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Early History of the Concept of Chemical Transmission of the Nerve Impulse

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Like many older physiologists, I had known something of the history of the concept of chemical transmission of the nerve impulse, but when I began to work up the history of the physiology of nervous control of salivary secretion, particularly the contributions of J. N. Langley, I encountered Zenon Bacq's little book on the subject (1). Bacq's historical sketch caused me to look into the subject more thoroughly. Bacq had written, "Certain authors attribute great importance to a sentence by E. Du Bois Reymond (dating back almost a century), who in his time was a prominent figure." Du Bois Reymond was indeed a prominent figure: the father of modern electrophysiology and the discoverer of the action potential. Bacq's dismissive remark may reflect the distain of a chemical pharmacologist for a mere electrician.

Bacq quoted and translated a sentence buried on page 700 of volume II of Du Bois Reymond's *Gesammelte Abhandlung zur Allegemeinen Muskel- und Nervenphysik:*

> Of known natural processes that might pass on excitation, only two are, in my opinion, worth talking about: either there exists at the boundary of the contractile substance a stimulatory secretion in the form of a thin layer of ammonia, lactic acid, or some other powerful stimulatory substance; or the phenomenon is electrical in nature (2).

Bacq went on to say:

> Langley's work on nicotine is universally known; all physiologists and pharmacologists acknowledge that he was the first to give a valid description of the idea of 'receptors', but no-one remembers that, in 1906, Langley had already taken the logical and decisive step which led him to postulate the existence of a 'chemical mediator.'

Bacq wondered "Why is there this relative neglect of this part of Langley's work? Is it deliberate? Had Langley annoyed his contemporaries by his excessively severe control of the *Journal of Physiology?*"

J. N. Langley's Ideas of Chemical Transmission

Michael Foster, who had begun to rejuvenate Cambridge physiology in 1870 (3), was not himself a distinguished experimenter, but he had a genius for attracting and stimulating promising youngsters. One of those was J. Newport Langley, who in 1874 switched from the study of mathematics at Cambridge to the study of physiology under Foster (4). Langley's two major achievements as a physiologist were his description and analysis of the functions of the salivary and gastric glands and his analysis of the structure and functions of the autonomic nervous system. The latter study began about 1888 when Professor Archibald Liversidge, then of Sydney, Australia, gave Langley a sample of *pituri,* an

Orr E. Reynolds Award

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Inside . . .

As A Matter Of Opinion

Our Society Publications

The first issue of the *American Journal of Physiology* was published in 1898, 11 years after the founding of the American Physiological Society. Since 1914 *AJP* has been wholly owned and operated by the Society. Gradually publications have assumed a larger and larger role among the several major functions of APS. Several new journals have been added (*Physiological Reviews,* 1921; *Journal of Applied Physiology,* 1948; *Journal of Neurophysiology,* 1962; *The Physiologist,* 1957; *News in Physiological Sciences.* 1986), and 1977 the *AJP* first became available as five (now eight) specialty journals as well as in its consolidated form.

In addition to its rightful reputation for publishing cutting edge physiological research and for general scientific excellence, overall the publications program has produced substantial income for the Society. Do you know that income from an endowment from our journals supports most of the scientific symposia at our spring meeting? Do you known that the 1987 centennial was extensively subsidized by publications income? Clearly our Society would be much poorer (both intellectually and financially) without our journals and your dues would be higher.

In spite of the obvious importance of publications to the American Physiological Society, most of us, even when we are on Council, have little understanding of the how and why of our publications program. Partly our ignorance is because running publications is a complex process involving many people and large sums. Like other Society committees, the Publications Committee, currently under the chairmanship of John Cook, Oak Ridge, is advisory to Council, but Council gives them wide latitude over the basic operation of the journal and book projects.

Ultimately Council, as the governing body of APS, must approve all policy decisions. It was not always that way. Until 1961 a publications Board of Trustees ran publications almost entirely as an independent entity. Only eternal vigilance and courageous action by a few of our leaders saved the day. The Board was dissolved and the Publications Committee inaugurated.

Except for Council, the Publications Committee is the hardest working body within APS. It supervises all journals, selects editors, budgets editorial expenses, and oversees the publications office at our Bethesda headquarters. It is responsive to letters about editing practices, journal content, ethical and animal use considerations, and, yes, even costs. Annually the Committee recommends to Council the pricing structure for all journals.

For members the prices for journals range from $70 for *Physiological Reviews* to $417.50 for the consolidated *AJP.* No doubt your next thought is, why do the various Society journals cost so much. Well, you may find the next few facts incredible, BUT:

- Librarians consider our journals a bargain by any standard of comparison;
- The nominal price members pay doesn't come close to covering the cost of the journal;
- The cost per page published is not increasing faster than inflation;
- Most revenue from journals comes from libraries, not individual subscribers.

Recently Council was reminded that less than half our total membership subscribes to any APS journal (for shame!) and that total income from members' subscriptions accounts for only 8% of subscription income. The latter fact is both good and bad news. The good news is that prices to members are fairly stable and will rise slowly. The bad news is that what members want is less important than what libraries want. For example, in our recent consideration about repackaging the consolidated *AJP,* how librarians perceive that journal as a unit is of paramount importance.

Beginning last year APS began to restructure its journal pricing policy into a three-tiered system, which will be completed by 1993. Members will pay one-third and nonmembers two-thirds of the library rates. This means your subscription rates will probably remain stable for two more years.

One of the best policies of the APS journals is that they publish every approved paper. Thus, although the rejection rate of 30–40% is not low, there is no total page limitation. Unfortunately we are reaching a point of no return. Major rethinking of how we publish papers is needed. Continued splitting of journals along specialty lines does not solve the problem. The *Journal of Applied Physiology* has grown very large. A decision to split it three years ago resulted in the new *AJP: Lung, Cellular and Molecular Physiology,* but that did not accomplish the purpose of dividing *JAP* adequately.

APS journals will continue to promote excellent science and innovative publishing ideas. We are exploring several publication options, ways to curb editorial and production expenses, page charges and submission fees, and new ways to handle reprints.

The APS book program led the way with the *Handbooks, Clinical Physiology* series, and the *People and Ideas* history series, and other special publications. Making a profit has never been a priority, which is just as well because the program with all good intentions has floundered. Even the Handbooks, which were innovative and trend-setting in the early 1960s, now have to compete with similar series. Fortunately Oxford University Press has taken the book program off our hands so that the continued financial drain has ended, although all editorial content remains under APS control. How does Oxford expect to make money when we can't? As a major publisher they can benefit from the economies of size by maintaining a pool of free-lance copy editors, by contracting for lower printing rates, and by using their own mar-

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AMERICAN PHYSIOLOGICAL SOCIETY
144th Business Meeting

Time: 5:45 P.M., Wednesday, April 24, 1991

Place: Georgia World Congress Center, Atlanta, GA

I. Call to Order

Calling the meeting to order, President **Shu Chien** welcomed the members to the 144th Business Meeting of the Society. The election ballot for new members, a list of recipients of 1991 APS Awards, and a list of APS Conferences and Society meetings were distributed with the agenda.

II. Membership Report

President-Elect **Norman Staub** presented a report on the status of the Society membership with a listing of deceased members.

A. Summary Membership Status

Since the spring meeting, the Society membership increased to 7,062. As of March 8, 1991, there were 4,913 regular, 761 emeritus, 27 honorary, 276 corresponding, 749 associate, 21 associate corresponding, and 315 student members.

B. Deceased Members

With a deep sense of sorrow, Dr. Staub read the names of 38 deceased members. The membership observed a moment of silence in tribute to their dedication to physiology (page 159).

III. Election of Officers and Society Affairs

A. Election of Officers

The Nominating Committee, composed of representatives from the six sections, identified the slate of candidates nominated by the membership. **Pamela J. Gunter-Smith** and **Robert S. Balaban** audited 1,908 ballots received from the members. The incoming President-Elect

President Shu Chien

is **Stanley G. Schultz,** who takes office on April 25, 1991 as will the newly elected Councillors, **Helen J. Cooke, John E. Hall,** and **L. Gabriel Navar.**

B. Society Affairs

Martin Frank announced that the FASEB has been reorganized to be more responsive to the needs of the member societies and will play a proactive role in the legislative process. The new executive director is **Michael Jackson,** formerly of George Washington University and a member of the APS. The Society continues to grow, and the APS staff stands ready to provide the services necessary to fulfill the needs and objectives of the membership.

IV. Election of Members

A. Appointment of Tellers

The members were instructed to strike from the ballot those names for whom they did not wish to vote, and tellers **Richard Effros, Robert Finestein,** and **Michael Matthay** were asked to collect and count the ballots.

B. Election of New Members

President-Elect Staub expressed pleasure in announcing that the 246 regular and 52 corresponding candidates were unanimously elected to membership. In addition, 56 associate, 10 associate corresponding, and 128 students have been approved for membership by the executive director, total increase of 492 new members since the spring meeting.

V. State of the Society

President Chien said, "Fellow members of the Society, it is my pleasure to report to you on the state of the Society. This has been an active and exciting year. What has been accomplished was made possible by the cooperative efforts of the Council, The Sections, various Committees, and Society members. I would like to take this opportunity to thank the Society staff members for their hard work led by our executive director, Marty Frank, and assisted by James Liakos, business manager; Brenda Rauner, publications manager; Lorraine Tucker in the executive office; Linda Buckler in membership; Bill Samuels in public affairs; and their associates. APS has a history of 104 years, and one year is only a short period in a long continuum. What has been achieved in this year represents the fruit of the efforts of many years under the leadership of many past presidents and officers.

"First, I would like to report on our new initiative, the **APS Conferences.** In order to promote physiology and to improve the image of the Society, APS places a very high priority on the organization of superlative APS Conferences on specific topics. These conferences will provide a forum for scientific exchange among researchers at the cutting edge of physiological sciences. It is my pleasure to report that the first APS Conference entitled 'From Channels to Cross Bridges' will be held in Mount Desert Island, Maine, from July 13–16, 1991. It has an outstanding program consisting of internationally renowned speakers. From September 29–October 3, 1991, there will be another APS Conference in San Antonio, Texas, on 'Interactions of the Endocrine and Cardiovascular Systems in Health and Disease.' The format of this San Antonio meeting represents a transition between the previous fall

meetings and the new APS Conferences. Two more APS Conferences have been organized for the fall of 1992, a conference on 'Integrative Biology of Exercise' will be held from September 23–26, 1992, in Colorado Springs, Colorado, and a conference on 'The Cellular and Molecular Biology of Membrane Transport,' will be held from November 4–8, 1992, in Orlando, Florida. The organization of these meetings is well under way and every indication is that they will be superb in scientific quality. Proposals for APS Conferences in 1993 are being considered by the Program Committee, and I understand that there are excellent possibilities. We will use our financial and other resources to strongly support these conferences to make them the best there is in biomedical sciences.

"We will continue to hold our annual **spring meetings** with several other societies in FASEB through 1998. For 1999 and onward, APS is pursuing the possibility of meeting with other societies either within or outside the FASEB framework.

"**Publication** is a major activity of our Society. Our journals are widely recognized as premier publications in their fields. While journal publication has continued to be successful, as measured by the number of manuscripts submitted, the frequency of citation, and other criteria, the Publication Committee and the publications office are looking ahead to ways to further improving the quality of the journals and their operation.

"We are fortunate to have first-rate scientists agreeing to serve as new editors, associate editors, and editorial board members whenever there is a turnover. The editorial offices are striving to reduce the time delay between manuscript submission and completion of review. We are encouraging manuscript submission on disks, which has reached 30% of all manuscripts published. In anticipation of the development of electronic publishing, consultants were invited to hold a Library Focus Group meeting in March. The consensus was that hard copies of journals will continue to be the main mode of publication for years to come, but we should constantly be on the alert regarding future developments.

"The publications budget represents about 85% of the total Society budget. Therefore, a small fluctuation in publications balance can have a serious financial impact. A major uncertainty in the budget for journal operations lies in the number of pages published, which has almost tripled since 1977. We need to critically address the issue of whether to continue to have an open-ended policy with respect to pages to be published.

"While scientific excellence is our most important goal we also treat our publications operation from a business point of view. Several changes have been instituted to reduce publication cost while improving operation. Examples are the computerization of the copy editing process and the contracting with Oxford University Press to publish APS books, whereby APS will only be responsible for the scientific content of the books and not for the mechanics of publication and marketing or the financial liability.

"In recent years, the governance of the Society has been strengthened by the establishment of **sections**. In order to further broaden the representation on Council, the Long Range Planning Committee made the recommendation that the Section Advisory Committee become the Council some time in the future. A Task Force on Governance has been formed to consider the implications of implementing this recommendation.

"The **membership** of the Society has continued to grow, with the total number exceeding 7,000 this year for the first time. The age distribution of the APS members has not changed significantly over the past few decades. We need to recruit young scientists to move the Society forward with vigor. We also need to recruit more women and underrepresented minorities.

"The Society is working to make membership attractive to prospective candidates by continually improving its program and activities. The Membership Committee is considering some changes

APS Council. Top row (l-r): J. S. Cook, D. R. Ramsay, A. W. Cowley, Jr., B. Bishop, B. R. Duling, N. R. Alpert, L. S. Jefferson, P. D. Wagner. Front row (l-r): W. S. Spielman, J. E. Hall, H. J. Cooke, V. S. Bishop, S. Chien, N. C. Staub, S. G. Schultz.

designed to simplify the preparation of an application without compromising the evaluation process. Starting this year, APS is waiving the first-year dues to new student members. This has led to a large increase in student applications.

"The Career Opportunities in Physiology Committee published a new brochure on Career Opportunities in Physiology last year.

"APS has been active in promoting **physiological education** at the level of graduate studies. Through the Caroline tum Suden Awards and the Procter & Gamble Professional Opportunities Awards, we support and encourage the participation of students and young scientists at APS meetings. The NIDDK Minority Student Program has been very successful in bringing underrepresented minority students to APS meetings. The Porter Physiology Development Program, supported by the Porter Foundation and the American Cyanamid Company, provides funds for the training of minority students.

"A number of educational activities have been sponsored by APS. We have begun a High School Teachers Summer Research Program, which is very successful. The Society has submitted an application to NIH for a Science Education Partnership Award. This application will use our high school science teacher summer research program as a starting point, and it also involves collaboration with local schools, teachers' organizations and physiologists to develop and implement educational programs for the teachers.

"APS has had an active year in **international physiology.** The American Physiological Society/Chinese Physiological Society Joint Meeting in Taiwan (November 2-5, 1990) was a great success. Participants from both sides are enthusiastic about future cooperation on research and training. The Canadian Physiological Society has suggested that we hold a Pacific Rim Regional Physiology Meeting in 1995. The US/USSR Bilateral Exchange Program had been fruitful.

"The International Physiology Committee has been helping countries in need through the donation of APS journals and recruitment of physiology teachers. In addition, education workshops for third world countries have been organized. The Perkins Memorial Fellowships continue to be valuable in supporting the visits to the US by families of international visiting scientists.

"We are all concerned by the progressive decline of **federal funding for research and training.** Cooperating with other societies in FASEB, APS is active in communicating to congressional representatives the importance of improving biomedical research funding, especially for investigator-initiated research. APS representatives have testified at congressional committees and at sessions sponsored by NIH and NSF on various issues related to biomedical research, including funding. In addition to the officers of the Society, many APS members have written to and/or visited their congressional representatives in relation to funding and/or research. These efforts are extremely important and they should be sustained and enhanced.

"The Society has been active in promoting support for **animal research.** Other societies for biomedical research look to APS for leadership in these issues. We are in close contact with the US Congress, and we work with several governmental and private agencies to monitor and respond to legislative initiatives. We are publishing a source book for members regarding animal issues; we are developing educational publications for the lay public on the need for animals in research and teaching; and we are designing educational programs for primary and secondary grade levels that deal with the use of animals in science and health-related industries.

"I would like to suggest that APS foster the formation of **local physiological societies or chapters** and enhance its interactions with existing local organizations, e.g., those in New England, Ohio, Oklahoma, Detroit, and Philadelphia. In addition to the promotion of scientific exchange, these organizations can also serve other important functions, particularly with respect to education, animal experimentation, and public affairs at the local level. Because of their regional nature, such associations can exert significant influence on legislative matters at the local level and also at the national level through their own members of congress. Such local organizations would be very effective in promoting life sciences, including physiology, in local schools at all levels and in organizing program such as the High School Science Teachers Program. Through such local organizations, APS members can be involved in the activities of the Society, thus maximizing the utilization of our talents and manpower. APS should provide the logistic and financial support required to form these local organizations, which are critically needed at this stage of growth and development of our Society.

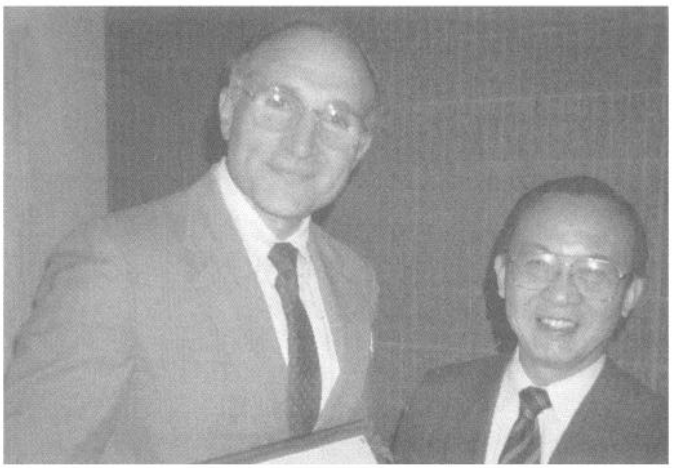
"The relationship between APS and **FASEB** had presented some problems for several decades, especially with regard to the monetary assessment, the lack of flexibility in the spring meeting and the noninclusion of many biomedical research societies. In response to the APS resolution (or ultimatum) in June 1989, the FASEB Board revised the Constitution and Bylaws effective July 1, 1990. Fundamental changes were made in the structure and operation of FASEB, with the aims of broadening its representation within the biomedical research community and better serving

Presentation of a gavel and plaque by V. S. Bishop carved by his father, to be displayed in the APS Headquarters.

1991 Bowditch Lecture

V. S. Bishop congratulating W. S. Ammons, Jefferson Medical College, on the presentation of the 1991 Bowditch Lecture, "Renal Afferent Inputs to Ascending Spinal Pathways," Atlanta, GA, April 22, 1991.

1991 Walter B. Cannon Lecture



S. Chien and P. Needleman, Monsanto Corporate Research, who delivered the 1991 Walter B. Cannon Lecture—Physiology in Perspective, Atlanta, GA, April 24, 1991. The lecture, sponsored by the Grass Foundation, was entitled, "Atriopeptin Discoveries and Implications."

the needs of the constituent societies. Since then, FASEB has been rapidly moving in the direction planned. In view of these changes, APS decided to remain in FASEB and help in its recruitment of new members. Several societies have already contacted APS informally to inquire about the possibility of joining FASEB. Momentum is definitely gathering to make FASEB an organization truly belonging to the biological research scientists and a federation to represent all of us with unity and visibility at the Capitol and elsewhere.

"The **discipline of physiology** and the American Physiological Society are facing some problems of image and identity as biomedical research has undergone dynamic evolutions in recent years. While the explosive developments of molecular biology have led to many new discoveries in biomedical sciences, molecular biologists are becoming increasingly aware of the need to apply the knowledge gained to elucidate physiological functions. During the past year, several biotechnology companies contacted APS regarding recruitment of scientists trained in both classical physiology and the new biology. We physiologists should integrate the concepts and techniques in cell and molecular biology with other available approaches to solve physiological problems at the organ-system levels. We are already making some progress toward that goal; this is evidenced by the papers published in our journals and by the presentations at our sessions in the FASEB meeting. We need, however, to redouble our effort at this critical junction to lead in the evolution of the biology of the future and put physiology once again at the center stage of biomedical sciences. This is indeed a time of challenge, but it is also a time of opportunity.

"Finally, a few words about finance. Thanks to the prudent management of the Society's financial affairs by the Finance Committee and staff, our Society is in an excellent financial condition. We have a reserve fund equivalent to approximately one year's operating budget, and it undergoes steady growth as a result of investment. In response to suggestions from the Finance Committee, Council has decided to devote a significant proportion of the income from the investments to meet the strategic goals of the Society. We are now developing a five-year **strategic plan** on how to utilize our resources to the best advantage of Society functions. As a first step, the Council has asked the various committees and sections to make suggestions. These suggestions will be reviewed at the next Council meeting in September 1991. Thereafter, a retreat will be held to formulate a five-year strategic plan for the most effective utilization of our resources for the growth and development of our Society.

"A financial plan for the next five years has been projected by the Finance Committee, and this provides a realistic framework for the development of our strategic plan. Computations based on various assumptions indicate that the state of balance can change dramatically with different scenarios. We need to make prudent decisions in managing our existing assets in order to safely maximize the yield. We should continue to look into ways to enhance our various income sources, e.g., from corporate donations, individual contributions, planned giving, etc., and also to reduce our expenditures by improving efficiency.

"In closing, I am pleased to report to you that the state of the Society is excellent, and I am particularly happy to say that we are planning ahead for a future which looks very bright. We are taking on the challenges presented to us, and we are capitalizing on the opportunities we have. Whatever we have achieved is a result of the efforts of our devoted members and our dedicated staff, as well as the foresighted planning of our predecessors. My dear fellow members, I wish to thank you for giving me the opportunity and privilege to serve this great Society for the past year, and to be a part of the total effort and a point in the continuum of over one century. We have many difficult tasks ahead of us. I am confident that the Society will move forward with vigor and achieve new heights under the leadership of our incoming President Norman Staub, our President-Elect Stanley Schultz, and with the cooperation and support from each and every one of you."

VI. Amendments to the Bylaws

The proposed Bylaw amendments (Article III, *Membership,* Section 8, *Student Members;* Section 10, *Nominations for Membership;* and Section 11, *Election of Members)* were published in the December issue of *The Physiologist* in compliance with the Bylaws.

Citizenship (or permanent residency) is required for student membership. Since many graduate students in this country are not from The Americas, it is recommended that this citizenship requirement be removed for student members. Candidates for regular, corresponding, and honorary membership will be required to wait a year before approval of their membership because there no longer will be a fall Business Meeting. The proposed amendments to Sections 10 and 11 will have the slate of candidates voted on by Council following review and recommendation of the Membership Committee.

A motion was seconded and passed unanimously that the Bylaws be amended as presented as follows:

ARTICLE III. *Membership*

SECTION 8. Student Members. Any student who is actively engaged in physiological work at an institution in The Americas as attested to by two regular members of the Society shall be eligible for proposal for student membership ~~and who is a resident of The Americas~~. No individual may remain in this category for more than five years, without reapplying.

SECTION 10. *Nominations for Membership.* Two regular members....

a. The Membership Committee shall ~~investigate~~ assess the qualifications of proposed regular and corresponding members and recommend nominations to Council. ~~Council shall nominate members for election at a Business Meeting of the Society. A list of nominees shall be posted for consideration by the members attending the meeting two days prior to the Business Meeting at which election occurs.~~

SECTION 11. *Election of Members.* Election of regular, corresponding, and honorary members shall be by secret ballot ~~at a Business Meeting of the Society~~ by members of Council. A two-thirds majority vote of the members present and voting shall be necessary for election.

VII. Awards and Presentations

A. Ray G. Daggs Award

The Ray G. Daggs Award was presented to **Hallowell Davis,** 31st President of APS (see page 138).

B. Orr E. Reynolds Award

The Orr E. Reynolds Award was established by the Society in honor of Orr Reynolds, who was the Society's third executive secretary-treasurer, and is presented annually for the best historical article by an APS member. This year's award is conferred to **Horace Davenport** for his manuscript, "The Early History of the Concept of Chemical Transmission of the Nerve Impulse." He could not be present to receive the award.

Shu Chien took the opportunity to say a few words about Orr E. Reynolds, who died March 30, 1991. Orr had a great love for the American Physiological Society and for the advancement of physiology education. He served as the executive secretary-treasurer from 1972 to 1985 and continued an additional two years as a full-time volunteer working on the APS Centennial Year celebration. The Society has established an Orr E. Reynolds Education Fund, the objectives of which are being developed by our Education Committee.

C. Caroline tum Suden Professional Opportunity Awards

The Caroline tum Suden Professional Opportunity Awards, open to graduate students or postdoctoral fellows presenting papers at the spring meeting, consists of a $500 check to attend the meeting, complimentary registration and access to the FASEB Placement Services. Six annual awards are made possible by the generous bequest of Caroline tum Suden, who was a neurophysiologist and long-time member of the Society. On behalf of the Women in Physiology Committee, Hannah Carey expressed pleasure in presenting awards to **Leslie S. Black** (VA-MD Regional College of Veterinary Medicine, Blacksburg), **Stephen M. Johnson** (University of Iowa), **Ingrid K. Krampetz** (Indiana University), **Wisuda Suvitayavat** (University of Illinois, Chicago) **Esther E. Versteegden** (University of Texas, San Antonio), and **Ning Wang** (Harvard School of Public Health).

D. Procter & Gamble Awards

The Procter & Gamble Company, a multinational, technically based consumer products corporation, provides support for Professional Opportunities Awards. **Ted Logan** was recognized for

S. Chien recognizing outgoing Councillors B. Bishop (l) and P. D. Wagner (r) for their dedication and outstanding service to the Society, APS Business Meeting, April 24, 1991, Atlanta, GA.

having made these generous awards possible. The APS Sections selected 18 predoctoral students who are within 12-18 months of receiving a PhD degree and presenting a paper as first author at the spring meeting. Each of the 18 recipients was presented a $500 check and complimentary registration (p. 163).

E. NIDDK Travel Fellowships for Minority Physiologists

A grant from the National Institute of Diabetes, and Digestive and Kidney Diseases (NIDDK) enables the Society to provide minority physiologists travel fellowship awards to attend and present a paper at the spring meeting. Twenty-five undergraduate, predoctoral, and postdoctoral scientists, who obtained their undergraduate education in the Porter Development Program, Minority Biomedical Research Support (MBRS) or Minority Access to Research Careers (MARC) institutions were recognized (p. 162).

VII. Recognition

In reporting on the State of the Society, Shu Chien said that many achievements are made possible because of the efforts of a lot of people. Each year, two Councillors rotate off Council. At the close of this meeting, Councillors **Beverly Bishop** and **Peter Wagner** will complete three-year terms on Council. Chien expressed pleasure in presenting each of them a certificate in recognition of their wisdom, hard work, and dedication to the Society. He gave special thanks to **Norman Alpert** for developing a financial plan, **William Spielman** for his efforts in advancing the Society's educational activities, and **Carl Gisolfi** for a tremendous job in organizing the Society's programming. As *ex officio* members of Council, their terms end December 31, 1991. We had the fortune of having **Vernon Bishop** as our President last year, and whatever we achieved today, Vernon paved the way to make it possible. In recognition of his many important contributions, Shu Chien took great pleasure in presenting him with a plaque commemorating his presidency. The members joined in applauding Vernon Bishop and the Councillors for providing leadership in moving the American Physiological Society forward.

Vernon Bishop presented the Society with a gavel and plaque, made by his father, on which the names of the officers will be inscribed. The plaque and gavel will be displayed in the APS Headquarters.

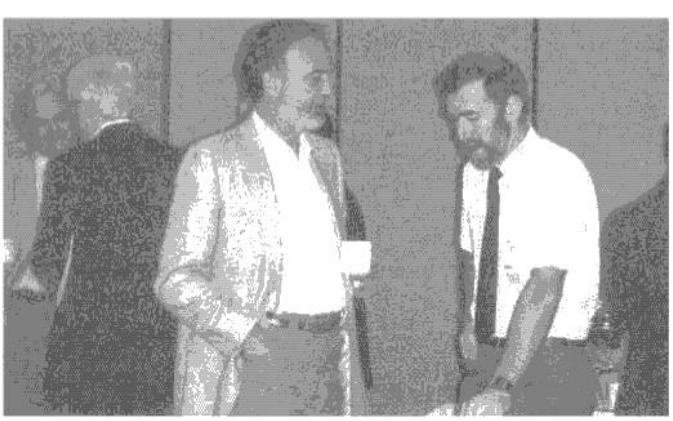
With no other business, the meeting was adjourned at 6:40 P.M., April 24, 1991.

Norman C. Staub
President-Elect

Joint APS Council and Section Advisory Committee Meeting April 21, 1991, Atlanta, GA.

(l-r): R. Lydic, D. Richardson, J. L. Kostyo, B. R. Duling, W. S. Spielman, L. Share.

(l-r): A. F. Bennett, J. R. Rodarte, N. K. Wills, S. G. Schultz, W. R. Boron, J. E. Hall.



(l-r): D. R. Ramsay (background), J. R. Rodarte, P. D. Wagner.

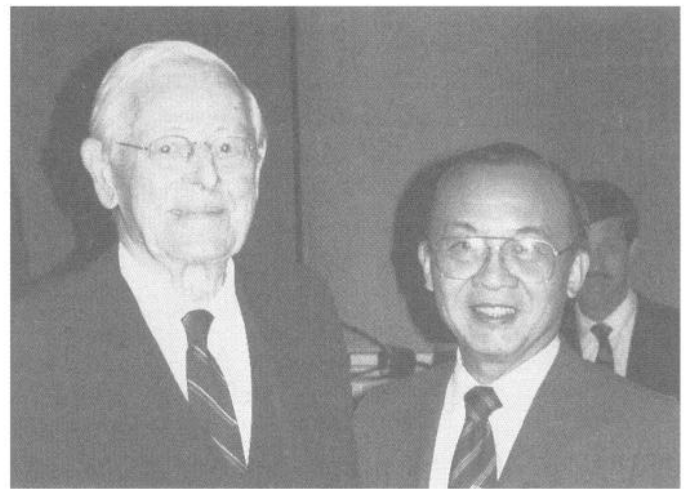
(l-r): M. J. Jackson, V. S. Bishop, S. G. Schultz, R. J. Traystman.

1991 Ray G. Daggs Award

The recipient of the Ray G. Daggs Award this year is **Hallowell Davis.** Shu Chien said, "when Hallowell Davis started to make major contributions to both the science of physiology and to the American Physiological Society, most of us here were not yet born."

He was born in New York City in 1896. After receiving his AB and MD degrees from Harvard and working for one year with Professor E. D. Adrian at Cambridge University, he was appointed instructor of physiology at Harvard in 1923. There he did pioneering work on electroencephalography and first demonstrated the recording of the EEG waves on an ink-writing instrument 60 years ago.

In 1946, he went from Harvard to St. Louis to become director of research at the Central Institute for the Deaf; he also held appointments at Washington University as a professor of physiology and research professor of otolaryngology. From 1965 to 1985, he was emeritus director of research at the Institute. Davis' reseach in St. Louis contributed importantly to both the fundamental physiology and the practical application of the sense of hearing. He was elected to the Presidency of the American Electroencephalographic Society and of the Acoustical Society.



H. Davis and S. Chien.

Hallowell Davis has played an important role in all of the functions of the American Physiological Society. He became a member in 1925. He served as Treasurer from 1942 through 1946. He was elected to the Council in 1956 and became President-Elect in 1957. He was the 31st President of our Society from 1958-59. He also served with distinction on many committees, including the Board of Publications Trustees (1954-1957), the Membership Advisory Committee (1955-1957 and 1960-1961), the Finance Committee (1961-1963), and the Senior Physiologists Committee (1966-1981). He was the APS representative to the Division of Medical Sciences of the National Research Council from 1947-1953.

In these various capacities, he worked closely with Ray Daggs, our Society's second executive secretary. Hallowell Davis once said, "I wonder what would have become of us without such an effective executive secretary as Ray Daggs." Ray Daggs' admiration for Dr. Davis is mutual.

The Ray G. Daggs Award is presented to a physiologist who is judged to have provided distinguished service to the science of physiology and to the American Physiological Society. Shu Chien stated, "It is most fitting that we honor Hallowell Davis today for all the important contributions he has made to physiology and to our Society. It is my great pleasure and privilege to present to you, on behalf of the American Physiological Society, the Ray G. Daggs Award."

Responding, Hallowell Davis said, "This is a very happy moment for me, and I appreciate this award tremendously. I have no words of wisdom; my words of wisdom are already recorded in *The Physiologist.* Thank you all, thank you very, very much."

Ray G. Daggs Award Recipients

1974	H. H. Brookhart
1975	M. B. Visscher
1976	J. D. Hardy
1977	J. H. Comroe
1978	H. Rahn
1979	J. R. Papenheimer
1980	J. R. Brobeck
1981	A. C. Guyton
1982	R. W. Berliner
1983	C. L. Prosser
1984	E. F. Adolph
1985	A. C. Barger
1986	D. B. Dill
1987	O. E. Reynolds
1988	H. W. Davenport
1989	B. Schmidt-Nielson
1990	R. M. Berne
1991	H. Davis

8th International Hypoxia Symposium Dedicated to Hermann Rahn

The 8th International Hypoxia Symposium held in Lake Louise, Alberta, Canada, February 26-March 2, 1991, was dedicated to the memory of Hermann Rahn. This conference begun in 1979 attracts more than two hundred scientists working in the areas of hypoxia and altitude physiology from around the world. Special tribute was paid to Hermann Rahn by Charles Houston and John West, and an annual scholarship to finance an international scholar to attend the conference was established in his honor.

