonio. He has served as Editor of American Journal of Physiology: Heart and Circulatory Physiology and on several editorial boards of APS journals.



Jen-Shih Lee Named ASME Fellow

APS member **Jen-Shih Lee**, chair of the Department of Biomedical Engineering at the University of Virginia, has been named a fellow of the American Society of Mechanical Engineers (ASME). The Fellow grade is conferred upon a member with at least 10 years active engineering practice whi has made significant contributions to the field. ASME is a worldwide engineering society focused on technical, educational, and research issues.

People and Places

People and Places notices come almost exclusively from information provided by members and interested institutions. To ensure timely publication, announcements must be received at least two months (by the 15th of the month) before the desired publication date. Send all information to *The Physiologist*, APS, 9650 Rockville Pike, Bethesda, MD 20814-3991.

APS member **Richard C. Vari** has accepted a position as Associate Professor of Physiology at the University of North Dakota School of Medicine in Grand Forks, ND. He was formerly at Tulane University School of Medicine in New Orleans, LA.

William J. Betz, APS member since 1976, has been appointed Chair, Department of Physiology, University of Colorado, School of Medicine, Denver, where he has been Professor of Physiology. Betz is also a recipient of a Humboldt Award to work with Erwin Neher and Bert Sakmann at the Max Planck Institute, Gottingen.

Formerly at the University of Tennessee, Mark R. Opp is now at the University of Texas Medical Branch, Galveston.

Kathleen P. O'Hagan has moved from the Medical College of Wisconsin to the Department of Physiology at Midwestern University, Downers Grove, IL.

John A. Bettice is now with the Office of Medical Education and Evaluation at the University of Illinois College of Medicine. Formerly at Case Western Reserve University, Bettice has been a member of APS since 1978.

APS member Victor A. Convertino is now with the Armstroing Lab at Brooks Air Force Base, Texas. He was formerly at the Kennedy Space Ceneter, Florida.

Michael A. Kurz has accepted a position in the Department of Medicine, Division of Cardiology at Emory University School of Medicine, Atlanta, GA. He was formerly with Gensia Pharmaceuticals.

Formerly at the University of Maryland, **James M. Hagberg** has moved to the Department of Medicine, University of Pittsburgh Heart Institute, Pittsburgh, PA.

Barry D. Lindley has accepted a position as Vice Chancellor of Academic Affairs, University of Arkansas for Medical Science. An APS members since 1967, Lindley moved from Case Western Reserve University.

APS member **Robert H. Gundel** has moved from Boehringer Ingelheim

Pharmaceuticals to the Institute of Inflammation and Experimental Medicine at Miles, Inc., West Haven CT.

Edward M. Lieberman is now with the Department of Physiology at East Carolina University School of Medicine. He was formerly with the National Science Foundation.

Robert J. Moriff has moved to Centron Med., Inc., Cincinnati, OH, from Eli Lilly & Co.

Formerly at Walter Reed, APS member Frederick C. Tyner has moved to the Headquarters at the US Army Medical Research Development Center, Fort Detrick, MD.

John H. Linehan has accepted a position as Chairman of the Department of Biomedical Engineering at Marquette University, Milwaukee, WI. He was formerly at the VA Medical Center in Milwaukee.

Simon Gelman is now with the Department of Anesthesia/Harvard Medical School, Brigham & Women's Hospital, Boston, MA. An APS member since 1985, Gelman moved from the University of Alabama in Birmingham.

APS member **Chester A. Ray** has moved to the Department of Internal Medicine and Cardiology at the University of Iowa Hospitals from the University of Georgia, Athens.

Kiyoshi Isida is now with the Department of Geriatrics, Faculty of Medicine, University of Tokyo, Japan.

Roger A. Norman has accepted a position as Director of Clinical Research at the North Mississippi Medical Center, Tupelo, MS.

APS member Arlene A. Stecenko is now with the Center for Lung Research, School of Medicine, Vanderbilt University, Nashville, TN. She was formerly at the University of Florida, Gainesville.

Roger M. Enoka has moved to the Department of Biomedical Engineering, Cleveland Clinic Foundation, Cleveland, OH. He was formerly at the University of Arizona.

Bonnie L. Blazer-Yost is now with the Biology Department at Indiana University—Purdue University,

Indianapolis. An APS member since 1990, she was formerly at the VA Medical Center, Philadelphia.

Jack D. Barchas has accepted a postion as Chair of the Department of Psychiatry, Cornell University Medical College, New York. He was formerly at UCLA School of Medicine.

K. Bridget Brosnihan has moved from Cleveland Clinic to the Hypertension Center at Bowman Gray School of Medicine, Winston-Salem, NC.

Formerly at Brown University, Cheryl Watson has moved to the Department of Physiology, University of Maryland, Baltimore.

