THE PHYSIOLOGIST

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EDITORIAL

Filling the Talent Pool

Like the proverbial "needle in a haystack," it is becoming increasingly difficult for departments of physiology to identify and recruit qualified graduate students. The problem, however, is not restricted to physiology. As demonstrated at the American Medical Association's National Initiative for Science and Technology Education Conference, "Strategies for Change," the problem plagues all areas of natural science and engineering (NS&E).

Based on demographics, this country faces a significant shortage of doctoral scientists through much of the next decade. The advent of new technologies, the aging of our faculties, and the decreasing birthrate all contribute to the anticipated shortfall. Unless something is done to change this pattern, pressures on the talent pool will create difficulties for industry and academia.

The talent pool represents those students entering our educational pipeline. As students move through high school and college to graduate school, leakage reduces the size of the pool. Presently, this selection process produces one doctorate in NS&E fields from every 412 high school sophomores. In 1977, there were ~4 million high school sophomores, ~730,000 of whom showed an interest in NS&E fields. From this group, only 61,000 went on to graduate school, with 46,000 obtaining Master's degrees. In all probability, 9,700 of these students will receive Ph.D. degrees in NS&E by 1992.

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Use of Animals for Teaching and Research at the University of the Witwatersrand, South Africa

G. Mitchell

Professor of Physiology and Chairman, Animal Ethics Committee
University of the Witwatersrand, Johannesburg, South Africa

Articles in *The Physiologist* and elsewhere have highlighted the dangers that "animal liberation lobbies" have for biomedical research. Biomedical scientists, in general, react apathetically to this threat for three reasons: first, they perceive these lobbyists as prejudiced and ineducable; second, scientists find it difficult to counter antivivisectionist propaganda (What, they ask, will make an impression? What might convince antivivisectionists to adopt a more constructively critical role?); third, scientists by nature are not publicists. Indeed, there is an unwritten law that prohibits scientists from advertising themselves inasmuch as the scientific community views such activities as frivolous.

Martin Frank, the executive director of the American Physiological Society, has argued that scientists must communicate more. However, good communication techniques are not skills possessed by all scientists. While I do agree that reaction is necessary, I also suggest that the skills all scientists use constantly are skills to harness, such as collecting relevant data, critical analysis, and frank and constructive debate.

The University of the Witwatersrand recognizes that the animal experimentation debate is a many faceted argument, having philosophical, moral, scientific, and legal components. The University also accepts that the public should know what research is being done in its name inasmuch as experiments are done for the benefit of the community and the animals with which it interacts. To achieve this accountability the University makes available to those who are interested the scientific substrate on which subsequent moral and legal arguments can be built.

The community the University serves has access to our animal-based research in three ways. First, the University has taken the position that applications to use animals, which are reviewed by the University's Animal Ethics Committee (AEC), are available for scrutiny by anyone. The second route of access is via the publications that arise from experiments.

These documents, however, do not give an overview of experimentation. Instead they represent tips of the icebergs. What the public most wishes to see is the rest of the iceberg.

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Deadline for submission of material for publication: Dec. 5, February issue; Feb. 5, April issue; April 5, June issue; June 5, August issue; Aug. 5, October issue; Oct. 5, December issue. **If you change your address or telephone number, please notify the central office as soon as possible.**

Headquarters phone: (301) 530-7164. TELEFAX: (301) 571-1844.

EDITORIAL *(Continued from p. 37)*

Based on data provided by NSF, there will be 18,000 available positions for NS&E doctorates in 2004. Only 8,600 American citizens earned NS&E Ph.D.'s in 1987—about half the indicated demand in 2004.

Where can we find the bodies to meet the anticipated demand for NS&E graduates? In part, the demand is currently being met through the training of foreign students. In 1987, almost 6,000 foreign students received their doctorates. Unfortunately, foreign students do not provide the answer to our problem since many are precluded from working in US laboratories and industry and many others have to return to their home country.

According to conference participants, the answer to the problem must come from within the United States. Increasingly, American students are unwilling to endure the rigors of a science education. They enroll in astronomy classes to enable them to construct their own horoscope. As a result, American students trail students from every industrialized country in science and math literacy by 12th grade, ranking 13th out of 13 countries in biology.

The source of students for the NS&E fields has to be the increasing numbers of minority children in our schools. In 1988, our school population (5- to 17-yr-olds) was 30% minority. By 2020, our school population is predicted to be 50% white, 20% Black, 25% Hispanic, and 4% other, mostly Asian. These projections were provided to conference attendees to demonstrate how essential it is that we increase educational opportunities and encouragement for our minority youngsters. If we lose most of this talent, there won't be enough talent to fill our needs. There is far more than a moral issue of fairness at stake. Our survival as a world leader is involved.

Even small initiatives on the part of individuals, institutions, and industry can make a difference in increasing the participation of all students in science. From "hands-on" after-school classes to science fairs and laboratory visits, each of us can do our share.

In its own small way, the Society has been actively trying to increase the size of the talent pool. Through the distribution of career brochures and support of minority students, interest in science has been stimulated in a small segment of the talent pool. However, that is not enough and the Council has taken action to further prime the pump. In New Orleans, Council allocated funds to support a High School Science Teacher Summer Research Program. By exposing the teacher to research, the Council hopes to stimulate the teacher's and his/her students' interest in science. With luck, the host laboratory will serve as a resource for the teacher's students during the academic year. Additional details about the program will be issued shortly.

As was apparent from the AMA conference, America is in crisis. The lack of an adequate talent pool will greatly impede our ability to remain at the forefront of science and technology. To succeed in these areas, we must become involved with students in our communities. We must help to turn them on to science just as we were.

Martin Frank

Moving?

If you change your address or telephone number, please notify the APS office (301-530-7171) as soon as possible.

ANIMAL USE *(Continued from p. 37)*

It is this hidden, gray zone of supposedly secret information that generates the half truths and insinuations of animal activists. Thus, the third route is to make available the information gathered and collated by the AEC. The information found to be most useful is the classification of experiments, the total number of animals used, and the category of experiment in which animals are used.

Classification of Experiments

The University uses a classification similar to that of the Canadian Council on Animal Care wherein the use of animals is classified according to the response expected from each experiment. Three types of response giving rise to six categories of experiment are recognized. The three types are

- discomfort: a response to a stimulus that produces evasive reactions but not pain;
- stress: a measurable biological or physiological response to a stimulus; and
- distress: a pathophysiological response to a stimulus.

The six categories of experiment are

Category 1: Experiments that involve *no discomfort, stress, or distress,* e.g., dissection of dead animals;

Category 2: Experiments on living animals that produce little or no *discomfort,* e.g., venepuncture;

Category 3: Experiments that produce *stress* but that do *NOT* require anesthesia, e.g., exercise;

Category 4: Experiments that produce *stress* and require short (<30 min) anesthesia, e.g., catheterization of blood vessels;

Category 5: Experiments that produce *stress* and require long (>30 min) anesthesia, e.g., surgical procedures; and

Category 6: Experiments that produce *distress,* e.g., LD_{50} tests.

The value of this categorization is threefold: it provides a rationale for deciding the stress of an experiment; it provides an insight into what constitutes an experiment; and it allows the matching of technical skills of researchers with the difficulty of the technique to be used. The University believes that such matching is the most reasonable way of ensuring a successful experiment.

TABLE 1. **Species of Animals Used and Number of Applications**

Species	1985	1986	1987	1988
Rats	5,368	5,698	4,155	4,595
Mice	3,018	2,031	898	762
Frogs	1,967	1,461	1,100	1,127
Rabbits	393	280	369	247
Baboons	363	407	179	269
Dogs	45	58	46	5
Cats	62	15	20	13
Hamsters	140	59	59	10
Guinea pigs	212	268	82	272
Chickens	147	507	713	300
Pigs		37	34	5
Total	11,806	10,849	7,649	7,605
Number of applications	134	140	192	212
Animals per application	88	77	40	36

TABLE 2. **Analysis of Experiments by Category**

	Category of Experiment						
Year	1	2	3	4	5	6	Total
1987	3,171	757	1,188	1,428	1,099	6	7,649
1988	3,785	916	636	1,078	1,012	178	7,605
Mean	3,478	837	912	1,253	1,056	92	7,628

Total Number of Animals Used

One of the main objectives of an AEC should be to optimize use of animals. This implies that reduction, refinement, and replacement of animals are achieved without a reduction in research. Table 1 illustrates these principles by listing the main species of animal the University has used for the years 1985–1988. The table also shows the number of applications to use animals and the ratio of animals per application.