APS/FASEB Spring Meeting

Anaheim, California April 5-10, 1992

APS Sponsored Symposia

Imaging Techniques for Assessing Cell Function. L. J. Heller

Advances in Understanding Cerebral Ischemia/Reperfusion Damage. R. J. Traystman

Pericyte and Mesangial Post-Translational Mechanisms and Vascular Function. D. Shepro

Gene Regulation of Endothelial Cells as a Response to Injury. C. M. Bloor

Strength of Pulmonary Capillaries. J. B. West

Genome Mapping and Sequencing: Role in Cell Physiology. I. S. Edelman

Classical and Unconventional Thyroid Physiology. H. B. John-Alder

Stable Isotope Applications in the Studies of Carbohydrate Metabolism. W. N. P. Lee

Mechanisms of Exercise Modulation of Human Growth. D. M. Cooper

Comparative Effects of Training and Detraining on Muscle Function. S. J. Wickler and D. F. Hoyt

Immunomodulation of Smooth Muscle Function. S. M. Collins

The Origins of Molecular Biology. G. S. Stent

Effects of Hypoxia on Cellular Protein and Gene Expression. H. W. Farber

Excitatory Amino Acid Systems: A New Era in Modification of Central Cardiovascular Neurotransmission. R. W. Rockhold

Molecular Approaches to Motile Systems. D. M. Warshaw

Myoblast and Whole Skeletal Muscle Transplantation: Replacement Therapy for Functional Deficits. J. A. Faulkner

Epithelial Protein Secretion and Trafficking: Mechanisms and Function. S. A. Lewis

Role of Organic Osmolytes in the Renal Inner Medulla. J. M. Sands

How is Urine Concentrated by the Renal Inner Medulla? J. L. Stephenson

Approaches to Cloning Renal Transporters. S. C. Hebert

Mechanisms of Hyperpnea-Induced Airflow Obstruction. J. Solway

New Maps of Flow for the Lung: Fractal, Statistical and Anatomic Descriptions. H. T. Robertson

Renal Responses to Altered Sodium Intake. J. L. Osborn

Debate

Most of the Pulmonary Vascular Resistance is in the Microvessels. J. Butler

Workshop

An Experience of Various Interactive Teaching Techniques. R. Thies

BMES Symposia

Quantitative Studies of Cardiovascular Function with Magnetic Resonance Imaging. L. Axel

Leukocyte-Mediated Ischemic Injury in Muscle. B. Ito and R. J. Korthuis

Mechanical Interactions of the Coronary Vasculature with the Surrounding Myocardium. F. C. P. Yin

NABS Symposia

The Rheology of Cellular Deformation and Activation. R. M. Hochmuth and E. L. Elson

Rheology of Cell Attachment and Adhesion. H. L. Goldsmith and D. A. Hammer

SEBM Symposium

Induction of the Stage of Tumor Progression: Progressor Agents. H. C. Pitot

APS Code of Ethics

Membership in the American Physiological Society includes the acceptance of and the responsibility to uphold the following Code of Ethics.

The role of the physiologist is to advance the field through teaching, research, and service. In the process physiologists shall be honest in their reporting of research findings and ethical in their dealings with others. Moreover, physiologists shall be humane in the treatment of human and nonhuman subjects. Physiologists shall also have the professional responsibility to bring to the attention of appropriate authorities apparent violations of these principles.

Physiologists recognize the Society's responsibility to consider breaches of ethical behavior and to take any response deemed necessary in accordance with the Society's Bylaws, Article IX, Section 5 and as defined in the Operational Guide.

Call for Symposia Topics – Spring 1993

Members are invited to submit proposals for APS symposia to their Section Program Advisory Committee representative. Organizers should consider multidisciplinary approaches with other sections and the contribution by experimentation at multiple levels of investigators.

What specific questions will the symposium address? Are there two or three conflicting issues that warrant presentation and discussion? What does the symposium offer to the intended audience? Are future directions considered in the material to be presented?

Symposia proposals are welcome for the 1993 APS/FASEB spring meeting. Submit proposals to the appropriate Section Program Advisory Committe representative by January 15, 1992. All proposals should include the following: *1*) Title; *2*) Organizer and address; *3*) Abstract (150 words); *4*) Number of half-day sessions; *5*) Names of session chairperson(s); *6*) Presentors/Discussants – approximately six per half day (list the participant's name and title of presentation as it would appear in the program); *7*) Brief biographical sketch (2-3 sentences) of each speaker in the symposium; *8*) Budget information. To coordinate fund-raising efforts by the national office, the anticipated costs to support the travel and lodging of symposia speakers are needed. Symposia are evaluated on the basis of their scientific merit. Organizers will be notified immediately on acceptance of the symposia.

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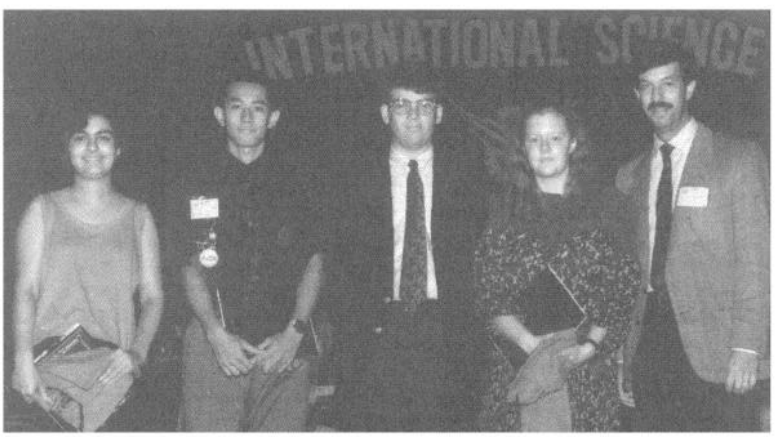
APS Participation in 42nd ISEF

The American Physiological Society expanded its efforts in precollege science education by participating in the 42nd International Science and Engineering Fair (ISEF), Orlando, Florida, May 8-9, 1991. The ISEP, the "World Series" of science fairs, is held annually and marks the culmination of a selection process involving thousands of schools and regional fairs. In Orlando, APS joined with 46 other professional organizations making awards in a variety of disciplines.



(l-r): P. Khatri, Q-A. Thai, B. C. Preisner, R. D. Elms, M. Frank.

The APS selection committee consisted of Carleton H. Baker, Joel M. Price, and Stanley Nazian from the department of physiology, University of South Florida, Tampa; M. Ian Phillips and Sarah Galli from the department of physiology, University of Florida, Gainesville; and Martin Frank, American Physiological Society. The selection committee had the difficult task of first identifying which of the 748 ISEF finalists had projects related to the physiological sciences. From a potential pool of 109 projects, the committee then had to visit and interview the candidates for awards.

During the awards ceremony the APS presented four awards for excellence in the physiological sciences: a first award of $250, and three honorable mention awards. All winners received certificates, subscriptions to *News in Physiological Sciences,* and APS T-shirts "Physiologists Know the Inside Story."

The recipients of the Honorable Mention Awards were Rene D. Elms, Yorktown High School, Arlington, VA (Osmosis and diffusion Part IV: transport and uptake of lead in human erythrocytes); Ben C. Preisner, Hilton Head Preparatory School, Hilton Head, SC (Pursuing Parkinson's project: does caffeine affect L-dopa therapy in MPTP-treated C57BL6 mice?); and Quoc-Anh Thai, Warwick High School, Newport News, VA (PEG-SOD in preventing free radical-mediated reperfusion injury).

The first prize recipient was Pooja Khatri, Lincoln Park High School, Chicago, IL (Prostaglandin-induced potassium currents).

The judging committee regretted that it was only able to make four awards, because there were so many outstanding projects that deserved recognition.

APS Conferences

For the past several years, the American Physiological Society has been transforming its fall meeting from one encompassing all aspects of physiology to one embracing a clearly defined theme or topic. Culmination of that transition has been the scheduling of the APS Conferences for 1991–1993. A listing of their topics can be found elsewhere in *The Physiologist.*

The APS Conferences offer the Society membership the ultimate in programming opportunities. The organizing committee will select the theme or topic, meeting format, abstract categories, method of presentation, and duration of the meeting. The APS will be responsible for all aspects of meeting management and financial support. In essence, the Society is simply asking you to help organize a meeting that presents the best science, and it will provide the space and resources to support you. What more could you possibly ask?

Listed below are more specific guidelines to follow in organizing an APS Conference. Any questions regarding the organization of such meetings should be directed to Carl V. Gisolfi, Chairperson, APS Program Committee, or Martin Frank at the APS office. The deadline for proposals to be considered for 1994 is **February 1, 1992.**

APS Conference Guidelines

Scope

These meetings should focus on a circumscribed area of physiology that attracts a limited (300-500) audience. A concerted effort should be made to integrate overlapping fields of study and levels of investigation, i.e., from molecular biology through systemic physiology.

Organizing Committee

The Program Committee should provide direction by identifying select persons, groups, or perhaps Sections and requesting them to organize a specialty meeting. The "organizing committee" will be responsible for providing APS with *1*) a list of potential meeting sites, *2*) contacts from other societies who may wish to attend or participate in the meeting, *3*) potential outside funding, and *4*) a budget detailing the cost of the meeting.

Management

The APS staff will be responsible for booking site selection, advertisement, setting the registration fee, attracting exhibitors if desired, and solicitation of supporting funds.

Abstracts

Inclusion of volunteered papers on the program is desired. There should be a format that provides graduate and postdoctoral students the opportunity to present their data if the material falls within the scope of the conference. Abstracts will be accepted without evaluation and published by the Society. The organizing committee will be responsible for generating a list of topic categories that fall within the scope of the APS Conference.

Location

The site of the meeting will be flexible. The Society requires at least two years advance notice of proposed meeting sites to book meeting space.

Duration

The meeting should be scheduled for two to three days, preferably over a weekend to take advantage of reduced travel costs.

Program Advisory Committee

The Program Committee will evaluate and contribute to the framework of the meeting. Once this has taken place, and the Program Committee has given its approval, the final content will be presented to Council for their endorsement and approval.

Joint Sponsorship

Joint sponsorship with other societies will be considered.

Number of Meetings

The number of meetings will depend upon the needs of the membership. From 1992 through 1995, not more than two meetings per year will be sponsored by the Society.

Reimbursement Policy

Partial reimbursement for member and nonmember invited speaker expenses may be provided by the Society based on availability of funding.

Time of Year

The meetings should be scheduled from June through December to avoid overlap with preparations for the FASEB meeting.

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.

American Physiological Society Endowment Fund

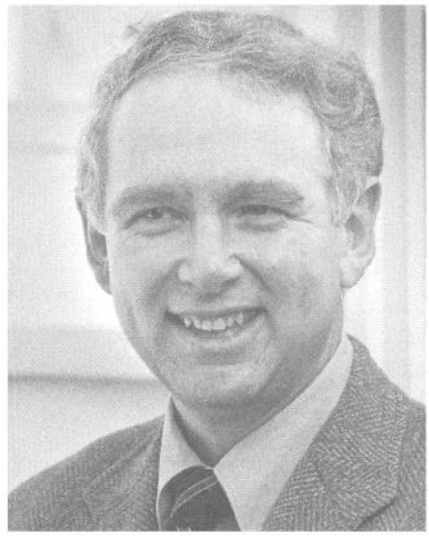
The APS Endowment Fund was established in 1977 to support programs for the development of physiologists and physiology, to encourage communication with other disciplines of science and the public, and to foster scientific and cultural relations with other parts of the world.

The APS Endowment Fund was established to encourage tax-deductible contributions or requests to the society at any time and in any amount, for specific or general purposes. Upon request, the society will provide to a donor or institution contributing a memorial gift a replica of the plaque bearing the name of the individual living or deceased in whose honor the gift was made. The family of or the individual being honored by a donation to the fund will be advised formally of the donor's name, unless the contributor specifically requests that the donation be anonymous.

Donations to the APS Endowment Fund or queries should be addressed to 9650 Rockville Pike, Bethesda, MD 20814.

Introducing . . .

Claude Desjardins



On July 1st, Claude Desjardins will assume responsibility for the *American Journal of Physiology: Endocrinology and Metabolism.* The new editor is a professor at the University of Virginia, where he provides leadership for research and training programs in reproductive endocrinology.

He received a PhD in physiology from Michigan State University, and obtained postdoctoral training in neuroendocrinology at the Jackson Laboratories in Bar Harbor, Maine. He served in the Department of Physiology at Oklahoma State University and then at the University of Texas at Austin. In 1987 he moved to the University of Virginia, where he directs the Center for Research in Reproduction and holds appointments in the Department of Physiology and the Department of Urology.

Desjardins' research has focused on the neuroendocrine control of testicular function. Work from his laboratory has explored the neural control of luteinizing hormone release via sensory and nonsensory pathways, and the action of luteinizing hormone on Leydig cells. Recently his laboratory developed new approaches to study the microvascular control of Leydig cell performance in situ. Intravital microscopy was used to investigate the temporal coupling between the episodic discharge of luteinizing hormone, the delivery of rate-limiting substrates via testicular capillaries, and the discharge of secretory products by Leydig cells.

The new editor's goal for *AJP: Endocrinology and Metabolism* is to speed the review process. Authors can expect to receive editorial decisions within 4–5 weeks after their manuscript arrives in the editorial office. The editors plan to broaden the scope of the Journal to include the endocrine, paracrine, and autocrine actions of hormones. The Journal will continue to emphasize reports on the metabolic action of hormones at all levels of organization: molecular, cellular, and organismal.

The editorial team includes Alan Cherrington, Michael Kilberg, and Robert Wolfe. This team is committed to bringing new referees into the review process. The quality of review will be maintained by soliciting critiques from new and seasoned referees for each manuscript. The editors look forward to serving the Society and any investigator who wishes to submit a manuscript to the *American Journal of Physiology: Endocrinology and Metabolism.*

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, 1991.

APS Hosts Science Teachers

The APS served as host for the 1990 High School Science Teachers Summer Research Fellows at the FASEB 91 meeting in Atlanta, Georgia. Ten of 12 teachers supported by APS and 2 from Wright State University, Dayton, Ohio, attended the meeting with their laboratory hosts. A special feature of the meeting was a luncheon in their honor hosted by the APS Council and Education Committee. During the luncheon, the teachers were asked to talk about their summer experiences and how their exposure to laboratory research had contributed to the enhancement of their education mission.

The teachers were uniformly supportive of the program and expressed their appreciation for the opportunity to see science in action. As Mike Stormo, Vermillion High School, South Dakota indicated, "Research was FUN!!! I experienced science! I can relate (and have been relating) science and research in ways not ever done before. I have a new enthusiasm that even the students have picked up on. When explaining the scientific method this year, I used my summer experience that made the presentation more exciting. The kids loved it also."

Lesli Adler, Wootton High School, Rockville, Maryland, found the summer program very enlightening, expressing the view that "science teachers need more opportunities of this kind." She indicated that "collectively, professional societies . . . are in a position to influence school systems to develop policies that would encourage and enable more teachers to participate in programs like this." Adler has accepted appointment as the lay representative to the IACUC at the Armed Forces Radiobiological Research Institute, Bethesda, where she spent her summer. As she indicated, "the animal rights movement has already impacted my classes" and "has become a sensitive issue in the classroom." Her service on the IACUC has given her "the background, insight and credibility to meet/counter SOAR's (Students Organized for Animal Rights) claims."

Lana Hays, Simon Kenton High School, Independence, Kentucky, expressed her opinion that her summer fellowship "has been the most enjoyable and beneficial program that I have ever experienced for science education." She hopes to translate her experience into a "share-a-thon" to be held at the annual convention of the National Science Teachers Association. According to Hays, "If this can be accomplished, it is hoped that anatomy/physiology teachers will be encouraged to work together to establish practical labs, develop standards, offer future convention sessions, and promote anatomy/physiology in high schools."

Each of the teachers provided testimony to the success of the program, sharing with their colleagues information on how their summer experience improved their teaching. For most of the teachers, the interactions with their hosts have continued during the academic year with visits by the scientists to the classroom and students to the laboratory. Many of the departments participating in the program have contributed their time by serving as mentors for student research projects.

Travis Barnes, Granbury High School, Texas, extended his summer experience by initiating an essay contest on the impact of physiology education for a high school student. His host institution, the Texas College of Osteopathic Medicine, judged the essays and selected Dovie Reynolds's essay as the best (see page 145). Through the generosity of the local Rotary Club, Reynolds was able to attend the meeting in Atlanta and participate in the luncheon.

Because of the success of the 1990 program and the teachers' comments during the luncheon, APS President-Elect Norman Staub said he hopes to see the Society expand the program by developing the luncheon into an all-day workshop providing updates in physiology and a share-a-thon for APS Summer Fellowship recipients and anatomy-physiology teachers from high schools in the vicinity of the APS/FASEB meeting site. By such activities, additional teachers can gain information about current research procedures, techniques, and breakthroughs that will enrich their physiology background.

1990 High School Science Teachers Research Fellows and President-Elect Norman Staub (center top row).

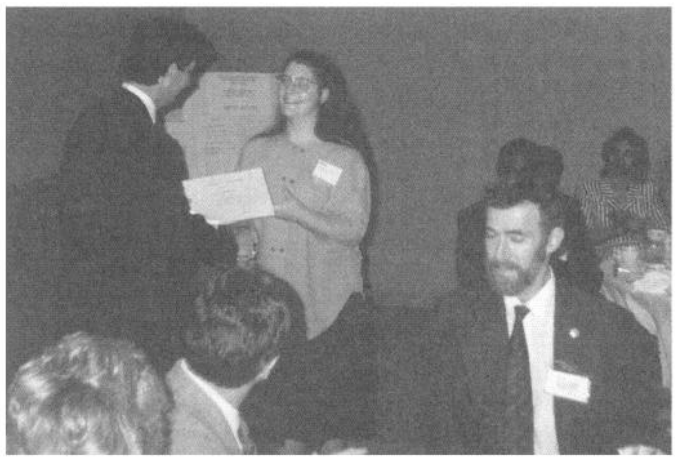
Student Essay
The Importance of Physiology in High School Education

"No knowledge can be more satisfactory to a man than that of his own frame, its parts, their functions and actions," Thomas Jefferson wrote to his friend Thomas Cooper. Physiology, as an autonomous science, has been studied only since the latter half of the nineteenth century, but, as Jefferson pointed out, the subject is quite valuable.

The human body has been a mystery for years. What it does, how, and why are questions to which answers are worth knowing. What is the advantage, however, of including physiology in the subject matter of a secondary school?

The obvious answer always presents itself: physiology should be studied by any student wishing to pursue a career in any medically related field. Future doctors, nurses, and veterinarians would benefit greatly by being exposed to physiology in a high school setting. This reasoning applies to those who wish to teach any biological science. A less distinct and less common reason to study physiology in high school is curiosity. Although there are few students these days who practice "pure science"—knowledge merely for knowledge's sake—a few do remain. For them, because they simply want to know, studying physiology is essential. In addition, not to encourage quackery, yet, knowing how the body functions under normal conditions might give current and former students of physiology an idea of when something is awry—whether a disease is beginning or a disorder is present. Some problems that exhibit no immediately painful symptoms may be heralded to a layman subtly, and knowledge in physiology could help the average person know that something is "wrong," prompting him or her to seek medical help.

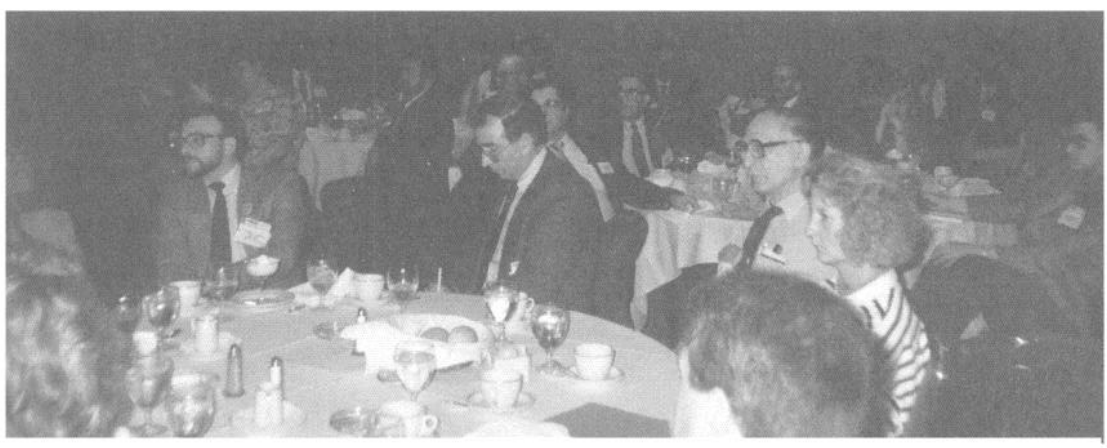
Finally, the study of physiology at the high school level might aid in the prevention of teenage pregnancy. Physiology curricula include an indepth investigation of the human reproductive system, much more detailed than its treatment in a general biology course. In one biology classroom, composed of 30 students (22 sophomores, 9 freshmen, and 1 junior), only two students knew the time in the menstrual cycle in which impregnation is most likely to occur. An instructive course such as physiology could largely increase the awareness of young people to the possibility of pregnancy, as well as dispelling some of the myths regarding conception.



M. Frank congratulating D. Reynolds, winner of the High School Student Essay contest (P. D. Wagner in the foreground).

Physiology, therefore, is an important subject in secondary school. It can aid future learning and career advancement. It can satisfy the curiosity of humans about themselves and their bodies. Not only can physiology safeguard the health and well-being of its students in the future but it can also make certain that they do not forfeit their futures through careless acts. All of these reasons indicate that physiology is advantageous, if not necessary, to a high school curriculum.

Dovie Reynolds
Granbury High School, Texas



1990 High School Science Teachers Research Fellows, 1991 APS/FASEB Meeting, Atlanta, GA, April 22, 1991.

1991 High School Science Teachers Summer Research Program

Twelve high school science teachers were selected for the 1991 Summer Research Program sponsored by the American Physiological Society. The program, in its second year, provides high school science teachers with experiences in modern physiology research.

The 12 teachers, selected in a national competition, were awarded grants that included up to a $5,000 stipend plus $750 to support the teacher's attendance at the April 1992 APS/FASEB meeting in Atlanta, where they participated in a workshop and were honored at a luncheon.

Listed below are the teachers, their high schools, and their host institutions and mentors:

- Roy A. Baldwin, John Marshall High School, San Antonio, TX; University of Texas Health Sciences Center, Roger J. McCarter.
- Haigouhe H. Benson, Cass Tech High School Detroit, MI; Wayne State University, Detroit, Douglas R. Yingst.
- Alice M. Browne, Woodlands High School, Hartsdale, NY; New York Medical College, Valhalla, Francis L. Belloni.
- Cecilia Duenas, Washington Prepatory High School, Los Angeles, CA; University of California School of Medicine, Los Angeles, Kenneth P. Roos.
- Elizabeth Hannon, W.T. White High School, Dallas, TX; University of Texas Southwestern Medical Center, Dallas, James T. Stull.
- Stanley H. Krantz, Cherry Hill High School, Cherry Hill, NJ; Jefferson Medical College, Philadelphia, Allan M. Lefer.
- Edwin F. Robinson, High School Development Center, Detroit, MI; Wayne State University, Detroit, Joseph C. Dunbar.
- Ernest Schiller, Central Lee High School, Donnellson, IA; University of Iowa, Iowa City, Carl V. Gisolfi.
- Jeffrey L. Sellers, Dunedin High School, Dunedin, FL; University of South Florida, Tampa, Carleton H. Baker.
- Harry Shelton, Samuel Gompers Secondary School, San Diego, CA; University of California, San Diego, Peter D. Wagner.
- Mark A. Stallings, Gilmer High School, Ellijay, GA; The University of Georgia, Athens, Benjamin G. Brackett.
- Carolyn Van Norman, Jefferson Parish School System, Harvey, LA; Louisiana State University Medical Center, New Orleans, John J. Spitzer.

High School Science Teachers Research in Physiology Program

$5,000 Summer Stipend

The American Physiological Society is pleased to announce the continuation of a program aimed at providing high school science teachers with experience in physiology research. The program will be carried out through the awarding of grants on a competitive basis to individual members of the American Physiological Society. The grants will fund the involvement of a high school science teacher in the research program ongoing in the APS member's laboratory. Grants will be made for up to $5,750, which includes a $750 allowance for the high school teacher to attend the annual FASEB meeting. Cost sharing of the teacher's stipend or travel award by the APS member's institution is encouraged but not required. The stipend supports full time participation of the high school teacher for up to ten weeks during the summer. In addition to participation and research, it is expected that the high school teacher will take part in a variety of activities at the APS member's institution such as seminars, journal clubs, laboratory rotations, etc. At the FASEB meeting, a special luncheon for the high school teachers and their sponsors will be held so participants can share their experiences.

Grant awards will be based on the overall quality of the program, including: the level of involvement in the research activities of the laboratory; the background and teaching responsibilities of the high school teacher; the quality of the research program as indicated by publication record and financial support of the APS member; plans for other activities in which the high school teacher will take part; plans for continued interaction between the high school teacher and the APS member or the respective institution; and an indication of the expected impact of the high school teacher's participation in his/her own school.

Additional information and application forms can be obtained from: High School Teachers Physiology Research Program, American Physiological Society, 9650 Rockville Pike, Bethesda, Maryland 20814. Tel: (301) 530-7164, Fax: (301) 571-1814.

The program encourages the participation of minority groups by making special efforts to include high school science teachers who are members of underrepresented minority groups or who teach significant numbers of minority students.

Application Deadline: January 15, 1992

Life Scientists Form Coalition for Science Education

Thirty life science organizations representing a combined membership of more than 250,000 scientists have formed a Coalition for Education in the Life Sciences (CELS). The Coalition will take positive steps to remedy the declines in the quantity of students electing careers in the life sciences and in the quality of biological knowledge among the nation's students.

APS Education Committee member **Lois J. Heller** represented the Society at a landmark national Life Science Education Summit held February 1–3, 1991, in Racine, WI, at which CELS was formed. The summit was cosponsored by the American Society for Microbiology and the Johnson Foundation.

Recognizing the importance of major changes in precollege, undergraduate, and graduate-level science teaching and learning, summit participants urged life scientists to undertake a wide range of hands-on actions that will have a positive impact on the pipeline of future life scientists and the scientific literacy of the American public.

The Life Science Education Summit pledged to initiate actions in five key areas:

- Supporting the work of classroom life science teachers through greatly expanded interaction between scientists and teachers;
- Supporting the teaching and learning of science as it is practiced—as an inquiry-based subject rather than a series of facts;
- Supporting nationwide efforts to recruit and retain more ethnic minorities, women, and people with disabilities into the life sciences;
- Fostering the leadership role life science professional societies must take in improving, developing, enhancing, and marketing science education; and
- Creating a reward system that will encourage scientists themselves to become more involved with and committed to science education.

In support for the work of classroom teachers, the Summit recommended actions that would:

- Improve the working environment and reward system for science teachers;
- Help teachers and professors in their understanding of science as a process of inquiry;
- Integrate the intellectual competencies of teacher-scholars and researcher-scholars;
- Find new and better ways for scientists to work with teachers; and
- Foster interaction among scientists and teachers with a special focus on the needs of underrepresented populations.

Howard G. Adams, executive director of the National Consortium for Graduate Degrees for Minorities in Engineering and Science, addressed the critical issue of recruiting minorities in his keynote presentation. "We need to change things. What we're doing now isn't working. We need to find those hard-to-find people and bring them in," he said. "Only students who are identified can be recruited; only students who enroll can be retained; you can't teach them if they're not there."

To help in the recruitment of underrepresented populations, the Summit recommended:

- Encouraging a strong mentoring component to help prepare students academically and improve their self-esteem and chances for success;
- Identifying and rewarding positive role models and making them visible to help change the image of scientists as it is often perceived by underrepresented groups; and
- Developing a data base to share information about ongoing programs that have been effective.

To support teaching and learning science at all levels, the Summit called for a wide range of activities that include help and grant support for developing new investigative laboratory experiences for students, disseminating teaching and learning information in the journals of the scientific societies, distributing materials about life science disciplines and careers, increasing teachers' participation in professional scientific society meetings, and encouraging scientific colleagues to recognize and reward their peers for working with the education community.

ASM is acting as the initial coordinating agent for CELS. A steering committee has been formed and is initiating organizational steps. The ASM Education Officer, Sharon Zablotney, said, "This conference provided the first opportunity for the life sciences community to establish a real network. While no one organization with limited resources can resolve the nation's problems, a coalition of the scientific community working together has infinite potential."

Computerized Editing

Can you supply a disk for your **accepted** manuscript? The APS Publications Office is encouraging the submission of disks for accepted manuscripts for the *American Journal of Physiology* and the *Journal of Applied Physiology.* Disk manuscripts can be created with any popular word-processing software and may be submitted on 3.5- or 5.25-inch low- or high-density diskettes. For information: Krysia Moore (301/530-7169).

1991 Officers and Standing Committees

APS Council

Officers
Norman C. Staub, President (1993)
Stanley G. Schultz, President-Elect (1994)
Shu Chien, Past President (1992)

Councillors
Helen J. Cooke (1994)
Allen W. Cowley, Jr. (1993)
Brian R. Duling (1992)
John E. Hall (1992)
L. Gabriel Navar (1994)
David J. Ramsay (1993)

ex officio members
Norman R. Alpert, Finance (1991)
John S. Cook, Publications (1992)
Carl V. Gisolfi, Program (1991)
Leonard S. Jefferson, Sections (1993)
William S. Spielman, Education (1991)

Society Standing Committees

Animal Care and Experimentation

Maintains and updates the APS "Guiding Principles in the Care and Use of Animals"; provides consultation regarding animal experimental procedures and care; and keeps abreast of legislation and new developments in animal models for student teaching and alternatives for animal usage.

Virginia M. Miller, Chair (1992)
Kenneth M. Baldwin (1993)
Phyllis M. Gootman (1992)
Charles W. Leffler (1993)
Howard S. Lowensohn (1991)
Richard L. Malvin (1991)
Stephen F. Flaim, *ex officio* (1993)
William M. Samuels, *ex officio*

Finance Committee Report – 1991

It is the responsibility of the Finance Committee to review and modify the 1991 budget that was approved by Council in October 1990. With the executive director, business manager, and publications manager, the committee reviewed the Society's performance in 1990, revised the 1991 budget, and submitted it to the Council for final approval. Based on the performance of the Society in 1990, the Finance Committee recommended an overall budget for 1991 of $9,304,200.

During 1990, the Society's journal operations ended the year with expenses in excess of income of $104,217. This figure includes the allocation of $200,000 to a contingency fund. The Society's book operations ended the year with income in excess of expenses in the amount of $86,132. The Society's general fund derived from direct membership activities ended the year with a deficit of $151,916.

The Finance Committee is also responsible for reviewing the performance of three management groups managing our investment accounts through the consultative services of Shearson Lehman Hutton. As of December 31, 1990, the accounts had the following market value: Operating Reserve Investment Account = $4,205,474; Publications Contingency and Reserve Account = $3,175,083; Caroline tum Suden Account = $285,071; IUPS Account = $205,240; Perkins Memorial Fund = $165,030.

In 1991, the Society began its transition to a three-tiered subscription system with the goal that nonmember individuals and members would ultimately pay two-thirds and one-third of the institutional rates, respectively. As a result of Council's decision, the 1991 institutional subscription rates were increased by 12% above the 1990 rates, while member and nonmember individual rates remained unchanged.

In proposing the 1992 subscription rates, the Finance Committee had extensive discussions with the Publications Committee and journal editors. Several options were considered for recovering the additional costs associated with an expanding journal program. These included increasing page charges, increasing subscription prices, initiating a manuscript handling fee, and limiting the number of pages published. As a result of the discussions, the Finance Committee recommended, and the Council approved, an increase in page charges to $50 per page, a 15% increase in institutional subscription rates for the consolidated *American Journal of Physiology*, and a 10% increase for all other journals. The 1992 rates for members and nonmember individuals will remain unchanged.

For 1991, the Society General Fund is projected to show a deficit of $139,560 as a result of the Council's decision to support two APS Conferences, one in Bar Harbor, Maine, and the other in San Antonio, Texas, and to allocate funds for a high school science teachers summer research program. As part of the Finance Committee's and Council's strategic plan to utilize a portion of the Society's reserves to benefit the membership, $150,000 was transferred from the managed accounts to the Society General Fund. In addition, $25,000 was allocated for support of the minority programs administered by the Porter Physiology Development Committee.

During the Council meeting, it was recommended that contributions received under the Second Century Corporate Founders Program ($275,000) be combined with funds derived from the Society's short-term investment accounts to formally establish a $1 million Program Endowment Fund to support the spring meeting program. This represents the culmination of an effort initiated in 1987 to develop a mechanism to ensure stable funding for the meeting.

In reviewing the Society General Fund, the Finance Committee expressed concern about the fact that approximately 10% of the membership is in arrears in their dues. In part, this was thought to be a result of the July 1 start date for the dues year. In order to encourage prompt payment of dues and to encourage members to subscribe to the APS journals, it was recommended that dues and subscriptions be combined on the same notice. This will also help ensure that members who are in arrears will have to pay their dues before they can subscribe to the journals at member rates.

The Finance Committee is also responsible for receiving and reviewing the annual audit performed by Coopers and Lybrand. The audit found the operations of the Society to be "in conformity with generally accepted accounting principles" and that the finance statements "present fairly, in all material respects, the financial position of the American Physiological Society." For the information of the membership, the Society's Balance sheet for 1990 is provided for review.