Christopher Hardin has moved from the University of Washington to the Department of Physiology, University of Missouri, Columbia.

Jo Rae Wright, formerly at the University of California, San Francisco, has moved to the Department of Cell Biology, Duke University Medical Center, Durham, NC.

APS member **Robert F. Wideman** has accepted a position as Professor of Poultry Science and Arkansas Poultry Federation Chair, Department of Poultry Science, University of Arkansas, Fayetteville. He was formerly at Pennsylvania State University.

Ronald J. Torry has moved from the University of Iowa to the Center for Reproductive and Transplant Immunology, Methodist Hospital Indiana, Indianapolis.

Richard J. Sinclair, a member of APS since 1978, has moved from the Texas College of Osteopathic Medicine to the Texas Academy of Math and Sciences, University of North Texas, Denton.

Formerly at Pennsylvania State University, **Russell L. Moore** has moved to the Department of Kinesthesiology, University of Colorado, Boulder.

Yuochi Suzuki is now at the Laboratory of Physiology, School of Food and Nutritional Sciences, University of Shizuoka, Shizuoka, Japan. Suzuki was formerly at the Yamagata University School of Medicine.

Kenneth G. Adams is now with

the Division of Lung Diseases, National Heart, Lung and Blood Institute, NIH, Bethesda, MD. An APS member since 1980, Adams was formerly with Shering-Plough Research.

Serge von Duvillard has moved to the Department of Exercise and Movement Science, The William Paterson College, Wayne, NJ. Von Duvillard was formerly at the University of Chicago.

APS member **Catherine S. Chew**, formerly at Morehouse School of Medicine, is on a one-year sabbatical at the Department of Physiology and Medical Biophysics, Uppsala University Biomedical Center, Uppsala, Sweden.

David O. Foster has moved to the National Research Council of Canada, Institute for Biodiagnostics, Winnipeg, Manitoba. He has been an APS member since 1987.

Joel G. Pickar has moved from the University of California, Davis, to the Department of Anatomy and Physiology, Kansas State University College of Veterinary Medicine, Manhatten, KS.

Formerly at the Milton S. Hershey Medical Center, APS member Joseph J. McInerney is now with the Biological Sciences Curriculum Study, Colorado Springs, CO.

Pedro R. Lowenstein has moved to the Department of Physiology, University of Wales College at Cardiff. Lowenstein was formerly at the University of Dundee, Scotland.

APS member **Rajagopala Sridaran** has moved from the University of California, Santa Cruz, to the Department of Physiology, Morehouse School of Medicine, Atlanta, GA.

Craig W. Stevens is now with the Department of Physical Education, West Chester University, West Chester, PA.

Gary A. Dudley has moved to the Department of Exercise Science at the University of Georgia, Athens. He was formerly at the Bionetics Corporation.

Adam Sun has moved from Brigham & Women's Hospital to the Renal Division of Rhode Island Hospital, Providence, MA.

Positions Available

There is a \$50 charge for each position listed. Positions will be listed in the next available issue of *The Physiologist* and immediately upon receipt on the **APS Gopher Information Server**. Listings will remain on the APS Information Server for 3 months.

A check or money order payable to the American Physiological Society must accompany the position listing. Purchase orders will not be accepted unless accompanied by payment. Ads not prepaid will not be printed. Copy must be typed double spaced and is limited to 150 words. All copy is subject to the editorial policy of *The Physiologist*. EOAAE indicates Equal Opportunity/Affirmative Action Employer and appears only when given on original copy. Copy dead-line: copy must reach the APS office before the 15th of the month, two months preceding the month of issue (e.g., before February 15th for the April issue). Mail copy to APS, *The Physiologist*, 9650 Rockville Pike, Bethesda, MD 20814-3991.

Assistant to Full Professors. University of Virginia, Department of Biomedical Engineering, invites applications for these tenure track positions in Biomedical Engineering. Areas of interest include 1) cellular engineering to study the functions of living cells, 2) cardiopulmonary and neural engineering, 3) mechanisms of pressure sores, 4) biosensor development and image analysis with emphasis on physiological mechanisms. Affiliated with the School of Engineering and Applied Science and the School of Medicine, the department has 22 faculty and 50 graduate students and offers the ME, MS, and PhD in biomendical engineering. Submit curriculum vitae, statement of current and future research interest, and up to three selected reprints to J. S. Lee, Chairman, Department of Biomedical Engineering, Box 377, University of Virginia Health Sciences Center, Charlottesville, VA 22908. [EOEAA]

Know Your Sustaining Associates

Groupe de Recherche Servier

Of the 6,000 people working throughout the world at the Groupe de Recherche Servier, 25% carry out research involved in the development of new drugs.