The analysis shows that between 1985 and 1988 the number of animals used decreased 36% and the number of animals used per application decreased 59%. Despite these reductions the number of publications in international journals produced by the 25 departments in the University that use animals continued to be between 400 and 450 per year. Thus the University can show that refinement, replacement, and reduction are taking place while research output is maintained.

Animal Use in Each Category of Experiment

The third statistic necessary to provide the overview that reveals an institution's research activities is the use of animals in each category of experiment. Table 2 gives an example of this type of analysis for the years 1987 and 1988.

The value of this analysis is that it shows the proportion of all animals used in experiments likely to produce severe stress or distress (categories 5 and 6) and the proportion used in experiments likely to cause little or insignificant or no stress (categories 1–4). Thus the common perception that the bulk of experimental animals are exposed to painful surgical procedures is refuted.

By providing objective data the University shows that it is not reluctant to report the use of animals in teaching and research. The University also believes these analyses create a base of knowledge necessary for developing informed opinions. It is data like these that every research institution can and should generate so that facts rather than opinions form the basis for public debates.

Arizona Animal Lab Thefts and Fires Spark Legislation Against Break-Ins

Within days after the Animal Liberation Front (ALF) had set fire to two buildings and broke into and vandalized three facilities and stole 1,231 animals at the University of Arizona, a bill was introduced in the US Senate that would make such incursions a federal offense.

Sen. Howell Heflin (D-AL) introduced the Animal Research Facilities Protection Act of 1989 (S. 727), which calls for penalties of up to one year in prison and a maximum fine of $5,000 for anyone convicted of vandalism, stealing animals, or any other violation against an animal research facility.

Heflin said his bill is necessary because animal liberators transport the animals they have taken across state lines, thus taking away the jurisdiction of local police.

(The American Physiological Society has a long-standing interest in this type of legislation. In 1982, Walter Randall, who then was the APS president, recommended such legislation when he testified before a Senate committee considering laboratory animal reforms. A draft by APS of a model bill was used in 1985 by Rep. George E. Brown, Jr. (D-CA), who introduced similar legislation that died in committee, and by Heflin. APS had been working with Heflin's staff for approximately 18 months in support of the legislation.)

The ALF set fire to two University of Arizona buildings in a predawn raid before breaking into and defacing other campus buildings and stealing a variety of animals involved in research. From two buildings the raiders stole 1,081 animals, including 1,010 mice, 42 rats, 16 rabbits, 9 guinea pigs, and 4 frogs. From a third building 150 mice were reported missing, including 30 mice infected with cryptosporidiosis, which could be passed on to humans handling the animals.

Damage to the buildings has been estimated to be approximately $100,000.

Proposed Animal Regulations Cost Starts At $1.5 Billion

The US Department of Agriculture's proposed regulations for the implementation of the 1985 amendments to the Animal Welfare Act have an estimated start-up cost of $1.5 billion for the nation's research community.

The proposed regulations were developed by the Department's Animal and Plant Health Inspection Service (APHIS), which is charged with the enforcement of the Animal Welfare Act. The 132-page APHIS proposal is broken down into three parts: Part I, definitions; Part II, responsibilities of research institutions and animal care committees, requirements for reporting and record keeping, and general administrative duties; and Part III, rewritten standards for dogs, cats, and nonhuman primates and amended standards for guinea pigs, hamsters, and rabbits.

For research institutions to meet the requirements of the proposed regulations an initial cost of $1.083 billion has been estimated for private-sector facilities and about $500 million for federal facilities. Moreover, to maintain compliance with the proposed regulation, there is an additional estimated annual cost of $207 million for private-sector facilities.

The Lobster Trap: Coast Guard Assumed PETA Was A Governmental Agency

The US Coast Guard claims its efforts in assisting PETA (People for the Ethical Treatment of Animals) to return seven lobsters to the Atlantic Ocean came about because a boatswain's mate made an incorrect assumption.

In December PETA purchased seven lobsters from a Rockville, MD, restaurant and flew them to Portland, ME, where the lobsters and a PETA member were met by the Coast Guard who took them 15 miles out to sea where the lobsters were released.

The American Physiological Society, under the Freedom of Information Act, requested information from the Coast Guard as to who authorized the Coast Guard's involvement in an animal rights protest (the serving of lobsters by a restaurant), what was the cost to the Coast Guard, and who paid that cost, PETA or the taxpayers?

According to Capt. Peter L. Collom, chief of the operations for the First Coast Guard District, the Coast Guard assists all government agencies, and in Maine it often responds to requests from the Maine Marine Patrol to return to the ocean oversized lobsters that have been confiscated.

"In the incident in question, he [Chief Petty Officer James Caulkett] received a telephone call from a person in Washington, DC, requesting that the Coast Guard assist her in returning some lobsters to the sea. Being accustomed to performing the same service for state agencies, he assumed, incorrectly, that the person calling him from the nation's capital represented a federal agency and responded that he would be happy to assist her.

"Although she never misrepresented herself as a government official, Chief Petty Officer Caulkett assumed that she

was and never questioned her motives. It is not the Coast Guard's policy to support one special-interest group over another, and Chief Petty Officer Caulkett's action in assisting Ms. [Cam] MacQueen were incorrect. He subsequently realized that he had been mistaken about who he was assisting, and reported this to his group commander."

Capt. Collom said that the only cost to the taxpayers was the expense in using a Coast Guard vehicle for transporting MacQueen and the lobsters to and from the boat station and the airport, a distance of approximately five miles.

Scientific Integrity Offices Established

The US Department of Health and Human Services (DHHS) has announced the establishment of offices of scientific integrity and scientific integrity review.

The Office of Scientific Integrity is to be located within the office of the director of the National Institutes of Health (NIH). The office will serve as the Public Health Service's contact point for coordinating issues of scientific misconduct in the intramural and extramural research programs, oversee scientific misconduct investigations, investigate allegations of misconduct when necessary, and make recommendations to DHHS concerning allegations of misconduct. The Institutional Liaison Office in the NIH Office of Extramural Research had been responsible for much of this activity in the past.

The Office of Scientific Integrity Review will be located in the Office of the Assistant Secretary for Health in DHHS and will have oversight responsibilities for the Public Health Service research agencies in assuring that they carry out the policies and procedures concerning allegations of scientific misconduct.

Consumer Product Testing Reintroduced

Rep. Barbara Boxer (D-CA) has reintroduced the Consumer Products Safe Testing Act (HR. 1676) to provide for "the modernization of testing consumer products which contain hazardous or toxic substances" without using animals. The bill had been introduced in the two previous Congresses, but each time it died in a House committee.

The current bill differs from her previous legislative proposals in that this bill eliminates the use of the Draize test and seeks to halt all acute toxicity testing involving animals.

Washington Ins and Outs

In: D. Allan Bromley, 62, as science adviser to the President, replacing George A. Keyworth II. Bromley, a world leader in nuclear science and director of the A. W. Wright Nuclear Structure Laboratory at Yale University, is expected to have a major impact on decisions concerning the space station, the superconducting supercollider, global warming, AIDS, Strategic Defense Initiative, and how to pursue a project to map the entire complement of human genes.

Out: James B. Wyngaarden, 64, as director of the National Institutes of Health. Wyngaarden came to NIH in 1982 from Duke University medical school where he was chairman of the department of medicine. Although a national search was started, an early favorite to replace Wyngaarden was Anthony S. Fauci, director of the Institute of Allergy and Infectious Disease, who President Bush described during the election campaign as one of his heroes.

AMA Takes Leadership Role Against Animal Activists

The American Medical Association (AMA) has moved to the forefront in the fight against animal activists who seek to abolish the use of laboratory animals.

The AMA's decision to take a leadership role in the animal issues was announced at an international meeting of 53 invited organizations who are concerned about the animal rights movement. The meeting, sponsored by the AMA, was held in Washington.

For a decade the animal activists have set the agenda, said AMA Executive Vice President James Sammons, and now "the AMA intends to change the agenda." He added that the AMA is prepared to take over the lead role in an effort to counter this antiscience conspiracy and is prepared to take the heat that may come.