Norman Alpert, Chair
Finance Committee

APS Balance Sheet December 31, 1990

Assets		Liabilities	
Cash, including savings accounts	$ 1,214,580	Accounts payable and accrued expenses including $83,370 in 1990 due FASEB	$ 678,911
Certificates of deposit	4,852,636		
	6,067,216	Unearned income	
US treasury bill, at cost which approximates market value	965,736	Subscriptions	3,998,747
Marketable securities, at cost, market value: 1990, $7,380,559	7,343,407	Dues	213,598
Accounts receivable, including $20,000 in 1990 due from FASEB	510,509		4,212,345
Accrued interest receivable	100,580		4,891,256
Advances to section editors	178,134	Unexpended grants and programs	1,206,092
Inventories, net of inventory reserve of $300,000 in 1990	811,616		6,097,348
Prepaid expenses	32,002	**Fund Balances**	
Furniture, fixtures and equipment, net of accumulted depreciation of $135,981 in 1990	88,775	Publications general fund	7,839,555
	16,096,975	Publications special fund	21,904
Net assets restricted and allocated for unexpended grants and programs:		Society general fund (deficit)	(72,459)
Cash, including savings accounts: 1990, $58,147	324,205	Publications contingency and reserve fund:	
Certificates of deposit	192,227	Program Endowment Fund	500,000
US treasury bills, at cost which approximates market value	—	Principal	2,397,620
Marketable securities, at cost, market value: 1990, $655,341	632,290	Income	519,099
Accounts receivable, net	57,370		11,205,719
	1,206,092		$17,303,067
	$17,303,067		

Career Opportunities in Physiology

Provides Council with information regarding availability and needs for appropriately trained physiological personnel and recommends measures to assure proper balance in the supply and demand for physiologists.

Lewis B. Kinter, Chair (1991)
Nancy M. Coddington (1991)
Mary A. Frey (1993)
Ronald R. Geller (1993)
M. Harold Laughlin (1992)
Paul A. Murray (1992)
Mary Townsley (1991)

Committee on Committees

Serves as an advisory committee on Council to make recommendations for nominees to the standing committees and reviews charges of the various committees regarding overlapping responsibilities.

Beverly Bishop, Chair (1991)
Edward H. Blaine (1992)
Elsworth R. Buskirk (1992)
Stanley M. Cain (1993)
Brian R. Duling (1992)
Alan R. Hargens (1991)
Leonard R. Johnson (1991)
John T. Stitt (1993)

Ray G. Daggs Award

Annually selects a member of the Society to receive this award in recognition of distinguished service to the Society and to the science of physiology.

David F. Bohr, Chair (1991)
A. Clifford Barger (1993)
Walter C. Randall (1992)

Education

Provides leadership and guidance in the area of physiology education of undergraduate, graduate, and professional students; recommends objectives for graduate programs in physiology; and organizes workshops on the application of new techniques to physiological problems.

William S. Spielman, Chair (1991)
Mukul R. Banerjee (1992)
Francis L. Belloni (1993)
James P. Filkins (1991)
Lois J. Heller (1992)
Barbara A. Horwitz (1993)
Michael G. Levitzky (1991)
Lynne E. Olson (1993)
Robert G. Carroll, *ex officio* (1994)

Finance

Reviews the proposed annual budget and fiscal plan for all Society activities and recommends a final budget and implementation plan to Council. Supervises the investment of the Society's financial resources subject to approval of Council.

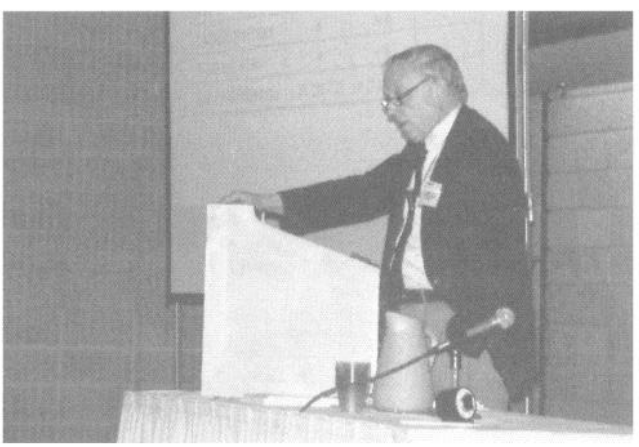
Norman R. Alpert, Chair (1991)
Franklyn G. Knox (1992)
M. Ian Phillips (1993)
Stanley G. Schultz, *ex officio* (1992)
John S. Cook, *ex officio* (1992)
Martin Frank, *ex officio*
James C. Liakos, *ex officio*

Publication Highlights

Journals

In 1990 the *American Journal of Physiology,* including *Advances in Physiology Education,* and the *Journal of Applied Physiology* published only 1% more pages than in 1989, and the number for the first half of 1991 has declined by about 4% compared with the same period last year. During 1990, however, there was an increase of 8% in manuscript submissions, and as the reviewing and processing of these manuscripts is completed, we can anticipate a corresponding rise in the number of papers published in the rest of 1991. Overall growth in these journals is continuing, with a further 4% increase in submissions through June 1991 compared with submissions through June 1990. Statistical fluctuations make it dangerous to predict long-range trends in the individual journals, but those showing the largest and most sustained increases appear to be *AJP: Cell Physiology, AJP: Gastrointestinal and Liver Physiology, AJP: Regulatory, Integrative and Comparative Physiology,* and the *Journal of Applied Physiology.*

AJP: Lung Cellular and Molecular Physiology will change from bimonthly to monthly publication in 1992, which should enhance the journal's attractiveness to submitting authors and strengthen its position with respect to its competitors.



J. S. Cook addressing the journal editorial boards in Atlanta, GA.

The number of articles published in the *Journal of Neurophysiology* has remained fairly constant over the past two years. *Physiological Reviews,* however, almost doubled in size in 1990 to accommodate a large backlog, but fortunately its new larger format resulted in significant savings in printing costs per article. Further savings were effected by editing all articles on disk.

Three new journal editors assumed their duties in 1990: **Dale Benos** (University of Alabama at Birmingham) for *AJP: Cell Physiology;* **William Dantzler** (University of Arizona) for *AJP: Regulatory, Integrative and Comparative Physiology;* and **Luis Reuss** (University of Texas Medical Branch at Galveston) for *Physiological Reviews.* In addition, three other editors have been appointed and assume their posts in 1991: **David Alpers** (Washington University) for *AJP: Gastrointestinal and Liver Physiology* succeeds John Williams; **Claude Desjardins** (University of Virginia) for *AJP: Endocrinology and Metabolism* succeeds **Jim Jefferson,** and **Mary Anne Farrell Epstein** (University of Connecticut) takes over from Joe DiStefano as editor of the Modeling Methodology Forum (newly named Modeling in Physiology). **Neil Cherniack** has accepted reappointment as editor of the *Journal of Applied Physiology* from July 1992 through June 1995.

To help balance the journals' budget for 1992, the Publications Committee recommended increasing page charges from $40 to $50 and postponing institu-

tion of a manuscript handling fee. (The average total cost for printing a page in one of our journals is approximately $250.) The recommendations have been approved by Council, but it is apparent that a manuscript handling fee will soon become unavoidable.

D. J. Massaro meeting with editorial board members of *AJP: Lung Cellular and Molecular Physiology.*

Council also approved a 15% increase in the institutional subscription rate for the *American Journal of Physiology* and a 10% increase for all other journals. The increases were mandated, as usual, by increased printing costs and the anticipated increase in the number of pages to be published next year. The differential increases reflect the fact that, although the journals' overall budget is virtually in balance, the *American Journal of Physiology* is the major money loser and is supported by modest excess income over costs for the other journals.

The Council also moved to cut costs by ceasing publication of abstracts from other related journals (mostly affecting the *Journal of Applied Physiology*), with an exception being made for *Advances in Physiology Education* where the abstracts are culled largely from nonphysiology journals, and by restricting the publication of symposia.

The number of subscriptions to the consolidated *American Journal of Physiology, Journal of Applied Physiology, Journal of Neurophysiology,* and *Physiological Reviews* declined an average of 3%, about the same rate as the last 10 years and about the same as other professional journals. This net figure is the result of a fairly high turnover, with most of our journals losing 8–10% of their old subscribers and gaining 6–7% new subscribers. We are continuing a promotional campaign to win back the old subscribers. Subscriptions to the individual specialty journals of *American Journal of Physiology* show even larger fluctuations in turnover numbers, but the net numbers remain virtually constant.

The program offering *News in Physiological Sciences* at half price ($25 per year) to any member of a society affiliated with IUPS has netted about 600 new

V. S. Bishop discussing the fine points of refereeing with the *AJP: Heart and Circulatory Physiology* board members.

Government Relations Initiative Program (ad hoc)

Develops short-term and long-term educational, informational, and political strategies for the Society to use to counter the challenge of antivivisectionists and recommends to Council policy statements and positions on legislation and regulatory proposals affecting the use of animals in research and teaching.

Allen J. Cowley, Jr., Chair (1991)
Thomas F. Burke (1991)
Arthur C. Guyton (1991)
Francis J. Haddy (1991)
Howard S. Lowensohn (1991)
Sidney Solomon (1991)
Fred W. Zechman (1991)
Virginia M. Miller (1992)
Gabor Kaley (1993)

Honorary Membership

Recommends to Council Candidates for nomination to honorary membership, distinguished scientists who have contributed to the advancement of physiology.

Robert W. Berliner, Chair (1991)
William F. Ganong (1992)
Aubrey E. Taylor (1993)

International Physiology

Handles all matters pertaining to international physiological affairs, with an emphasis on developing countries; maintains a clearinghouse for linkages with developing countries; and recommends to Council, APS members to participate in the US/USSR Bilateral Exchange Program in Physiology.

Donald B. Jennings, Chair (1991)
Clark M. Blatteis (1991)
Phillip D. Gollnick (1993)
Dike N. Kalu (1992)
Daniel R. Richardson (1993)
Harvey V. Sparks, Jr., *ex officio* (1991)

Liaison with Industry

Fosters Interactions and improved relations between the Society and industry; cooperates with the Career Opportunities in Physiology Committe to encourage high school and college students to choose a career in physiology.

Stephen F. Flaim, Chair (1993)
Mordecai P. Blaustein (1991)
David P. Brooks (1993)
Michael J. Cronin (1993)
John W. Fara (1991)
Lyle H. Hamilton (1991)
Carl V. Gisolfi, *ex officio* (1991)
Lewis B. Kinter, *ex officio* (1991)
William S. Spielman, *ex officio* (1991)

Long-Range Planning

Advises and reports annually to Council and interacts with the Section Advisory Committee; prepares systematic, periodic analyses and realistic assessments of past and present societal performance and accomplishments; conducts with other organizations; and devises specific goals and objectives pertinent to the future scientific mission of APS and American physiology.

Francis J. Haddy, Chair (1993)
Gerhard Giebisch (1991)
Joey P. Granger (1991)
John E. Hall (1993)
Ralph Lydic (1992)
Donald J. Marsh (1993)
Jere H. Mitchell (1991)
David J. Ramsay (1993)
Jackie D. Wood (1992)

subscriptions, of which 300 are purchased by IUPS for distribution to Third World and Eastern European countries. This promotion is continuing and, for example, is being publicized at the regional IUPS Meeting in Prague July 1–5, 1991.

W. H. Dantzler welcomes input from the board members of *AJP: Regulatory, Integrative and Comparative Physiology.*

Books

On recommendation of the Handbook Advisory Committee, chaired by **Douglas Stuart,** with the concurrence of Oxford University Press, the Publications committee and Council have appointed editors for new handbooks: **Maurice Goodman** (University of Massachusetts) for Endocrines, **Melvin Fregly** (University of Florida) and **Clark Blatteis** (Memphis) for Adaptation to the Environment, **Lee Peachey** (University of Pennsylvania) for Muscle and Motility, **Edward Masoro** (University of Texas Health Science Center) for Aging, and **William Dantzler** (University of Arizona) for Comparative Physiology. **Joseph Hoffman** and **Jim Jamieson** (Yale University) are well along with Cell Physiology. Editors have been proposed for Neurophysiology and editors for Exercise Physiology are currently being recruited. Initiation of handbooks on Heart and Circulation has been postponed for two years. The final volume of *The Gastrointestinal System,* edited by **Stanley Schultz,** appeared in January 1991, and the two volumes on *Renal Physiology,* edited by Erich Windhager, are in press.

Five books in the Clinical Physiology series, organized by **Julien Biebuyck's** committee, have achieved or are nearing publication: *Response and Adaptation to Hypoxia: Organ to Organelle* (Lahiri and Cherniack), published in February 1991, and *Hypoxia, Metabolic Acidosis, and the Circulation* (Arieff), *Endothelin* (Rubanyi), *Glucose Metabolism, Diabetes, and the Vascular Wall* (Ruderman), and *Hypertension in Blacks* (Fray and Douglas), which all have a 1992 publication date.

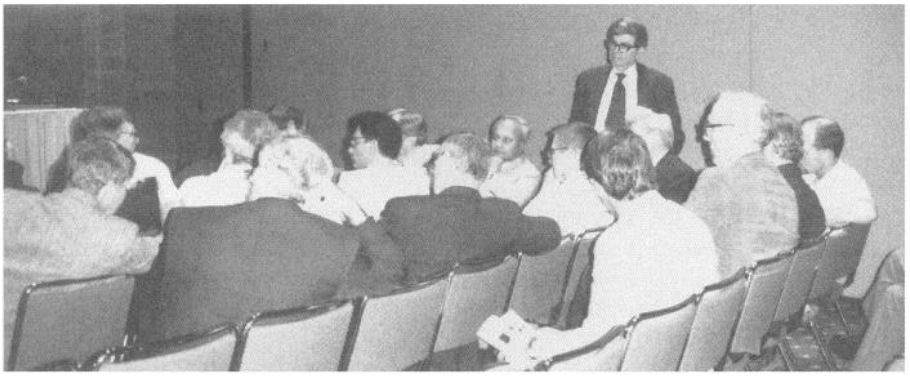
D. Benos exhorting the board members of *AJP: Cell Physiology* to even greater efforts.

Also expected within the year is the first volume in the new Technical Book series, *Fractals in Physiology,* edited by **J.B. Bassingthwaighte, L.S. Liebovitch,** and **B.J. West. Stephen White** is progressing with *Membrane Proteins: Structural and Analytical Methods.*

Initiatives

Keeping journal expenses in line is always an issue. A number of cost-cutting procedures have already been introduced, and new ones are under consideration. Authors (and editors) can help by reducing repetitions and overextensive literature citations in their Discussions; this reduction could easily save 10% in pages published and the associated costs and would greatly improve the readability of most papers.

Editing of accepted manuscripts on disk continues to expand; a third of the articles published in the first five months of 1991 were processed on disk, which is almost twice as many as in the same period last year. Publications is prepared to receive accepted manuscripts on disks in many formats, although a hard copy is still required for initial submissions. Submission of accepted manuscripts on disks is encouraged, because processing disks costs less than typesetting articles from hard copy.



Journal of Applied Physiology editor, N. S. Cherniack, has a lively discussion with his board members.

A major concern of the Publications Committee is the potential impact of electronic publishing on our journals. At a meeting this winter with librarians we heard that the printed journals are not likely to go out of fashion in this decade and that options for electronic publishing are now so numerous and chaotic that we would be well advised not to make any major commitments or investments until things settle down. We plan to monitor developments closely.

Given that we have no plans to discontinue publishing journals, we are faced with problems with the consolidated *American Journal of Physiology.* In its present format, it is too big to mail at second-class rates overseas and foreign subscribers have to bear the considerable extra expense of expedited mailing. In addition, references to the *American Journal of Physiology* are clumsy, inconsistent, and create problems in retrieval. Several options are being considered to deal with these issues. The most likely course, though it is by no means certain, is to discontinue the specialty journals and their individual volume numbers (currently anywhere from volume 4 to 30) and publish the *American Journal of Physiology* in eight parts that correspond to the specialty journals, all with the historical volume number of the consolidated journal (currently volume 260). Subscriptions would continue to be available in single parts, and the editorial structure would remain unchanged. There remain technical problems to be resolved and the change, if it occurs, will not come before 1993. Constructive suggestions from the readers and APS members are welcome.

J. S. Cook, Chair
Publications Committee

Membership

Considers all matters pertaining to membership; reviews and evaluates applications received from candidates for membership and recommends to Council the nominees for election to regular and corresponding membership.

Eugene M. Renkin, Chair (1992)
Frank P. Conte (1993)
Suzanne M. Fortney (1993)
James G. Dobson, Jr. (1992)
Ronald J. Korthius (1991)
Jay A. Nadel (1993)
Edward G. Schneider (1991)

Perkins Memorial Fellowship

Selects recipients for visiting scientist family support awards and supervises the administration of the Perkins Funds.

Harvey V. Sparks, Jr., Chair (1991)
Robert F. Grover (1992)
Charles V. Paganelli (1991)
Nicholas Sperelakis (1992)
Molly P. Hauck, *ex officio*

Porter Physiology Development

Selects recipients for visiting scientists and professorships; teaching and training fellowships, aimed at improving physiology departments of medical schools with predominantly minority enrollments. Counsels underdeveloped physiology departments; assists in the selection of NIDDK minority fellowship awards; and supervises the administration of the Porter Fund.

H. Maurice Goodman, CoChair (1992)
Eleanor L. Ison-Franklin, CoChair (1993)
Douglas C. Eaton, (1993)
Richard M. Effros (1993)
Pamela Gunter-Smith (1993)
David E. Mohrman (1992)
L. Gabriel Navar (1991)
Fleur L. Strand (1993)
James G. Townsel (1991)

Program

Develops the scientific programs for the Society with the assistance of the Program Advisory Committee; assists Council in shaping policy for scientific programs and in the organization of fall specialty meetings.

Carl V. Gisolfi, Chair (1991)
Larry I. Crawshaw (1993)
James M. Downey (1992)
Robert D. Foreman (1991)
George A. Hedge (1992)
Heinz Valtin (1991)
Stanley G. Schultz, *ex officio* (1992)

Program Advisory

Recommends to the Program Committee scientific programs for APS meetings; organizes contributed abstracts into sessions; selects session chairs and introductory speakers.

Cardiovascular – Erik L. Ritman & Diane Kunze (1994)
Cell and General Physiology – Peter M. Cala (1993)
Comparative Physiology – Stephen H. Wright (1991)
Endocrinology and Metabolism – David Wasserman (1992)
Environmental and Exercise Physiology – Barbara A. Horwitz (1993)
Gastrointestinal Physiology – Gilbert A. Castro (1993)
Nervous System – Richard A. Hawkins (1994)
Neural Control and Autonomic Regulation – Marc P. Kaufman (1991)
Renal Physiology – Mark A. Knepper (1992) & Bruce M. Koeppen (1993)
Respiratory Physiology – Aron B. Fisher (1994)
Teaching of Physiology – Philip A. McHale (1994)
Water and Electrolyte Homeostasis – Gerald F. DiBona (1992)
Clinical Physiology Subcommittee – (To be announced)
Epithelial Transport Group – Douglas C. Eaton (1991)
History of Physiology Group – Giuseppe Sant'Ambrogio (1994)
Hypoxia Group – Hershel Raff (1992)

Council of Academic Societies Association of American Medical Colleges

The Council of Academic Societies (CAS) is one of the three Councils that make up the Association of American Medical Colleges (AAMC), the other two being the Council of Deans (126 medical school deans) and the Council of Teaching Hospitals (administrators of 405 hospitals that teach medical students, interns, and residents). CAS has 90 member societies that cover the whole range of medical faculty interests from biomedical research to clinical specialty groups. Each society has two CAS representatives, and we are the representatives from the American Physiological Society. CAS meets twice a year, in the fall at the annual AAMC meeting and in the spring. The following is an account of several of the discussions items from the recent spring meeting that may be of interest to physiologists.

For several years AAMC has been interested in issues related to the conduct of biomedical research, such as ethical issues surrounding the humane use of animals, misconduct and conflict of interest of researchers, the availability, or lack of availability, of federal grant funds from NIH and ADAMHA, grant policy (grant duration, costs, full funding/downward negotiation, etc.), and research manpower (funding of research training programs for basic scientists and clinicians). AAMC has now formed an Advisory Panel on Biomedical Research (APBR) to consider these and other important research issues on a regular basis, to gather information, set policy, lobby federal agencies and Congress, and inform the research public as well as the general public.

In the following discussion sessions, CAS members considered some current issues related to junior faculty; the first two relate specifically to the medical school situation, but the last two relate to any research university.

The Role of PhD Investigators in Clinical Departments

The discussion centered on some of the differences in responsibilities of PhDs in basic science and clinical departments: teaching and the availability of graduate students, how research problems are selected and whether research interests must coincide with those of clinical colleagues, and financial support. It was concluded that there are many benefits to these types of appointments, such as the interaction with colleagues who can help with clinically relevant aspects of research problems. In many instances interim financial support is available if needed, and in some schools salaries are higher than in basic science departments. The drawbacks were seen to be the lack of choice in research projects in instances where the clinicians decide the projects that will be supported by departmental funds, lack of access to graduate students, and lack of peer evaluation in personnel actions. The drawbacks were seen to be problems that could be solved by having a joint appointment in a basic science department.

Overcoming Disincentives and Creating Incentives to Attract Junior Faculty who are Committed to Research in Clinical Departments.

The group discussed many problems related to recruiting and retaining competent junior-level clinician investigators. The issues are largely financial ones: the need for investigators to see a large number of patients to assure a salary large enough to live comfortably and also to pay back educational loans that commonly amount to $80,000–$100,000, the lack of protected time for research, and the inability to say no to increased clinical duties. The suggested solutions involve instituting "bridging" salaries for the first three years to allow new clinical faculty more time in the laboratory and away from patient care duties, stronger policies on protected time, in-house Research Career Development Awards, and the development

of mentors and support groups for clinical researchers in the early stages of their careers.

The Balance Between Nurturing and Fostering in Young Investigators

The problems discussed related to the wide range in quality of the training programs experienced by graduate students, postdoctoral fellows, residents and clinical fellows, from the extreme of "slave labor" types of labs to those with no structure and little guidance. They identified the best training situation as that in which the mentor(s) not only privides the research resources but also the necessary time and personal contact. Senior researchers and/or their departments should identify the body of knowledge that is to be transmitted by the training program and should address issues related to the ethics of science (including the use of animal and human subjects in research), conflict of interest, issues of authorship and publication, as well as grantsmanship, career choices, and assistance with job hunting.

Tensions Between Teaching and Research Duties of Young Faculty

The perception of many faculty is that the universities reward research contributions to a greater extent than they do teaching and service. Young faculty in clinical and basic science departments learn quickly that they are expected to help in meeting the financial needs of their departments, by either clinical income or research grants, and these expectations are reflected in the promotion process. Although many schools have stated principles that emphasize the importance of good teaching, the above-mentioned attitudes are well entrenched. Part of the problem may be due to the fact that training programs emphasize research and provide little or no formal training in teaching methodology, which is largely learned by example and "on the job." This is particularly true of clinical faculty, because at least some basic science faculty have served as teaching assistants (TAs) in laboratory courses during their training as graduate students, and in some institutions instruction in teaching methodology is required for TAs. The discussants suggested that there is a need for task-related criteria for academic advancement and that excellence in teaching should be rewarded in a similar manner as excellence in research. They also suggested that peer-review of teaching should be formalized to ensure that a faculty member's contributions to the department's teaching program are fully documented.

Sarah D. Gray
University of California, Davis

George A. Hedge
West Virginia University

APS Representatives

APS Conferences

Integrative Biology of Exercise
Colorado Springs, Colorado
September 23-26, 1992

The Cellular and Molecular Biology of Membrane Transport
Orlando, Florida
November 4-7, 1992

Myo-Bio — Jack A. Rall
Liaison with Industry — Stephen F. Flaim (1993)
Education Committee — William S. Spielman (1991)

Public Affairs

Advises Council on all matters pertaining to public affairs that affect physiologists and implements public affairs activities in response to Council guidance.

Gabor Kaley, Chair (1993)
John R. Claybaugh (1992)
Claude Desjardins (1992)
Malcolm S. Gordon (1991)
Henry R. Hirsch (1991)
Virginia H. Huxley (1993)
Virginia M. Miller, *ex officio* (1992)
Stephen F. Flaim, *ex officio* (1993)
William M. Samuels, *ex officio*

Publications

Manages all Society publications including the appointment of editors and editorial boards; supervises the Book Advisory Committees (handbooks, technical, clinical series, and history) to ensure timely publication.

John S. Cook, Chair (1992)
Melvin J. Fregly (1991)
Loring B. Rowell (1993)
James A. Schafer (1993)
Charles M. Tipton (1992)
Norman C. Staub, *ex officio* (1992)
Martin Frank, *ex officio*
Brenda B. Rauner, *ex officio*
NIPS Managing Board
John S. Cook (1992)
Howard E. Morgan (1993)

Section Advisory

Recommends to Council ways to strengthen the sections' roles in programs, public affairs, and governance of the Society; serves as a Nominating Committee to nominate Society officers; and nominates members as candidates for membership on Society committees.

Leonard S. Jefferson, Chair (1993)
Cardiovascular – Richard Traystman (1992)
Cell and General Physiology – Melvyn Lieberman (1992)
Comparative Physiology – Eldon J. Braun (1994)
Endocrinology and Metabolism John Resko (1992)
Environmental and Exercise Physiology – Ethan R. Nadel (1994)
Gastrointestinal Physiology – Jackie D. Wood (1994)
Nervous System – Richard A. Hawkins (1994)
Neural Control & Autonomic Regulation – Marc R. Kaufman (1993)
Renal Physiology – Walter F. Boron (1993)
Respiratory Physiology – Joe R. Rodarte (1993)
Teaching of Physiology – Daniel Richardson (1993)
Water and Electrolyte Homeostasis – John E. Hall (1994)

Senior Physiologists

Maintains liaison with senior and emeritus members and assists in the selection of recipients of the G. Edgar Folk, Jr., Awards.

David G. Greene, Chair (1992)
Horace W. Davenport (1992)
A. Pharo Gagge (1993)
Steven M. Horvath (1992)
John T. Reeves (1993)
Helen M. Tepperman (1993)

Cardiovascular Section

The Annual Banquet and Business Meeting of The Cardiovascular Section was held on Tuesday, April 23, 1991, at the Marriott Marquis, Atlanta, Georgia.

Section Committee Membership for 1991-92

Richard J. Traystman will be the new section chairman and James W. Covell will be the new treasurer. Harris Granger was elected the new secretary. D. Neil Granger was elected to a 3-year term on the Nominating Committee (1994) to replace James B. Bassingthwaighte. The remaining members of the Nominating Committee are James M. Downey, *Chairman* (1992) and Kim P. Gallagher (1993). Diana Kunze will serve as a new Program Advisory Committee representative to replace Harris J. Granger. Erik L. Ritman is the other Program Advisory Committee representative. Richard J. Traystman was appointed the Section Advisory Committee representative to replace Douglas Griggs, who resigned from this position. Traystman's term will end in 1992, at which time the section will begin the practice of having a three-year term for the Section Advisory Committee representative with the new representative every three years being the incoming secretary. Thus in 1992 the new Section Advisory Committee representative to replace Traystman will be the newly elected secretary in 1992. Frank C. Yin will serve as the representative of the Cardiac Mechanics Subsection and D. Neil Granger will serve as the representative of the Splanchnic Circulation Subsection, Granger replacing Albert P. Shepherd, whose term expired.

Section Membership and Fellowship

The Cardiovascular Section is open to any APS member. The current primary regular membership of the Cardiovascular Section is 942, which is 40% of all primary regular members of the APS.

Fellows are those members of the Cardiovascular Section who have made contributions to the understanding of cardiovascular physiology. There were 280 fellows in 1990 and 4 new fellows were elected this year, for a total of 284 current fellows. Nominations for new fellows must be made by two active fellows of the Cardiovascular Section, with supporting letters optional. Nomination materials are sent to the secretary of the Cardiovascular Section. Nominations are then voted on by the Steering Committee. In 1991, the following members were elected to fellowship: Jeffrey L. Ardell, Virginia H. Huxley, Steven W. Mifflin, and Robert S. Reneman.

Awards

The Cardiovascular Section presents two awards annually. The Lamport Award is presented to an outstanding investigator less than 36 years of age who has made contributions to cardiovascular physiology. The Lamport Awardee is selected by the Wiggers Awardee of the previous year. Vernon Bishop selected Frank M. Faraci, assistant professor, University of Iowa, as the 1991 Lamport Awardee. At the Cardiovascular banquet, Faraci was presented with a certificate and a check for $200 from the Cardiovascular Section.

The Carl J. Wiggers Award is presented in honor of the founder of the Section. Each year at the Cardiovascular Section banquet, the award is presented to an outstanding cardiovascular physiologist in recognition of continued contribution to cardiovascular physiology. The award for 1991 was presented to Norman Alpert, professor and chairman, Department of Physiology, University of Vermont. Alpert was presented with a bronze plaque and delivered a lecture entitled "Molecular Motors in Heart Failure: Reminiscences."

Banquet Program

At the annual banquet, Allyn Mark introduced the participants in the chairman's symposium, which was held on Tuesday afternoon, April 23, 1991. The symposium was entitled "Advances in Integrative Neurocirculatory Physiology" and consisted of the following presentations: Chairman's Introduction, Allyn L. Mark, University of Iowa; Signal Analysis in Assessing Neural Control of the Cardiovascular System: What's to be Learned?, J. Philip Saul, Children's Hospital and Harvard Medical School; Simultaneous Measurements of Sympathetic Nerve Traffic and Norepinephrine Spillover in Study of Sympathetic Study in Humans, Robert F. Rea, University of Iowa; Positron Emission Imaging of Cardiac Sympathetic Innervation and Function Using [^{18}F]Fluorodopamine, David S. Goldstein, Clinical Neuroscience Branch, NIMDS, NIH; Autonomic Cardiovascular Adjustments to Exercise, Jere Mitchell, University of Texas Health Science Center at Dallas; Regulation of Sympathetic Function in Heart Failure, David W. Ferguson, University of Iowa; Sympathetic Mechanisms in Cyclosporine-Induced Hypertension, Ronald G. Victor, University of Texas Health Science Center at Dallas; and Autonomic Failure: New Insights, Chris Mathias, University of London and St. Mary's Medical School, London.

Aubrey E. Taylor presented an irreverent introduction of the new secretary, Harris Granger. Allyn L. Mark presented a memorial tribute to Michael J. Brody, who died on December 3, 1990. The secretary, James Covell, introduced the new member of the Nominating Committee, D. Neil Granger. Covell also delivered a report and obtained approval for election of four individuals who were recommended for fellowship. The individuals are Jeffrey L. Ardell, University of South Alabama; Virginia H. Huxley, University of Missouri-Columbia; Steven W. Mifflin, University of Texas Health Science Center at San Antonio; and Robert S. Reneman, University of Technology, Eindhoven, The Netherlands.

Richard Traystman gave the treasurer's report and indicated that the Section's finances were sound. Vernon Bishop presented the 1991 Harold Lamport Award. Allyn Mark introduced the new chairman of the Cardiovascular Section, and he presented the 1991 Wiggers Award.

Other Business

In addition to the items discussed above, there are several items that were discussed by the Steering Committee during 1991-92 with no resolution.

First, Allyn Mark drafted a proposal to alter the selection process for the Harold Lamport Award so that it would resemble many other young investigator awards. The applications might include a brief manuscript, perhaps limited to less than 10 pages, a curriculum vitae, and a letter of nomination of the candidate, with five finalists selected. The proposal would involve having the five finalists present their work at a Lamport Award session at FASEB with the selection committee acting as judges and selecting the winner and runner-up based on the presentations. The winners would be announced at the annual banquet. The proposal received general enthusiastic support from the treasurer and secretary, as well as from Vernon Bishop and Martin Frank. It was not, however, implemented in 1990-91 because Allyn Mark envisioned the need for travel support for the finalists, as well as for an increased financial support from a pharmaceutical company. Upon reflection it would seem that it is not unreasonable to have the five finalists obtain support for their travel and attendance at the meeting from their own institution in an effort to substantially reduce the amount of monies that the Section would need to assure funding for the Lamport Award selection process and program. The plan for altering selection process has been discussed generally with Anthony Lamport, who represents the Lamport family.

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Women in Physiology

Deals with all issues pertaining to education, employment, and professional opportunities for women in physiology. Develops programs to provide incentives enabling graduate students to present their research work at APS meetings; coordinates activities with other committees on women in the FASEB organization; and administers the Caroline tum Suden Professional Opportunities Awards.

Hannah V. Carey, Chair (1993)
Helen J. Cooke (1991)
Andrea R. Gwosdow (1992)
John W. Manning (1993)
Jessica Schwartz (1992)
Barbara Vance (1993)
Susan A. Ward (1993)
Martin Frank, *ex officio*

Society Representatives to Other Organizations

American Association for Accreditation of Laboratory Animal Care

Stephen M. Cain (1992)
Virginia M. Miller (1992)

American Association for the Advancement of Science

Robert L. DeHaan (1992)
M. Ian Phillips (1992)

American Institute of Biological Sciences

Martin Frank

Council of Academic Socieites of the Association of American Colleges

Sarah D. Gray (1992)
George A. Hedge (1993)

Federation of American Societies for Experimental Biology

Board
Shu Chien (1993)
Stanley G. Schultz (1994)

Executive Officers Advisory Committee
Martin Frank

Finance Committee
Francis J. Haddy (1992)

Life Science Advisory Committee
Walter B. Severs (1991)

Public Affairs Committee
Gabor Kaley

Research Conference Advisory Committee
Frank Booth (1993)

3M Life Sciences Award Committee
Jerome A. Dempsey (1993)

National Association for Biomedical Research

Martin Frank

US National Committee for IUPS

Shu Chien (1992)
Norman C. Staub (1993)
Stanley G. Schultz (1994)

US National Committee on Biomechanics

Roger M. Glaser (1993)

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He indicated that he would be willing to review any modifications in the selection process.