Among these, various specialists including chemists, pharmacists, pharmacologists, toxicologists, and physicians work in our research laboratories located in Suresnes, Orleans, Gidy, Fulmer, Tokyo, and in our development teams in Courbevoie, Fulmer, Brussels, Munich, Rome, Madrid, and Tokyo.

The main areas of research at the Groupe de Recherche Servier concern the following areas of pathology: cardiovascular disease: especially in hypertension, myocardial ischemia; heart failure: cardiovascular aging, venous diseases; oncology and immunology; respiratory disease: chronic obstructive pulmonary diseases, asthma; metabolic disease: diabetes, lipid disorders, obesity and their consequences particularly in terms of cardiovascular damage; neurological disease: cerebral impariment in elderly, Parkinson's disease; Carebrovascular disease: memory impariment, Alzheimer's disease; psychiatric disease: emotional disorders, anxiety, depression; and rheumatology: imflammatory and painful joint diseases, joint and bone aging including osteoporosis.

Eli Lilly and Company

The Lilly Research Laboratories is dedicated to the advancement of basic scientific information upon which further targeted medical breakthroughs may be identified. Scientists in the Lilly Research Laboratories are committed to excellence in research as evidenced by a steadily increasing investment in research and development over the years. Scientific research is being supported by the construction of new research facilities and with the use of a Cray II supercomputer. Scientists are focusing on basic research and targeted medical therapy for cardiovascular disease, central nervous system dysfunction, cancer, diabetes, and pulmonary disorders.

SmithKline Beecham

SmithKline Beecham is one of the world's leading healthcare companies. Its principal activities are the discovery, development, and marketing of both human and animal pharmaceuticals, over-the-counter (OTC) medicines, health-related consumer brands and clinical laboratory testing sevices.

First Announcement—1997 IUPS Congress

The Russian Academy of Science, the National Committee and the people of St. Petersburg invite physiologists to the XXXIII International Congress of Physiological Sciences to be held in Russia, July 1–6, 1997.

The Congress will be organized in the most efficient manner possible by using the experience of previous congresses. To make a complete and focused presentation of all current trends in modern physiology, satellite symposia will not be arranged.

Each day will commence with a special review lecture devoted to the latest achievements and ideas in the global directions of modern physiology. Later there will be free and open discussions at the symposia.

Oral and poster presentations are to be arranged. There will also be a special symposium on the history of physiological science and a series of survey lectures for young physiologists as well as teachers.

The National Committee of Russian Physiologists and the Organizing Committee of the Symposium will inform the IUPS, as well as the National Physiological Societies, of progress in organizing the Congress. These Committees will also invite stimulating ideas and suggestions to contribute to a better organization of the Congress.

S. V. Medvedev, chair; S. V. Pakhomov, treasurer; I. A. Maximova, secretary; and P. V. Simonov, programme are members of the Organizing Committee of IUPS 1997 and of the Institute of the Human Brain of the Russian Academy of Science, 9 Acad. Pavlova St., St. Petersburg, 197376, Russia. Tel: +7-812-234-1390, Fax: +7-812-234-3247.

There is a variety of hotel accommodations available to the participants of the congress. These options range from hotels of varying cost and university dormitories to a chartered, Finnish hotel-ship. The living quarters are situated in the picturesque areas of the city and are close to public transportation. The times and locations of the sessions will be planned to keep transit time to a minimum. There will be chartered buses to take the delegates to sessions of the Congress and also on excursions.

Accompanying guests will be invited to join the delegates for all social programs. A wide variety of tours around St. Petersburg and excursions to famous places and museums will be offered.

Return the form below by mail or fax by December 1993. Fax number to CONGREX is +358-0-7520899. Mail the form to IUPS 1997, c/o CON-GREX, PO Box 35, Fin-00621 Helsinki, Finland.

Preliminary Registratio	n

I plan to participate in the IUPS Congress, July 1-6, 1997 in St. Petersburg.

Please print	
Surname	First Name
Title	Position
Company/Organization	
Street Address/PO Box	
City, State, ZIP	
Country	
My main area of interest is	

Mail form to IUPS 1997, c/o CONGREX, PO Box 35, Fin-00621 Helsinki, Finland.

The Hijacking of the Humane Movement

Rod & Patti Strand Wilsonville, OR: Doral, 1993, 174 pp., index, \$16.95. ISBN: 0-944875-28-9

Those who write about animal rights tend to focus on specific issues within the movement, such as the use of live animal models for purposes of research, teaching, and testing. This is not the case, however, with Rod and Patti Strand's book, *The Hijacking of the Humane Movement*. The Strands give their readers a broad brushed review of the animal rights phenomenon from its grassroots in England and tracing the movement's spread to the United States and its infiltration into the animal-related industries.