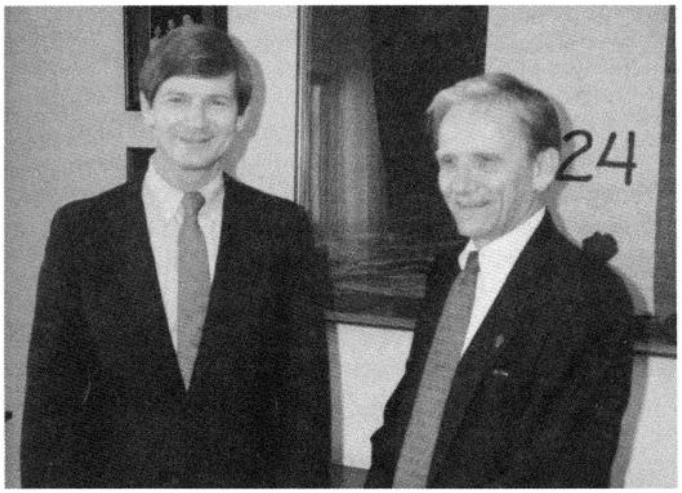
"The AMA does not intend to try to convince the animal rights advocates that they are wrong," Sammons said, "because you can't convince them of that. What the AMA is going to try to do is to convince the American public that the animal rights advocates are wrong."

Sammons also said that the AMA does not intend to intrude on any ongoing activities by organizations who are involved in this battle.

Attending the meeting were representatives from academia; professional, educational, and scientific societies; governmental agencies; voluntary health organizations; law enforcement agencies; and the pharmaceutical industry. The scientific societies were represented by APS, American Association for the Advancement of Science, and the Society for Neuroscience. Also in attendance was the German Physiological Society.

A Day on Capitol Hill

APS President Vernon S. Bishop spent a day on Capitol Hill discussing concerns of physiologists regarding funding for research, programs to attract individuals into biomedical research, and issues involving the use of laboratory animals. Shown here with Bishop are Rep. Albert G. Bustamante (D), who is receiving an APS medallion, and Rep. Lamar S. Smith (R). Both Congressmen are from San Antonio.



Physicians Urged to Inform Patients About Benefits of Animal Research

The American Medical Association has adopted a resolution encouraging physicians to make available to patients in the waiting room informational materials describing the benefits of animal research.

The resolution reaffirms the association's commitment to public awareness and education in regard to the medical benefits of animal research, the kinds of animals used and the efforts employed to avoid animal suffering, and the concern with the animal rights movement on the conduct of biomedical research.

William M. Samuels

Proposed Amendment to the Bylaws for Program Committee

Recognizing the importance of the Program Committee in developing innovative programs for the various types of specialty meetings, the following amendment to the Bylaws to increase the number of Program Committee members from four to six, approved by Council, will be offered for vote at the Society Business Meeting, Wednesday, October 17, 1989.

ARTICLE V. *Standing Committees.*

Section 5. *Program Committee.* A Program Committee composed of ~~four~~ six regular members of the Society appointed by Council shall be responsible for scientific program. . . .

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 out 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 the 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.

Each application should be made by both visiting scientist and host. 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 June 1 and December 1. Applications may be obtained from the Executive Director, American Physiological Society, 9650 Rockville Pike, Bethesda, MD 20814, USA.

APS Welcomes First Soviet Exchange Visitor

The Society welcomed Professor Alexei Ivanitsky, Secretary of Pavlov's All-Union Physiological Society on April 14th as the first exchange visitor under the US-USSR bilateral exchange program. Ivanitsky is a neurophysiologist at the Institute of Higher Nervous Activity and Neurophysiology and at the Serbsky Institute for General and Forensic Psychiatry in Moscow. He also visited the Uniformed Services University for the Health Sciences, Bethesda; the University of Illinois, Urbana-Champaign; the University of California, Davis; the University of California San Diego, LaJolla; and The Salk Institute, San Diego.

Under the agreement, Ivanitsky's travel was supported by the Society and local living expenses by the host institutions. APS members interested in participating in the US-USSR bilateral exchange program should contact APS Executive Director, 9650 Rockville Pike, Bethesda, MD 20814.

Alexei Ivanitsky and Martin Frank

Honorary Members

Since the first election of Honorary Members in 1904, the Society has recognized the outstanding contributions to physiology of the following distinguished scientists. **Christian Crone, Oleg G. Gazenko,** and **Johannes Piiper** were elected to Honorary membership at the Society's 1989 Business Meeting in New Orleans, Louisiana.

E. D. Adrian†, Cambridge, UK (1946)
J. Barcroft†, Cambridge, UK (1946)
E. Braun-Menendez†, Buenos Aires, Argentina (1959)
F. Bremer†, Brussels, Belgium (1950)
C. Crone, Copenhagen, Denmark (1989)
A. Dastre†, Paris, France (1904)
P. Dejours, Strasbourg, France (1981)
D. A. Denton, Melbourne, Australia (1987)
S. Ebashi, Oxazaki, Japan (1988)
J. C. Eccles, Contra, Switzerland (1952)
T. W. Engelmann†, Berlin, Germany (1904)
T. P. Feng, Shanghai, People's Rep. of China (1983)
B. Folkow, Goteborg, Sweden (1982)
O. G. Gazenko, Moscow, USSR (1989)
R. Granit, Stockholm, Sweden (1963)
R. A. Gregory, Liverpool, UK (1981)
E. Gutmann†, Prague, Czechoslovakia (1971)
B. Halász, Budapest, Hungary (1987)
O. Hammarsten†, Uppsala, Sweden (1907)
W. R. Hess†, Zurich, Switzerland (1950)
A. V. Hill†, London, UK (1946)
A. L. Hodgkin, Cambridge, UK (1952)
F. Hofmeister†, Strassburg, Germany (1904)
B. A. Houssay†, Buenos Aires, Argentina (1941)
A. Hurtado†, Lima, Peru (1959)
A. F. Huxley, London, UK (1981)
H. E. Huxley, Cambridge, UK (1981)
M. Ito, Tokyo, Japan (1986)
G. Kato†, Tokyo, Japan (1965)
B. Katz, London, UK (1985)
A. Krogh†, Copenhagen, Denmark (1946)
Y. Kuno†, Tokyo, Japan (1959)
J. N. Langley†, Cambridge, UK (1904)
L. Lapicque†, Paris, France (1946)
G. Liljestrand†, Stockholm, Sweden (1950)
C. Monge†, Lima, Peru (1952)
G. Moruzzi, Pisa, Italy (1959)
E. Neher, Goettingen, FRG (1988)
L. A. Orbeli†, Leningrad, USSR (1946)
I. P. Pavlov†, Russia (1904)
E. Pflüger†, Bonn, Germany (1907)
J. Piiper, Goettingen, FRG (1989)
W. T. Porter†, Dover, MA (1948)
F. J. W. Roughton†, Cambridge, UK (1957)
E. Sharpey-Schafer†, UK (1912)
C. S. Sherrington†, Oxford, UK (1904)
E. T. A. Teorell, Uppsala, Sweden (1985)
K J. Ullrich, Frankfurt/Main, FRG (1985)
H. H. Ussing, Copenhagen, Denmark (1950)
K. von Frisch†, Munich, FRG (1952)
J. R. Vane, London, UK (1986)
C. von Voit†, Munich, FRG (1970)
H. H. Weber†, Heidelberg, Germany (1959)
E. R. Weibel, Berne, Switzerland (1988)
S. Weidmann, Berne, Switzerland (1987)

†Deceased

Members are invited to submit nominations for Honorary membership. Send nominations and documentation of the candidate's contributions to physiology to the APS Honorary Membership Committee, 9650 Rockville Pike, Bethesda, MD 20814, by December 1, 1989.

Preview
APS/ATS Fall Meeting
Rochester, MN
October 15–19, 1989

The Role of Imaging Techniques in Physiological Investigation

Plenary Session: Imaging for Physiology

Chair: R. A. Robb. *Speakers:* R. A. Robb, T. F. Budinger, J. W. Keyes, G. M. Pohoust, K. I. Gibson, and E. L. Ritman.

This plenary session features internationally renowned experts in the field of biomedical imaging who will present overviews of different multidimensional imaging modalities and their application to investigative studies of a variety of biological systems.

MR Spectroscopy in Humans

Chairs: M. Barany and R. Millard. *Speakers:* R. Millard, P. Turski, J. S. Leigh, Jr., T. Richards, K. Ugurbil, and M. Barany.

The use of magnetic resonance spectroscopy (MRS) for noninvasive in vivo analysis of tissue metabolites will be illustrated with special emphasis on human tissues. Localized H-1 MRS detects differences in the metabolite pattern of various parts of the brain, and it is also a powerful method for differentiation of human brain tumors or for understanding the nature of multiple sclerosis in humans. P-31 MRS is classical for studying the energy metabolism in muscle and has been applied recently to investigate regulation of oxidative phosphorylation in the normal and postischemic myocardium. F-19 MRS is a selective noninvasive probe for Po_2 in vivo via relaxation time measurement. The sodium distribution within normal and pathologic tissue can be directly visualized in vivo by sodium magnetic resonance imaging.