There was also discussion of having the Wiggers Awardee give a scientific presentation during the scientific sessions and present some personal reflections at the banquet. There was general support for this plan, and there was also some consideration of having the Wiggers Award Lecture as part of the Lamport Award Session. However, problems of scheduling to avoid conflict with other symposia of the Cardiovascular Section would have to be addressed.

Environmental and Exercise Physiology Section

The EEP Section broke from tradition by holding a breakfast meeting, sponsored in part by The Quaker Oats Company/Gatorade Thirst Quencher, which 85 section members attended. After a brief business meeting, the section honored two graduate students for their contributions made at the 1991 meeting and one senior investigator for his contributions made over his lifetime. The graduate students honored were **John Charles McDermott**, Dalhousie University, for his paper entitled "Lactate transport into skeletal muscle vesicles" (Procter & Gamble Award) and **Craig S. Stump**, University of Arizona, for his paper entitled "Increased muscle responses to insulin for glucose uptake and metabolism in rats after hindlimb suspension" (Young Investigator Award).

(l-r): E. R. Nadel and R. E. Johnson.

The senior investigator honored was **Robert E. Johnson.** He was presented a plaque that states: 'Physiologist, Biochemist, Nutritional Scientist and Physician. Devoted member of the American Physiological Society since 1944. Recipient of many honors and esteemed of the Environmental and Exercise Physiology Section of the American Physiological Society. In recognition of his exceptional scientific career and his many contributions to our understanding of the metabolic and nutritional effects of stress associated with environmental virables and exercise.'

Dr. Johnson reminisced for 10 minutes about his past, particularly as a youth, as a Rhodes Scholar, and as a staff member of the Harvard Fatigue Laboratory, and closed with some remarks about his current endeavors at the University of Vermont.

Ethan R. Nadel
Incoming Chair

Renal Section Awards

Renal Section selected winners for the Excellence in Renal Research Award (l to r) were presented at the 1991 APS/FASEB spring meeting, in Atlanta, Georgia. **C. L. Chou,** (postdoctoral category, advisor: Mark Knepper); **Barbara Stoos,** (postdoctoral category, advisor: Jeff Garvin); **Bruce Stanton,** chair, Awards Committee; **Dirk Schrader** (graduate student category, advisor: Jeff Sands); **John Streiter** (graduate student category, advisor: John Stephenson).

Future Meetings

1991	
APS Conference: From Channels to Cross Bridges	July 13-16 Bar Harbor, ME
APS Conference: Interactions of the Endocrine and Cardiovascular Systems in Health and Disease	September 29-October 3 San Antonio, TX
1992	
FASEB Spring Meeting	April 5–9, Anaheim, CA
APS Conference: Integrative Biology of Exercise	September 23-26, Colorado Springs, CO
APS Conference: The Cellular and Molecular Biology of Membrane Transport	November 4–7 Orlando, FL
1993	
FASEB Spring Meeting	March 28–April 1, New Orleans, LA
1994	
FASEB Spring Meeting	April 24–29, Anaheim, CA

Deceased Members

Herbert L. Borison, Hanover, NH *(01-09-91)
Phyllis A. Bott, Souderton, PA (02-03-91)
Michael J. Brody, Iowa City, IA (11-26-90)
Victor J. Brookes, Corvallis, OR *(11-30-90)
William C. Buchbinder, Highland Park, IL *(06-19-90)
Robert W. Clarke, Middletown, CT (10-19-89)
Bennett J. Cohen, Ann Arbor, MI (08-23-90)
Christian Crone, Copenhagen, Denmark (08-02-90)
Larry L. Ewing, Baltimore, MD (08-13-90)
Edward J. Fedor, Los Angeles, CA (12-26-89)
Giles F. Filley, Denver, CO (January 89)
Arthur S. Gilson, Jr., University City, MO (01-08-91)
Roderic A. Gregory, Liverpool, UK (09-05-90)
John F. Hall, Jr., Dayton, OH (01-19-90)
Chester W. Hampel, Delhi, NY (07-16-90)
J. Raymond Johnson, Omaha, NE (04-08-90)
Joseph L. Johnson, Alexandria, VA *(03)-05-91)
Morley R. Kare, Gainesville, FL (07-30-90)
Herbert G. Langford, Jackson, MS (01-17-89)
Charles W. Lloyd, Winston-Salem, NC *(06-19-90)
Melvin Marcus, Iowa City, IA (10-19-89)
Paul Nace, Woods Hole, MA (03-05-90)
Richard R. Overman, Memphis, TN (01-08-91)
Juan C. Penhos, Miami, FL (06-18-90)
Edgar J. Poth, Galveston, TX *(06-15-90)
Hermann Rahn, Buffalo, NY (06-23-90)
Orr E. Reynolds, Ft. Lauderdale, FL (03-30-91)
Stanley J. Sarnoff, Bethesda, MD *(06-04-90)
Alfonso Schettini, Richmond, VA *(03-21-90)
David Symmes, Bethesda, MD (04-08-90)
Charles Thirumalai, Kingston, Jamaica (05-27-90)
Archie R. Tunturi, Portland, OR *(06-29-90)
Kurt N. Von Kaulla, Freiburg, FRG *(10-24-90)
George E. Wakerlin, Oakland, CA (04-20-90)
James V. Warren, Columbus, OH (02-14-90)
Bruce L. Welch, Kensington, CT (03-08-90)
Ernest B. Wright, Cooperstown, NY (04-29-90)

** Indicates date notified of death*

Physiology and FASEB 1991

The 1991 FASEB Meeting in Atlanta, GA was a joint meeting of the six FASEB member societies and three guest societies. Over all, 8,242 abstracts of volunteered papers were submitted. Of this total, 2,200 papers were submitted by the APS membership and two APS guest societies: the Society of Experimental Biology and Medicine (SEBM) and the Biomedical Engineering Society (BMES). The physiology component of FASEB 91 represented 27% of the short communications presented by APS members and guests.

Of the 2,290 abstracts processed by APS, 21% (488) represented women physiologists as first authors and 5% (115) were by members from outside the Americas. In addition, 5% (110) were received from US Government laboratories and 4% (85) were received from physiologists employed by industry. Table 1 provides information on the various departmental abstracts received by APS of which 22% (515) were received from departments of physiology and 4% (98) were received from departments of physiology and biophysics.

Of the 2,068 APS member-sponsored abstracts, 25% (518) were designated by authors for inclusion in topics programmed by other FASEB societies (Table 2).

Table 3 displays the distribution of volunteered papers programmed by APS and its guest societies in relation to Society Sections. Of the 2,139 papers programmed by the Program Advisory Committee, 1,464 (68%) were scheduled as poster presentations, 571 (27%) as slide presentations and 102 (5%) as poster-discussion presentations, 52 slide sessions, 40 symposia/invited sessions, and 7 poster-discussion sessions. A total of 189 physiology sessions were scheduled during FASEB 91.

Table 4 displays the total number of abstracts programmed by each Section. The Cardiovascular Section programmed 638 abstracts (30%), followed by the Respiration Section, which programmed 358 abstracts (17%).

Table 1. **Author Affiliations of Programmed Volunteered Papers**

Department	Number of Papers	% Total
Physiology	515	22
Physiology & biophysics	98	4
Medicine	141	6
Pharmacology	84	4
Biology	70	3
Surgery	64	3
Anesthesiology	91	4
Pediatrics	37	2
Biochemistry	48	2
Anatomy	12	1
Pathology	54	2
Other	327	14

Table 2. **Volunteered Papers Sponsored by APS, BMES, and SEBM for FASEB 91**

Society	Total Received	FASEB Program Designation						Total
		APS	ASBMB	ASPET	AAP	AIN	AAI	
APS	2,068 (94%)	1,550 (70%)	33 (2%)	176 (8%)	216 (10%)	72 (4%)	21 (1%)	2,068
BMES	61	49	0	3	6	3	0	61
SEBM	71	34	3	13	13	7	3	71
Total	2,200	1,633	36	190	235	82	24	2,200

Table 3. **APS Scientific Sessions at FASEB 91**

Section	Slide	Poster	Poster Discussion	Symposia/ Invited	Total
Cardiovascular	17	20		4	41
Cell and general	4	10		3	17
Comparative	0	4		1	5
Endocrinology & metabolism	6	13		2	21
Environmental & exercise	3	5		1	9
Epithelial	2	3		1	6
Gastrointestinal	1	7		2	10
History	0	1		1	2
Hypoxia	0	0		1	1
Muscle	1	5		2	8
Nervous system	0	1		0	1
Neural control and autonomic regulation	3	3		1	7
Renal	4	2		3	9
Respiration	5	9	4	2	20
Teaching	0	0	3	0	3
Water and electrolyte	4	3		1	8
BMES	2	4		2	8
SEBM	0	0		1	1
Clinical	0	0		1	1
Public Affairs/GRIP	0	0		2	2
Other*	0	0		9	9
Total	52	90	7	40	189

* Includes Bowditch Lecture, Cannon Lecture, Career Opportunities Symposium, Education Symposium, NAS/NRC Workshop, NIH workshop, Past-President's Symposium, Space Life Science Lecture, and Joint APS/AIN Symposium.

Table 4. **Programming of Volunteered Papers by Sections/Groups**

Section	Number of Abstracts
Cardiovascular	638
Cell and general	126
Comparative	30
Endocrinology & metabolism	209
Environmental & exercise	123
Epithelial	109
Gastrointestinal	65
History	1
Hypoxia	13
Muscle	71
Nervous system	44
Neural control and autonomic regulation	78
Renal	95
Respiration	358
Teaching	16
Water and electrolyte	83
BMES	65
Other*	15
Total	2,139

* Includes abstract submissions for Developing Countries poster discussion and Debate session.

Biomedical Research in Developing Countries

In recent years several members of APS have been involved in collaborative research and/or teaching projects in developing countries (the "helping hand" theme of Harvey Sparks – *The Physiologist* 32: 1, 1989). To "formalize" the helping hand idea, the International Committee of APS has taken on the role of an organizer and clearing house for the involvement of APS in promoting physiology in developing countries. The poster-discussion session reported here was organized in conjunction with the Teaching Section of APS with input from IUPS. It is the first of what hopefully will be many such APS/FASEB programs aimed at fostering interactions between North American physiologists and our colleagues in developing countries.

The main objective of this first session was to increase the awareness of the biomedical science community for collaborative interaction with developing countries. The poster-discussion format was chosen as the most effective means to showcase the variety of collaborative projects that have been undertaken and to provide an opportunity for interested parties to learn how they can become involved.

A healthy interest among FASEB members in this topic was evident: at least 75 of those in attendance either signed the guest book and/or gave their address to be contacted about future programs.

The session, which began with the usual open viewing of the posters (12 of them), was characterized by lively discussions around the boards even as the posters were being mounted. Following this activity John Ibu from the University of Jos, Nigeria, and Harvey Sparks from Michigan State University keynoted the session with their views on the needs and rewards of lending a helping hand.

Using Nigeria as the prototype of a developing country, Ibu presented a succinct overview of the variety of research projects in need of collaborators from developed countries. His list of projects included such diverse activities as the physiological effects of climate on humans, genetic diseases, nutrition, occupational health, and the biology of indigenous animal species. He emphasized how rewarding and mutually beneficial these projects can be and urged all interested parties to get involved. Finally, Ibu extended an invitation for North American physiologists to attend the inaugural meeting of the African Association of Physiological Sciences (AAPS), which will be held in Nairobi, Kenya, in September of 1992. Persons wishing additional information about biomedical research in Nigeria and/or the AAPS conference may contact Ibu at the Department of Human Physiology, Faculty of Medical Sciences, University of Jos, Nigeria.

In addition to emphasizing the tremendous personal satisfaction that awaits those who interact with colleagues in developing countries, Sparks provided some concrete information on the steps required to establish a successful linkage between departments in developed and developing countries. His suggestions included drafting a written description of the proposed collaboration, including a chronology of visits and commitments to reduce the potential for misunderstanding; arranging for an exchange of personnel (technicians to full professors); and establishing solid sources of support. Suggested funding agencies included the United States Agency for International Development, the United States Information Agency, the World Health Organization, and the Education Commission for Foreign Medical Graduates.

The keynote addresses were followed by a round of summary presentations by each of the poster authors. This was indeed an international potpourri and included projects from Africa, Asia, India, and South America. The nature of the activities ranged from teaching experiences to clinical research to basic science research to descriptions of fellowship opportunities to instrumentation construction. In some cases the presenter was from the APS member of the team, whereas in other instances the developing country representative did the honors. Thus, views from both sides of the helping hand were expressed. Since the objective details of the projects could be gleaned from the posters and the abstracts (*FASEB J.* 5: A1029–A1031, 1991), the summary presentations gave testimony to the personal rewards and warm experiences that these type of interactions generate. These experiences were "universally" positive, and the enthusiasm of the presenters was projected to those in attendance.

In brief, this session provided a comprehensive sampling of the types of collaborative interactions that are possible between biomedical scientists and educators in first and third world countries, offered guidelines for getting such programs off the ground, and gave a flavor of the interpersonal rewards and self-satisfaction that goes with this type of endeavor. To foster further interaction between presenters and attendees, the end of the formal program gave way to informal conversations centered around a delightful food and beverage reception graciously sponsored by Beckman International, Ciba-Corning Corporation, and Packard Instruments.

All in all, this was a very positive start to what will hopefully be a long-term involvement of APS in promoting physiology in developing countries. Those wishing further information are encouraged to contact the session chairperson, Daniel Richardson, Department of Physiology, University of Kentucky, Lexington, KY 40536.

APS Poster Discussion Session presented at the 1991 APS/FASEB Spring Meeting, April 23, Atlanta, GA.

Moving?

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

Recipients – 1991 APS Awards

Ray G. Daggs Award

Hallowell Davis, University City, Missouri

Orr E. Reynolds Award

Horace W. Davenport, University of Michigan, "The Early History of the Concept of Chemical Transmission of the Nerve Impulse"

Caroline tum Suden Professional Opportunities Awards

Leslie S. Black, VA-MD Regional College of Veteriniary Medicine, Blacksburg
Stephen M. Johnson, University of Iowa
Ingrid K. Krampetz, Indiana University, Indianapolis
Wisuda Suvitayavat, University of Illinois, Chicago
Esther E. Versteegden, University of Texas, San Antonio
Ning Wang, Harvard School of Public Health

1991 Caroline tum Suden Professional Opportunities Awardees with H. V. Carey (c), Chair, Women in Physiology Committee, Atlanta, GA, April 24, 1991.

NIDDK Minority Fellowship Awards

George T. Blevins, Jr., University of Michigan
Lillie M. Boyd, Shaw University, Raleigh, NC
Ricardo A. Brown, Wayne State University
Shirley Burton, University of the Virgin Islands
W. Richard Campbell, University of Michigan
Maria Castro, Ponce School of Medicine, PR
V. Michelle Chenault, Wake Forest University
Jose R. Criado, Jr., University of Oklahoma
Edward Daniel, University of the Virgin Islands
Robert Dunn, Jr., Northwestern University
Lillybeth Feliciano, Ponce School of Medicine, PR
Lorette Fahie, University of the Virgin Islands
Alane Gresham, University of Hawaii at Manoa
Bennye S. Henderson, Jackson State University
Cynthia Ann Jackson, University of California, Davis
Shelly King, Temple University, Philadelphia
Patricia A. Warren Marks, University of Arkansas
Jose Mercado, University of Puerto Rico
Gwen-Marie Moolenaar, University of the Virgin Islands
Patrick Oates, Howard University
Elizabeth Quintana, College of Arts & Sciences, Las Cruces, NM
Caridad D. Rosette, University of California, San Diego
Arnold L. Silva, University of Arizona
Alice Renee Villalobos, University of Arizona
Keith Williams, New York University

John F. Perkins, Jr., Fellowship Awards

Visiting Scientists and Hosts

Digambar Behera, Postgraduate Institute of Medical Education and Research, Chandigard, India
John Butler, University of Washington

Jaime Eugenin, Pontificia Universidad Catolica de Chile, Santiago,
Carlos Eyzaquirre, University of Utah, Salt Lake City

Tohru Ide, Chiba University, Chiba, Japan
Robert S. Fitzgerald, Johns Hopkins University

J. F. Laycock, Charing Cross and Westminster Medical School, London
Heinz Valtin, Dartmouth Medical School, Hanover

Sela Mager, Technion – Israel Institute of Technology, Haifa
Henry A. Lester, California Institute of Technology, Pasadena

Endre Nagy, University Medical School, Debrecen, Hungary
Francis E. Carr, Walter Reed Army Medical Center

1991 NIDDK Fellows, APS/FASEB Spring Meeting, Atlanta, GA.

Procter & Gamble Professional Opportunities Awards

Cardiovascular Section

Ina Brown, New York Medical College (Francis L. Belloni) Robert Feinstein, University of California, San Diego (Marvin R. Brown)
Daniel G. Todd, Marshall University (Gary L. Wright)
Arline C. Tomeo, UMDNJ, New Jersey Medical School (Walter Duran)

Cell and General Physiology Section

Eric Bennett, University of Rochester (George Kimmich)
Paul S. Matsumoto, Emory University (Douglas Eaton)

Comparative Physiology Section

Alice Villalobos, University of Arizona (Eldon J. Braun)

Endocrinology and Metabolism Section

Allison Freyaldenhoven, Audie Murphy VA Hospital (Michael Katz)
Renee A. Poulin, University of Southern California (Richard Bergman)

Environmental and Exercise Physiology Section

John C. McDermott, Dalhousie University (A. Bonen)

Gastrointestinal Physiology Section

Ming Pan, University of Florida (Bruce R. Stevens)

Neural Control and Autonomic Regulation Section

James M. Kiely, Emory University (Frank J. Gordon)

Renal Physiology Section

Jon Strieter, Cornell University (John L. Stephenson)

Respiratory Physiology Section

Lars E. Olson, Vanderbilt University (Thomas R. Harris)
Daniel Spergel, University of Pennsylvania (Sukhamay Lahiri)
Michael Spinella, Albany Medical College (A. B. Malik)
Stephanie Watts, Indianapolis, IN (William M. Armstrong)

Water and Electrolyte Homeostasis Section

Maria R. Trolliet, University of Florida (M. Ian Phillips)

1991 Procter & Gamble Professional Opportunities Awardees

APS and Section Awards

Society Awards

Caroline tum Suden Professional Opportunity Awards

The annual Caroline tum Suden Professional Opportunity Awards ($500, complimentary registration, and placement service fees) are granted to as many as six graduate students or postdoctoral fellows who present a contributed paper at the APS/FASEB spring 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 January 31 and presented with their awards during the APS Business Meeting.

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 APS/FASEB spring 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 a US citizen or hold a permanent resident visa. 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, or American Indian) with which the applicant identifies himself/herself; *6*) an estimate of required travel and per diem expenses. The deadline for receipt of completed applications is December 15.

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 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 APS/FASEB spring meeting. If the awardee wishes, and there is a suitable place on the program, an oral presentation will be made at the spring or subsequent fall meeting 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 of the members will be a professional historian.

Manuscripts should be typed and double-spaced with wide margins on 8½ × 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 APS/FASEB spring meeting.

Section Awards

Procter & Gamble Professional Opportunity Awards

The Procter & Gamble Professional Opportunity Awards (provides $500 and complimentary registration for the APS/FASEB spring 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 the 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.

Comparative Physiology

The Comparative Physiology Section **Scholander Award** is presented annually to recognize an outstanding young investigator presenting a paper as first author in a comparative physiology slide session at the APS/FASEB spring 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 the third postdoctoral years—are presented at the spring APS/FASEB meeting. Applicants must be first author on abstracts submitted for the spring APS/FASEB 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 recipient on 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.

News From Senior Physiologists

Letters to Horace Davenport

Clarence Collier writes, "I moved away from close academic ties in 1983 to the western foothills of the Sierras in Somerset, CA. Most of my time is spent in active care of several acres of fruit and walnuts. I chose to retire early because of extensive heart surgery in 1979. "My most challenging project is short-term teaching of respiratory and cardiovascular blocks to medical students in a small church-owned and operated medical school in Mexico. The first time, I had studied almost no Spanish, so I lectured only in English through student interpreters. Now, I do most of the formal lecturing in English but work on my Spanish in demonstration laboratory work and individual discussions. I can now read rather fluently and write my own exams to be corrected by my Mexican colleagues. "My advice to younger colleagues is to plan a good deal of exercise and a good diet."

"It was kind of you indeed to send me your greetings and those of the American Physiological Society on my 80th birthday, writes **Piero Foa.** Your card arrived while I was in Italy where, on that very day, I delivered a lecture as part of my duties as visiting professor at the Universities of Cagliari in Sardinia and of Parma. "While in Italy I discovered an iron-clad rule against renting cars to anyone older than 73, but in Italy even iron is soft and, after describing me on the phone as "vecchio, ma arzillo" (old, but sprightly) the agent got a special dispensation from the president of Budget Rent-a-Car enabling us to enjoy a little touring of the Sardinian archeological sites and wonderful seascapes."

A few weeks earlier Piero Foa had received an award in Aspen for being the skier with the longest experience, 72 years. He continues as editor of a series of monographs on endocrinology and metabolism, and he has just finished a review on glucagon citing almost 700 papers mainly published since 1984. "This after eliminating a large number of papers describing the invention of the wheel by authors who apparently are not aware of any work done before computerized bibliography retrieval systems became available."

Letters to Steve Horvath

Irvine Page, who has been confined to his room since a year ago last February due to leg paralysis, said, "I don't like old age and I say to hell with it and it says the same to you."

Research continues to be of prime interest to **Robert L. Kroc,** who also enjoys contributing by serving on the boards reviewing monographs and traveling from his home in Santa Barbara, CA, to lectureships and symposia at research centers here and abroad.

Letter to David G. Greene

Stanley E. Bradley, who is Samuel Bard Professor Emeritus of Medicine at the College of Physicians and Surgeons of Columbia University, writes that since his retirement in 1978 he and his wife, Gerry, have spent much of their time in Berne, Switzerland, working in the clinical pharmacology department at the University of Berne.

Until 1984 he was a fulltime visiting professor, continuing work in biliary physiology in dogs and rats with emphasis upon the potential differences across the canaliculi and the effect this has upon clearances of charged molecular species—including plasma protein. Since 1984 he has returned to Berne each summer and for the last three years has been working with the Bundesamt für Umweltschutz (the Swiss EPA).

Letters to John T. Reeves

Author J. Riopelle, writing from Baton Rouge, LA, said his primary activities are in psychology in which he edits a journal and publishes occasionally on the effects of protein deprivation of infant primates.

George G. Rowe retired in June 1989 from cardiologic practice at the University of Wisconsin and has become an emeritus professor of medicine and "Class mentor." "I have become a regular member of the medical school class of 1993. This has been a thoroughly enjoyable experience reliving lectures and laboratories in basic physiology, anatomy, pathology, and chemistry with an enthusiastic group of bright young medical students. What progress has been made in 50 years!! I am warmly accepted as a quaint but friendly dinosaur." Rowe added that he and his wife travel a bit, walk a lot, and intermittently watch birds or four delightful granddaughters.

Letters to Helen M. Tepperman

"Following my retirement I continued to monitor the 150 Montreal multiple sclerosis (MS) patients on low-fat diets," writes **Roy I. Swank,** who is professor emeritus at the Oregon Health Sciences University. "Analysis of this 34 year study was started in 1985."

Swank noted that patients who followed low fat diets closely deteriorated very little, whereas those who consumed as little as 10 grams of extra fat daily deteriorated rapidly. He also treated and

followed a group of MS patients who also cooperated in plasma and plasma protein studies.

"In Montreal we had observed that infusion of two units of normal plasma immediately after major surgery or childbirth prevented aggravation of MS. In collaborative studies, using a two dimensional chromatography technique MS plasma was observed to differ from normal. Later in Portland a series of studies revealed electrophoretic changes in MS plasma which differed from normal. This led to a studies of the effect of plasma infusions into patients suffering various degrees of activity of their disease. The results were almost always beneficial."

"I feel I have identified the major precipitating cause of MS, namely saturated animal fats. In addition I have been involved in the identification of an abnormal protein in the plasma of MS patients. Whether or not this protein is the key to the disease will have to await further investigation."

Silvio Weidmann writes that five years after his official retirement he is still welcome to work at his former department at the University of Berne. "I looked for a line of research that 1) would require a minimum of dependence on qualified colleagues, 2) might benefit from the existence of an excellent and flexible workshop, and 3) was not the general fashion among physiologists.

"Accordingly, I find myself recording membrane potentials during magnetic stimulation and comparing threshold reqirement for magnetically induced current to these for conventionally applied electrical current. To be in daily contact with people in the department without having to make any decisions is a very comfortable way of getting on."

Weidmann added that some of this time is spent reading manuscripts for the *Journal of Physiology* and once in a while during the summer months he and his wife go sailing on Lake Thurn.

Unique Materials

Work published in the Society's journals must necessarily be independently verifiable. Authors describing results derived from the use of antibodies, recombinant plasmids and cloned DNAs, mutant cell lines or viruses, and other similarly unique materials are expected to make such materials available to qualified investigators on request. Authors should also submit published nucleic acid/amino acid sequences to a widely accessible data bank. Sequence data submission forms for the National Biomedical Research Foundation—Protein Identification Resource Database (NBRF-PIR) are available from the APS Publications Office, 9650 Rockville Pike, Bethesda, MD 20814 (301-530-7186).

Fifty-Year Members

David I. Abramson, 1937
Errett C. Albritton, 1933
Willard M. Allen, 1934
Samuel B. Barker, 1938
Lyle V. Beck, 1941
A. Lawrence Bennett, 1941
Karl H. Beyer, 1941 (Regular)
Richard J. Bing, 1922
Emil Bozler, 1932
Auston M. Brues, 1940
Paul C. Bucy, 1933
Carl A. Bunde, 1939
Hubert R. Catchpole, 1938
Aurin M. Chase, 1939
Herbert Chasis, 1941
Charles F. Code, 1939
Madeleine F. Crawford, 1933
Phoebe J. Crittenden, 1937
Ray G. Daggs, 1935
Hallowell Davis, 1925
F. Curtis Dohan, 1941
Robert S. Dow, 1940
Gerald T. Evans, 1940
Louis B. Flexner, 1933
Florent E. Franke, 1934
M.H.F. Friedman, 1941
A. Pharo Gagge, 1937 (Regular)
Robert Gaunt, 1939
Anna Goldfeder, 1940
Harold D. Greene, 1936
Roy O. Greep, 1940
James B. Hamilton, 1938
A. Sidney Harris, 1939
Frank Harrison, 1941
Frances A. Hellebrandt, 1933
Charles B. Huggins, 1932 (Regular)
Herbert H. Jasper, 1940
Frederic T. Jung, 1930
Herman Kabat, 1941
Ancel Keys, 1939
Nathaniel Kleitman, 1923
Robert A. Kehoe, 1940
Walter Kempner, 1940
Henry I. Kohn, 1940
Irvin M. Korr, 1939
Martin G. Larrabee, 1940
Paul S. Larson, 1939
Donald B. Lindsley, 1937
Rafael Lorente de No, 1937
Horace W. Magoun, 1937
George L. Maison, 1939
Ade T. Milhorat, 1934
Hayden C. Nicholson, 1932
Seward E. Owen, 1938
Irving H. Page, 1937
Elizabeth Painter-Marcus, 1941
C. Ladd Prosser, 1935
Nathan Rakieten, 1941
Milton J. Schiffrin, 1941
Francis O. Schmitt, 1930
Herbert Shapiro, 1937
Herbert Silvette, 1933
Paul W. Smith, 1933
Franklin F. Snyder, 1936
Heinz Specht, 1941
J. Newell Stannard, 1938
George W. Stavraky, 1937
Theodore J.B. Steir, 1938
Eugene U. Still, 1928
Maurice L. Tainter, 1929
George W. Thorn, 1939
Richard F. Tislow, 1941
Louis A. Toth, 1940
Everett G. Weir, 1941
C. Beecher Weld, 1936
Charles A. Winter, 1940
Robert A. Woodbury, 1936
Clinton N. Woolsey, 1938
William B. Youmans, 1939

Membership Status

(March 1991)

Regular	4,913
Emeritus	761
Honorary	27
Corresponding	276
Associate	749
Associate Corresponding	21
Student	315
Total	7,062

Newly Elected Members

The following, nominated by Council, were elected to membership in the Society at the 1991 Spring Business Meeting, Atlanta, GA.

Regular

Joseph S. Adorante
Allergan Pharmaceuticals, Inc., Irvine

Deborah E. Allen
University of Delaware

Jonathan C. Allen
North Carolina State University

Seth L. Alper
Beth Israel Hospital, Massachusetts

James H. Anderson
Johns Hopkins University, Maryland

Steven E. Anderson
University of California, Davis

Stephen L. Archer
Minneapolis VA Medical Center

Tak Y. Aw
Louisiana State University

Tony R. Bai
University of British Columbia

R. Wayne Barbee
Alton Ochsner Medical Foundation, Louisiana

Scott A. Barman
University of South Alabama

Robin A. Barraco
Wayne State University, Michigan

Mary M. Beck
University of Nebraska

Bradford C. Berk
Emory University, Georgia

Yves Berthiaume
University of Calgary, Alberta

Ajay S. Bhatnager
CIBA-GEIGY Ltd, Switzerland

Mark A. Bisby
Queen's University, Ontario

Sally E. Blank
Washington State University

Matthew A. Boegehold
West Virginia University

Helen A. Boghdoyan
Pennsylvania State University

Arend Bonen
Dalhousie University, Nova Scotia

James L. Borke
Loyola University Dental School, Illinois

Robert G. Boutilier
Dalhousie University, Nova Scotia

Gregory Boyarksy
University of Texas at Galveston

Michael W. Brands
University of Mississippi

Robert J. Bridges
University of Alabama, Birmingham

Andrew J. Buda
University of Michigan

Richard D. Bukoski
Oregon Health Sciences University

Maria A. Burnatowska-Hledin
Michigan State University

Gail E. Butterfield
Palo Alto VA Medical Center, California

Joseph G. Cannon
Tufts University, Massachusetts

Wayne W. Carley
Lamar University, Texas

C. George Carlson
University of North Dakota

Thomas O. Carpenter
Yale University, Connecticut

Gregory D. Cartee
University of Wisconsin

Margaret J. Chandler
University of Oklahoma

Eugene B. Chang
University of Chicago, Illinois

Peter J. S. Chiu
Schering-Plough Research, New Jersey

Brian W. Christman
Vanderbilt University, Tennessee

Horacio E. Cingolani
CONICET, Argentina

Robert J. Contreras
Florida State University

Robert L. Coon
Medical College of Wisconsin

Calvin U. Cotton
Case Western Reserve University, Ohio

Karen D. Crissinger
Louisiana State University

William E. Dale
Washington University, Missouri

Thomas P. Davis
University of Arizona

Joseph S. Davison
University of Calgary, Alberta

Adolfo J. De Bold
University of Ottawa Heart Inst, Ontario

Thomas E. Decoursey
Rush Presbyterian St. Luke's Medical Center

Kevin C. Dellsperger
University of Iowa

Jonathan R. Diamond
Milton S. Hershey Medical Center, Pennsylvania

Stephen E. DiCarlo
Northeastern Ohio University

Thomas E. Dick
Case Western Reserve University, Ohio

Kenneth T. Dodd
Walter Reed Army Inst of Research, Washington, DC

Gerald W. Dorn
University of Cincinnati, Ohio

Douglas W. Duff
Indiana University

Gaylen Edwards
University of Georgia

Brenda R. Eisenberg
University of Illinois at Chicago

Ada S. Elgavish
University of Alabama

Stephen J. Elliott
Baylor College, Texas

Stephen W. Ely
University of Virginia

Chukuka S. Enwemeka
University of Miami, Florida

Julie M. Fagan
Rutgers University, New Jersey

Gary A. Fantini
Cornell University, New York

Harrison W. Farber
Boston University, Massachusetts

Peter D. Feldman
Louisiana State University

John J. Ferrara
University of South Alabama

Henry E. Fessler
Johns Hopkins Asthma & Allergy Center, Maryland

Candice D. Fike
Baylor College, Texas

Gordon T. Ford
Calgary General Hospital, Alberta

Janie M. Fouke
Case Western Reserve University, Ohio

Scott E. Fraser
University of California, Irvine

Arthur H. L. From
VA Medical Center, Minneapolis

Patricia A. Gabow
Denver General Hospital, Colorado

Vadivel Ganapathy
Medical College of Georgia

Michael B. Ganz
VA Medical Center, Cleveland

Walter R. Gibbons
University of Vermont

John B. Gordon
Montreal Children's Hospital, Quebec

Gregory J. Gores
Mayo Clinic, Minnesota

Ronald C. Gorewit
Cornell University

Paul E. Gottschall
Tulane University, Louisiana

David A. Gough
University of California, San Diego

Jeffrey B. Graham
University of California, San Diego

Brydon J. B. Grant
Erie County Medical Center, New York

Robert H. Gundel
Boehringer Ingelheim Pharmaceuticals, Connecticut

Harold J. B. Guy
University of California, San Diego

Jeffrey B. Halter
University of Michigan Hospitals

Diane K. Hartle
University of Georgia

Andrew Harver
SUNY at Stony Brook

Duncan H. Haynes
University of Miami

Stephen O. Heard
University of Massachusetts

Martha E. Heath
Naval Medical Research Institute

Frederick Heineman
National Institutes of Health, Maryland

James F. Helm
Medical College of Wisconsin

Scott A. Henderson
University of California, Los Angeles

Erik J. Henriksen
University of Arizona

James O. Hill
Vanderbilt University, Tennessee

A. C. Hillemeier
University of Michigan

Charles A. Hodson
East Carolina University

William H. Hoffman
Medical College of Georgia

Michael C. Hogan
University of California, San Diego

Brian D. Hoit
University of Cincinnati, Ohio

Maryanne R. Hughes
University of British Columbia

Ben F. Hurley
University of Maryland

Steve A. Hyman
Vanderbilt University, Tennessee

Lin J. Hymel
Tulane University, Louisiana

Glenn L. Irion
University of Central Arkansas

Steven D. Iscoe
Queen's University, Ontario

Bruce R. Ito
VA Medical Center, San Diego

Arnold Johnson
VA Medical Center, Albany

Bodh I. Jugdutt
University of Alberta

Jayakumar R. Kambam
Vanderbilt University, Tennessee

Donald L. Kaminski
St. Louis University, Missouri

Jack H. Kaplan
University of Pennsylvania

Gregory L. King
Armed Forces Radiobiological Research Institute

Mark M. Knuepfer
St. Louis University, Missouri

Donal E. Kohan
Washington University, Missouri

Stephen M. Krause
Jefferson Medical College, Pennsylvania

Edward R. Kuczmarski
Chicago Medical School, Illinois

Charles D. Kurth
Children's Hospital of Philadelphia, Pennsylvania

Joan E. Lafuze
Riley Hospital for Children, Indianapolia

Mark C. Lakshmanan
Case Western Reserve University, Ohio

Timothy S. Larson
Mayo Clinic

Jiann-Trzuo Lin
Mayo Clinic & Foundation, Minnesota

Joel M. Linden
University of Virginia

Shi Liu
Duke University

Walter C. Low
Indiana University

John W. Ludders
Cornell University

Roberto Maass-Moreno
Indiana University

Subir R. Maitra
SUNY at Stony Brook

Craig C. Malbon
SUNY at Stony Brook

Robert T. Mallet
Texas College of Osteopathic Medicine

Christiane Malo
University of Montreal

Richard S. Manalis
Purdue University at Fort Wayne

Carl M. Maresh
University of Connecticut

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Medical College of Virginia

Kevin J. Martin
St. Louis University, Missouri

Sleilagh M. Martin
University of Calgary

Wade H. Martin
Washington University

G. Paul Matherne, Jr.
University of Virginia

Gordon O. Matheson
University of British Columbia

Richard T. Mathias
SUNY at Stony Brook

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University of Washington

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Margaret K. McLaughlin
University of Cincinnati

Ellen G. McMahon
Monsanto Company

Michael M. Meguid
University Hospital, Syracuse

Igor B. Mekjavic
Simon Fraser University

Martha J. Miller
Rainbow Babies & Children's Hospital, Cleveland

Robert F. Miller
University of Minnesota

Thomas M. Mills
Medical College of Georgia

Haruko Mizoguchi
Procter & Gamble Company

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University of Michigan

Kurt A. Mossberg
University of Texas

Paul A. Munch
University of California, Davis

Michael J. Murphy
SUNY at Cobleskill

Mark W. Musch
University of Chicago, Illinois

Karl A. Nath
University of Minnesota

W. Peter Nathanielsz
Cornell University, New York

John M. Nicklas
University of Michigan

T. Richard Nichols
Emory University

Peter J. Oates
Pfizer, Inc.