The Strands are not strangers to the animal rights movement for they are a target for activists. For nearly a quarter of a century the Strands have bred, raised, and showed Dalmatians. Moreover, Patti Strand is the executive director of the National Animal Interest Alliance, an umbrella organization representing the interests of veterinarians, sports enthusiasts, biomedical researchers, pet owners, and animal breeders.

The book provides a researched insight as to how the humane movement—which began in England in 1824 with the founding of the Society for the Prevention of Cruelty to Animals and the National Antivivisection Society—was hijacked in the 1970s by two radical activists groups, the Hunt Saboteurs and its covert counterpart, Band of Mercy. The Band of Mercy was composed of several bands in England and later bands were established in the United States. These bands are known now as the Animal Liberation Front.

Two individuals of note in the take over of the humane movement in England are Ronnie Lee and Kim Stallwood. Lee, who subscribes to the philosophy that the end justifies the means and who has served (and currently serving), several prison terms for his actions in the cause of animal rights, believes in disruption by destruction. Stallwood believes in using the political process as the means to take control of organizations and their agenda concerning animal rights.

Alex Pacheco, who founded the People for the Ethical Treatment of Animals (PETA), was in England during this time with Stallwood, who in 1986 came to the United States to be the executive director of PETA. It was during Stallwood's stay here that both the New England Antivivisection Society and the Toronto Humane Society, which had treasuries of \$8 million and \$14 million, respectively, were taken over by PETA members.

The book tells of the successful strategy of the animal activists in their infiltration of mainstream humane and animal welfare organizations with the intent to taking them over and converting their status, influence, and finances to an animal rights perspective. Prominent animal welfare societies from the Humane Society of the United States and the American Society for the Prevention of Cruelty to Animals down to a majority of local animal pounds and shelters have moved now toward the animal rights philosophy. Moreover, the animal rights philosophy has become a part of the agenda for some feminist and environmental groups.

In addition to telling how animal rights activists operate, both overtly and covertly, the Strands also present three case studies: the attack on the tuna fishing industry, Ed Taub and the Silver Spring monkeys, and Bobby Berosini and his use of orangutans in his Las Vegas Show. Also presented is a chronology of raids and destruction by animal rights activists since 1984. What is interesting to note is that whether the activists won or lost in the courts of judicial and public opinion following an attack upon a person or an animaluse industry, the incident is used as a renewed reason to solicit funds for carrying out future endeavors.

Whether you have been long-involved in the animal rights issue or a newcomer to the scene, *The Hijacking of the Humane Movement* is a book worth the time to read. It is a crisply written book that not only gives the reader the broad view of the animal rights movement, but also explains how it has quietly subverted many organizations that the public-at-large unwittingly still considers worthwhile charitable organizations.

> W. M. Samuels North Potomac, MD

Molluscan Neurobiology

K. S. Kits, H. H. Boer, and J. Joosse (Editors). Amsterdam, Holland: Royal Netherlands Academy of Sciences, 1991, 360 pp., illus., index, \$55.86

Proceedings of the Third Symposium on Molluscan Neurobiology, Free University of Amsterdam, The Nethterlands, 1990

Molluscan Neurobiology is subtitled Proceedings of the Third Symposimum on Molluscan Neurobiology held at the Free University of Amsterdam, August 20-24, 1990. The goal of this and the preceding symposia was to cover the entire field of molluscan neurobiology. In this regard, it has succeeded admirably. It represents the contributions of more than 150 authors, many of whom are the recognized leaders in the field. The book covers topics ranging from biophysics to behavior and morphology to molecular biology. The editors have organized the 54 papers into six broad categories such as the "biosynthesis, processing, transport and release of chemical messengers" and "Plasticity, neural growth and aging." The major molluscan model systems: Aplysia, Helisoma, Helix, and Lymnaea, are all well represented as well as several of the less commonly used molluscan species. There is even a paper on cultured hippocampal neurons from the rat, a truly unusually "mollusc." One of the more distinctive categories is "Molluscs in Biomedical Research." While molluscs have become a mainstay for investigating the basic properties of neurons, their clinical significance and utility for unraveling clinical problems is frequently overlooked. In short, there is something of interest here for almost everyone interested in molluscan neurobiology.

As might be expected from such a divergent group, the quality of the papers varies. Some papers pack a large amount of information into a few pages. Others are more lean. Only one paper fails to have any useful information (despite multiple authors). Many of the contributions represent the (then) current efforts of the authors' laboratories. Overall, the caliber is high. The publishers should be commended for the superior photomicrapraphs and photographs. All have reproduced very well. One of the few faults that I have is with the abbreviated format of the references. Only the author, journal and pages are given. This lack of full citations, presumably to keep down the number of pages and costs, slightly diminishes the book's usefulness for students. Nonetheless, Molluscan Neurobiology still serves as an excellent starting place for a broad range of topics. At \$55.86, the price is not out of line with today's specialty book prices. All-in-all, I think *Molluscan Neurobiology* is well worth it and recommend it.