Measurement of Myocardial Metabolism and Blood Flow With Positron Emission Tomography

Chair: S. R. Bergmann. *Speakers:* S. L. Bacharach, J. B. Bassingthwaighte, A. J. Liedtke, M. Schwaiger, and S. R. Bergmann.

There have been major advances in instrumentation and radiotracer techniques that now permit quantitative estimation of myocardial blood flow and metabolism using positron emission tomography. This symposium will focus on instrumentation needs, mathematical modeling, and techniques available to measure metabolism and perfusion of the heart. The goal is to provide an overview of the field and in particular describe the advantages and limitations of PET measurements and positron emission tomography as an expanding technology; this state-of-the-art review by leaders in the field will be of seminal value to attendees.

Organ Structure and Function by X-Ray CT

Chair: E. L. Ritman. *Speakers:* E. L. Ritman, E. A. Hoffman, J. W. Shepard, M. L. Marcus, J. C. Romero, and M. W. Vannier.

These presentations provide examples of X-ray CT used to evaluate cardiac, renal, vascular, and skeletal structure-to-function relationships. The common theme of all presentations is the use of multislice scanning CT imaging to generate three-dimensional information about organ dimensions and, where appropriate, their time rates of change. This approach has been shown to provide accurate and detailed analysis of organs' three-dimensional geometric shape without the need for significant invasion.

If the scan is performed during injection of roentgen contrast medium into the blood stream, much can also be deduced about an organ's perfusion of the mass transport of that dynamic organ.

New Techniques in Microscopy

Chairs: D. E. Clapham and S. R. Taylor. *Speakers:* D. E. Clapham, S. R. Taylor, H. Schuman, A. Boyde, B. Amos, J. Sedat, and W. Webb.

This symposium will present new information on the rapidly changing area of microscopy. In particular the session will highlight the confocal microscope, which will be contrasted to other methods of enhancing image resolution for thick specimens.

Fundamentals of Imaging Biological Structures and Functions

Chair: R. A. Robb. *Speakers:* M. W. Vannier, M. Phelps, J. F. Greenleaf, S. J. Riederer, and R. A. Robb.

This symposium features reviews by experts in the field of biomedical imaging that will describe and illustrate the fundamental capabilities of several imaging methods used for direct display, measurement, and analysis of organ system structure and function. The combined presentations will provide an informative comparison of the intrinsic capabilities, advantages and limitations, and biomedical significance among the different imaging modalities, including XCT, PET, MRI, and US. In each modality, an unambiguous view of the "third dimension" can be obtained, with capabilities for nondestructive detailed investigations of any region of interest. The increases in biomedical investigative power provided by these current imaging techniques to obtain dynamic quantitative measurements of structural/functional relationships within organs and organ systems by minimally invasive methods will provide the basis for continued important advances in physiology, biophysics, and molecular biology.

Imaging Physiological Processes in Cells

Chair: S. R. Taylor. *Speakers:* S. R. Taylor, R. Y. Tsien, D. L. Taylor, K. P. Roos, F. S. Fay, and J. A. Connor.

The recent development of new probes for several ions and the organelles and skeleton of living cells has been paralleled by the improvement in the hardware and software used in digital imaging microscopy. Each speaker will discuss major new findings in many areas of cell physiology that have resulted from these developments.

Mechanisms of Smooth Muscle Function

Plenary Session: Physiology of Smooth Muscle

Chair: J. H. Szurszewski. *Speakers:* J. H. Szurszewski, G. Gabella, G. Burnstock, T. B. Bolton, and A. P. Somlyo.

This plenary session will review the latest concepts in smooth muscle physiology, including *1*) structure of smooth muscle tissues at the light and EM levels and structural components of individual cells at the EM level; *2*) mechanisms of synaptic transmission and identity of putative neurotransmitters and neuromodulators; *3*) the ionic basis of smooth muscle excitability with emphasis on single-cell voltage-clamp data and nature of single ion channels using off-cell patch-clamp methods; and *4*) molecular mechanisms responsible for force generation and for maintenance of tone that is characteristic of smooth muscle tissues.

Transmitter and Receptor-Operated Channels in Smooth Muscle

Chair: D. E. Clapham. *Speakers:* D. E. Clapham, T. Bolton, C. Benham, T. Hallam, J. Singer, and D. Friel.

Contraction and relaxation of smooth muscle is often initiated by receptors on the cell surface. How these receptors control smooth muscle responses is an active area of investigation. Recently, evidence has accumulated for receptors that open nonselective cation channels, resulting in a rise in intracellular calcium. These receptor-operated channels may allow the rapid initiation of smooth muscle contraction. Other receptors modulate the smooth muscle action potential and control bursting and repetitive firings. Some of these currents, such as the M current in gastric smooth muscle, are moderated indirectly via second messengers. This symposium will examine the evidence for receptor-operated channels in smooth muscle and associated endothelia and provide an update in receptor control of ion currents in smooth muscle.

Pulmonary Circulation

Chairs: A. P. Fishman and A. E. Taylor. *Speakers:* A. P. Fishman, J. H. Linehan, C. A. Dawson, S. A. Barman, S. Permutt, T. S. Hakim, J. T. Sylvester, and A. L. Hyman.

Over the past several years, methods have been developed to study the pulmonary vascular smooth muscle in isolated and in vivo lungs. This method utilizes analysis of vascular pressure transients following clamping of either arterial inflow, venous outflow, or both. Using this approach, the pulmonary circulation is described in terms of a large and small artery resistance and a large and small vein resistance. The major capacitance is located in the microvessels (or capillaries) while two smaller capacitances are located in the arterial and venous segments of the circulation. In this symposia, C. A. Dawson and J. H. Linehan will describe the physics and physiology of these segmental resistance and capacitance measurements. S. A. Barman will present his recent data on histamine's effect on the segmental resistances and compliance in normal and toned blood vessels, and S. Permutt will present his data on how mechanical factors affect the vascular resistance and capacitance profiles in the lungs' alveolar and extra alveolar blood vessels. The next two presentations deal with determining of the anatomical sites of these segmental vascular resistances. J. T. Sylvester will discuss his latest research related to using graded sizes of microspheres to determine the vascular location of the segmental resistances, and T. S. Hakim will present his data on actual measurements of pressure drops within the pulmonary circulation using micropuncture techniques to determine the sites of the segmental resistance, i.e., an anatomical comparison of pressure drops to the organ measured segmental pressure drops. Finally, A. L. Hyman will present his most recent data on the involvement of endothelial relaxing factor in controlling the tone of pulmonary vascular smooth muscle. This is a state-of-the-art symposium on pulmonary vascular smooth muscle as measured in isolated and in vivo lungs. This new technique for analyzing vascular resistances and capacitances in lungs will be vigorously discussed and analyzed relative to smooth muscle physiology.

Dynamics of Mucus Secretion

Chair: T. M. Dwyer. *Speakers:* T. M. Dwyer, C. G. Plopper, P. Verdugo, A. E. Spruce, A. Almers, J. H. Widdicombe, J. M. Farley, S. Shimura, and T. Takishima.

Mucus secretion is now being studied by new methods in cell physiology, as well as histology, physical chemistry, and electrophysiology. The structure of mucus cells is now better understood because of new preparation techniques and immunospecific stains. Physical chemical studies have shown mucus to be stored in a highly ordered, condensed form; release results in, and may be caused in part by, a rapid expansion of this stored material. The exocytotic event itself is now amenable to electrophysiologic study, allowing millisecond time resolution and precise control of the composition of the intracellular solution. Intracellular control of epithelial function is understood in terms of the identity of the messengers and their action. Studies of isolated cell function have demonstrated that mucus gland cells are capable of fluid secretion as well as the better known glycoprotein secretion. A previously unexpected aspect of submucosal gland function is its contractile ability.

Signal Transduction in Smooth Muscle

Chair: D. J. Hartshorne. *Speakers:* A. M. Brown, E. M. Ross, R. Rapoport, T. M. Lincoln, and J. A. Beavo.