Neil C. Olson
North Carolina State University

James M. Overton
University of Louisville

Carol S. Packer
Indiana University

Jeffrey M. Palmer
Medical College of Wisconsin

Howard B. Panitch
Temple University

Wade S. Parkhouse
Simon Fraser University

Judith T. Parmelee
Rhode Island Hospital, Brown University

Joseph B. Patlak
University of Vermont

Gerald J. Pepe
Eastern Virginia Medical School

John R. Petersen
Dianostic Systems Laboratories

Kenneth D. Philipson
University of California, Los Angeles

Patricia G. Phillips
VA Medical Center, Albany

Thomas E. Pissarri
University of California, San Francisco

Kenneth H. Pitetti
Wichita State University, Kanas

Zalmon Pober
Massachusetts College of Pharmacy

Janice L. Podolski
Rush University

Kenneth B. Pomerantz
Cornell University

David J. Prezant
Montefiore Medical Center, New York

M. Judith Radin
Ohio State University

Malcolm A. Ramsay
University of Saskatchewan

Papineni S. Rao
University of South Florida

Radhakrishna Rao
University of Arizona

Stephen T. Rapundalo
Parke-Davis Pharmaceutical Research

Wendy D. Reid
University of British Columbia

Peter Reischl
San Jose State University

Christopher M. Rembold
University of Virginia

George E. Revtyak
University of Iowa

Marc J. Rhoads
University of North Carolina

Keith M. Robinson
Merrell Dow Research Institute

Peter J. Robinson
Procter & Gamble Company

Marc A. Rogers
University of Maryland

Michael W. Rooney
Loyola University

Michael J. Rutten
VA Medical Center, Kansas City

Kyoo-Hai L. Ryu
Wright State University

Brenda M. Sanders
California State University

Guido E. Santacana
UCCEM, Puerto Rico

Russell C. Scaduto, Jr.
Pennsylvania State University

Marlowe J. Schneidkraut
Wayne State University

Geoffrey G. Schofield
Tulane University, Louisiana

Peter M. Scholz
Robert Wood Johnson Medical School

Harold D. Schultz
University of California, San Fracisco

Frank W. Sellke
Harvard University

Barbara A. Shirley
University of Tulsa

Laurence S. Shore
Kimron Veterinary Institute, Israel

Barbara E. Shykoff
SUNY at Buffalo

Gary C. Sieck
Mayo Clinic

Louis Simchowitz
Washington University

Bruce J. Simon
University of Texas

Francine G. Smith
University of Iowa

Wiley W. Souba
University of Florida

Ronald S. Spangler
SmithKline Beecham Company

Nicholas C. Spitzer
University of California, San Diego

Enrico Stefani
Baylor College

Kevin J. Sullivan
University of Southern California

Bauer E. Sumpio
Yale University

Kuo-Li Paul Sung
University of California, San Diego

Lanping Amy Sung
University of California, San Diego

David T. Tanaka
Duke University

Charles H. Thirumalai
University of the West Indies, Jamaica

George P. Topulos
Brigham & Women's Hospital

Michael G. Tordoff
Monell Chemical Senses Center

Ligia G. Toro de Stefani
Baylor College of Medicine, Texas

Robert D. Toto
University of Texas Southwestern

Roger Y. Tsien
Howard Hughes Medical Institute

Bradley J. Undem
Johns Hopkins University

Jacques Van Dam
Harvard Medical School

Herman H. Vandenburgh
Miriam Hospital, Providence

Gerald van de Werve
University of Montreal, Quebec

Usha S. Vasthare
Temple University

Jean-Claude Veille
Bowman Gray University, North Carolina

Stephen A. Vitkun
SUNY, Stony Brook

Gordon M. Wahler
University of Illinois at Chicago

John L. Wallace
University of Calgary

David H. Warden
University of Iowa Hospitals

Donald E. Wesson
Houston VA Medical Center

Randall B. Wilkening
University of Colorado

Jay H. Williams
Virginia Tech

John L. Williams
Cleveland Clinic Foundation

Charles S. Wingo
University of Florida

Eugene E. Wolfel
Denver General Hospital

Ruth A. Young
Austin Peay State University, Clarksville, Tennessee

Christian W. Zauner
Oregon State University

William Byron Zipf
Children's Hospital, Columbus

Corresponding

Joseph J. Batenburg
Utrecht University, The Netherlands

Klaus I. Baumann
Chinese University of Hong Kong

Joseph D. Bruton
Chinese University of Hong Kong

Cheng-Yu Ch'in
University of Baltimore, Maryland

Itzhak Choshniak
Tel-Aviv University, Israel

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John P. Headrick
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University of Auckland, New Zealand

Niels-Henrik Holstein-Rathlou
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Josef Moravec
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Kazuo Obara
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Hae Kun Park
Chungham Natl University, Korea

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University of South Carolina

Shaobin Zhong
Wayne State University, Michigan

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WHO GETS THE MONEY?*

Budgets of Largest Groups in US Opposed to Animal Research

Organization	1989 Budget
American SPCA	$16,487,294
Humane Society of United States	13,560,523
People for Ethical Treatment of Animal	6,522,457
Doris Day Animal League	4,737,524
International Fund for Animal Welfare	4,165,313
Friends of Animals	4,104,444
Animal Protection Institute	2,656,640
New England Antivivisection Society	1,471,459
National Antivivisection Society	1,444,660
The Fund for Animals	1,214,788
American Antivivisection Society	984,915
Physicians Comm. for Responsible Medicine	897,401
United Action for Animals	729,152
In Defense of Animals	654,802
The Animals' Agenda	595,513
International Society for Animal Rights	551,400
Animal Welfare Institute	467,969
Primarily Primates	267,539
TOTAL	$61,510,794

*From the April 1991 issue of the California Biomedical Research Association (CBRA) *Bulletin* as excerpted from *The Animals' Agenda,* April 1991, p.33, based on 1989 IRS Form 990 filings.

Animal Activists Groups Sue USDA In Move To Change Animal Standards

A suit has been filed in US District Court for Washington, DC, to force the US Department of Agriculture (USDA) to revert from its newly promulgated animal welfare regulations of performance-based standards to engineering standards.

The suit was filed jointly by the Animal Legal Defense Fund, Society for Animal Protective Legislation, and others against the USDA, US Department of Health and Human Services (DHHS), and the Office of Management and Budget (OMB).

The suit asked the court to set aside Part III of the Animal Welfare Act regulations adopted last February and to order USDA to reissue the standards proposed in March 1989.

The standards proposed in 1989 were fixed directives for the exercise of dogs and the psychological well-being of primates. After reviewing a record number of letters of comment, the proposed regulations were withdrawn by USDA and new regulations based on performance standards were issued.

The performance-based standards were drafted jointly by USDA and DHHS. OMB was named in the suit for alleged interference with the rule-making process and exceeding its authority.

"We Have to Say No" To Animal Activists

(Since April, animal activists have been picketing the home of Sharon Juliano, who conducts neurological research using cats at the Uniformed Services University of the Health Sciences in Bethesda, MD. In his column "Public Speaking" in The Montgomery (MD) Journal, Robert Jacques made the following observation about animal activists).

"I believe that the self-appointed animal rights zealots have transcended all boundaries of civility.

"I received a call in my office from a concerned neighbor of the doctor who is being besieged by some of these people; they apparently think it is chic to stand outside of her house at night with candles and signs. It's legal, of course, as long as they stay on the sidewalk and not on her property, but that's not really the point.

"If a group of concerned parents went to one of their homes and did the same thing, they (the activists) would be screaming bloody murder about intimidation and harassment and abridgement of their First Amendment rights. When I heard one of these people on television recently say that animals have the same rights as human beings to life, I finally realized that we have reached a point where we simply have to say no to these people.

"Concern about animal cruelty is one thing, but to say that it is wrong to take an animal's life in the interest of saving a child's life is simply absurd and discredits any dignity or worth these groups claim to have."

ALF Claims Credit For Fire, Bomb Threat

The Animal Liberation Front (ALF) has claimed credit for setting a fire in Washington state and telephoning a bomb threat in North Carolina.

According to the *Seattle Post-Intelligencer,* a branch of ALF called Western Wildlife said it set fire to a building at the Northwest Farm Food Cooperative at Edmonds, WA. The three-alarm fire caused $400,000 damage and gutted a dry storage area.

Western Wildlife said the fire was an act of "economic sabotage" to punish an industry that "profits from the misery and exploitation of fur animals." The coop's customers for animal food include 150 mink farms.

In North Carolina ALF claimed credit for calling in a bomb threat to the Hanes Research Center at the Bowman Gray School of Medicine in Winston-Salem, NC. Although no bomb was found, police did find a box of plumbing fittings in the facility, which houses animal research projects. No one knows why the bomb threat was made or why the box was placed where it was.

Senator Files Bill To Protect Hunters

Senator Wyche Fowler, Jr., (D-GA) has introduced a bill in Congress that would subject animal activists to federal prosecution for harassing hunters.

The bill, cosponsored by Sen. Conrad Burns (R-MT), would establish fines of $500 to $5,000 each time a person is convicted of intentionally obstructing or interfering with legal hunting on national forest lands. Anyone using force or violence to interfere with legal hunting on public lands would be subject to fines of $1,000 to $10,000.

State Court Told To Determine Custody For Silver Spring Monkeys

It now is up to a Louisiana state court to decide who should have custody of the two remaining Silver Spring monkeys at Tulane University's Delta Regional Primate Center at Covington, LA.

The US Supreme Court in an 8-0 vote ruled that the National Institutes of Health (NIH) should not have been allowed to transfer a lawsuit challenging the ownership of the monkeys from a state court to a federal district court, where the suit was dismissed.

Animal rights organizations—International Primate Protection League, People for the Ethical Treatment of Animals (PETA), and Louisiana In Support of Animals—had filed the suit in order to gain custody of animals and to prevent NIH and Tulane from carrying out planned euthanasia of the ailing and suffering monkeys and to perform terminal experimentation while the animals were anesthetized.

"We hold that removal was improper and that the case should be remanded to state court," wrote Justice Thurgood Marshall for the court. Justice Antonin Scalia did not participate in the case.

The controversy dates back 10 years when Alex Pacheco, founder of PETA, worked as a volunteer at the Institute for Behavioral Research in Silver Spring, MD. In September 1981 he instigated a police raid of the facility on the grounds that 17 monkeys being used by researcher Edward Taub were not provided with sufficient food, water, veterinary care, or sanitation. Taub, charged with 117 counts of animal mistreatment, was cleared of all wrongdoing by the Maryland courts.

Experimentation on Silver Spring monkeys shows brain can rewire itself.

Taub was working under a federal grant studying the ability of monkeys to use their limbs after their nerves had been severed at the spine. The research was designed to seek help for persons disabled by stroke and head trauma injury.

Only two of the 17 monkeys are subject to the court's ruling. Five of the control monkeys were moved to the San Diego Zoo and 10 have died. Of the two remaining monkeys, only one could be the subject of further experimentation. The other monkey is a control animal.

The monkeys were seized in the police raid and turned over to NIH, which transferred them to the Delta center. In 1988 the suit seeking custody was filed in a Louisiana state court by the animal rights groups, but NIH had the case transferred to a federal district court. The move was challenged and the Fifth US District Court of Appeals ordered the suit to be dismissed. That action then was appealed to the US Supreme Court.

Justice Marshall said the Fifth Circuit Court made a mistake because federal agencies have no such power to move a suit from a state court to a federal court. The court said no removal power is accorded when an entire agency of the federal government is named as the defendant.

W.M. Samuels

Silver Spring Monkey Research Shows Brain Can Rewire Itself

Research on the Silver Spring monkeys shows that the brain compensates for injury by reorganizing itself far more extensively than previously thought possible.

Tim P. Pons, a National Institutes of Health researcher in the study, said the findings mean it may be possible some day to train healthy portions of the brain to take over functions lost to stroke or to head injury. The research was conducted on four of the monkeys.

The research project was begun more than 12 years ago when the arm nerves in the monkeys were severed at the spine, making the limbs numb from the shoulder to the hand. This was done in both arms of one monkey and in one arm on the other three monkeys.

As a result of the severed nerves, Pons said a portion of the brain cortex that usually functions for the arms receives no sensory inputs. The purpose of the research was to determine if a brain cortex deprived of sensations would change over a long period of time.

"What we thought would happen is that the region of the brain would lie dormant," Pons told the Associated Press. "But what we found is that the region had reorganized to represent another body part."

Portions of the brain that once detected only tactile sensations from the arms instead were found to have "rewired themselves" into detecting sensations from the face and chin. This shows that one portion of the brain that normally processes information for the hand can just as easily process information for the face.

"So rather than the brain being fixed or hard-wired, the brain appears to be dynamic," Pons said, adding that the new findings eventually could lead to helping people with stroke or brain injury to recover some of their lost functions. If you know how the knowledge of brain reorganization works may make it possible to enhance the process and cause healthy portions of the brain to take up the work previously performed by the damaged part of the brain.

The Physicians Committee for Responsible Medicine, an animal rights group opposed to animal research, said in a statement that the experiment "had little resemblance to a proper scientific study."

"Whatever the changes that have occurred in scientific knowledge, and scientific technology over the last 100 years, our current status indicates that not only are animal experiments essential, but that the gains that are being made by the molecular and cell sciences cannot be brought to fruition without the use of appropriate animal models, and that these animal models must be fully established before the potential benefits can be transferred to man."

-Prof. K. M. Spyer, from lecture at the meeting of the British Endocrine Society.

Vermont Told To Open Animal Care Meetings

The University of Vermont Institutional Animal Care and Use Committee was ordered by the Chittenden Superior Court to open its meetings and records to the public.

People for Animal Rights and the Animal Legal Defense Fund sued the university in February 1990 for access to the committee's records. "We are going to attend the meeting now and we are going to read the documents," said Lance Polya of People for Animal Rights.

Judge John Meeker said the university became open to public scrutiny in 1988 when the definition of public body was expanded by the legislature to include the university, which now must disclose all papers, staff reports, individual salaries, or any other recorded matters produced or acquired in the course of business.

PRESIDENT'S COLUMN

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The Publications Committee and Council welcome comments and ideas for further improvements. In return we ask you to write a note to your librarians every year, when journal selections are being considered. Tell them how important library access to the Society journals is in your research. Be sure you list them by title. Librarians have limited budgets but are sensitive to faculty requests.

Oh, one more thing. Whenever you go to your school or hospital library would you mind leaving any APS journal you consult on the reading table? Many libraries determine usage by noting which journals have to be reshelved. I kid you not!

Norman C. Staub

AWARD
(continued from p. 129)

alkaloid he had extracted from the leaves of the Australian plant *Duboisia Hopwoodii.* Langley and his junior colleague W. Lee Dickinson quickly determined that "as far as the action of pituri is concerned, . . ., its physiological action is identical with that of nicotin." (5) Thereafter Langley used nicotine to study the distribution of autonomic nerves. For example, when he applied a warm 1% solution of nicotine by means of a fine brush to the superior cervical ganglion of an anesthetized cat, he saw that the nictitating membrane on that side retracted, the pupil dilated, and the hairs on the face and on the back of the neck rose (6). By this means Langley mapped the distribution of autonomic nerves, and then he thoroughly analyzed the function of each segment. He summarized his findings in a small book published in 1921 that is the definitive description of the organization and actions of the autonomic nervous system (7).

At the time Langley began this work physiologists believed that there is a direct physical connection between one nerve cell and another and that a nerve impulse in a preganglionic fiber is conveyed directly to the postganglionic fiber by means of this physical continuity. In addition, they believed compounds that block the transmission from one nerve to its effector act by paralyzing the terminal fibers of the afferent nerve. Thus atropine paralyzes the endings of the vagal fibers in the heart, and curare blocks neuromuscular transmission by paralyzing the terminal fibers of a motor nerve (7). In the next few years, neuroanatomists demonstrated that the nervous system is not a syncitium, and Wilhelm Waldeyer (8) published the definitive statement of the neuron doctrine. Langley's Cambridge colleague C. S. Sherrington said in 1899 that nerve cells "are anatomically discontinuous, physiologically continuous," and he coined a word when he wrote that "a feature of the concatenation of neurons more probably explicative of modification and delay of nerve impulses is the synapse." (9)

Langley wrote in 1901:

> In the earlier accounts by Dickinson and myself upon the action of nicotine upon the sympathetic system, we spoke of it as first stimulating and then paralysing the nerve-cells of the ganglia, since at that time we held the common view that the axis cylinder of a nerve-fibre which excited a nerve-cell was continuous with it.

Langley went on to cite publications of Golgi, Ramon y Cajal, von Kölliker, and Dogiel "which satisfied most histologists that nerve-fibres are not continuous with nerve-cells, but form endings in close connection with them." He continued: "It seemed probable that nicotine acted on these nerve-endings and not directly on the nerve-cells." Langley himself immediately controverted this conclusion by cutting preganglionic sympathetic fibers in a cat and allowing them to degenerate. He saw that "application of warm 1 p.c. nicotine" to the deafferented ganglion "produces effects like those produced by *brief* stimulation of its pre-ganglionic fibres," and he wrote that "it follows, I think, that nicotine does not stimulate nerve-endings of pre-ganglionic pilomotor fibres, and it is probable that it does not stimulate the nerve-endings of any pre-ganglionic fibres." (10) In other words, nicotine, and by extension other drugs, act directly upon the cells of the ganglion.

Langley extended these observations to motor innervation of striated muscle by cutting the nerves to leg muscles of chickens. After axon endings on the muscles had degenerated, Langley found that injection of nicotine still caused the muscles to contract and that injection of curare blocked the action of nicotine. He said:

> I conclude then that in all cells two constituents at least must be distinguished, (1) substance concerned with carrying out the chief functions of the cells, such as contraction, secretion, the formation of special metabolic products, and (2) receptive substances especially liable to change and capable of setting the chief substance in action. Further, that nicotine, curari, . . .as well as the effective material of internal secretions produce their effects by combining with the receptive substance, and not by an action on axon-endings if these are present, nor by a direct action on the chief substance. (11)

When Langley wrote those words the word *receptor* had recently been introduced into neurophysiology to designate the ending of afferent nerves that respond to their specific stimuli, and Langley did not use it in the modern sense. Here he called it the *receptive substance,* but in his Croonian Lecture delivered on 24 May, 1906, he also called it a *radicle.* In that lecture Langley defined what we now call a *receptor:*

> Since neither curari nor nicotine, even in large doses, prevents direct stimulation of muscle from causing contraction, it is obvious that the muscle substance which combines with nicotine or curari is not identical with the substance which contracts. It is convenient to have a term for the specially excitable constituent, and I have called it the receptive substance. It receives the stimulus and, by transmitting it, causes contraction.

He continued:

> On the latter view it is clear that the contractile molecule must either have at least one receptive radicle in addition to that affected by nicotine and curari, or it must be capable of direct stimulation. The hypothesis, however, demands that the stimuli passing by the nerve cannot effect the contractile molecule except by the radicle which combines with nicotine and curari. And this seems in its turn to require that the nervous impulse should not pass from nerve to muscle by an electric discharge, but by the secretion of a special substance at the end of the nerve, a theory suggested in the first instance by du Bois Reymond.

Finally:

> The mutual antagonism of nicotine and curari on muscle can only satisfactorily be explained by supposing that both combine with the same radicle of the muscle, so that nicotine-muscle compounds and curari-muscle compounds are formed. Which compound is formed depends upon the mass of each poison present and the relative chemical affinities for the muscle radicle. (12)

Here Langley defined competitive inhibition seven years before Lenonor Michaelis and Maud Menten (13) described it in mathematical terms. Langley's early training in mathematics would have enabled him to write the equations had he wished.

The First Mediator: Adrenalin

The story of adrenalin[1] as the first compound to be identified as a chemical mediator of nerve impulses begins at Guy's Hospital in London in the early 1850s when Thomas Addison distinguished between what we now call Addisonian pernicious anemia and Addison's disease. Addison (14) had identified 11 patients who had in common a peculiar bronzing of the skin, progressive weakness ending in death, and destruction of the adrenal glands. Shortly after publication of Addison's book in 1855, Brown-Séquard demonstrated that the adrenal glands are essential for life, and his observation, despite the inevitable report that the glands are *not* essential, was frequently confirmed. In addition, many clinicians identified similar patients and were eventually able to distinguish between patients with Addison's disease and those with bronzing of a different etiology (15). Nevertheless, nothing of any importance was learned about the physiological functions of the adrenal glands in the next 38 years.

The Work of George Oliver and Edward A. Schfer

On 10 March 1894, George Oliver and Edward A. Schäfer (16) gave a paper entitled "On the physiological action of extracts of the suprarenal capsules" before a meeting of the Physiological Society. Oliver and Schäfer were working in the physiological laboratory of University College London, and because the meeting was held there, they could illustrate their paper with a demonstration. The next year, 16 March 1895, they gave another paper with the same title, again at University College London (17).

The two long abstracts taken together are in essence the conclusions of the paper Oliver and Schäfer (18) published in the 18 July 1895, issue of the *Journal of Physiology.* Intravenous injection of an aqueous or glycerol extract of the adrenal medulla into an anesthetized animal produces a large rise in arterial blood pressure by causing profound arteriolar constriction and by augmenting and accelerating the heart. The pressor principle is confined to the medulla of the gland, and any activity shown by extracts to the cortex can be accounted for by contamination with medullar tissue (18).

Ladislaus Szymonowicz (19), a Privatdozent working under Professor Cybulski at the University of Krakow, published in 1896 a long paper describing the results of his studies of the effects of extirpation of the adrenal glands in anesthetized dogs. Szymonowicz removed the left adrenal of a small dog on 17 December 1894, and 12 days later he removed the other adrenal. The dog's blood pressure fell from a control value of 145/98 to 12/3 in the next 10 h. With hindsight we can conclude that the fall was the result of the profound hypoglycemia resulting from acute adrenalectomy. When Szymonowicz injected an aqueous extract of adrenal glands, the blood pressure rose to 130/104 and the heart rate fell. Many repetitions of the injection of a similar extract caused even greater rises in blood pressure. Later Szymonowicz determined that if he had previously cut the vagus nerves the heart rate rose following such an injection. In addition, he found that the pressor principle could be obtained only from the medulla of the glands. Thus Szymonowicz duplicated some of Oliver and Schäfer's results. He was at great pains to show that he had begun the work and that Professor Cybulski had reported the results to the Krakow Academy of Science before they had read the abstracts published by Oliver and Schäfer in the 1894 and 1895 issues of the *Journal of Physiology.* Szymonowicz discussed his observations at length, citing 103 references, and he concluded that Addison's disease is a disorder of the autonomic nervous system.

Oliver and Schäfer's work poses two questions. First, who was George Oliver? He is an example of a familiar type, the disappearing scientist who has his name on an important paper and who is never heard of again. There is no problem about Schäfer. He was professor of physiology at University College London at the time, and he became Sir Edward Sharpey-Schafer, professor of physiology at the University of Edinburgh. Second, why did they do the work? It came out of the blue (20). The answer to the second question is contained in the answer to the first.

George Oliver was the son of a Yorkshire physician, and he obtained his own medical education at University College London, where upon graduating he won the Gold Medal. he particularly admired William Sharpey, the professor of physiology, and late in life he endowed the Oliver-Sharpey Lectures. He practiced at Harrogate in Yorkshire where he was eminently successful, first as a general practitioner and then as a consultant. Oliver devoted his spare time to original physiological research. He had a private laboratory and a shop in his home, and "[h]e was always clever at any mechanical device, and most ingenious and resourceful in overcoming difficulties." He was also "a man of a singularly sweet, genial, and unselfish disposition." (21)

Oliver was particularly interested in blood and blood pressure. He devised a hemoglobinometer and a simple method for estimating the number of erythrocytes. He had an instrument maker construct a hemodynamometer (Fig. 1) and an arteriometer (Fig. 2). Oliver used the first to measure arterial and venous blood pressure and used the second to estimate the diameter of blood vessels under the skin. The hemodynamometer is essentially an oscillometer that measures the pressure that must be applied to a blood vessel to occlude it. The arteriometer measures the distance its foot must be moved to occlude the vessel. Oliver described his methods and the results he obtained in normal and diseased human subjects in a series of lectures before the Royal College of Physicians in 1896, and he described them with additions in a book published in 1901 (22).

The reader must remember that in the 1890s only a few university-based clinicians worried about blood pressure and

[1]For the sake of clarity I propose to call the substance liberated from the adrenal medulla and sympathetic nerve endings *adrenalin,* no matter what persons under consideration called it at the time, and *Adrenalin®*, to designate the Parke, Davis product.

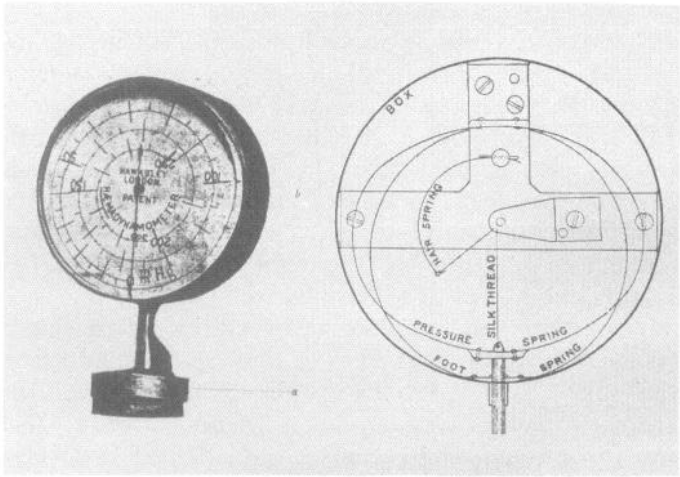


FIG. 1. Oliver's hemodynamometer. *Left:* the face. *Right:* the mechanism. The pad enclosed in a metal rim is applied to the artery, and the pressure at which oscillations of the needle begin and then cease is read. [From Oliver (22).]

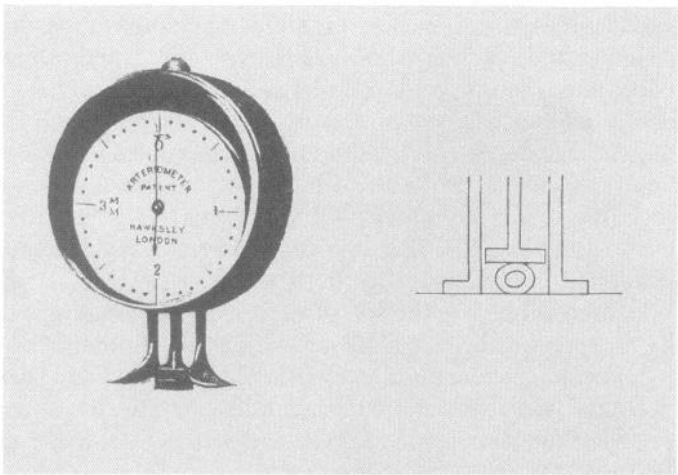


FIG. 2. Oliver's arteriometer. *Left:* the apparatus. *Right:* its application to a blood vessel. [From Oliver (22).]

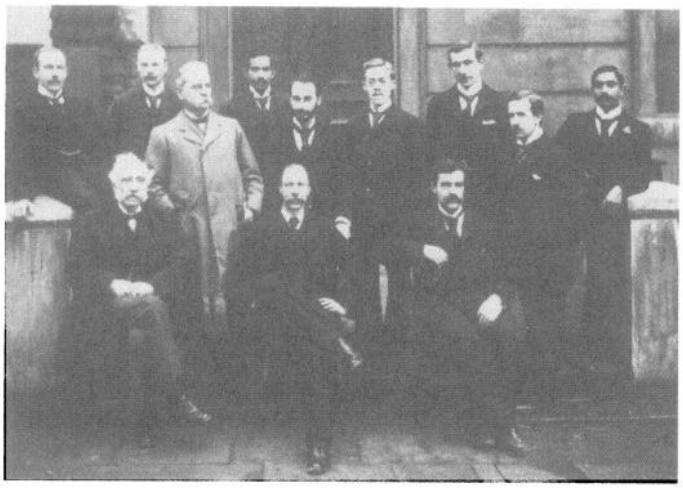


FIG. 3. The staff of the physiology department, University College London, about 1895. E. A. Schäfer is seated in the middle, and Benjamin Moore is to his left. George Oliver is the man in the light-colored coat standing behind Schäfer's right shoulder. (Courtesy of Professor Henry Barcroft.)

how to measure it. The Riva-Rocci cuff, now universally used to measure arterial pressure in human subjects, was not described until 1896 (23), and the Korotkoff sounds were not heard before 1905 (24). George Oliver was one of the few physicians in general practice who knew about blood pressure, who devised instruments to measure it, and who tried to spread word of its importance. As a practicing physician, he knew about Addison's disease, and he knew that arterial blood pressure is low in Addisonian patients. If destruction of the adrenal glands is the cause of Addison's disease, it is obvious to look for a blood pressure-raising principle in the glands. Oliver and Schäfer said only that there is "a great want of tone in the vascular system," but they were thinking about Addison's disease when they were doing their experiments. Schäfer said 13 years later that when he and Oliver collaborated in 1894, "we extended [our joint investigation] to other animals and to suprarenal glands obtained from various sources. These included the suprarenal glands from two cases of Addison's disease, which we found to yield no active principle at all." (25, p. 1347) It took 30 years to discover that the adrenal medulla has nothing to do with Addison's disease (26).

Schäfer described his first meeting with Georger Oliver:

> In the autumn of 1893 there called upon me in my laboratory in University College a gentleman who was personally unknown to me, but with whom I had a common bond of interest—seeing that we had both been pupils of Sharpey, whose chair I at that time had the honour to occupy. I found that my visitor was Dr. George Oliver, already distinguished not only as a specialist in his particular branch of medical practice, but also for his clinical applications of physiological methods. Dr. Oliver was desirous of discussing with me the results which he had been obtaining from the exhibition by the mouth of extracts from certain animal tissues, and the effects which these had in his hands produced upon the blood vessels of man, as investigated by two instruments which he had devised—one of them, the haemadynamometer, intended to read variations in blood pressure, and the other, the arteriometer, for measuring with exactness the lumen of the radial or any superficial artery. Dr. Oliver had ascertained, or believed he had ascertained, by the use of these instruments, that glycerin extracts of some organs produce diminution in calibre of the arteries and increase of pulse tension, of others the reverse effect. (27).

Oliver had given a glycerine extract of the adrenal gland by mouth to his son (28). Oliver and Schäfer began to collaborate.