Steven M. Fredman Meharry Medical College

Animal Experimentation and the Future of Medical Research

Jack H. Botting (Editor)

Proceedings of the Research Defense Society Conference, Royal Society, London, April 26, 1992.

Colchester, UK: Portland Press, 1992, 98 pp., illus., index, \$30.00

This book represents the proceedings of a one-day symposium held at the Royal Society in London by the Research Defense Society to bring together biomedical scientists of "unquestionable stature" to discuss the contributions of animal experimentation to past and future medical and technical advances. There are seven chapters that emphasize the "internationalism" of sciences and tactics of those who oppose animal experimentation. The contributions that animals have made to medical advances outlined by each contributor may not be new to those actively involved in biomedical research. However, the organization of the material is logical and provides an excellent resource. An important recurrent message of the book is an urgency for the scientific community to counter the antiintellectualism and anti-technological attitudes of the animalists (a term Sir John Vane uses to describe all those who oppose animal experimentation). It is emphasized that "public opinions influence government and thus legislation; we then bear the fruits of that." The discussions following the invited contributions indicate the impact the impact of the animalist's activities on voluntary health-related charities and medical practice that promotes "alternative" or "complementary" medical care that is based on an anti-scientific approach to healing. Concerns about the alignment of the animalists with environmental issues and of the distribution of their materials to children within public schools are discussed. Each contributor provides suggestions as to how some of the activities of the animalists can be combatted, including involvement of primary care physicians at an individual level, rallying the support of hospital administrators and ultimately coming to the question that each individual must answer: if you oppose research involving animals, are you actually prepared to deny yourselves or your children the fruits of that medical research?

In summary, the book is well-written and would provide excellent source material for an ethics of science course or for individual investigators preparing to talk to the public about the contributions animals have made to improving the health of all of us.

> Virginia M. Miller Mayo Foundation

Dynamic Biological Networks: The Stomatogastric Nervous System

R. M. Harris-Warrick, E. Marder, A. I. Selverston, and M. Moulins (Editors)

Cambridge, MA: MIT Press, 1992, 328 pp., illus., index, \$65.00

The crustacean stomatogastric nervous system, a collection of ganglia that generate the motor patterns that move the foregut, has been much studied by workers interested in the production of rhythmic behavior. However, in their introduction to this book, the editors make it clear that their aim is not an exhaustive coverage of the physiology of the stomatogastric nervous system (STNS) but rather a description of the important principles that have arisen from research in this area.

Happily this aim is fulfilled. The first chapter is designed to give one a feel for the preparation and is written at a level that enables newcomers to the field, or those who have been confused by its nomenclature, to appreciate the subsequent chapters. This is followed by a description of stomatogastric neurons in terms of their ionic channels and cellular properties, most notably the plateau potentials that are of such importance in the generation of rhythmic activity (chapter 2). Although most of the 30 cells that form the stomatogastric ganglion (a portion of the STNS) innervate muscles of the foregut and are therefore classified as motor neurons, they also function to generate the motor patterns. While the patterns generated by the isolated ganglion can be remarkably stereotyped, neuromodulators whether added exogenously or released by neuronal stimulation can sculpt both the cellular and synaptic properties of individual neurons. The resulting flexibility in motor output is described in chapters 3 and 4, which illustrate how the functional con-

1995 APS Conferences

Understanding the Biological Clock: From Genetics to Physiology Organized by Jay C. Dunlap and Jennifer J. Loros (Dartmouth)

New Discoveries Within the Pancreatic Polypeptide Family: Molecules to Medicine Organized by William Zipf (Children's Hospital, Columbus), Ian Taylor (Duke), Claes R. Wahlestedt (Cornell), Richard Rogers (Ohio State), and Helen J. Cooke (Ohio State) nections between neurons within a circuit can be markedly altered following the activity of modulatory neurons. Flexibility is also apparent at the network level with neurons switching their allegiance from one central pattern generating circuit to another. The suggestion is made that these networks are not discrete circuits of neurons, and that the STNS should be viewed as a "multiple task processor" rather than as a collection of separate central pattern generators. Interestingly, while the pattern generating networks of the STNS are well conserved between decapod species, the modulatory inputs that determine the final network configuration have proven to be relatively labile (chapter 7).