The five speakers in this symposium will address the general topic of the transduction of extracellular signals to alterations in the chemistry of second messengers. The first two speakers will emphasize the critical role played by G-protein–gated ion channels and other G-protein–linked surface receptors. The other speakers will

Mayo Research Lab Tours and Demonstrations

At least 20 research laboratories in the Departments of Physiology, Biophysics, Pharmacology, Biochemistry, Molecular Biology, Medicine, and Radiology of the Mayo Medical School will be open for tours and demonstrations during the 1989 APS/ATS Meeting. How-to sessions and work stations for computer-based image analysis of physiological function at the organ, cell, and subcellular levels will be conducted in several laboratories. Industrial exhibits of the latest instruments available in biomedical imaging studies will also be on display.

address some of the intracellular consequences initiated at the cell membrane, touching briefly on some of the second-messenger systems involved. Among the items to be discussed are the activation of protein kinase C via phospholipid metabolism, control of intracellular Ca^{2+} via cGMP-linked processes, and cAMP metabolism as influenced by multiple forms of phosphodiesterase. In addition, we will attempt to define some of the established roles in cellular function (with an emphasis on smooth muscle) for the second messengers Ca^{2+}, cAMP, cGMP, and IP_3. This is a very rapidly moving area of research and we will attempt to incorporate any exciting new discoveries.

Regulation of Airway Smooth Muscle Responses. Sessions I and II

Chair: A. R. Leff. *CoChairs:* P. T. Macklem and R. H. Ingram, Jr. *Speakers:* A. R. Leff, L. Lichtenstein, L. Diamond, R. Mitchell, R. Coburn, P. Barnes, M. Grunstein, J. Douglas, P. Henson, H. Boushey, R. H. Ingram, Jr., and P. T. Macklem.

Resistance to airflow and airway caliber are regulated acutely and chronically by a variety of physiological and pathological influences. These include antagonistic innervation from the parasympathetic and nonadrenergic inhibitory system and bronchodilatory influences from sympathetic secretion. Ultimately, bronchomotor tone is controlled at the cellular level by membrane transduction and electrophysiological phenomena and regulated further intracellularly by mechanisms influencing the contractile apparatus of the smooth muscle cell. This symposium will examine first the systemic regulatory influences on bronchomotor tone, including the physiological distribution of bronchoconstrictor responses and immunological influences on bronchomotor tone. Further presentations will focus on electrophysiological influences, receptor pharmacology, membrane transduction phenomena, and contractile properties of airway smooth muscle. The application of basic investigations to human asthma and the understanding of integrative homeostatic influences on bronchomotor tone are a final objective of the symposium.

Pulmonary Microcirculation: New Developments

Chair: M. A. Matthay. *Speakers:* G. W. Schmid-Schoenbein, U. Raj, J. Bhattacharya, J. C. Hogg, M. A. Matthay, and P. Henson.

This symposium will provide new data on the physiological factors that regulate vascular tone, liquid and protein transvascular flux, and cell sequestration in the lung.

Cellular Mechanisms Involved in the Production of Myogenic Vascular Tone

Chairs: G. A. Meininger and J. H. Lombard. *Speakers:* G. A. Meininger, J. E. Faber, M. J. Davis, I. Laher, J. H. Lombard, G. Osol, and D. R. Harder.

Myogenic contraction of blood vessels in response to transmural pressure elevation has been actively investigated for over three-quarters of a century and is considered to contribute to regulation of blood flow and basal vascular tone. Yet the cellular signaling pathways responsible for initiating and maintaining the myogenic response remain to be delineated. This symposium will examine new evidence regarding the myogenic response that indicates that it probably involves several mechanisms. Evidence will be presented demonstrating the importance of an interaction between pressure-dependent myogenic activation and receptor-mediated vasoconstrictor activation in controlling vascular tone. Another presentation will examine the possibly separate roles of rate-sensitive and tonic components of the myogenic response in single arterioles and arteriolar networks. Other recent evidence will be examined regarding the role of endothelial cells in stretch activation of blood vessels. The possibility that multiple calcium channels participate in myogenic activation, including some that are activated by stretch but are resistant to calcium channel blockers, will also be discussed. Finally, recent electrophysiological evidence that vascular smooth muscle in isolated small arteries depolarizes in response to transmural pressure elevation will be examined.

Hormonal Regulation of Vascular Smooth Muscle Function

Chair: T. Inagami. *Speakers:* T. Inagami, J. C. McGiff, W. Alexander, J.-F. Liard, and J. D. Corbin.

The contraction and proliferation of vascular smooth muscle cells are induced and controlled by various hormones and humoral factors. Abnormality in the modes of the contraction and proliferation of arterial wall is considered to be the primary cause of vascular diseases such as hypertension and degenerative vascular diseases. The abnormality can occur both in the regulatory hormones and in the cellular responsiveness.

Recent studies on hormones in general and vasoactive substances in particular necessitate enlarging the classical definition of the hormone to substances that exhibit paracrine and autocrine functions. Local synthesis of hormonal peptides such as angiotensin II has been demonstrated in vascular tissues.

This symposium is designed to integrate new and classical views on hormones and humoral factors regulating the vascular smooth muscle cell functions.

Among the classical peptide hormones, vasopressin and angiotensin II have received the continuous attention of vascular and endocrine physiologists. Angiotensin II produced in the vascular bed has been shown to have a significant effect on arterial tone. This peptide was also shown to activate a Na-H antiporter. New roles of arachidonate metabolites are being discovered. Intracellular mechanisms of signal transduction by these substances involve various elements, such as calcium channels, intracellular calcium release from sarcoplasmic reticulum, cAMP, cGMP, Na-H antiport, and other new mechanisms. Mechanisms involving calcium metabolism will be discussed in conjunction with angiotensin II, endothelin, and ANF. Mechanisms involving cyclic nucleotides will be discussed in conjunction with ANF arachidonic metabolites and summarized in the comparison of the role of cAMP and cGMP. Na-H antiporter mechanisms will be discussed in conjunction with angiotensin. Thus this symposium will cover and integrate the major developments in recent years of our understanding of hormonal regulation of vascular muscle control by participants with diverse backgrounds encompassing physiological, pathological, pharmacological, and biochemical approaches.

Contractile System Function and Regulation in Smooth Muscle

Chair: R. A. Murphy. *Speakers:* R. A. Murphy, J. R. Sellers, D. J. Hartshorne, K. E. Kamm, and D. R. Hathaway.

Smooth muscle has a low efficiency in work performance but a very high economy during force maintenance in comparison with striated muscle. These characteristics are appropriate for muscle cells in the walls of hollow organs that must contract tonically to bear imposed loads such as blood pressure. This symposium is organized to present the current understanding of the contractile apparatus and its regulation by Ca ions in smooth muscle. A chairman's overview will describe the functional characteristics of smooth muscle and how they differ in some respects from striated muscle. The applicability of the sliding filament/crossbridge paradigm to smooth muscle will be considered. J. R. Sellers will focus on biochemical and biophysical estimates of the kinetics of the crossbridge cycle. The characteristics of the myosin light chain kinase/myosin light chain phosphatase system and the role of phosphorylation in regulating actin-myosin interactions will be described by D. J.

Hartshorne. K. E. Kamm will consider the role of Ca^{2+}-induced crossbridge phosphorylation in regulation of cellular contraction. The evidence for an additional regulatory system in the thin filaments and the role of caldesmon will be reviewed by D. R. Hathaway.

Single Ionic Channels

Chair: J. L. Rae. *Speakers:* J. L. Rae, T. Bolton, C. Miller, R. Horn, and P. Hess.

Modern electrophysiological analysis of almost any cell type requires study of the single ionic channels in the preparation. Patch-clamp techniques and the incorporation of channels into lipid bilayers are two approaches that have become key to these studies. In this symposium, an overview of channels in smooth muscle is presented as an overview of the lipid bilayer technique. Approaches to the analysis of single-channel gating are also presented. The symposium concludes with a description of new approaches in the study of Ca^{2+} channels.

Ionic Basis for Electrical Rhythmicity in Smooth Muscle

Chair: K. M. Sanders. *Speakers:* K. M. Sanders, C. Y. Kao, J. J. Singer, R. J. Lang, W. C. Cole, and N. G. Publicover.

This symposium will address the question of the ionic basis for electrical rhythmicity in smooth muscle. Applications of the patch-clamp technique have not yielded obvious mechanistic answers to this question because the dispersed muscle cells commonly used for these studies either lack rhythmicity or they express quite different activity from the rhythmic events in situ. Nevertheless, many of the channels and currents already characterized probably participate in the rhythmic process, because many are activated at physiological voltages and/or Ca^{2+} concentrations. The symposium will attempt to *1*) reconcile recent single-channel and whole-cell current data with voltage recordings from syncytial preparations and *2*) predict how known ionic channels might participate in electrical rhythmicity. Properties of channels responsible for inward and outward currents will be reviewed with emphasis on how these channels behave at physiological voltages and ionic environments. The effects of some agonists known to affect rhythmicity will also be described. Finally, the role of these channels in regulation of rhythmicity and frequency will be discussed.