In the 1890s physiological chemistry was still practiced in departments of physiology, and Benjamin Moore, later the first professor of biochemistry at Oxford, was the physiological chemist in Schäfer's department (Fig. 3). While Oliver and Schäfer were doing their work, Moore tried unsuccessfully to identify the pressor principle. He found it to be water soluble and capable of passing through a parchment membrane. Because the solutions gave the color reactions of a strongly reducing substance, a substance Alfred Vulpian (29) had found in the adrenal medulla in 1856, Moore (30) concluded that the principle is the reducing substance. Later Moore (31) discovered that oxidation of a solution containing the reducing substance destroyed it pressor activity.

Moore was wrong; the reducing substance was first identified as hexuronic acid and then as vitamin C (32).

Now that a method was available for identifying the active principle by its effect upon blood pressure, there was a flurry of activity attempting to isolate and identify it. The man who succeeded was Jokichi Takamine.

Jokichi Takamine's father was a Japanese physician who by learning Dutch learned something about Western medicine at the time Japan was an almost-closed society. His son was born the year after Commodore Perry forced his way into Yedo Bay, and Jokichi Takamine's youth and early manhood coincided with Japan's strenuous and successful effort to modernize itself. He was educated at the College of Science and Engineering in Tokyo at government expense, and he was sent to Glasgow for three years to study chemical engineering. Thereafter he acted as an unofficial science attaché in the United States with the task of transferring American scientific and industrial skills to Japan. Takamine himself developed an enzymatic extract of aspergillis he called Taka-diastase that rapidly converted starch to sugar. His effort to substitute it for malt in the distilling industry was unsuccessful, but the Detroit pharmaceutical manufacturers, Parke, Davis, sold it for many years as a treatment for dyspepsia. Somehow around 1897, Takamine, with the support of Parke, Davis and its research director, began an attempt to isolate the pressor principle. When Takamine treated an aqueous extract of the adrenal medulla with ammonia, he obtained active crystals. He and a chemist working for Parke, Davis correctly determined its elementary composition. Takamine patented the process on behalf of Parke, Davis and registered *Adrenalin* as a trade mark (33). As a reward, the Emperor of Japan gave Takamine a decoration, and he sent 15 flowering cherry trees to Parke, Davis. The company planted them in front of its Detroit headquarters and cut them down during the Second World War.

In 1903 Hermann Pauly (34) deduced the correct structure of adrenalin, and almost immediately Friedrich Stolz and Henry Dakin (35) synthesised it. The synthetic compound is racemic, but it can be resolved by precipitating the levo-rotatory fraction with dextro-rotatory tartaric acid (36).

After Adrenalin® became commercially available about 1901, British and American physiologists used it. One of the first and most thorough was T. R. Elliott, who worked under Langley's direction. Elliott tested "Langley's generalisation that the effect of adrenalin upon plain muscle is the same as the effect of exciting the sympathetic nerves supplying that particular tissue." He found that adrenalin acts at the periphery only upon tissues that are innervated by sympathetic nerves and that the action of adrenalin, excitatory or inhibitory, is the same as that produced by sympathetic impulses. Furthermore, adrenalin produces the same action long after the nerves have degenerated following section. Elliott ended his presentation before the Physiological Society on May 21, 1904, by saying: "Adrenalin might then be the chemical stimulant liberated on each occasion when the impulse arrives at the periphery." (37)

When he wrote the paper describing these results in full, Elliott omitted that suggestion. Langley was the editor of the journal in which the paper was published, and perhaps he would not allow such speculation. That was not because Langley did not believe there is a mediator, for the paper was written when Langley was coming to the conclusions cited earlier in this essay. Instead, Elliott wrote: "Its single characteristic is the aptness to stimulate plain muscle and gland cells that are or have been in functional union with sympathetic nerve fibres." (38)

Elliott turned his conclusion around by writing confidently: "A positive reaction to adrenalin is a trustworthy proof of the existence and nature of sympathetic nerves in any organ." The long controversy, of whether cerebral blood vessels are or are not sympathetically innervated proves Elliott's assertion to have been rash.

After the structure of adrenalin had been determined, a large number of chemists, physiologists, and pharmacologists studied the blood pressure-raising properties of compounds related to adrenalin. Among these was Henry Dale, who had been Langley's student at Cambridge and a close friend of T. R. Elliott (39). George Barger, Dale's colleague in the Wellcome Physiological Research Laboratories, collected or prepared 54 such "sympathomimetic amines," and Dale studied their actions. Dale said that measurement of their pressor properties was not enough, and he studied other effects: dilatation of the pupil, contraction of smooth muscle of the orbit, contraction of the nictitating membrane, flow of saliva and tears not readily prevented by atropine, and inhibition of smooth muscle of the intestine and the urinary bladder. He thought inhibition of the nonpregnant cat's uterus to be particularly useful. One of the compounds collected by Barger was No. 11, *dl*-aminoethylcatechol. That had been synthesized by Stolz in 1904, and it was marketed under the trade name of *Arterenol* by Farbenwerke Hoechst A. G. Years later it was called *noradrenalin.* Dale agreed with earlier workers that it is more potent than *dl*-adrenalin in raising blood pressure, but he found that, in contrast with adrenalin, it did not inhibit the nonpregnant cat's uterus (Fig. 4; 40).

In the early 1930s, Walter B. Cannon at Harvard tried to

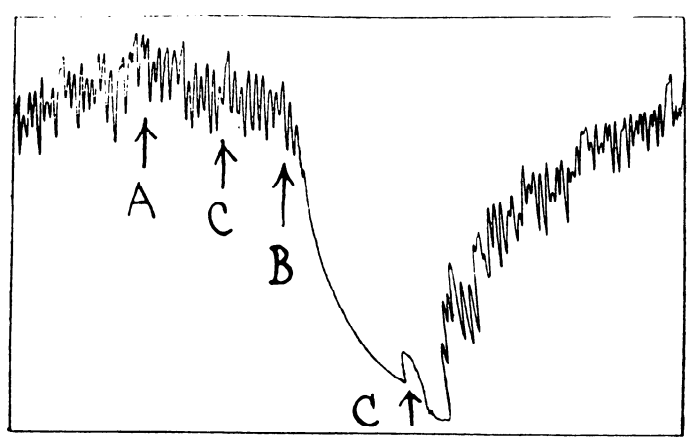


FIG. 4. Contractions of the nonpregnant cat's uterus in vitro. At A, addition of noradrenalin. At B, addition of adrenalin. At C, washing with fresh physiological salt solution. [From Barger and Dale (40).]

demonstrate, first, that there is a chemical mediator in the sympathetic nervous system and, second, that the mediator is adrenalin. Working with Zenon Bacq, Cannon showed that stimulation of postganglionic pilocrector nerves of the cat results in liberation into the blood stream of a substance that causes a gradual increase in blood pressure, a gradual increase in heart rate, and a gradual increase in salivary secretion. A similar substance, Cannon and Bacq found, is liberated when postganglionic fibers to intestinal muscle and to the bladder are stimulated. In this respect the substance resembled Adrenalin® with which they compared it, but they cautiously called it *sympathin* (41).

Shortly thereafter the Mexican physiologist Arturo Rosenblueth began to work with Cannon, and he and Cannon extended the work Cannon had done with Bacq. It soon became obvious that the responses to sympathin differ from those to Adrenalin®. For example, when hepatic nerves are stimulated the nictitating membrane contracts, but the nonpregnant cat's uterus fails to relax. In this instance the liberated mediator appeared to be purely excitatory. Adrenalin® is both excitatory and inhibitory, for it causes the nonpregnant cat's uterus to relax. Cannon and Rosenblueth found other differences, and they concluded that two kinds of sympathin are liberated: sympathin E, which is excitatory, and sympathin I, which is inhibitory. This is a reasonable conclusion, but because Rosenblueth's imagination was at work, Cannon and Rosenblueth wrote (emphasis added):

> Sympathin is defined as the chemical mediator of sympathetic impulses, ME or MI, which in the [effector] cell induces the typical response, contraction or relaxation, *and which, escaping from the cell into the blood stream, induces effects elsewhere in organs innervated by the sympathetic.* (42)

In a book Cannon and Rosenblueth published in 1937 the hypothesis is more clearly stated: sympathetic nerve endings liberate the mediator M, which acquires its E or I characteristics by combining in the effector cell with either E or I, upon which it becomes either excitatory or inhibitory. After acting on the effector cell, sympathin E or I escapes into the blood and then excites or inhibits other effector cells.

The fact that sympathin liberated by stimulation of hepatic nerves fails to inhibit the uterus of the nonpregnant cat was one of the crucial pieces of evidence that convinced Cannon and Rosenblueth that there is a purely excitatory sympathin E. It was also one of the pieces of evidence that caused Bacq (44) to propose in 1934 that sympathin E is noradrenalin. Sympathin I, Bacq thought is adrenalin. At the time Bacq published his proposal, noradrenalin was not known to be a natural product, but the story of its eventual detection in sympathetic nerve endings and in the adrenal medulla would carry us beyond the early history of chemical transmission (45).

There was one more stumbling block in Cannon and Rosenblueth's way. They compared the effects of stimulation of sympathetic nerves with the effects of an injection of Parke, Davis's Adrenalin®. At that time Parke, Davis's Adrenalin® was a natural product, and it was a mixture of adrenalin and nor-adrenalin (46). After 1975 Parke, Davis did not need to produce adrenal cortical hormones from adrenal glands, and consequently it was uneconomical to isolate Adrenalin® from the same source. Parke, Davis substituted synthetic adrenalin for the natural product on 13 May 1975.

The Second Transmitter: Acetylcholine

T. R. Elliott is another disappearing physiologist, for after his work at Cambridge in the 1900s his name disappears from the physiology literature. He himself did not disappear, for he became physician to University College Hospital and the first full-time professor of medicine in Great Britain. Throughout his long life he was a close friend of Henry Dale. In 1914 he was sufficiently eminent to be asked to give the Sidney Ringer Memorial Lecture. Elliott spoke on "The Adrenal Glands," and early in the lecture he said:

> The distribution of the efferent nerves, which the central nervous system supplies to the viscera and blood vessels of our bodies, was first clearly described by Dr. W. H. Gaskell, a man whom we are proud to remember was once a student with Ringer at our hospital. Following up his brilliant generalizations the English school of physiologists has analysed in great detail the intricate networks of these nerves, and Professor Langley's account of the autonomic nervous system in now accepted the wide world over. These nerves to plain or unstriped muscle issue from the central nervous system in three main groups—the vagal, the sympathetic, and the pelvic, which histologically cannot be distinguished from one another. The test of adrenalin laid bare a fundamental difference. Adrenalin was found to stimulate all plain muscle or gland cells that were united with the nerves arising in the thoraco-lumbar tract of the spinal cord between the roots of supply to the fore and hind limbs of the body. From no other contractile tissue did it call forth any response. . . . From this peculiar reaction it became evident that the thoraco-lumbar set of visceral nerves belong to an entirely different group from the vagal and the pelvic. (47).

Therefore, if there is a mediator of impulses in vagal and pelvic nerves, it is something other than adrenalin. Elliott, of course, knew of Langley's postulation of a "receptive substance," and he knew that nicotine and curare act in similar manners on each receptor. While he was still at Cambridge, Elliott (48) had suggested that the motor endplate is homologous with the receptors on ganglion cells. In his lecture, Elliott went on to extend his concept of chemical transmission to motor nerves supplying striated muscle and to infer that because adrenalin does not stimulate striated muscle, the mediator must be something else. He said:

> I have tried in vain to discover an active substance in the muscle plates of striped muscle. And Professor Herring was also disappointed when he examined for this purpose the electric organs of the skate, which are exaggerated motor plates. The ganglia of other visceral nerves, the auriculo-ventricular bundle of His, the spinal cord itself—all have been extracted and nothing as yet found.

At the time Elliott was speaking, physiologists and in particular pharmacologists had acetylcholine, a compound synthesised in 1866, in their hands, and they had accumulated evidence suggesting it might be the missing transmitter. If

they thought it to be the transmitter, they did not say so in print.

Reid Hunt and Acetylcholine

In 1898-1903 Reid Hunt was an assistant professor of pharmacology at Johns Hopkins working under John Jacob Abel. Abel, after obtaining his Ph.B. degree at Michigan in 1883, spent a year working under Newell Martin at Hopkins. Then he went to Europe with the object of learning chemistry to be applied to medicine. He worked first under Carl Ludwig in Leipzig, and Ludwig assigned him a Du Bois Reymond-type electrophysiological problem, determination of the "negative variation" during reflex action in the spinal cord. Then Abel went to Strassburg intending to study under Felix Hoppe-Seyler. Hoppe-Seyler was too busy to bother with Abel, but Abel used his Leipzig work as the basis of his thesis required for the Strassburg M.D. degree. Abel worked briefly in Heidelberg and Vienna and then in Bern under Marcel von Nencki, just before von Nencki moved to St. Petersburg. In all this and in the papers Abel published while he was in Europe there is little evidence that he did learn much chemistry. After he became professor at Johns Hopkins in 1893 he undertook to isolate adrenalin, but he made a complete botch of the job. Abel's fatal mistake was to treat an extract of the adrenal medulla with benzoyl chloride. Two benzoyl groups attached themselves to adrenalin, and Abel failed to remove the second. When he abandoned the project about 1904, Abel still believed the wrong elementary composition and the wrong structure of adrenalin (49).

After Abel had removed the pressor principle from his extracts, he turned them over to Reid Hunt who found that the residue lowered blood pressure when injected into an anesthetized animal. Hunt knew that choline is present in nervous tissue and that choline itself lowers blood pressure. Hunt tried to purify the active material by mercury and platinum precipitation. Choline was there, but Hunt found that there was a second more potent component of the mixture. Furthermore, as the mixture stood, its depressor activity decreased and its choline content increased. Hunt thought "that this 'precursor' of choline might be some ester-like body containing choline in its molecule. A number of such esters are known to chemists, but their physiological action has not been tested." (50)

Hunt moved to the Hygienic Laboratory of the US Public Health and Marine Hospital Service, and by 1906 his assistant René deM. Taveau had collected 19 derivatives of choline. Of these, acetylcholine was the most active in reducing blood pressure and heart rate, and Hunt thought that its action on the circulation identified it as the most powerful substance known. Its effects were prevented by administration of atropine (51).

Henry Dale and Henry Wellcome

Henry Hallett Dale finished his studies at Cambridge under Langley in 1902, and he spent the years 1902-1904 in the physiological laboratory at University College London. To be able to afford to marry, Dale took the job of director of research in the Wellcome Physiological Research Laboratories (Figs. 5 and 6).

Henry Wellcome, by then the sole proprietor of Burroughs-Wellcome & Co., had been born in Wisconsin on 21 August, 1853. After his family moved to Rochester, Minnesota, he worked in a pharmacy there. The offices of Dr. William Mayo and of his sons Will and Charlie were above the pharmacy. The Mayos, recognizing Wellcome's ability, helped to support his studies of pharmacy in Chicago and Philadelphia. After an adventurous career selling the newly devised gelatin-coated pills in South America, Wellcome went to England where he introduced compressed pharmaceuticals to replace the powders and elixirs prepared by the corner apothecary. In association with Silas Burroughs, he was enormously successful. Dale said the physiological laboratory in

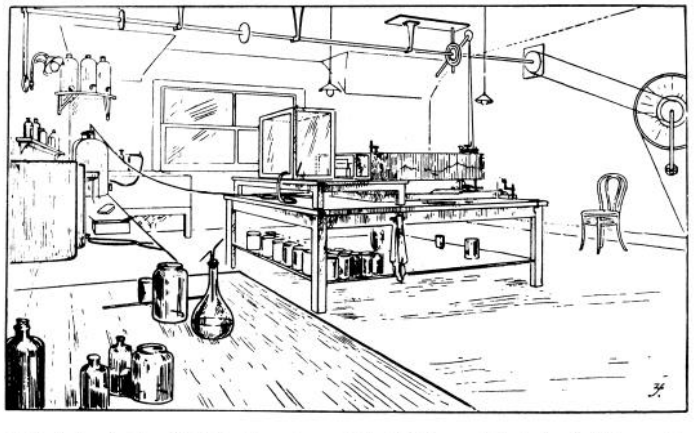
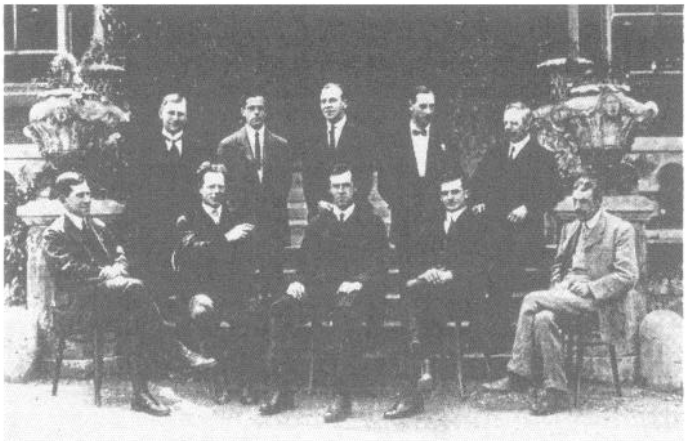


FIG. 5. A sketch of Dale's laboratory at the Wellcome Physiological Research Laboratories. (From a catalog prepared by the Wellcome Physiologicl Research Laboratories for the Franco-British Exhibition, London, 1908.)



The Scientific Staff of The Wellcome Physiological Research Laboratories, 1914. Front Row (left to right): G. H. J. MacAlister, S. Barger, H. H. Dale, R. A. O'Brien, H. J. Sudmersen. Back Row: G. S. Walpole, A. T. Glenny, J. H. Burn, J. B. Buxton, A. J. Ewins

FIG. 6. Dale's staff in 1914. (From a brochure prepared by the Burroughs-Wellcome Company in 1953.)

which he was employed was something of a hobby of Wellcome, and Wellcome told Dale he could do whatever he wanted in the way of research. Dale wrote much later that

> When I accepted the appointment, Mr. Wellcome said to me that, when I could find an opportunity for it without interfering with plans of my own, it would give him a special satisfaction if I would make an attempt to clear up the problem of ergot, the pharmacy, pharmacology and therapeutics of that drug being then in a state of obvious confusion. (52)

Ergot turned out to be a scientific gold mine for Dale and a commercial gold mine for Wellcome.

In the course of identifying actions of components of ergot, Dale found that some specimens contained something that inhibited contraction of the frog heart and stimulated contraction of mammalian intestinal muscle. Because both these actions were abolished by atropine and because muscarine has the same properties, Dale thought that ergot might contain muscarine. Accordingly he asked one of the chemists, Arthur Ewins, to attempt to isolate muscarine from ergot. Ewins gave Dale the fractions as he prepared them, and Dale assayed them with an isolated loop of rabbit intestine. Ewins soon found that the action was always associated with choline, and the fact that the active component was destroyed by alkali made him think the active component might be acetylcholine. Upon working up a large batch of ergot, Ewins isolated and positively identified acetylcholine, a result he described in 1910 (53). Thus Ewins demonstrated that acetylcholine is a natural product, not merely a synthetic comound (54).

Immediately thereafter Dale undertook a comprehensive study of esters and ethers of choline. Because "acetyl-choline occupies a somewhat unique position, due, as will be suggested, to the facts that it is an extraordinarily active but extremely unstable substance," Dale devoted most of his attention to that compound. He found that it reproduced "the effects of stimulating nerves belonging to the cranial and sacral divisions of the involuntary (autonomic) system." The parallelism was not perfect. Sweat glands receive sympathetic innervation, but they are stimulated (in the species Dale used) by acetylcholine. In addition acetylcholine caused vasodilatation over the entire circulatory system.

In considering the evanescence of acetylcholine's action, Dale (55) said it

> may be connected, with some probability, with the readiness with which the ester is hydrolysed into its relatively inert constituents, choline and acetic acid. . . .In the blood at body temperature it seems not improbable that an esterase contributes to the removal of the active ester from the circulation.

(It seems not improbable in the study or in the laboratory, not in the blood.) Dale cited the parallel with adrenalin, which is rapidly inactivated by oxidation, but he made no effort to find the esterase (55).

Dale's paper was received for publication in an American journal on 20 May 1914. By the end of the summer he knew he would have other things to do for a while, and he and his continental colleagues did little about acetylcholine for another five years.

Otto Loewi's Dream and Its Consequences

Otto Loewi's dream has become part of the folklore of pharmacology.

In an autobiographical sketch published in his old age Otto Loewi wrote:

> The night before Easter Sunday of that year I awoke, turned on the light, and jotted down a few notes on a tiny slip of paper. Then I fell asleep again. it occurred to me at six o'clock in the morning that during the night I had written down something most important, but I was unable to decipher the scrawl. The next night, at three o'clock, the idea returned. It was the design of an experiment to determine whether or not the hypothesis of chemical transmission that I had uttered seventeen years ago was correct. I got up immediately, went to the laboratory, and performed a simple experiment on a frog heart according to the nocturnal design. (56, p. 17)

In the immediately preceding paragraph, Loewi had written that he had conceived the idea of chemical transmission in 1903, but "at that time I did not see a way to prove the correctness of this hunch, and it entirely slipped my conscious memory until it emerged again in 1920."

There is something wrong with these dates. Everyone, including Loewi (57) himself at an earlier date, agreed that Loewi's experiments were done in 1921, and Gerald Geison in his entry for Loewi in the *Dictionary of Scientific Biography* inserted [1921] after "Easter Sunday" (58). The date 1920 is evidently a slip of the pen, but Easter Sunday is more suspect. When Loewi went to his laboratory at 3 A.M., all the apparatus, solutions, and animals were at once at hand, "and at five o'clock the chemical transmission of nervous impulse was conclusively proved" (57). Altogether Loewi performed 18 experiments, 10 on one species of frog, 4 on another species, and 4 on toads, and in his paper describing the results, he said they were done in February and March (59). That paper is headed (*Eingegangen am 20 März 1921*) to indicate the date the manuscript was received in the editorial office. Easter Sunday in 1921 was March 27.

Dale wrote that "I suppose that I must have been one of the earliest to hear from him the remarkable story of the dream." (60) Dale was not the last. When Loewi was in exile in London and New York, he did little laboratory work himself, but it was his custom to go to the laboratory where younger men were working and to entertain them with sprightly accounts of his career, his dream, and his opinions about physiological research (61).

Loewi prepared two amphibian hearts by the Straub method (Fig. 7). A cannula is thrust down the aorta and through the aortic valves into the ventricle. All other vessels to the heart are tied off by a mass ligature. The cannula is held vertically in a clamp, and some physiological salt solution is pipetted into it. The fluid surges up and down the cannula as the ventricle contracts and dilates. A lever is attached by a thread to the apex of the heart, and it registers the rate and extent of contraction on the smoked paper of a kymograph. In one of the two preparations, Loewi isolated the vagus nerve, a simple procedure, and he placed elec-

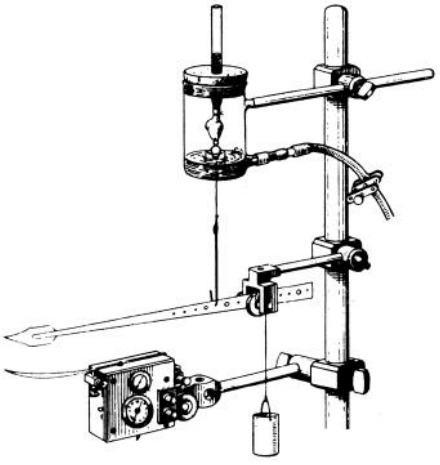


FIG. 7. Führer's version of the Straub heart preparation. Loewi probably did not use the enclosing cylinder, for the heart survives well if periodically wetted with physiological salt solution. (From Mangold, E. Methodik zur allgemeinen Physiologie des Herzens. In: *Handbuch der biologischen Arbeitsmethoden,* edited by E. Abderhalden. Berlin: Urban & Schwarzenberg, 1923, Abt. V, Teil 4, 1., p. 735.)

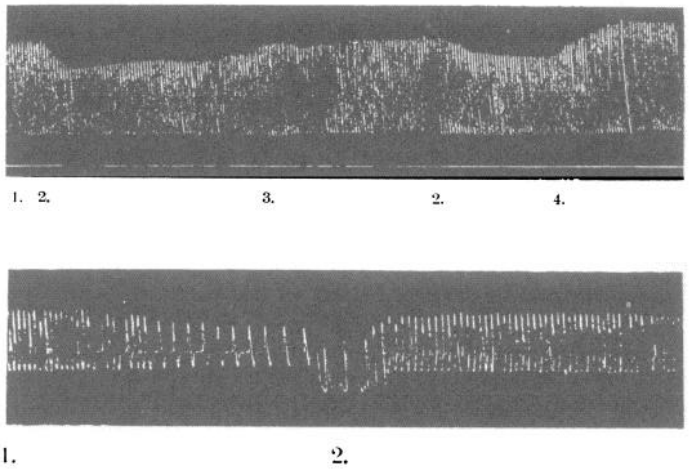


FIG. 8. Two of the records published by Loewi in his first paper on chemical transmission. *Top:* demonstration of the negative inotropic effect. The legend reads: 1. Ringer. 2. Ringer aus 15' Vagusreizperiode. 3. Ringer aus 15' Normalperiode. 4. +0,1 mg Atropin. *Bottom:* demonstration of the negative chronotropic effect. The legend reads: 1. Ringer aus 15' Vagusreizperiode. 2. Ringer. [From Loewi (59).]

trodes on the nerve to stimulate it for a "bestimmte Zeit" by means of a Du Bois Reymond inductorium. It is important that Loewi did the experiments in February and March, for the amphibian vagus contains both inhibitory and excitatory fibers. In the winter the inhibitory fibers predominate, and electrical stimulation decreases the rate and strength of the contraction. In the summer, stimulation augments and accelerates the heart. Then Loewi removed the fluid from the cannula, probably by means of a glass pipette fitted with a rubber bulb, and substituted it for the fluid in the cannula of the second heart. The effect of the fluid was to decrease the strength and frequency of the second heart (Fig. 8). Loewi concluded that the fluid transferred from the vagus-inhibited donor heart contained a substance that inhibited the recipient heart and that therefore he had proved chemical transmission of inhibitory impulses carried in the vagus.

In 1906 William H. Howell working in the physiological laboratory at Johns Hopkins University knew that an increase in potassium concentration of physiological salt solution bathing a heart "augments the sensitivity of the heart to vagal inhibition," and he speculated that "inhibition of the heart depends upon the presence of diffusible potassium in the heart tissue, and that the vagal impulses act indirectly by increasing the amount of potassium compounds of this character." (62) Two years later Howell completed experiments to test the hypothesis that potassium is the chemical mediator of inhibitory impulses. He perfused the coronary vessels of dogs, rabbits, and cats with Ringer-Locke solution

> under oxygen pressure. From time to time the circulation of the stock liquid was suspended and the heart was inhibited for one-half minute to a minute by stimulation of the vagus in the neck, or, as was frequently necessary, by stimulation of a branch from the level of the inferior cervical ganglion on the right side. At the end of the stimulation the heart was washed out through its coronary arteries by a special supply of the circulating liquid, amounting to 75 to 100 c.c.

At the end of the experiment Howell analyzed for potassium the fluid that had passed once through the unstimulated heart and the special supply that had circulated through the heart after inhibition. He found that

> Under the conditions of the experiment, . . . the increase in the potassium may amount to as much as 29 percent. . . .Assuming that the process occurs in the auricular tissue or in a definite portion of the auricles, this amount of potassium should be sufficient to inhibit the heart. The results obtained are presented, therefore, as evidence in favor of the view that the inhibitory action of the vagus nerve upon the heart is mediated through the influence of diffusible potassium compounds set free in the heart by the inhibitory impulses. (63)

Loewi knew that an increase in potassium can produce the effects he had observed, although he did not refer to Howell's work. He found, however, that the influence of the inhibitory material in his solution was completely blocked by atropine, whereas the influence of an increased potassium concentration was not. Therefore, the inhibitory substance is not potassium. Loewi (64) gave it the noncomittal name of *Vagusstoff.* He later admitted he knew all along that Vagusstoff had the properties of acetylcholine (65).

Loewi's paper presents a problem far more serious than that of dates. It is almost impossible to duplicate Loewi's results if the experiments are repeated in the way Loewi described. Loewi himself had trouble repeating them, and in the next few years there were numerous publications by others recording their own failure (66). I discuss the probable explanation in a moment, but in the meantime I cite a letter I received from William van der Kloot, who was professor of physiology at New York University when Loewi was research professor of pharmacology there. Van der Kloot wrote:

> Otto did say that he had great difficulty in repeating the experiment after the initial succes, and he had a complicated explanation about fluctuations in the Graz electrical supply voltage as a function of the day-night cycle and its effects on his inductorium. . . Another possibility is that the temperature was very low in his lab at 3 AM, and that helped him with his initial success. (67)

Cholinesterase has a positive temperature coefficient, and it is inactive at 0°C. In those days European laboratories were indeed cold much of the year, and volumetric glassware was calibrated for 15°C. Loewi's laboratory was probably colder than 15°C at 3–5 A.M. in February 1921 when he did his first experiment, but it must have been a bit warmer when he did at least some of the 17 additional experiments that he implied in his first paper were equally successful. In a later paper, Loewi (68) published data from which it can be inferred that the daytime laboratory temperature was sometimes as high as 18°C between October and April.

We now know the reason for Loewi's trouble. The transmitter is indeed acetylcholine. Cholinesterase catalyzes the hydrolysis of acetylcholine into ineffective choline and acetic acid, and cholinesterase is present in heart muscle. In view of this, it is surprising that Loewi obtained any positive results. Loewi's chances of success would be better if he used only a small volume of fluid in the Straub cannula and if he pipetted the fluid rapidly from the donor to the recipient heart. That this is possible is shown by the one successful confirmation of Loewi's results. Instead of using a pair of Straub cannulas, R. H. Kahn of Prague made a small vessel with two cannulas (Fig. 9). One cannula was inserted into the donor heart and the other into the recipient heart. Kahn put only 1 ml of fluid in the device. Contractions of the hearts rapidly mixed the fluid, and the result was that when Kahn stimulated the vagus to the donor heart the recipient heart was inhibited (69).

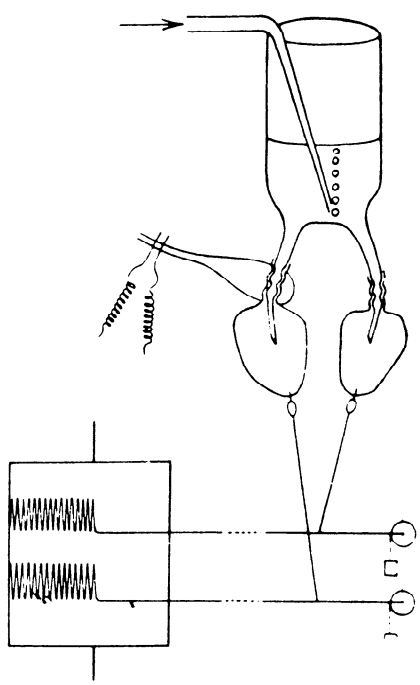


FIG. 9. R. H. Kahn's arrangement permitting successful repetition of Loewi's experiments. Volume of the fluid was 1 ml. [From Kahn (66).]

Physostigmine and Cholinesterase

When I was young I heard unsubstantiated gossip that Loewi had put physostigmine into his physiological salt solution and failed to say he had done so. The parasympathomimetic, or muscarinic, properties of physostigmine, also known as eserine, had been known long before Loewi did his experiments. In fact, Loewi himself had published in 1910 a paper showing that "physostigmine increases the sensitivity of organs innervated by the parasympathetic nervous system to stimulation through their nerves. This has been demonstrated for striated muscle, the salivary glands, the urinary bladder, and the heart" (Fig. 10; 70). Furthermore, Hermann Führer (71) had demonstrated in 1917 that physostigmine increases 10^6-fold the sensitivity of the back muscle of the medicinal leech to acetylcholine, and he (72) had published a simple lecture demonstration of the effect (Fig. 11). Believing the transmitter to be acetylcholine and with the facts he himself as well as Führer had discovered, nothing would have been more natural than for Loewi to add some physostigmine to his physiological salt solution.

We can dismiss this explanation, for if it were true, Loewi would have had no trouble duplicating his results. Had he done so and said nothing, he would have been committed to half a lifetime of duplicity. When questioned on this point, van der Kloot replied:

> He certainly loved a good story, and they sometimes showed some natural variation. He was also one of the most upright and decent men I have ever known, so I find it hard to think him capable of hiding a tool that would basically support his discovery. (73)

When Gerald Geison was preparing his account of Loewi for the *Dictionary of Scientific Biography,* he too puzzled over the ability to get positive results at one time but negative ones at another. He consulted van der Kloot, who proposed that "the heart of the Hungarian frogs that Loewi used

Ergebnisse.

1. Das Physostigmin steigert die Empfindlichkeit der kranial- und sakral-autonom innervierten Organe für Nervreizung. Nachgewiesen ist dies für den quergestreiften Muskel, die Speicheldrüse, die Harnblase und das Herz. Wir schließen daraus, daß die peripheren Wirkungen des Physostigmins Folge dieser Empfindlichkeitssteigerung sind, durch die normale unterschwellige Reize wirksam werden.

2. Mittelst der Anwendung von Physostigmin läßt sich der Nachweis erbringen, daß gewisse Organe einen peripheren autonomen Nerventonus besitzen. Hierher gehören der Sphincter Iridis und die Speicheldrüse. Die Harnblase scheint eines solchen zu ermangeln.

FIG. 10. The conclusions of the 1910 paper by Loewi and Mansfeld. [From Loewi and Mansfeld (70).]