Recently, by monitoring the activity of the foregut in intact animals with an endoscope it has become clear that the range of motor patterns seen in the in vitro preparations correspond to a complex range of behaviors (chapter 6). Given that so much is known about the properties of the neurons and of the networks, it may appear strange that computer models of the STNS are being constructed. However, as pointed out in the section that deals explicitly with theoretical matters (chapter 5), it is for this reason that network models may be an appropriate way to examine problems that are technically difficult (such as the roles played by individual ionic currents in shaping neuronal activity). Such an approach is discussed in a concise, nonmathematical manner. A recurring sentiment expressed in this and other chapters is the hope that information about the properties of the STNS will "scale-up" to larger and more complex neuronal networks. The extent to which this may be true is examined in the final chapter, which discusses how the principles that have emerged from the study of the STNS have parallels in other invertebrate and vertebrate model systems. Common themes (such as the ability of neural networks to generate several motor patterns) do indeed emerge.

Overall the tone of the book is candid and the authors make clear where gaps in knowledge exist. Cross-referencing between chapters and the single bibliography at the end of the book means that it reads evenly. In view of the large amount of information presented, a formal summary at the end of each chapter might have been helpful. Nevertheless, this is a well-written book that can be recommended to anyone interested in the mechanisms that underlie the generation and modulation of motor patterns.

> Matthew D. Whim Yale University

BOOKS RECEIVED

Annual Review of Pulmonary and Critical Care Medicine 93/94. Richard A. Matthay, Michael A. Matthay, and Herbert P. Wiedemann (Editors). Philadelphia, PA: 1993, Hanley & Belfus, Inc., 365 pp., illus., index, \$55.00. ISBN: 1-56053-073-1.

Aspects of Synaptic Transmission 2: Acetylcholine, Sigma Receptors, CCK and Eicosanoids, Neurotoxins. T. W. Stone (Editor). Bristol, PA: Taylor & Francis, 1993, 255 pp., illus., index, \$99.00. ISBN: 07484-0063-X.

Dyslexia and Development: Neurobiological Aspects of Extra-Ordinary Brains. Albert M. Galaburda (Editor). Cambridge, MA: Harvard University Press, 1993, 378 pp., illus., index, \$45.00. ISBN: 0-674-21940-6.

Fetus and Neonate Physiology and Clinical Applications: Volume 1: The Circulation. Mark A. Hanson, John A. D. Spencer, and Charles H. Rodeck. New York, NY: Cambridge University Press, 1993, 438 pp., illus., index, \$110.00 (Hardcover), \$39.95 (Paper). ISBN: 0-521-41187-4:

Isotonic Transport in Leaky Epithelia. Hans G, Ussing, Jorge Fischbarg, Ove Sten-Knudsen, Erik Hviid Larsen, and Niels J. Willumsen (Editors). Proceedings of the Alfred Benzoin Symposium 34, Copenhagen, 1992. Copenhagen, Denmark: 1993, 520 pp., illus., index, \$66.15. ISBN: 87-16-11074-9.

Molecular Biology of the Skin: The Keratinocyte. Michael Darmon and Miroslav Blumenberg (Editors). San Diego, CA: Academic, 1993, 291 pp., illus., index, \$85.00. ISBN: 0-12-203455-4.

Muscles, Masses & Motion: The Physiology of Normality, Hypotomicity, Spasticity & Rigidity. E. Geoffrey Walsh. New York, NY: Cambridge University Press, 1993, 220 pp., illus., index, \$59.95. ISBN: 0-521-43229-4.

New Insights in Vertebrate Kidney Function. J. A. Brown, R. J. Balment, and J. C. Rankin (Editors). Society for Experimental Biology Seminar Series 52. New York, NY: Cambridge University Press, 1993, 389 pp., illus., index, \$120.00. ISBN: 0-521-38324-2.

Pathophysiology of the Gut and Airways: An Introduction. Paul Andrews and John Widdicombe (Editors). Studies in Physiology Series No. 1. Chapel Hill, NC: 1993, 150 pp., illus., index, \$27.50. ISBN: 1-85578-022-4.

Respiratory Control: Central and Peripheral Mechanisms. Dexter F. Speck, Michael S. Dekin, W. Robert Revelette, and Donald T. Frazier (Editors). Lexington, KY: The University Press of Kentucky, 1993, 238 pp., illus., index, \$80.00. ISBN: 0-8131-1788-7.

The Ergonomics of Manual Work. William S. Marras, Waldemar Karwowski, James L. Smith, and Leszek Pacholski (Editors). The Proceedings of the International Ergonomics Association World Conference, Warsaw, Poland, 1993. Bristol, PA: Taylor & Francis, 1993, 725 pp., illus., index, \$175.00. ISBN: 0-784-0060-5.

The Physiology of the Human Placenta. Kenneth R. Page. Bristol, PA: Taylor & Francis, Inc., 1993, 164 pp., illus., index, \$29.50. ISBN: 1-85728-066-0.