Signal Transduction and Calcium in Smooth Muscle

Chair: J. T. Stull. *Speakers:* J. T. Stull, P. Blackshear, C. Rembold, F. Fay, A. Somlyo, M. Blaustein, and W. Goldman.

The speakers of this symposium will present integrated information on the multiple levels of cellular regulation of smooth muscle contractility. One mechanism for signal transduction in smooth muscle contraction involves activation of phosphatidylinositol metabolism via cell surface receptors and generation of the second messengers diacylglycerol (DAG) and inositol 1,4,5-triphosphate, which releases Ca^{2+} from sarcoplasmic reticulum. DAG activates protein kinase C, whereas Ca^{2+} activates Ca^{2+}/calmodulin-dependent myosin light chain kinase. The possible mechanism(s) by which protein kinase C activation influences smooth muscle contraction and other cellular processes will be compared to the cellular regulation of myosin light chain phosphorylation by Ca^{2+}. Experimental tools have been recently developed to affect myosin light chain kinase activity directly in single smooth muscle cells thereby providing unique insights into contractile mechanisms. There are also multiple mechanisms for regulating cytosolic Ca^{2+} concentrations including release from internal stores and influx in addition to the Na^{+}/Ca^{2+} exchange mechanism.

Endothelium-Dependent Vasomotor Responses

Chairs: J. T. Shepherd and R. F. Furchgott. *Speakers:* J. T. Shepherd, R. F. Furchgott, S. Moncada, G. Rubanyi, Z. Katusic, and T. Masaki.

In recent years it has become obvious that the endothelium controls the function of the underlying vascular smooth muscle and does so by releasing potent vasoactive substances. Both endothelium-dependent relaxations and contractions have been reported that have been attributed to the release of endothelium-derived relaxing and contracting factors, respectively. The identity of these factors remains controversial. The purpose of the presentations in this symposium is to discuss the nature of endothelium-derived relaxing and contracting factors. First, the thesis will be proposed that the major endothelial substance leading to relaxation of the underlying vascular smooth muscle is the radical nitric oxide (NO), presumably derived from *l*-arginine. However, several experimental findings are not in accord with this hypothesis. It is hoped that the discussion at the symposium will permit better appreciation of the real role of NO in endothelium-dependent relaxations. Second, the numerous conditions will be described under which endothelium-dependent contractions have been observed, and the putative mediators (e.g., thromboxane A_2, superoxide anion) will be discussed. Among these, attention has been focused on the potent vasoconstrictor peptide endothelin; its actions will be reviewed. It is hoped that the discussion will clarify whether endothelin can be regarded as an active endothelium-derived contracting factor rather than as a by-product of endothelial cell culture.

Regulation of Pulmonary Blood Flow in Asthma

Chairs: N. F. Voelkel and P. D. Wagner. *Speakers:* P. D. Wagner, N. F. Voelkel, C. Hirshman, J. M. Drazen, and P. T. Schumacker.

While much attention has been paid to airway smooth muscle control in asthma, much less is known about regulation of pulmonary vascular tone in asthma and its consequences for perfusion distribution and gas exchange. There is evidence that hypoxic vasoconstriction and, separately, mediators associated with arachidonic acid system both influence blood flow distribution, and both may be of particular importance in asthma. This symposium will coordinate pharmacological/biochemical data on HPV and mediator release in asthma with known observations on blood flow distribution in asthma to attempt to determine how important vascular control is in asthmatic lungs.

Cellular Dynamics of the Pulmonary Artery I: Cell Biology

Chairs: B. M. Twarog and R. A. Rhoades. *Speakers:* B. M. Twarog, R. A. Rhoades, J. C. McKenzie, A. Orlidge, P. A. d'Amore, G. L. Campbell, K. R. Stenmark, D. B. Badesch, W. B. Parks, R. P. Mecham, D. J. Riley, and C. A. Tozzi.

Cellular Dynamics of the Pulmonary Artery II: Signal Transduction

Chairs: R. A. Rhoades and B. M. Twarog. *Speakers:* R. A. Rhoades, B. M. Twarog, P. E. Dicorelot, P. L. Fox, I. F. McMurtry, T. Kitazawa, A. P. Somlyo, R. A. Meiss, C. S. Packer, and J. N. Evans.

The symposia will deal primarily with recent advances in pulmonary vascular biology, a field in which there have been many developments in the last five years. A major purpose is to bring together cell biologists and physiologists to develop unifying hypotheses on the control of pulmonary vascular function. Pulmonary circulation displays special characteristics. One striking feature of pulmonary arteries, as compared to systemic, is their response to stimuli. For example, alveolar hypoxia induces pulmo-

nary vasoconstriction and is a primary stimulus leading to pulmonary hypertension. However, in a systemic vessel such as the aorta, hypoxemia causes vasodilatation and is not linked to systemic hypertension. Another contrast is that sustained elevated pressure in a systemic artery leads to an increase in wall thickening due to hypertrophy and hyperplasia of vascular smooth muscle along with a proportionate increase in connective tissue. In the pulmonary artery, there is a disproportionate increase in connective tissue in the large vessels.

One section will deal with cytoarchitecture in the normal and pulmonary hypertensive artery; control of microvascular growth; heterogeneity of phenotype organization in defined loci and correlations between function and cytoskeletal proteins during hypertrophy of smooth muscle cells; regulation of elastin synthesis in pulmonary hypertension; interaction of mechanical forces with cell proliferation; expression of mRNA for growth factors; and connective tissue synthesis. The second will examine paracrine growth factors from the endothelium; the role of cGMP in the regulation of pulmonary arterial smooth muscle responsiveness to hypoxia; regulation of contraction in tonic pulmonary vessels; and mechanical properties of the normal and hypertensive pulmonary artery.

Crossbridges in Smooth Muscle

Chair: D. M. Warshaw. *Speakers:* D. M. Warshaw, R. Meiss, A. Arner, T. Butler, A. V. Somlyo, D. Harris, and R. Paul.

Most studies of smooth muscle physiology and pharmacology in both normal and diseased states relate in some way to smooth muscles' basic functional capability, i.e., force production and shortening. Since these mechanical properties are related to the most basic contractile unit, the crossbridge, this symposium will serve as a forum to discuss our current understanding of the crossbridge in smooth muscle and its relationship to smooth muscle's contractile properties.

Debate: Cell-To-Cell Conduction Across Gap Junctions Can Account for Electrical Syncytial Properties of Gastrointestinal Muscle

Chair: J. D. Wood. *Pro:* A. Bortoff. *Con:* N. Sperelakis.

Cavazos Meets With Society Representatives

In February, representatives of the Society met with Secretary of Education Lauro Cavazos to discuss educational opportunities for minorities in science. A. Clifford Barger and Eleanor Ison-Franklin informed the Secretary of the Society's efforts to stimulate minority student involvement in physiology and outlined some plans for the future. Cavazos encouraged the APS to continue its efforts and indicated that the Bush administration would be increasing its support for minority education. It was agreed that efforts to work together in this area might be possible in the future.

Left to right: Martin Frank, Eleanor Ison-Franklin, Secretary Lauro Cavazos, and A. Clifford Barger

Future Meetings

1989	
APS Fall Meeting	October 15–18, Rochester, MN
1990	
FASEB Annual Meeting	April 1–5, Washington, DC
APS Fall Meeting	October 6–10, Orlando, FL
1991	
FASEB Annual Meeting	April 14–18, Atlanta, GA
APS Fall Meeting	September 29–October 3, San Antonio, TX
1992	
FASEB Annual Meeting	April 5–9, Anaheim, CA
1993	
FASEB Annual Meeting	March 28–April 1, New Orleans, LA

Two New Editors Appointed

Effective July 1, 1989: **Keith A. Hruska** from Washington University, St. Louis, is replacing James A. Schafer, University of Alabama at Birmingham, as editor of the *American Journal of Physiology: Renal, Fluid and Electrolyte Physiology;* and **Gordon M. Shepherd** of Yale University, New Haven, replaces Lorne M. Mendell, State University of New York, Stony Brook, as editor of the *Journal of Neurophysiology.* The Publications Committee extends appreciation for the dedication and hard work of the outgoing editors.