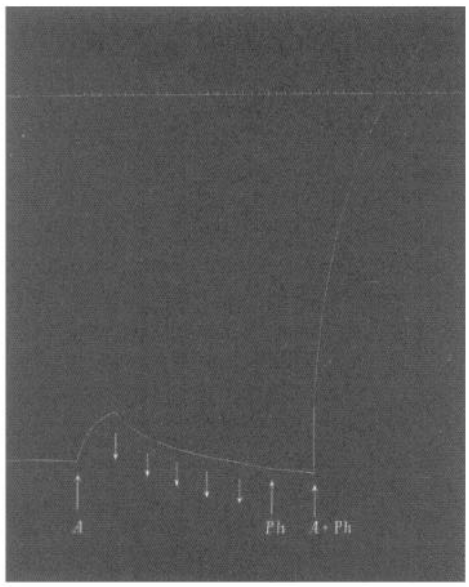


FIG. 11. Führer's demonstration of the potentiation of the action of acetylcholine by physostigmine. The legend reads: Blutegelpräparat. Bei *A* Azetylcholin 1:1 Million 5 Minuten. Bei *Ph* Physostigmin 1:1 Million 5 Minuten. Bei *A* + *Ph* Mischung beider. Zeit = Minuten. [From Führer (72).]

contains only a small amount of cholinesterase, so that the acetylcholine released by vagus stimulation persists unusually well in it." (74) Such a cholinesterase deficiency might be a species or a seasonal phenomenon. In his initial experiments, Loewi (76) did 10 with *R. esculenta,* 4 with *R. temporaria,* and 4 with an unspecified species of toads. Loewi obtained positive results with all three. Furthermore, when Loewi and Navratil (76) looked for the esterase Dale had postulated but failed to search for, they found it in extracts of hearts of *R. esculenta* and of the toads, the same species Loewi had used in his first successful experiments. Thus there is not certain explanation of the failure.

Acetylcholine and the Superior Cervical Ganglion

By 1926 Loewi finally brought himself to add a coy footnote to the last page of his paper on the fate of Vagusstoff:

> 1) Bei der ausserordentlich starken Wirksamkeit des Vagusstoffes könnte sogar daran gedacht werden, dass er Acetylcholin ist. (77)

Others, in particular Henry Dale, had already deduced that acetylcholine is the transmitter of autonomic preganglionic fibers, of parasympathetic postganglionic fibers, and of somatic motor nerves. Proof of the deduction waited, in part, for development of a quantitative method of measuring acetylcholine. That method was supplied in 1930 by Bruno Minz while working in the Berlin Physiological Institute.

Minz simply turned Hermann Führer's demonstration of the exquisite sensitivity of the physostigmine-treated back muscle of the medicinal leech into a quantitative method (78). For the next six years Minz's method was used by Wilhelm Feldberg to demonstrate chemical transmission by acetylcholine. Minz had developed the method under Herrn Privatdozenten Dr. W. Feldberg, and for the rest of his life, Minz repeatedly expressed his resentment of the credit Feldberg received when he exploited what Minz thought was his own intellectual property.

Feldberg wrote that a few weeks after he had been dismissed from his university posts in April 1933 as a consequence of Hitler's anti-Semitic decree

> someone told me that the representative of the Rockefeller Foundation was staying in Berlin and that I should try to see him. I succeeded. He was not sympathetic, but said something like this: 'You must understand, Feldberg, so many famous scientists have been dismissed whom we must help that it would not be fair to raise any hope of finding a position for a young person like you.' Then, more to comfort me, 'But at least let me take down your name. One never knows.' And when I spelt out my name for him, he hesitated and said, 'I must have heard about you. Let me see.' Turning back the pages of his diary, he suddenly said, delighted himself: 'Here it is. I have a message for you from Sir Henry Dale . . . . Sir Henry told me, if by chance I should meet Feldberg in Berlin, and if he has been dismissed, tell him I want him to come to London to work with me. So you are all right,' he said warmly. 'There is at least one person I needn't worry about any more.' (79)

Feldberg did work with Dale and with Dale's colleague J. H. Gaddum at the National Institute for Medical Research in London between 1933 and April 1936 when Feldberg left for a post in Australia. In those two-and-a-half years Feldberg published 24 communications in the *Journal of Physiology* in collaboration with Dale, Gaddum, and others in the Institute on transmission by acetylcholine. Feldberg wrote:

> To make use of a metaphor: perhaps it was that I had brought with me a key that would open the doors. Dale and Gaddum seemed to know what lay behind them, but I had the key. So I was asked to open first this one, then that one and so on, one after the other; and I never refused to do so. (80)

Ten of those communications were on transmission in the superior cervical ganglion. Feldberg adopted a method of perfusing the ganglion that had been developed by A. W. Kibjakow (81) of Kazan (Fig. 12). Feldberg and Gaddum identified acetylcholine in the effluent perfusate by physiological and pharmacological tests, by its ability to cause contraction of the physostigmine-treated leech muscle, by its negative inotropic effect upon a Straub frog heart preparation, by its negative chronotropic effect upon an isolated rabbit auricle, by the fact these responses were all prevented by atropine, and by the fact that the fluid's activity was destroyed by making it dilutely alkaline. Acetylcholine was present in the effluent fluid when they stimulated the ganglion's preganglionic fibers but not when the fibers were not stimulated. Neither was acetylcholine present in the fluid when Feldberg and Gaddum stimulated the postgangiolic fibers antidromically. No acetylcholine could be detected if physostigmine were omitted from the physiological salt solution perfusing the ganglion, and physostigmine in a concentration of only 1: 10^{-6} potentiated ganglionic transmission 8–20 times. During prolonged preganglionic stimulation the amount of acetylcholine released from the ganglion fell off in a logarithmic manner, and transmission decreased as judged by a concurrent falling off in contraction of the nic-

titating membrane. The total amount of acetylcholine liberated during prolonged stimulation was greater than the amount originally present in the gland, and when the amount was depleted by prolonged stimulation, both the amount liberated and contraction of the nictitating membrane increased when choline was added to the perfusion fluid (82).

On 4 July 1976 when the Physiological Society celebrated its centenary at a meeting in Cambridge, some physiologists gave historical demonstrations. Richard Keynes showed the remarkable properties of the apparatus Keith Lucas had used for his pioneer work on the nature of the nerve impulse, and M. de Burgh Daly, using Starling's apparatus, showed a heart-lung preparation. Feldberg perfused a cat's superior cervical ganglion and bathed a leech muscle with the effluent fluid (Fig. 13). To enable the scribe on the end of the lever attached to the leech muscle to cut through the soot on the kymograph paper, Feldberg rhythmically tapped with a pencil the table on which the kymograph stood. In the old days, other inhabitants of Feldberg's laboratory equated his continued tapping with Chinese water torture. The demonstration table was surrounded in part by a wooden bleacher, and two old ladies sat on its top bench. In the midst of his tapping Feldberg look up and said: "Am I doing it right, Lady Dale; I mean Lady Gaddum?" (83)

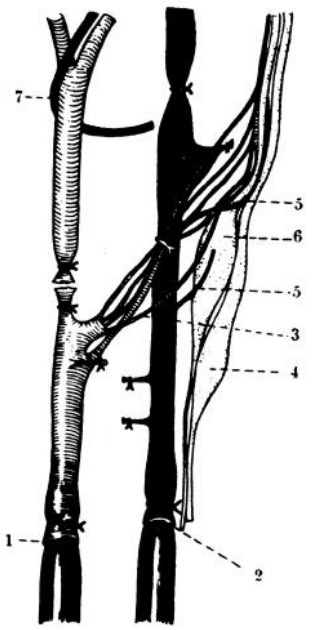


FIG. 12. Kibjakow's method of perfusing the superior cervical ganglion. 1, Common carotid artery; 2, internal jugular vein; 3, artery to the superior cervical ganglion; 4, nodose ganglion; 5, vein from the superior cervical ganglion; 6, superior cervical ganglion; 7, hypoglossal nerve. [From Kibjakow (81).]

FIG. 13. Wilhelm Feldberg demonstrating perfusion of the superior cervical ganglion of a cat on 4 July 1976 at the Centenary Meeting of the Physiological Society.

The Opposition

At this point I return to DuBois Reymond's assertion that if transmission is not chemical, "the phenomenon is electrical in nature."

All the time Loewi, Dale, Feldberg, and Gaddum were collecting evidence for chemical transmission of the nerve impulse others were collecting evidence that transmission is electrical in nature. Chief among the latter was J. C. Eccles, who was working in the physiological laboratory at Oxford. At the frequent meetings of the Physiological Society, each side presented its arguments. The chemical side was presented by Sir Henry Dale and the electrical side by J. C. Eccles. The contrast was striking. Dale was a practiced debater, and he had a magisterial air acquired as chairman of innumerable important committees and boards of directors. He was a Nobel Laureate, recipient of the Order of Merit, past secretary of the Royal Society, a knight, and holder of many decorations and memberships in learned societies in many countries. Eccles was young, brash, and excitable, and in addition he was from Australia; he was a mere Colonial.

Eccles fully and fairly summed up his arguments for and against chemical as opposed to electrical transmission in a long review published in the 1936 volume of *Ergebnisse der Physiologie.* Although Eccles believed the evidence for electrical transmission was stronger than that for chemical transmission, he concluded:

> *At present the chemical and electrical hypotheses must both be regarded as on probation.* This uncertainty must be emphasized, as the apparently convincing evidence which has been adduced in support of either hypothesis has led to premature decisions, just as in the case of the biochemistry of muscular contraction. (84)

The emphasis was Eccles', and the last phrase was a covert criticism of another English physiologist, one as well established as Sir Henry Dale. A. V. Hill had received the Nobel prize together with Otto Meyerhof for, in part, demonstrating that lactic acid formation is essential for muscular contraction just before Einar Lundsgaard had proved that it is not essential.

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John J. Spitzer, professor and head of the Department of Physiology at Louisiana State University Medical Center in New Orleans, was named a Boyd Professor of the LSU system on April 19, 1991. The Boyd Professorship, which is awarded in recognition of distinguished scholarship and outstanding contributions to education, is the Louisiana State University system's highest academic designation. There are only 18 Boyd Professors currently on the faculty of LSU system schools and only 45 have received this high honor since the title was established in 1953.

Victor J. Dzau, Brigham and Womens Hospital, Boston, has accepted a position as chief, Division of Cardiovascular Medicine, Standford University School of Medicine.

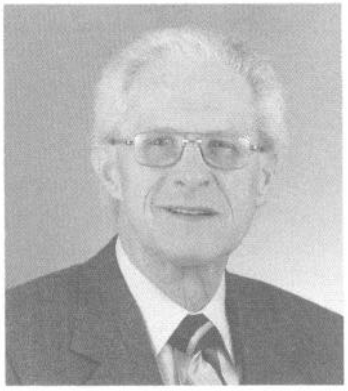
Formerly at the Veterans Administration Hospital in San Francisco, **Alan I. Faded** has moved to Georgetown University Medical Center, Washington, DC.

Roy D. Goldfarb of the Albany Medical College has joined the Section of Cardiology at Rush Medical School, Chicago.

Science Academy Elects New Members

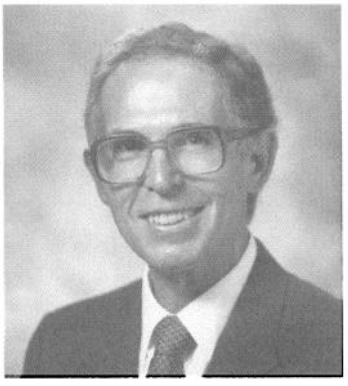
The National Academy of Sciences (NAS) elected 60 new members and foreign associates during their annual meeting in Washington, DC. This brings the NAS membership total to 1,625 and foreign associates total to 277. The APS members elected to the NAS include **Mathew Alpern, Maurice B. Burg,** and **Susan E. Leeman.**

Alpern is professor of opthalmology, physiology, and psychology at the Kellogg Eye Center, University of Michigan. His research interests include the physiology, pathophysiology, and psychology of the human light sense and color senses, as well as the effector mechanisms of the eye. With several colleagues, Alpern has become known for the development and application of a wide variety of different noninvasive techniques to resolve experimental questions elucidating cellular and molecular organization of the human visual system at different levels in the retina and visual pathways.



M. Alpern

Burg is chief of the Laboratory of Kidney and Electrolyte Metabolism, National Heart Lung and Blood Institute. Burg and his collaborators have developed methods to prepare renal tubules as suspensions and to dissect them out individually to study their biochemical and transport functions in vitro. Since 1985 Burg and his colleagues have been studying osmotic regulation by the cells in the medulla of the kidney, where they are exposed to potentially harmful levels of NaCl and urea in the blood and interstitial fluid. By a combination of analytical, tissue culture, and molecular biology techniques, they identified the protective substances (organic osmolytes) that the cells accumulate in their own defense, analyzed how these substances help protect the cells, and are now elucidating the osmotic regulation of the genes that are involved in their accumulation.



M. B. Burg

Leeman is professor of physiology at the University of Massachusetts Medical Center, Worcester.

Kandel Receives Bristol-Myers Squibb Awards

On June 27, 1991 APS member Eric R. Kandel, whose pioneering research into the molecular foundations of learning and memory, received the fourth annual Bristol-Myers Squibb Award for Distinguished Achievement in Neuroscience Research.

Kandel, university professor, Center for Neurobiology and Behavior, College of Physicians and Surgeons of Columbia University, and senior investigator at the Howard Hughes Medical Institute, was the first to show the brain undergoes physical changes when laying down long-term memory.

Working with the marine snail *Aplysia,* Kandel found that nerve cell connections laying down short-term memory changed chemically—that is, each nerve cell fired off larger quantities of proteins and released more elements such as calcium. These substances helped transmit a message to the next cell in line in a chain reaction that would reach the brain.

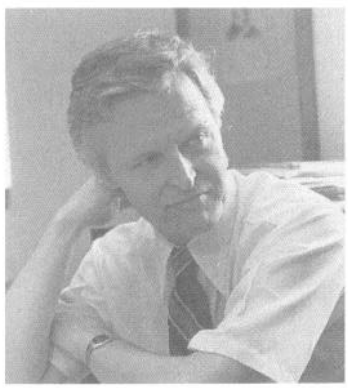
In long-term memory, lasting days or longer, nerve cells actually grew new physical connections to the next cell.

His research points the way to new solutions for psychiatric problems, learning disabilities, mental retardation and dementia and may one day lead to drugs to enhance memory and learning.

Kandel shares the $50,000 prize with Dr. T.V.P. "Tim" Bliss, head of the division of neurophysiology and neuropharmacology at the National Institute of Medical Research in London.

IOM Elects New Members

The Institute of Medicine (IOM) has elected 45 new members, raising the total active membership to 471. Two of the new active members, **C. Wayne Bardin** and **Suzanne Oparil,** are members of the APS.



C. W. Bardin

Bardin is director at The Population Council's Center for Biomedical Research, New York. Over the last 30 years his research interests have been concentrated in two areas. The first is testicular function with emphasis on androgen secretion, mechanism of androgen action, and the diverse protein secretory products of Sertoli cells, Leydig cells, and germ cells. More recently, the mechanisms by which these proteins interact to regulate spermatogenesis have been studied. His second area of investigation is contraceptive development. Bardin directs a team of investigators who have formulated, studied, and registered with the FDA the Copper T-380A intrauterine device, Norplant® contraceptive implants. In addition, this team is currently investigating a variety of other contraceptives and hormone-delivery systems for a wide variety of uses in reproductive health care.

S. Oparil

Oparil is director of the Hypertension Program, University of Alabama School of Medicine, Birmingham. Her research career has focused on neurohumoral mechanisms of hypertension with two major areas of emphasis, angiotensin-converting enzyme and the role of central neural mechanisms in the pathogenesis of hypertension. While working in Edward Harber's laboratory at the Massachusetts General Hospital, Oparil and colleagues defined the substrate specificity of angiotensin-converting enzyme. They were the first to demonstrate by direct radioimmunoassay techniques

Y-C. B. Fung

that angiotensin I is converted to angiotensin II in the pulmonary circulation and, further, to identify angiotensin conversion in other organ vascular beds, principally the kidney. Later studies conducted independently by Oparil and colleagues at the University of Chicago showed that the conversion of angiotensin I to II was impaired in patients with chronic obstructive pulmonary disease and hypoxia. Studies in porcine pulmonary artery endothelial cells in culture confirmed and extended these observations by showing that immunologically detectable converting enzyme levels were elevated in response to hypoxic exposure.

M. T. Stahlman

Studies currently in progress in Oparil's laboratory are addressing the molecular basis of this phenomenon. Oparil and colleagues were among the first to recognize the importance of central noradrenergic mechanisms in the pathogenesis of hypertension in the spontaneously hypertensive rat. Current studies in Oparil's laboratory are employing quantitative PCR techniques to assess ANP gene expression in anterior hypothalamic neurons.

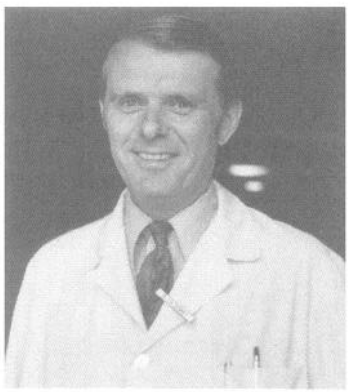
IOM also elected APS members **Yuan-Cheng B. Fung** and **Mildred T. Stahlman** directly to senior membership, joining three other new senior members.

Fung is professor emeritus of Bioengineering and Applied Mechanics at the University of California, San Diego. Among his early contributions were the development of theories of dynamics and stability of elastic structures in fluid stream. Fung's current work is centered on the relationship between physical stress and tissue remodeling. By examining the changes in the blood vessel wall when the blood pressure is increased as a step function, he found that the structure of the vessel is remodeled surprisingly fast and profoundly, which suggested that physical stress is a factor for tissue remodeling. The stress-growth relationship is one of the keys to tissue engineering, the creation of tissue replacement for clinical use.

Stahlman is professor of pediatrics and pathology at the Vanderbilt

University School of Medicine, Nashville. Her research interests have involved primarily studies of lung development in the fetus and newborn and hyaline membrane disease and its sequelae. At the present time, Stahlman is involved with studies of surfactant apoproteins in developing lung and during injury and repair in the newborn. She has also been recently involved with the role of vitamin A in lung injury and repair and in the role of the neuroendocrine cells of the developing lung and the newborn lung.

APS member **John A. Downey** was elected with four others to foreign associates membership. Downey is Simon



J. A. Downey

Baruch professor of rehabilitation medicine at Columbia Presbyterian Medical Center, New York. His principle interest is in body temperature regulation and autonomic function evaluation and testing in humans. Downey has done work in the spinal injury patient to elucidate clinical problems and also to investigate the basic understanding of temperature regulation. Additional clinical work has been in the area of the physiological effects of exercise and aging. A special area of interest, growing out of body temperature regulation and autonomic function, is the study of the physiological nature and etiology of menopausal hot flashes. Clinically this extends into the study and management of aging and the prevention of disability.

1991 Toxicology Merit Award Presented to Narahashi

Toshio Narahashi received the 1991 Merit Award of the Society of Toxicology at its 30th annual meeting in Dallas, Texas, February 25 to March 1, 1991. The award is the society's highest honor and was given to Dr. Narahashi "in recognition of a career of outstanding merit in the profession and of noteworthy contribution to the science of toxicology." The award was based on his lifelong work on the cellular neurophysiological mechanisms of actions of insecticides, tetrodotoxin, and other toxicants on ion channels. Narahashi is chairman of the Department of Pharmacology, Northwestern University Medical School and has been an APS member since 1967.

Trubatch New ORAU Leader

Janett Trubatch has been named vice president for university and industry programs at Oak Ridge Associated Universities (ORAU). She will be responsible for developing and managing corporate-sponsored communication, collaborative and consortial activities in service to the ORAU member institutions. ORAU is a consortium of 59 colleges and universities and a management and operating contractor to the Department of Energy.

Trubatch served for four years as the associated vice president for research at the University of Chicago and served as a health science administrator in the neurological disorders program at the National Institutes of Health. From 1977 to 1979, she was program director for neurobiology with the National Science Foundation.

A member since 1975, she was one of the leaders in developing opportunities for women to have a larger role in the affairs of the American Physiological Society.

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.

ANNOUNCEMENTS

Scientific Meetings and Congresses

10th Annual Laurence Irving-Per Frederik Scholander Memorial Lecture. Institute of Arctic Biology of the University of Alaska, Fairbanks September 16-18, 1991. *Information:* B. M. Barnes, Institute of Arctic Biology, University of Alaska Fairbanks, AK 99775-0180. Tel: 907-474-7640, Fax: 907-4774-6967.

7th International Symposium on Nephrology, "Kidney, Proteins and Drugs," Montecatini Terme, Italy, October 14–16, 1991. *Information:* Claudio Bianchi, Unita di Nefrologia, Clinica Medica 2, University of Pisa, 56100 Pisa, Italy. Tel: 050-592573.

SCAW Workshop on US Regulations and Canadian Guidelines for Research Animal Welfare. Vancouver, Canada, October 20, 1991. *Information:* SCAW, 4805 St. Elmo Avenue, Bethesda, MD 20814. Tel: 301-654-6390.

Aging: The Quality of Life, Omni Shoreham Hotel, Washington, DC, February 1992. *Information:* Suzanne Kuntz, Conference Coordinator. Tel: 202-639-4524.

First International Symposium on Brain Death, International Conference Center, Havana, Cuba, September 22–25, 1992. *Information:* 1er. Simposio Internacional Sobre, Muerte Encefálica, Palacio de las Convenciones, Apartado 16046, La Habana, Cuba. Telex: 511609 palco cu, Fax: 22-8382.

Know Your Sustaining Associates

Abbott Laboratories

Abbott Laboratories is a worldwide company devoted to the discovery, development, manufacture and sale of a broad and diversified line of human health care products and services. Abbott innovations include *Nembutal* and *Pentothal* anesthetics, the *Erythrocin* line of antibiotics, the *Ausria* and *Auszyme* diagnostic kits for hepatitis B, the first US licensed AIDs virus antibody detection kit, *Similac* and *Isomil* infant formula, the *TDx* drug detection system, and the *ADD-Vantage* drug delivery system. Abbott's commitment to the future is evident in its $500 million dollars spent on research and development in 1989 and an annual compound growth rate in R&D spending over the past 5 years of 20%.

American Medical Association

The American Medical Association promotes the art and science of medicine and the betterment of public health. The AMA accomplishes this mission by advancing standards of medical education, promoting support for biomedical research, representing the medical profession, providing information about medical matters, and upholding professional conduct and performance.

Axon Instruments, Inc.

Axon Instruments, Inc. designs and manufactures instruments and software for electrophysiology. Axon Instruments produces full-featured amplifiers for single-channel and whole-cell patch clamp and for single and two-electrode current/voltage clamp applications. These hardware products are supported with PC and Macintosh software and acquisition hardware for the acquisition and analysis of biophysical data. The latest products are the CyberAmp series of general-purpose analog signal conditioners. They provide up to eight channels of computer-controlled adjustment of gain, offset, and low-pass Bessel filtering. Virtually any type of transducer can be adapted for the CyberAmp. The computer can instantly determine the scaling and units of each transducer. Support for the CyberAmps is provided by software from Axon Instruments and others. The CyberAmp used in conjunction with Axotape software and TL-1-125 acquisition hardware makes a complete computer-based chart recorder system.

Berlex Laboratories

Berlex Laboratories is a US subsidiary of the multinational pharmaceutical and chemical firm Schering AG West Germany (not connected with Schering-Plough Corp. or Schering Corp. of New Jersey). It conducts research and markets prescription drug products primarily for cardiovascular, diagnostic imaging, metabolic, endocrine, and central nervous system uses.

Coulbourn Instruments, Inc.

Coulbourn Instruments, Inc. manufactures electronic instruments for in vivo life science applications. Products include the LabLinc Modular Instrument System for physiological signal conditioning, experiment control, and data acquisition, featuring over 100 modules, including computer interface ports, signal conditioning and processing, and counting and timing modules for chart and computer-based polygraphs.

The company also produces transducers, biotelemetry, signal processors, stimulators, and auditory and animal behavior test equipment.

Major markets include pharmaceutical, chemical, and biotechnological firms, universities, research hospitals, and government laboratories.

Dagan Corporation

Dagan Corporation manufacturers electronic instruments used in electrophysiology. Dagan offers a full line of analog and digital products, including preamplifiers for use in intracellular and extracellular recording, single and two electrode voltage/current clamps, patch clamps/whole-cell clamps, signal averagers, programmable multichannel stimulators, and iontophoresis generators.

Du Pont Pharmaceuticals

Du Pont Pharmaceuticals is a part of The Du Pont Company, a diversified international corporation. Located in Wilmington, Du Pont Pharmaceuticals is a research-intensive firm whose major products are used to combat cardiovascular diseases, pain, and viral diseases. It is also a leading manufacturer of radiopharmaceuticals.

Major products include "Coumadin," "Sinemet," "Percodan," "Percocet," and thallium.

Primary areas of research are medicines for cardiovascular illnesses, inflammatory diseases, central nervous system disorders, central nervous system diseases, and viral illnesses.

Genentech, Inc.

Genentech, Inc., founded in 1976, is a leading biotechnology company focusing on the development, manufacture, and marketing of pharmaceuticals produced by recombinant DNA technology. Four approved therapies derived from biotechnology were pioneered by Genentech, including human insulin, alpha interferon, human growth hormone, and recombinant tissue plasminogen activator.

Glaxo, Inc.

Glaxo Inc., a leading research-based pharmaceutical company headquartered in Research Triangle Park, North Carolina, manufactures and markets prescription medicines including treatment for respiratory ailments, ulcers, hypertension, infectious diseases, and diseases of the skin. Glaxo is a wholly owned subsidiary of Glaxo Holdings p.l.c.

Grass Foundation

The Grass Foundation underwrites the annual Walter B. Cannon Lectureship given at the spring meeting of the American Physiological Society. The naming of this lectureship serves two functions: to commemorate the enormous contribution of Cannon to the growth of knowledge of physiology and to pay a tribute to Cannon on behalf of many of the founding trustees of the Grass Foundation who were members of his research group at Harvard Medical School early in their careers.

This lectureship is in accordance with the Grass Foundation's charter mandate to support research and education in neurophysiology. Other programs include funding for other annual and visiting lectureships, summer fellowship support for young students, and occasional relevant course support.

Harvard Apparatus

Harvard Apparatus, since its inception in 1904 at the Harvard Medical School, continues to design, develop, and supply the unique apparatus that has shaped the development of teaching and research in physiology and allied science, including syringe peristaltic and respiration pumps, recording systems, and research accessories.

ICI Pharmaceuticals Group

The ICI Pharmaceuticals Group R&D facility is based in Wilmington, Delaware. It consists of about 700 staff, of whom about 170 are in drug discovery. Within ICI, the US drug discovery function has sole responsibility for discovering new drugs in the pulmonary and CNS therapeutic areas. Current CNS targets are nondyskinetic antipsychotic drugs, disease-modifying drugs for Alzheimer's disease, and drugs for cerebral stroke and ischemia. The entire gamut of experimental approaches is available, including biochemical, neurochemical, electrophysiological, histochemical, and behavioral. Subserving the discovery efforts are a Molecular Pharmacology Unit at Wilmington and a Biotechnology Department in ICI-UK.

Jandel Scientific

Jandel Scientific designs and sells IBM-compatible software for scientific research. Products include Sigma-Plot for publication-quality scientific graphs (with automatic error bars, regression lines, and many other scientific graphing options); Sigma-Scan for *x-y* digitizing, morphometric measurement, and analysis; and PC3D for generating three-dimensional reconstructions of objects from serial sections. JAVA, the latest product, is a video analysis system capable of image processing, densitometry, automatic object counting and edge tracking, and morphometric measurement. JAVA works with a video digitizing board and input from a video camera, VCR, or other video source.

Janssen Pharmaceutica

Janssen Pharmaceutica was founded in Belgium in 1953 by Paul Janssen. It is now an international company built on the foundation of research and a bedrock of innovation. The company remains under the direction of Janssen and has an unparalleled record in the successful development and marketing of new pharmaceutical products. According to the Japan Drug Research studies, Janssen was responsible for more significant new drug discoveries during the period 1970–1983 than any pharmaceutical company in the world.

The company currently has approximately 6,000 employees worldwide. It is a world leader in medication used in the treatment of allergies, mental disorders, digestive and intestinal problems, cardiovascular conditions, and worm and fungal infections. Janssen's compounds have also enabled major advances in anesthesia and immunology. In addition, Janssen has also discovered many chemical compounds to identify and characterize receptors in the brain and the periphery that have played a prominent role in advancing our knowledge about neurotransmitters.

R. W. Johnson Pharmaceutical Research Institute

Ortho Pharmaceutical Corporation is now a part of the R. W. Johnson Pharmaceutical Research Institute. It is headquartered in Raritan, New Jersey and is a research-based pharmaceutical company engaged in the development and manufacture of a wide range of health care products marketed in more than 60 countries around the world. A wholly owned subsidiary of Johnson & Johnson, R. W. Johnson Pharmaceutical's operating divisions produce a variety of contraceptives, gynecological therapeutics, prescription and proprietary skin-care products, self-care diagnostics, and a growing number of biotechnology-derived pharmaceuticals, including immunomodulators and monoclonal antibodies.

With more than 4,000 trademark registrations worldwide, R. W. Johnson

Pharmaceutical continues its commitment to an intensive research and development program to ensure tomorrow's innovative health care products in the areas of conception control, immunobiology, and the treatment of gastrointestinal disorders and cardiovascular disease.

Narco Bio-Systems

Narco Bio-Systems designs, manufactures, and distributes the Physiograph® physiological recording systems for use in clinical, research, and teaching applications. A selection of multichannel chart recorders are available with a complete line of modular input preamplifiers, signal conditioners, transducers, and accessories. This allows maximum flexibility for designing systems for recording physiological functions.

Pharmacia

Pharmacia is the world's leading supplier of separation and purification products for the biotechnology industry, as well as a research-intensive international manufacturer of products for use in areas of medicine, including gastroenterology, rheumatology, oncology, ophthalmology, blood volume replacement, allergy, and dermatology.

Procter & Gamble Company

Procter & Gamble is a multinational, technically based consumer products corporation with operations in 28 states and 36 foreign countries. It has four technical centers, and its world headquarters are in Cincinnati, Ohio. Technical centers are also located in Egham and Newcastle, England; Brussels, Belgium; Schwalbach, Germany; and Osaka, Japan.

The worldwide PhD population of Procter & Gamble is ~850, divided equally between chemists and life scientists, and total employees number 75,000.

Sales in the paper, soap and detergent, health care, personal care, pharmaceutical, beverage, and food categories make Procter & Gamble one of the largest US corporations. *Fortune* magazine has named Procter & Gamble as one of the most admired corporations in the United States.

Schering-Plough

Born out of a 1971 consolidation of two companies—Plough, Inc. and the Schering Corporation—Schering-Plough is dedicated to the discovery, development, and marketing of novel therapeutic entities. The company focused its research in the fields of anti-inflammatory, antiallergic, cardiovascular, and anti-infective disorders. The company has also attained a leading position in immunology and recombinant DNA technology.

SmithKline Beecham

A division of Smith Kline Beckman Corporation, Smith Kline & French Laboratories is a technology-intensive, worldwide health care company. Smith Kline & French is a leading supplier of pharmaceuticals to treat infectious, gastrointestinal, cardiovascular, and arthritic diseases and a leader in research, development, and marketing of innovative medicines.

Squibb Corporation

Squibb Corporation, a leading worldwide developer, manufacturer, and marketer of pharmaceutical and allied health care products, is organized into the Squibb Operating Group and the Science and Technology Group.

The Squibb Operating Group is responsible for the manufacturing, marketing, and distribution of products and services. Squibb's pharmaceutical products are marketed by Squibb International and Squibb United States. The Medical Products segment consists of ConvaTec and the companies of Edward Weck Incorporated.

The Squibb Science and Technology Group is composed of The Squibb Institute for Medical Research, Worldwide Regulatory Affairs and Licensing. Celebrating its 50th anniversary in 1988, The Squibb Institute is among the nation's first industry-sponsored research centers. In recent years, it has focused on four main areas: *1*) cardiovascular disease, *2*) infectious disease, *3*) diagnostics, and *4*) inflammatory disease. It has recently broadened into molecular biology, the neurosciences, and metabolic disorders.

The Upjohn Company

The Upjohn Company, a multinational corporation headquartered in Kalamazoo, Michigan, has celebrated its centennial year as a maker of fine pharmaceuticals. It is one of the 15 largest research-based pharmaceutical manufacturers in the world. It has research, production, and warehousing facilities in more than 45 countries and its products are sold in more than 150 countries.

Upjohn has long been committed to the research, development, manufacture, and marketing of pharmaceuticals. Human health care is the heart of Upjohn's endeavors.

Waverly Press

Approaching its 100th anniversary, Waverly Press is a full-service publication printer specializing in journals and other periodicals.

Committed to servicing its customers through sharing knowledge, providing the best of modern technology, and establishing mutual respect, Waverly Press offers a full range of publishing services including design, editing, composition, printing, binding, mailing and distribution, warehousing, subscription fulfillment, and ad sales.

Waverly practices team concept management. Both client and staff are part of the team. Through this management concept, each publication receives close personal attention.

Striving for excellence in the graphic arts industry is a tradition at Waverly Press—one that continues. Waverly believes in quality products and service through quality people.

Responses to the Long Range Planning Committee Report

To the Editor:

The report of the Long Range Planning Committee (LRPC) is scholarly, broad and deep, thoughtfully and gracefully composed, as one expects from chairperson Ernie Knobil and his eight distinguished colleagues. It is their recommendation that Departments of Physiology seek to differentiate themselves from other basic life sciences departments by identifying their discipline as "integrative biology," which they characterize as the next revolution in biology. APS Council is reported to have "accepted the concept that APS promulgate a definition of physiology as 'Integrative Biology,' the biology of the future."