Vision: Coding and Efficiency. Colin Blakemore (Editor). New York, NY: Cambridge University Press, 1993, 448 pp., illus., index, \$34.95. ISBN: 0-521-36459-0.

Women Physiologists. Lynn Bindman, Alison Brading, and Tilli Tansey (Editors). Chapel Hill, NC: Portland Press, 1993, 166 pp., illus., index, \$15.00. ISBN: 1-85578-049-6.

X-Ray Microanalysis in Biology: Experimental Techniques and Applications. David C. Sigee, A. John Morgan, Adrian T. Sumner, and Alice Warley (Editors). New York, NY: Cambridge University Press, 1993, 337 pp., illus., index, \$89.95. ISBN: 0-521-41530-6.

Struggling Economy Hurts Salaries of Scientists and Engineers

The poor economic climate continues to plague experienced scientists and engineers whose salaries have remained stagnant during the past two years—in many cases not even keeping up with inflation. From chemists to engineers, from physicists to geologists, from those employed in industrial R&D to those employed in academe—no one saw much movement in increased economic benefits of their employment. Indeed, many felt fortunate to still have a job with the "downsizing," "rightsizing," and non-hiring taking place in all segments of the economy.

But there is a ray of hope, with employers expecting to hire a few more college graduates this recruiting year that in the previous two. Yet, little increase in starting salaries is foreseen. Employers are continuing their "mean and lean" philosophy, in terms of both number of new hires and in retention of current technological personnel. These are among the principal findings of the latest "Salaries of Scientists, Engineers and Technicians," by the Commission on Professional in Science and Technology.

A brief narrative analysis of economic conditions in the sciences and engineering reinforces the 282 tables of salary data from more than 60 salary surveys to provide a broad range of information on starting and advanced salaries by field, experience level, degree level, and type of employer; with differentials by sex, type of job, and geographic area. Other highlights of the Commission's report:

• While recruitment of college graduates has not improved significantly in 1993, it has at least remained steady and may even be somewhat better than in 1992. Engineering bachelors' graduates posted only slight gains, if any, in starting salary offers, even though still receiving the highest starting salary offers. Although down from 1992, petroleum engineering BS graduates had average offers of \$38,610. In contrast, women graduates in petroleum engineering received offers of \$42,900.

• Doctoral scientists and engineers working in industry reported the highest median salary, while those working in state and local governments reported the lowest. Teaching, the dominant work activity of doctoral scientists and engineers, continues to provide the lowest annual salary, while PhDs working in R&D management earn the most. The overall median salary for all doctoral scientists and engineers in 1991 was \$60,700.

• Women doctorates in science and engineering earned 20% less that did men. White PhDs earned more that minority PhDs, and women earned less that minorities.

• The more experienced R&D scientist or engineer reported higher salaries than their younger counterparts regardless of position, although salaries do begin to drop in the latter stages of their careers. Regardless of degree level, discipline, or experience level, R&D scientists and engineers earned the most working in industry.

• Median salaries for chemists were up 3.6% at the BS level, 3% at the master's level, and 4.7% at the PhD level from 1992 to 1993. Unemployment among chemists and chemical engineers was up in 1993 for the third year in succession.

• For the sixth year in a row, 1993 salaries of experienced engineers in the United States failed to keep up with inflation. Overall, the median salary of all engineers is \$53,800.

• Federal workers are just keeping up with inflation but may do considerably better if "locality pay" actually begins in July 1994. Government scientists and engineers have traditionally earned less than their counterparts in industry.

• Continuing a trend started in 1990–91, faculty salaries did not keep pace with inflation in 1992–92 and actually dropped by 0.4%. Engineering faculty continue to report the highest salaries at all types of institutions. The average salaries of women continue to be less that those of men, regardless of field, rank, or type of institution.

Salaries of Scientists, Engineers and Technicians—A Summary of Salary Surveys, 16th edition, by Eleanor L. Babco, 240 pp., August 1993 is available for \$75 prepaid (CPST Members \$50) from the Commission on Professionals in Science and Technology, 1500 Massachusetts Avenue NW, Suite 831, Washington, DC 20005.

Integrative Physiological Thought

A first meeting of physiologists with the conceptualization of higher aspects of organization in individual cells and multicellular organisms is being planned for April 28 and 29, 1994 (at the end of the Experimental Biology '94 meeting in Anaheim). It is organized by Joseph Engelberg (University of Kentucky College of Medicine, Lexington, KY), Penelope Hansen (Memorial University, St. John's New Foundland, Canada), and C. Leo Ortiz (University of California, Santa Cruz, CA). Scientists wishing to attend may contact any of the above. Engelberg is at the Office of Integrative Studies, University of Kentucky College of Medicine, Lexington, KY 40536-0084. Tel: 606-233-5563; fax: 606-257-1060.