Computerized Editing

The *American Journal of Physiology* and *Journal of Applied Physiology* are now encouraging the submission of disks of accepted manuscripts for computerized editing. The following criteria must be met: 5¼-inch, low-density disks preferably using WordPerfect (or other DOS-formatted software) done on an IBM-PC or compatible. Once accepted, please forward your disk containing the entire manuscript (title page, text, references, figure legends) with the following information: computer; software package and version; name of file, manuscript title, author(s), and reference number.

For further information, contact Krysia Moore at APS (301/530-7185).

Call for Nominations for Editor of *AJP: Cell Physiology*

Nominations are invited for the editorship of the *American Journal of Physiology: Cell Physiology* to replace Philip A. Knauf, who will complete his second three-year term as Editor on June 30, 1990. The Publications Committee plans to interview candidates in the Fall of 1989. Please send nominations, accompanied by a curriculum vitae, to John S. Cook, Publications Committee, Biology Division, Oak Ridge National Laboratory, P.O. Box 2009, Oak Ridge, TN 37831-8077.

Senior Physiologists News

Letter to Steven M. Horvath

Bruno Balke says he continues to maintain a part-time job with the Sportsmedical and Fitness Institute of the Aspen Club, treadmill testing a variety of people ranging from patients with cardiac problems to highly trained athletes. The purpose of the testing is the follow-up with an individualized exercise or training prescription and discussions on life style changes.

"But for fun we also do some experimentation, like finding out the heart rates for professional tennis players who battle it out for three hours; what the differences are in the physiological, subjective, and objective performance parameters when performing treadmill tests with or without hand support; and how massaging fatigued muscles in between bouts of strenuous exercise affects the performance of the next exercise. At present I experiment on myself to find out if after age 80 the strength of several muscle groups can be improved by regular, three-times-a-week resistance-type exercise. It could be a small contribution to the problem of aging."

Letters to John R. Brobeck

Since her retirement **Bodil Schmidt-Nielsen** and her husband Roger Chagon live half of the time in Gainesville, FL, and half of the time on their farm in Maine. In Gainesville she is an adjunct professor at the University of Florida Medical School's department of physiology. She also has found the time for skiing in Norway and kayaking in Maine. One of her real joys in life, however, is writing the biographies of her parents, August and Marie Krogh, who were physiologists in Copenhagen, Denmark.

J. H. U. Brown writes that he will be forced to retire at the University of Houston as tenured faculty in June but will continue teaching on a year-to-year basis. He also noted that he is still active in research, having a grant from NASA to develop a patient medical records system for astronauts and a contract to develop a patient record system for several large delivery systems.

He also continues to actively publish and now has 30 books plus three more in some stage on the press. He also has been averaging about 16 papers a year, mostly on record systems and hardware, plus speaking engagements.

Letter to Roy O. Greep

Seymour Katsh writes that he is at the University of Colorado Health Sciences Center in Denver where he is Physiology Professor Emeritus and Associate Dean Emeritus and where he acts in various capacities in other departments, including pharmacology, pathology, and ophthalmology. He also said that to pursue some exciting research projects he no longer consults for the university or outside agencies.

Gerd Heusch, M.D., formerly at the University of Dusseldorf, has become professor and chairman of the Department of Pathophysiology, University of Essen, West Germany. Heusch has been a corresponding member since 1986.

APS member **Daniel Bossut,** Ph.D., has moved from Richmond, Virginia, to the Department of Dental Research, University of North Carolina.

Paul C. Rambaut, Sc.D., Deputy Directory, Division of Extramural Activities, National Cancer Institute, has moved to Brussels with the North Atlantic Treaty Organization.

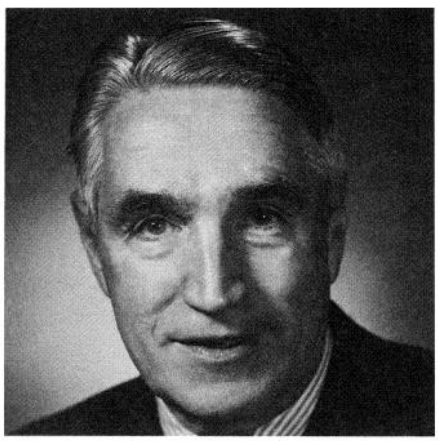
Formerly at the University of Illinois, **Suzanne S. Palmer,** Ph.D., is now in the Department of Physiology, Oral Roberts University, Tulsa.

Ronald G. Geller, Ph.D., has moved from the NIH Office of Scientific Policy and Legislation to the position of Director, Division of Extramural Affairs, National Heart, Lung, and Blood Institute, Bethesda, Maryland.

Bing Shuan Huang, M.D., Ph.D., has moved to the Hypertension Unit, The Heart Institute, Ottawa, Canada. APS member Huang was formerly with the Hypertension Unit in Toronto.

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 *three months* (by the 5th of the month) before the desired publication date. Send all information to Martin Frank, Editor, *The Physiologist,* APS, 9650 Rockville Pike, Bethesda, MD 20814.

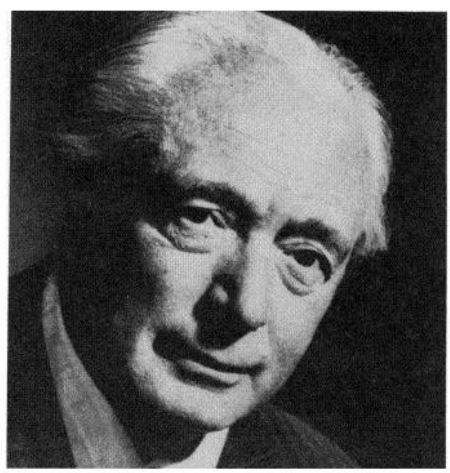
Wood Receives German Cardiac Society Award



Earl H. Wood, M.D., Ph.D., received the Carl Ludwig Ehrenmünze Medal, the highest scientific award of the German Cardiac Society, at its 55th annual meeting in Mannheim, West Germany. The President, Professor Paul Heintzen, said, "I want to pay hommage to a man, who is not only an outstanding scientist, but who had in particular by educating and stimulating many German cardiologists—now in leading positions—contributed profoundly to the German Cardiac Community." Wood's pioneering studies of the cardiovascular system led to videodensitometry and sophisticated, computer-based X-ray television scanning methods and to the futuristic project of a dynamic, high-fidelity, synchronous, volumetric imaging system. Other physiologists who received the award were L. Aschoff, Otto Frank, U. S. von Euler, O. H. Gauer, J. P. Henry, W. His, K. F. Wenckebach, and C. J. Wiggers. Wood, president of APS in 1980 and a member since 1943, has served on many of its committees.

Bing Receives Honorary Degree

Professor **Richard J. Bing,** M.D., FACP, received an honorary degree in medicine and surgery from the University of Bologna at the ninth centennial celebration of the University, the oldest in the world. Bing made important contributions to the humanities while contributing substantially to science. He was the first to perceive the fundamental importance of coronary sinus catheterization for the study of cardiac metabolism. Bing was one of the founding editors and President of the International Heart Society. He has been an APS member since 1942.



NRC Survey of Doctorate Recipients

The National Research Council recently published its findings from the 1987 Survey of Doctorate Recipients, a biennial employment survey of doctorate holders in the sciences, engineering, and the humanities.

In 1987, the total population of doctoral scientists and engineers residing in the United States rose to 451,000, up from 304,000 in 1977. Doctoral scientists comprised 84% of the population. Of the total number of doctoral scientists and engineers, 84% were men and 16% women; this is a shift from 1977, when only 10% were women.

Trends for most minority groups remained stable over the last 10 years. Asians increased their representation by 2% to 8%; 89% were white, 2% black, 2% hispanics (1% could not be classified).

Positions Available

There is a $25 charge per issue for each position listed. A check or money order payable to the American Physiological Society must accompany the copy. Purchase orders will not be accepted unless accompanied by payment. Ads not prepaid will not be printed. Copy must be typed double-spaced and 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 where given on original copy. Copy deadline: copy must reach the APS office before the 15th of the month, 2 months preceding the month of issue (e.g., before February 15 for the April issue). Mail copy to APS, 9650 Rockville Pike, Bethesda, MD 20814.