Research Associates in Space Biology

The current space shuttle program has allowed the development of space biology science that offers exceptional opportunities for research. NASA is offering Research Associate Awards at the postdoctoral level for scientists to conduct space biology research in a university laboratory or nongovernmental research institute of your choice that can provide the necessary facilities and research environment. Projects should be in the gravitational and space biology discipline. The awards are \$20,000 for the first year and \$22,000 for the second year if the renewal proposal is approved. Funding will begin July 1 to October 1, 1994. US citizens and permanent resident aliens with PhD, MD, DVM, DMD, or equivalent degrees are eligible to apply. Proposals are due February 15, 1994. For information and application booklet contact Gerald Sonnenfeld, Department of Microbiology and Immunology, School of Medicine, University of Louisville, Louisville, KY 40292. Tel: 502-588-8317; fax: 502-588-7043; or Thora Halstead, Life and Biomedical Sciences Division, NASA Headquarters, Washington, DC 20546.

APS Sustaining Associate Members

The Society gratefully acknowledges the contributions received from Sustaining Associate Members in support of the Society's goals and objectives

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Scientific Meetings and Congresses

Advances in the Understanding and Treatment of Multiple Sclerosis, San Diego, CA, December 9–10, 1993. *Information*: IBC USA Conferences Inc., 225 Turnpike Road, Southborough, MA 01772. Tel: 508-481-6400; fax: 508-481-7911.

Coronary Artery Spasm, New York, NY, February 22–25, 1994. *Information*: Conference Department, New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Tel: 212-838-0230; fax: 212-838-5640.

Modeling and Control in Biomedical Systems, Galveston, Texas, March 27–30, 1994. *Information*: IFAC Biomedical Symposium, U. T. Medical Branch, Box 55176, Galveston, TX 77555-5176. Tel: 409-770-6628 or 409-770-6623.

40th Anniversary Meeting of the American Society for Artificial Internal Organs, San Francisco, April 14–16, 1994. *Information*: ASAIO National Office, PO Box C, Boca Raton, FL 33429-0468. Tel: 407-391-8589; fax: 407-368-9153.

The Post-Polio Syndrome: Advances in the Pathogenesis and Treatment, Bethesda, MD, April 27–30, 1994. *Information*: Conference Department, New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Tel: 212-838-0230; fax: 212-838-5640.

29th Annual Meeting and Exposition of the Association for the

Advancement of Medical Instrumentation, Washington, DC, May 21–25, 1994. *Information*: AAMI Education Department, 3330 Washington Blvd., Suite 400, Arlington, VA 22201-4598. Fax: 703-276-0793.

Interleukin-6-type Cytokines, Poznan, Poland, June 20-22, 1994. Information: Conference Department, New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Tel: 212-838-0230; fax: 212-838-5640.

Osteopontin, October 21–23, 1994. *Information*: Conference Department, New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Tel: 212-838-0230; fax: 212-838-5640.

Receptor Activation by Antigens, Cytokines, Hormones and Growth Factors, New York, November 7–9, 1994. *Information*: Conference Department, New York Academy of Sciences, 2 East 63rd Street, New York, NY 10021. Tel: 212-838-0230; fax: 212-838-5640.

2nd International Congress of Pathophysiology, Kyoto, Japan, November 19–24, 1994. *Information*: Toshiie Sakata c/o JTB Communications, Inc., New Kyoto Center Bldg. 5F, Shiokoji, Shinmachi, Shimogyo-ku, Kyoto 600, Japan. Tel: 81 (Japan) 75-341-1618; fax: 81 (Japan) 75-341-1917.

FASEB Excellence in Science Lecture and Award 1995

The FASEB Excellence in Science Lecture and Award recognizes outstanding achievement by women in biological science. All women who are members of one or more of the societies of FASEB are eligible for nomination. The nomination recognizes a women whose research has contributed significantly to further our understanding of a particular discipline by excellence in research. The award includes a \$10,000 unrestricted research grant, funded by Eli Lilly and Company, travel expenses, complimentary registration, and a plaque.

The nomination deadline is March 1, 1994. Nominations may be made only by members of the FASEB societies and must be made in the form of a letter, original and nine copies, setting forth in detail: 1) the contribution(s) to the field that represents the nominee's outstanding achievement in science; 2) leadership and mentorship; 3) evidence of national recognition; and 4) honors and awards.

Ten copies of the curriculum, as well as a brief bibliography, reprints, and letters of support should be included. Nominations and supporting letters are to be sent to Leah C. Valdez, FASEB Excellence in Science Award, 9650 Rockville Pike, Bethesda, MD 20814-3998. Tel: 301-530-7092.