POSITIONS AVAILABLE

Faculty Positions in Physiology and Biophysics. The Department of Physiology and Biophysics at the University of Nebraska College of Medicine invites applications for three tenure track appointments at the assistant or associate professor level. Faculty are expected to develop active independent research programs supported by extramural funding and to participate in the teaching programs of the department. The applicant should hold a doctoral degree and have at least two years of postdoctoral experience. Salary is commensurate with experience. Applicants should be trained in microcirculatory control, neural control of the circulation, or cellular and molecular cardiovascular aspects of the cardiovascular system. Send curriculum vitae, a description of current research, and names and addresses of three references by June 30, 1989 to Irving H. Zucker, Ph.D., Chairman, Department of Physiology and Biophysics, University of Nebraska College of Medicine, 42nd and Dewey, Omaha, NE 68105. [EOAAE]

Correction

The title of the book reviewed in the April issue of the Physiologist is *Animal Liberators—Research and Morality.*

Frontiers of Hormone Research. Gut Regulatory Peptides: Their Role in Health and Disease

E. E. Blazquez (volume editor)
Basel: Karger, 1987, 236 pp., illus., $123.50

This book, which is the result of a conference, contains 22 chapters. The chapters consist of review articles or reports of original research. The chapters are divided into 5 sections entitled "Morphofunctional aspects of gut cells producing regulatory peptides," "Relevance of peptide receptors present in gut epithelium. Physiological effects," "Glucagon and related peptides," "Role of GIP in health and disease," and "The entero-insular axis and disease." The most recent references are from 1986.

One striking aspect of this book is the difference between what I expected from reading the title and what I found upon reading the book. Instead of contents dealing with the role of gut regulatory peptides in health and disease, this book focuses on the components of the enteroinsular axis and hormones related to regulation of carbohydrate metabolism. Some of the review articles such as "The changing concept of the enteroinsular axis" by Creutzfeldt, "Physiological relevance of receptor characterization in the study of the enteroinsular axis" by Rosselin, and "Role of gastric inhibitory polypeptide in regulation of insulin release" by Brown are first-rate. However, several chapters are superficial and others most likely would not be accepted in their present form in a leading peer-reviewed journal. Moreover, for reasons that are not clear this book also contains a chapter dealing with peptidergic innervation in amphibian stomach and another covering intrinsic innervation in bird anterior gut.

Overall, I would not buy this book for my personal use or recommend it for our library because I find it much too expensive for the contents. If one is interested in topics such as the enteroinsular axis or gastric inhibitory peptide this book might be helpful; however, these topics are also covered in other texts or review articles.

Jerry D. Gardner, M.D.
NIDDK, National Institutes of Health

BOOKS RECEIVED

Pediatric and Adolescent Endocrinology. Zvi Laron (Series Editor). *Early Vascular Complications in Children with Diabetes Mellitus.* B. Weber (Editor). Vol. 17. Basel: Karger, 1988, 284 pp., illus., index, $142.75.

Physiology. Robert M. Berne and Matthew N. Levy (Editors). Second Edition. St. Louis, MO: Mosby, 1988, 1077 pp., illus., index, $49.95.

Frontiers of Hormone Research. Tj. B. van Wimersma Greidanus (Series Editor). *Gut Regulatory Peptides: Their Role in Health and Disease.* E. Blazquez (Editor). Vol. 16. Basel: Karger, 1987, 234 pp., illus, index, $123.50.

Ion Transport in Prokaryotes. Barry P. Rosen and Simon Silver (Editors). San Diego, CA: Academic, 1987, 332 pp., illus., index, $85.00.

Otto Folin: America's First Clinical Biochemist. Samuel Meites. Washington, DC: American Association for Clinical Chemistry, 1989, 428 pp., illus., $55.00.

Biology of Extracellular Matrix: A Series. Robert P. Mecham (Editor). *Fibronectin.* Deane F. Mosher (Editor). San Diego, CA: Academic, 1988, 474 pp., illus., index, $95.00.

Bronchopulmonary Dysplasia. Eduardo Bancalari and J. Thomas Stocker (Editors). Washington, DC: Hemisphere, 1988, 441 pp., illus., index, $79.50.

Molecular Biology in Physiology. Shu Chien (Editor). New York: Raven, 1988, 181 pp., illus., index, $56.00.

Current Topics in Membranes and Transport. Joseph F. Hoffman and Gerhard Giebisch (Series Editors). *Vol. 33: Molecular Biology of Ionic Channels.* William S. Agnew, Tonio Claudio, and Frederick J. Sigworth (Vol. Editors). San Diego, CA: Academic, 1988, 453 pp., illus., index, $89.50.

Microcomputers in Physiology: A Practical Approach. P. J. Fraser (Editor). Washington, DC: IRL Press, 1988, 276 pp., illus., index, $58.00.

Neuromethods 10: Analysis of Psychiatric Drugs. Alan A. Boulton, Glen B. Baker, and Ronald T. Coutts (Editors). Clifton, NJ: Humana, 1988, 547 pp., illus., index, $79.50.

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ANNOUNCEMENTS

American Cancer Society Grants Available

Grants are available from the American Cancer Society for research in the area of nutrition and chemoprevention. Deadline for receipt of applications for Research and Clinical Investigation Grants is November 1, 1989. Deadline for receipt of applications for Grants in Support of Personnel for Research is October 1, 1989. There is no deadline for applications for Research Development Program Grants. Submit applications to American Cancer Society, Inc., Research Department, 1599 Clifton Road NE, Atlanta, GA 30329. *Information:* John Stevens (at above address), phone (404) 329-7550 or Allen Vegotsky (404) 329-7540.

NIH Fellowship Available

The John E. Fogarty International Center for Advanced Study in the Health Sciences of the National Institutes of Health announces the availability of postdoctoral fellowships and health scientist exchanges to US and foreign scientists who wish to conduct collaborative research abroad. The purpose of these programs is to provide opportunities for research experience and the exchange of information in the biomedical, behavioral, and other health-related sciences. *Information:* Lynn M. Amende, International Research and Awards Branch, Fogarty International Center, National Institutes of Health, Building 38A, Room 613, Bethesda, MD 20892. Phone: (301) 496-1653.

Reprints of Technical Report Available

Reprints of the technical report "G-Induced Loss of Consciousness and Its Prevention" are available. The report, USAFSAM-TR-87-41, can be obtained by writing to Kent K. Gillingham, Research Medical Officer, USAF School of Aerospace Medicine, Human Systems Division (AFSC), Brooks AFB, Texas 78235-5301. Limited copies are also available upon request from Earl H. Wood, Mayo Clinic, Rochester, MN 55905.

Scientific Meetings and Congresses

First Joint Meeting of the European Society for Comparative Physiology and Biochemistry and the Association des Physiologistes, Reims, France, September 3–7, 1989. *Information:* Prof. Jean Mellinger, President, Faculte des Sciences, B.P. 347, 51062 REIMS CEDEX (France). Phone: 26.05.33.46.

Society of General Physiologists' 43rd Annual Symposium on G-Proteins and Signal Transduction. Woods Hole, Massachusetts, September 6–9, 1989. *Information:* Society of General Physiologists, PO Box 257, Woods Hole, MA 02543.

International Symposium on Survival Under Critical Life Conditions. Rome, Italy, October 4–6, 1989. *Information:* Organizing Secretariat Fondazione Giovanni Lorenzini, Via Monte Napoleone, 23, 20121 Milan (Italy). Phone: (02) 783.868-702.267.

Fifth International Symposium of Digestive Surgery and Endoscopy, Rome, Italy, October 11–14, 1989. *Information:* Organizing Secretariat SC Studio Congressi, Via F. Ferrara, 40-00191 Roma. Phone: 06/3286897-3290250. FAX: 06/3286897.

Conference on Mathematical Models in Experimental Nutrition: Advances in Amino Acid and Carbohydrate Metabolism, Gatlinburg, Tennessee, October 15–18, 1989. *Information:* Marsha Bain, CME Course Coordinator, Vanderbilt Division of Continuing Medical Education, CCC-5526, MCN, Nashville, TN 37232-2337. Phone: (615) 322-4030.

First International Olympic Committee World Congress on Sports Sciences, Colorado Springs, Colorado, October 29–November 3, 1989. *Information:* Mary Margaret Newsom, US Olympic Committee, Department of Education Services, 1750 East Boulder Street, Colorado Springs, CO 80909. Phone: (719) 578-4575. FAX: (719) 635-2932.

Forty-Second Annual Scientific Meeting of The Gerontological Society of America, Minneapolis, Minnesota, November 17-21, 1989. *Information:* The Gerontological Society of America, 1275 K Street NW, Suite 350, Washington, DC 20005-4006.