The LRPC had a difficult enough task just to define physiology. As they point out, to paraphrase them, and as others have done before them, physiology is what physiologists do, and a physiologist is someone who practices physiology. They conclude, as do I, that physiology is a point of view. They emphasize that past is prologue, but their recommendation seems to me to have made very little use of the lessons of the past, nor is it based on a convincing assessment of the future.

Everything in life depends on a way of looking at things, a point of view. Every profession is characterized by sets of points of view. My son, who works in molecular genetics, tells me that he thinks of much of molecular biology as a tool kit. He uses the tools, gratefully, to help solve problems. but the tools do not define his discipline; what counts is the way he thinks about placing his results, and what he reads, in perspective with this view of how nature works.

The LRPC report has confused took kits with points of view, and so have those who would lump all basic medical sciences together. I suspect it is this that led to the unfortunate recommendation to define physiology as integrative biology, a definition too narrow and unrealistic, because it ignores much of what physiologists actually do, and will do. It is a too restrictive glimpse of the future.

Points of view are not immutable. They evolve. Points of view of physiologists have not been entirely independent of the period in which they flourished, of what was happening around them in society. It is risky to predict future emphases of physiology without considering where the world of which it is a part is going, and I am not going to guess what the world is coming to.

The report reminds us that for nearly two millenia *physiology* encompassed all knowledge of nature. Physiology is a word first used in Greece in the sixth century B.C. in a sense connected only remotely to its present use, the study of integrated functions of the whole organism, animal or plant, *and* the study of functions of individual organs and organ systems, of cells, and of subcellular components, such as cell membranes. Although there were early experimentalists, much of the catechism of function was simply guesswork based, in antiquity, upon interpretations of anatomy from sacrifices and butchery, and, into the seventeenth century, on speculative pathophysiology.

The LRPC report refers to Harvey's great intellectual achievement, his experimental design and observation. But Harvey's influence on his contemporaries was limited. The times were not yet right, and, in general, physiology remained a handmaiden of conjectural anatomy and pathology. It was not until the next century that Albrecht von Haller, a Swiss anatomist and botanist, popularized the notion that physiology is anatomy in motion; the scholarly area assigned to physiology was becoming constricted toward the present-day meaning. Haller didn't invent the concept; he articulated what seemed to be happening. Physiology dealt with questions of how organs and tissues of the body, particularly the human body, worked. Disease was regarded as disordered function, disordered physiology. Attention was directed toward nonhuman animal physiology almost only to the extent that information, if it was information and not simply conjecture, might be useful to mankind. Attention was directed toward plant physiology, again, largely as that knowledge might be related to treatment of disease with herbal concoctions. But there was still little experimentation.

As the Enlightenment began to spread early in the eighteenth century, myths succumbed to natural science. The movement gathered strength and was not realized fully until the nineteenth century. In England, France, and Germany people accepted that science could improve the quality of life; that it could be practical. Steam engines were developed and improved; new industries appeared. Study of physics and chemistry intensified as these sciences were encouraged to lay the foundation for industrial development. This was the age of our classical physics. Groundwork for revolutionary advance in physiology lay in burgeoning knowledge of electricity, gas laws, and heat in physics, and isolation of oxygen, hydrogen, and nitrogen, and understanding chemical combinations and reactions of acids and bases. The science of thermodynamics arose from the study of steam engines. Animals, particularly man, were analyzed as heat engines.

No one person was responsible; it was the climate of the times. But, if one person was most important in the transformation of physiology it was Francois Magendie, who, throughout the first half of the nineteenth century, introduced and developed experiments on living animals. He experimented on the dorsal roots of the spinal cord in the dog, on routes of intestinal absorption, on the origin of heart sounds, on the flow of cerebrospinal fluid, and used selected puncture and section of the brain to elucidate function. He had enormous influence through his writings, which were translated into German and helped stimulate the rise of the German experimental school of physiology, and through his students, the most illustrious of whom was Claude Bernard. A critical mass of experimental physiologists was forming in France.

Bernard's experiments were seminal. He is the father of many concepts in animal physiology, but he may be remembered best for his codification of scientific method. For Bernard, all hypotheses were tentative, to be challenged by

experiments. He laid out criteria: proof and counterproof; a substance or a maneuver can be said to cause a specified result if the maneuver always is accompanied by, or followed by, the conjectured result, and if removal of the conjectured cause leads to disappearance of the result.

As the LRPC report states, Carl Ludwig, a contemporary of Bernard, was the most influential of the German physiologists, and through his students exerted continuing influence on the development of the science. Ludwig was an inventive instrument designer. Science advances as new instruments make possible experiments previously inaccessible. He emphasized application of physical principles in his studies of the circulation and urine excretion. Indeed his textbook of physiology was oriented toward physical principles rather than toward anatomy, as had been previous texts.

Among the most important of Ludwig's students was Adolf Fick, originally a mathematician, who switched to medicine. With his mathematical background, Fick's first studies were of physiological optics. Shortly thereafter, stimulated by Ludwig's studies on mechanism of secretion, and based on Fourier's treatment of diffusion of heat, Fick derived the law that bears his name, the law of diffusion of solutes in solution; in order to make a contribution to physiology, he had first to formulate the basic physicochemical law. He investigated conditions necessary for electrical stimulation of excitable animal tissue, and discovered that duration of electrical stimulation was as important a parameter as its intensity. He suggested that the volume of blood ejected from the heart in one minute (cardiac output) could be calculated from the fact that the quantity of oxygen taken up per minute in inspired air had to be equal to the product of cardiac output and the difference in oxygen content between arterial and mixed venous blood, a simple formula, now known as the Fick Principle.

A contemporary of Ludwig, Hermann von Helmholz, a physician who applied mathematics and physics to the senses of hearing and sight, made important contributions to theory in physics, for example the thermodynamic law of conservation of energy. Helmholz was an intellectual giant who was able to draw general conclusions from simple experiments, often accomplished with jury-rigged apparatus. It is interesting that he had few disciples, perhaps because the rigor of his discipline was more demanding than students felt they could master. Among them, however, was Julius Bernstein, who studied bioelectricity and who produced a membrane theory which forms the solid basis of our contemporary view of cell membranes as electrical dipoles, due to gradients in specific ionic activity on the two sides of the membrane.

The German school of physiology, which flourished in the second half of the nineteenth century, was dominated by men who based physiology on physics, on electricity and mechanics. These physiologists trained younger men who continued their work in Germany and who spread it to other lands, particularly neighboring countries of Austria, Hungary, Switzerland, Holland, Belgium, and Scandinavia, but also to Russia, Italy, Great Britain, and the United States.

These are the origins of our points of view. I am aware that my own descends from both the French and the German schools, and in many ways the merger has served my research well.

Meanwhile, British physiology, which had a glorious beginning in the seventeenth century with William Harvey, had not kept pace with developments in France and Germany, and remained secondary to anatomy. In 1866 a young physician, Michael Foster, was recruited to join in teaching physiology at University College. Foster was an extraordinary organizer, a stimulating teacher, and a student of histological physiology, familiar with advances in the French and German schools. Shortly after his arrival at University College, Foster established the first physiological laboratory in the United Kingdom. He made physiology a medical school course separate from anatomy, he cofounded the Physiological Society in London in 1876, and he established the Society's publication, the *Journal of Physiology,* two years later.

Michael Foster was responsible not only for the transition to the experimental phase of British physiology but also for a revolution in its teaching. Prior to Foster, there had been no separate departments of physiology, and no teachers of physiology who identified themselves as exclusively, or even primarily, physiologists. Physiology was taught, sometimes along with anatomy, by clinicians, often surgeons, mainly to get on with the study of disease; that is, the area we now call physiology was of use only in the context of abnormal or pathophysiology, as a rationale for signs and symptoms of disease. Those who were assigned to teach it are said to have usually done so without enthusiasm; it was a charge to younger members of the faculty. Foster changed the system. He was able to do so because physiology was becoming an independent discipline.

Although it was Michael Foster in London who introduced the student hands-on physiological laboratory course into medical school, it was in the US that hands-on laboratory teaching reached its height. It was one of the glories of medical education in the US that students had access to, and indeed had to perform in, practical laboratories, where they learned how to set up animal preparations, how to use the equipment, how to keep laboratory notes, how to observe, how to think about an unexpected result, and how to extract a principle from a well-controlled experiment. In the 1960s and 70s, hands-on laboratories began to disappear from courses in the basic medical sciences. First it was the biochemists, who justified the move by asserting that most students had already had sufficient experience in college courses. But there was a whittling away at other courses, including physiology, which most students had not studied in college. It is not clear why this retrogressive move was made. In institutions at which the courses continue, some are in abbreviated form. Thus, we are witnessing a retreat in education to the days prior to Michael Foster in the second half of the nineteenth century.

All this is the heritage of our century. I was stimulated by Walter Cannon's *The Wisdom of the Body,* and I worked in the physiology laboratory throughout my medical student years. I was intrigued by the challenge of putting all the information together to understand how the whole body worked, but in my student apprenticeship I learned that it

isn't worth trying to put it all together unless the data are impeccable. The first job of any scientist is to obtain data of the highest reliability by the criteria of the times, and to understand the limitations of the methods, and, if the methods are not sufficient for the task, to either bring the methods up to the needs or defer the larger question until someone else develops the method.

A biochemist and a physiologist who ask the same question will design quite different experiments. Biochemistry remains essentially a qualitative or descriptive science. Biochemists have been extraordinarily successful in identifying organic compounds, in delineating steps in their syntheses, and they continue to do so at ever more refined levels, working, for example, with small amounts of genetic material. A biochemist wants to know if a certain biochemical reaction works, if it produces an identifiable product. One of my biochemist friends and colleagues told me that if he got a system to work once, that meant that the system existed, and if it did not work again that meant that some technical error had crept in. I have heard biochemists say that a result was reproducible; they got it twice. Much of molecular biology and biochemistry is more directly descended from taxonomy than from physiology; it deals with demonstration, important as it is, that there are three isomorphs of phosphokinase C, four forms of glucose transporter, and so on. Physiologists, in general, ask questions that require quantitative answers. Physiologists work with life, either with an entire organism, such as a complete vertebrate, or with components of that organism that retain properties of life, such as an excised muscle, or a muscle cell. Often, physiologists are reluctant to perturb too much the living material they study; they are therefore often compelled to seek only small effects. Verification that these small effects are real and not normal variation about a baseline requires careful quantitative methods. Many physiologists tend to develop mathematical models to which they compare data from their studies of the living system, and which, given goodness of fit between models and the experimental data, serve as predictive hypotheses to be challenged by further experiment. Successful exploitation of statistical methods in physiological experiments was realized only during my professional lifetime, and, as I remember it, and I have not documented this conclusion, design of wet bench experiments for subequent statistical analysis was a United States innovation; European physiologists and many elder physiologists in this country were leery of it. I remember, when the old hand-cranked Monroe calculator in our biophysics department suffered mechanical failure and began spitting out inaccuracies, Keffer Hartline, department director and Nobel laureate in physiology, announced satirically that it was now OK to use statistics.

Physiologists today are investigating life from the simplest functioning elements, such as channels of macromolecular dimensions in cell membranes whose function is to modulate flow of ions between the inside and the outside of the cell, all the way to integrated action of multiorgan systems in such performances as exercise. On the way to multiorgan integration, they are investigating complicated functions of single organs, such as the series of stimuli of cortical cells in the brain in anticipation of a well-defined motor activity, such as movement of a limb. These are examples, not an exhaustive list. As has been true throughout the history of physiology, physiologists use the tools of mathematics, physics, and chemistry. To these they add modifications of tools that have been made by immunologists, geneticists, and others.

At the other end are studies of integrated action of multiorgan systems. Large questions remain of mechanisms of coordination of these integrating systems with the cardiovascular, respiratory, renal and other organ systems in activities of daily living.

It is said that current technology has blurred distinctions between disciplines in the laboratory-oriented biological sciences, because faculty members in one life science department may be doing the same sorts of studies as those in other life science departments. Not only does this confuse tool kits with points of view, but also it is not entirely true. By and large, the Weltanschauung that determined the tools exploited by Ludwig and his students, the methods of physics, remains the provenience largely of physiologists.

What we are seeing today is illustrated by the single decade of studies of ion channels. First the tight-seal method was described and used by physiologists to identify and distinguish single channels on the basis of conductance, time courses of opening and closing, and ion preferences, and manner of activation and inactivation, whether by voltage, receptor, ligand, ionic, or organic messenger. The studies required help from electrical engineers and from mathematical statisticians. It emerged that there were many types of channels, even of those whose preference was for the same ion, and physiologists began at once to ask what the function of each type is. Then it became possible to extract ion channels from cell membranes. Some were placed in planar lipid bilayers for further studies of function. Others were analyzed for their amino acid composition and configuration. Site-directed mutagenesis was used as a tool to get leads on loci of gating and of ion recognition. These studies required either that the electrophysiologist learn to use the tools of molecular biology, or that the studies be cooperative. Some of the most multi-authored papers (one with 17 authors) have so arisen. The mom and pop neighborhood grocery store is being squeezed out by the supermarket in areas of this sort. But remember that if it weren't for the physiologists the questions would not have been asked.

It seems to me that the need remains, as it has from the time humans first asked what is life, to get reliable data. A. N. Whitehead, unfairly, since we are all prisoners of our times, indicted Aristotle before the tribunal of historical judgment, because Aristotle said "Classify" when he should have said "Measure." There will remain the need for physiologists, like Ludwig, to develop the instruments required by the task. There will remain the need for physiologists to apply methods with full understanding of their advantages and limitations. There will remain the need for physiologists to study all aspects of life and of living things, from subcellular elements to an entire vertebrate, from mathematical models to influences of environment on individuals, and influences of populations on individuals. To some extent, emphasis will

be determined, as it has been, by the extent to which society directs efforts, by controlling support and recognition.

There will, and should, remain many physiologies, all being done by people who identify themselves as physiologists. I share regret at hypenation of Departments of Physiology, as I do of faddism in general. I can understand concern that physiology departments may turn into amorphous blobs of molecular biology, as some already have, but remember that molecular biology is a tool kit for everybody to use when those are the tools the question demands. That is not what defines a physiologist, or a nonphysiologist. The LRPC asks where the teachers of medical school physiology are going to come from, if physiology departments in medical schools are going to be using alien tools, and presumably not kymographs. It is a good question. During my 45 years as a faculty member, my primary appointment has sometimes been in the department of medicine and sometimes in that of physiology. My experience is that an intelligent and energetic professional has it all over a gifted amateur. Those engaged in research at the moving edge of a field are far better teachers of that subject than those who have only a peripheral knowledge. I hear the words physiology and physiological used daily by my clinical colleagues in medicine, pediatrics, neurology, surgery, and all the surgical specialities. To clinicians, it is important to understand the pathophysiology of the disease, disorder, or dysfunction. In most patients, the goal is to restore nromal function, or to simulate it as much as possible. Many clinicians have made, are making, and will continue to make major contributions to understanding how disease has altered function, what normal function is, and what measures are best suited to restore or mimic it. A major function of physiology departments is to serve as a reservoir, a nucleus around which research and advice in these areas of research are seeded. This need will remain, and it cannot be met by those who are able, by virtue of clinical demands, to be only very part-time investigators.

There is no fear that physiology will follow gross anatomy as a science that is thought by many to be fully formed, requiring no further investigation, no new insights. Twenty-five years ago when I wrote a chapter on muscle for Bard's *Medical Physiology,* I thought that A. V. Hill and his school had found all there was to know about muscle heat, its time course and its relation to metabolism. By the time the next edition was due (by then it was Mountcastle's *Medical Physiology*), the subject had been re-opened, some of it by Hill himself, and it had become unsettled. From the time I entered physiological research, more than 50 years ago, I have kept a secret file labeled "Thoughts, Problems and Arguments." Some dealt with questions that could not yet be framed in terms of experimental design because methods did not yet exist. To some of those I returned as methods became available, and some seemed so tantalizing that I took time off to develop the method myself or with collaboration. Every new observation leads to another question. I sometimes think that nature is teasing us. She lets us get only so close to her secrets, and then retreats, laughing seductively. The horizon is ever-receding. I have no fear that there will ever be nothing new to learn.

Integrative biology is an important area. It is now, and it was in my father's day, and it will be in the future. But it is far from all there is or is to be in physiology. I advise my children and my students, do not close doors that do not need yet to be closed; do not abandon options until compelled to. It is a great mistake to seek to define physiology restrictively as integrative biology. Physiology had been anatomy in motion since Haller's day, and it will be so tomorrow and the day after, and the day after, . . .

Kenneth Zierler
Professor of Medicine and Physiology
Johns Hopkins University

Responses to The Future of APS and Physiology

To Shu Chien:

After reading the February 1991 issue of *The Physiologist* I decided the time has come for me to write to someone as to my perceptions of the APS.

Physiology is the study of the functioning of living organisms. Function can be studied at many levels of biological organization. Ultimately, information obtained from molecular studies should help to explain what is taking place at the cellular, tissue, organ, and organ system levels of organization. Knowledge is integrative. The entire scientific method of theory formulation based on hypothesis testing is integrative. Physiology as such has no priority on integration. Therefore, to define physiology as integrative biology is to say that the entire realm of science is physiology. In a sense that may be true. Since science involves a search for causes, I would leave the definition of physiology as the study of function of living systems. However, in amplifying that definition, I would stress the need to study functioning at all levels of biological organization and the interrelationships between and amongst these levels of organization.

The above approach to defining physiology automatically implies that physiologists must be conversant with the "new biology." If, in the course of their studies, physiologists require the use of the techniques of the new biology, then by all means they should use them without any fear of loss of identity. Certainly physiologists should continue to work on the organ system level. They should work on any level of biological organization they feel most comfortable with and the one that will supply the answers to the questions they ask. They should even work on the level of the whole multicellular, multi-organed organism.

Superlative conferences should be the aim of any organization. We should always be striving for excellence. A policy should be set as to why conferences are required. The number of conferences per year should be set by the relative rates

of advancement in specific fields. Only when a conference can be justified by the rapidity of advances in a field should one be convened.

We do not need new categories of class distinction. Therefore, we do not need fellows. Who cares if a nonmember invited speaker is given a one-year free membership. The fact that such individuals are not members is what should be ascertained. It is better to have positive programs with distinct professional benefits that would attract scientists to membership in the first place. Let us spend time making the organization more attractive to potential members. Emphasize why they should be members of the society. What can the society do for them that they should spend so much per year in (additional) dues.

Absolutely, the APS should stay within the FASEB framework. The APS, and other FASEB members, should be recruiting related science organizations as members.

APS should be an advocate for funding of excellent research, irrespective of its origin. There must always be support for investigator-initiated research.

The APS should be in the forefront of supporting new ideas and approaches and not only those that are safe and predictable.

APS should be working to see to it that consideration of proposals by the NIH is scrupulously fair. Also, APS should be working to assure greater support for all scientists, irrespective of age, even those in smaller universities who are not working in a medical school environment.

Yes, the APS is moving in the right direction. Just move faster and consult with some of us who are not part of an inner circle. APS should consider broadening its base of operations by including nonmedical school physiologists from large/small colleges/universities in its working- and policy-making committees.

With best wishes in your and the society's endeavors.

Sheldon F. Gottlieb
Department of Biological Sciences
University of South Alabama

I read your thoughtful and provocative statement in the February *Physiologist* on the future of physiology and APS with interest and some worrisom concern. I fully agree with your assessment of the problem and what needs to be done but I am fearful that the odds are against major improvements in the "perception" of physiology in the near future. The molecular partisans have gained such overriding dominance as to have a distrustive effect on organismic biology. I have observed this happening in my own discipline, endocrinology, and at my home base. Funds are being rechanneled away from integrative biology on a broad front.

No one questions the important contributions that molecular studies have made in recent years and will continue to make but why this must come at the expense of the elucidation of how bodily systems are integrated is indeed distressing and I think obstructionist.

Roy O. Greep
Foxboro, MA

I read with interest your message, "The Future of APS and Physiology" in the February issue of *The Physiologist.* In particular, that section which dealt with "The Science and the Images of Physiology" reminded me of a previous message delivered by Dr. Joseph Doupe some 35 years ago and reprinted in the *Canadian Medical Association Journal* (75:469–472, 1956).

In that message, Dr. Doupe set out to define physiologists and their relationship to medicine and surgery. It is his definition of a physiologist that I have used as my own "credo." Many of his words still ring true. Many of his concerns about the perception of physiology and physiologists parallel our own concerns today.

Richard W. Mitchell
Department of Medicine
University of Chicago

I see no pressing reason to define physiology uniquely as "integrative biology." Anatomy is also "integrative biology." It integrates structures in space. Physiology integrates events in time. Molecular biology is the greatest integrator of biological thought since the concepts of evolution as expressed by Darwin. Molecular biology has integrated much of biochemistry, microbiology, immunology, and genetics. Our understanding of the action of hormones and other chemical transmitters has been enhanced, and has integrated our understanding of many physiological processes.

I believe that most would agree that Alan Hodgkin and Andrew Huxley are physiologists of first rank. Their contributions, however, seem to me to describe mechanisms of local events rather than to integrate at the organ system level.

I sometimes think of physiology as the science of biological transport or motion. It deals with the movements of whole organisms, of parts of organisms, of molecules and ions. It is concerned with the transport of substances, with the transfer and transformation of energy, and the transport of information within organisms and between organism and environment.

Although it is an interesting intellectual exercise to try to define physiology, there is a danger that we may get preoccupied with angels and pinheads. I must agree with Wallace Fenn that to define it has no importance in itself. If we must define it formally, let's stick with "knowledge of nature." This allows us plenty of leeway in which to operate.

From a practical point of view physiology is best defined

in terms of what people who call themselves physiologists are doing at the present time and have done in the past.

I was not aware of the "deep malaise." Let us not talk ourselves into one. Perhaps we are taking ourselves too seriously. Physiology should be fun. Departments of physiology (under whatever name) and societies should remember this. Have you read Scholander's autobiography. *Enjoying a Life in Science* and Richard Feynman's *Surely You are Joking, Mr. Feynman!* and *What do You Care What Other People Think?*

Physiologists should, of course, be conversant about new biology (and old biology as well) whenever it is applicable to what they are trying to do. Physiologists should work at whatever level (subcellular, cellular, organ, system, whole animal, societal) they please.

One of the two most important functions of the APS is sponsoring superlative meetings (symposia, conferences, or whatever). The optimal number can be determined only by experiment.

The other primary function of the APS lies in its publications (journals, handbooks, *The Physiologist*).

The APS is a society of working physiologists; membership is open to anyone with an active interest in physiology. It is not and should not be an honorary society. Creation of a Fellowship category would, I fear, lead to petty jealousies and political activities that would be of no benefit to the APS. Those who feel the need for a more elite organization are free to form a separate society (e.g., The Brotherhood of Elite Physiologists).

I see no reason to give anyone a free introductory membership. If we have to resort to bribery to acquire desirable members, we should consider disbanding.

Since the Society is now sectionalized, it seems reasonable that the Section Advisory Committee should become the Council. However, if this would make the Council too large to function well, it would suggest that the Council be elected by the Section Advisory Committee, either from its own membership or from the Society as a whole. I do not know the optimal number of councillors; six seems like a good number.

I don't know enough about the current relationship between APS and FASEB to have a well-informed opinion. My impression is that although FASEB once performed useful services to the constituent societies, it may have outlived its usefulness and become an unneeded layer of bureaucracy. I would also question the value of our relationship with the AAMC. Personally I would like the APS to be more actively involved with the AIBS. Physiology is, after all, a biological science, not merely a medical science.

It might be healthy for the APS to meet with other societies from time to time. Such joint meetings need not be confined to other biological societies.

I don't know why the APS should advocate any particular type of funding. Probably I don't understand the question.

I think the primary function of the APS is to enhance exchange of information and ideas. This has traditionally been done effectively through meetings and publications. Meetings provide for a structured exchange of information, but what is equally or even more important, they are an opportunity for physiologists to get to know each other as human beings rather than just a name on a paper.

I do not think the APS should attempt to be a political organization. I believe physiologists can have more political influence by communicating individually with politicians in their district where their vote counts. The APS should not waste its time attempting to be a lobby.

I think the APS should provide members with a better financial accounting. This should be a completely open matter. How much goes to other organizations such as AAMC and FASEB, how much is spent on staff, how much on travel and per diem, how much on outside speakers. More detailed reporting would allow members better to judge whether their dues are well spent. It might also generate more interest in the governance of the Society.

Continue efforts to have exciting meetings that will stimulate young physiologists. Encourage presentations that are understandable to the whole audience, not just to a few specialists. Discourage those individuals who come to meetings just in time to present their paper and catch the next plane home.

Encourage authors to speak and write in a simple understandable style not laden with excessive jargon and acronyms.

The American Physiological Society has meant a great deal to me, and I hope it continues to thrive in the future as it has in the past, but I also believe that if a society outlives its usefulness, it is better to let it die a peaceful death than to prolong a futile or nonproductive life.

Arthur Otis
Gainesville, Florida

Response to How APS Spends Your Money

To the Editor:

I applaud President Staub's initiative in explaining to APS members how their dues are spent (*The Physiologist* 34:32, 1991). Dr. Staub writes: "We do not . . . require you to purchase one of our journals, although you do receive *The Physiologist* (our newsletter), *Advances in Physiology Education,* and *News in Physiological Sciences* (*NIPS*)—the last partly subsidized by income from our publications program." Although this statement is perfectly correct, strictly speaking, I am nevertheless concerned that in the context of the article the word "receive" might reasonably be interpreted to mean "pay for with dues," with the implied corollary that if these distributions were discontinued the dues could be reduced. As Dr. Staub knows very well, this is not the case and it is certainly not what he meant to imply.

Since all members do indeed receive these publications, it is appropriate to clarify how, in round numbers, the three are in fact budgeted. The numbers I use here are from the 1990 financial statement and thus differ somewhat from Dr. Staub's numbers from 1989. The numbers also depend some-

what on the accounting, as will be noted below:

The Physiologist, including the abstract issue, is in part but only in part supported by dues. $70,000, or about $10 per member, is allocated to this newsletter from the Society's general fund. An alternative way of accounting notes that dues are only about 40% of the income into the general fund, and if one prorates the expenses, each member's dues contribute only about $4 for *The Physiologist.* There is about $30,000 additional income from advertising and other sources. On the expense side *The Physiologist* costs about $142,000 to produce, for a net loss of about $42,000.

Advances in Physiology Education has listed expenses of $12,000. (If this journal were isolated from *American Journal of Physiology* and produced as an independent publication, it would be a good deal more costly, a fact that would take on more significance if the journal were distributed on a subscription-only basis.) The nonmember subscriptions and other income total about $4,000, for a net loss of $8,000.

The expenses for *News in Physiological Sciences* are about $179,000. Nonmember subscription income (including a grant from and subscriptions supported by IUPS) and other revenue total about $82,000, for a net loss of $97,000. (Dr. Staub is correct in deploring elsewhere in *The Physiologist* that *NIPS* does not reach all physiology-related institutions worldwide, a situation that we are trying to improve.) This budget could be balanced if the members were assessed $14 apiece for *NIPS,* but that is not done.

In sum, all these publications lose money, but the losses are not made up from the members' dues. In the Publications operation (1990 budget = $7,000,000) none of the 14 journals precisely breaks even. Some make money, some lose money. Subscription rates are set and finances are managed with the primary aim that the publications as a whole balance out while at the same time efforts are made to bring the more egregious moneylosers into line. The aggregate losses of the three publications discussed here amount to about 2% of the total publications budget (2.5% of subscription income) and are absorbed by that budget, with *NIPS* the biggest problem. As noted, efforts are being made to strengthen *NIPS'* circulation and with it *NIPS'* finances, but that it another issue.

John S. Cook, Chair
Publications Committee

Animal Nutrition And Transport Processes: 1. Nutrition in Wild and Domestic Animals

J. Mellinger (Editor)
Comparative Physiology (Series, Vol. 5)
R. K. H. Kinne, E. Kinne-Saffran, and K. W. Beyenbach (Series Editors)
Basel: Karger, 1990, 289 pp., illus., index, $189.00

This book constitutes a collection of reviews on aspects of animal nutrition presented at the 11th Conference of the European Society for Comparative Physiology and Biochemistry, Riems, September, 1989. It contains a diverse array of papers dealing with basic aspects of nutritional physiology and biochemistry as well as more applied topics in animals husbandry. The book is divided into three sections: reviews focusing on marine invertebrates, reviews on nutrition in insects, and papers on fish aquaculture and nutrition in typical farm animals.

The chapters on marine invertebrates cover a variety of topics ranging from polyunsaturated fatty acids in food webs to the importance of direct uptake of free amino acids by marine invertebrates. Among these reviews are very comprehensive discussions of nutrition in cnidarians (Van Praët; Achituv and Dubinsky), autotrophy in bivalve mollusks via symbiotic bacteria (Fiala-Medioni and Felbeck) and energy conversion in filter-feeding bivalves (Bayne and Hawkins). The section also contains a chapter on biological NMR spectroscopy that seems somewhat out of place since the focus of this particular review is on mammalian systems.

The series of chapters on insect nutrition constitutes the most cohesive portion of the book. Ribeiro, Ferreira, and Terra review insect digestive structures in relation to food type. This chapter is followed by reviews on regulation of food uptake and digestion in caterpillars (Reynolds), food selection by plant-eating insects (Strebler and Marion-Poll), and the role of fungal compounds in reducing plant herbivory by insects (Clay). Reynolds' review stands out. Based on a variety of lines of experimental evidence, he presents a strong case that caterpillars are optimized feeders, i.e., food uptake is adjusted to maximize nutrient intake and, hence, growth in these organisms.

The final section begins with three chapters on the physiology (Smith), biochemistry (Galand), and ultrastructure (Vernier) of absorptive surfaces in vertebrates. Three subsequent chapters deal with aspects of fish nutrition: role of free amino acids in larval fish nutrition (Fyhn), energy storage and mobilization in fish (Love and Black); and composition of artificial diets for fish (Guillaume). Love and Black give a particularly good account of the time sequence of energy mobilization during starvation and the underlying metabolic processes. This topic is also discussed by Guillaume in relation to the protein-sparing effect of carbohydrate and lipid. The final five chapters deal with nutrition in poultry and domesticated mammals. Blum and Geraet provide a review of energy partitioning in poultry. Additional chapters cover energy transformations during long-term fasting (Belkhou, Robin, Chevel, and Maho), role of dietary fibers in animal nutrition (Graham, Aman, and Pettersson), biology and physiological roles of symbiotic protozoa in mammalian guts (Bonhomme-Florentin), and importance of diet composition in the nutrition of ruminants (Sauvaut and Giger-Reverdin). Bonhomme-Florentin's thorough review of gut fermentation provides good insight into the biochemistry of degradation of complex carbohydrates in these animals.

Because of the diverse nature of the topics discussed in this book, I suspect that each individual specialist will find only a few of the reviews of interest. The general reader, however, will find a great deal of useful information. In my own case, it is likely that the volume will be a helpful resource for preparing lectures on nutrition for my course in comparative animal physiology. Given the high cost of the book, it is unlikely that this volume will find its way onto many personal bookshelves.

W. Ross Ellington
Department of Biological Science
Florida State University

Animal Nutrition and Transport Processes: 2. Transport, Respiration and Excretion

11th Conf. Euro. Soc. Comp. Physiol. Biochem., Reims, September, 1989. (Series, Vol. 6).
J.-P. Truchot and B. Lahlou (eds.); R. K. H. Kinne, E. Kinne-Saffran, and K. W. Beyenbach (series eds.) Karger, Basel. 1990. $129.00.

In a brief foreword, the editors state that the purpose of the volume is to "provide short, concisely written reviews on representative examples . . . [of] . . . invertebrates and vertebrates." Nearly all of the 12 articles, however, are partly reviews, mostly of the authors' own work, and partly new material more similar to journal articles. The book is organized into three sections of four articles each: osmoregulation in freshwater and seawater; blood oxygen transport; and ion exchanges, ammonia excretion, and acid-base regulation.

In the first section, M. Avella and M. Bornacin present a summary of their work on perfused trout head preparations, most of the discussion focussing on the relation between sodium and H^+ fluxes, and correlations between these fluxes and chloride cell numbers in the gills. J. M. Lignon and A. Péqueux review their work on the permeability and ion selectivity of crustacean cuticle. They present some interesting comparisons between low-permeability integuments of freshwater animals and high-permeability ones from seawater animals, but the seminal contributions of Krogh prior to 1920 are overlooked. U. Katz reviews recent work on the adaptations of *Bufo* to hyperosmotic environments, an unusual ability among amphibians that involves urea production for osmoregulation, and changes in water and electrolyte systems at all levels of organization. S. F. Perry and P. Laurent's chapter is on carbonic anhydrase in fish and crustaceans, a subject that has been reviewed extensively in recent years, and although the authors do a creditable job, most of the concepts and arguments are familiar.

The section on blood oxygen transport is focussed on adjustments to physiological and environmental conditions. Roy Weber gives a brief review of multiple hemoglobins found in ectothermic vertebrates, along with their varying functional properties. The remainder of the article consists of a series of speculations on the physiological significance of multiple hemoglobins. S. Thomas and R. Motais discuss their recent work on RBC physiology during acute hypoxia in the trout, a topic on which they have published about a dozen papers in the past few years. Charlotte Mangum's article is perhaps the freshest of the collection, examining the subject of inducibility of oxygen carriers in crustaceans. Some new aspects of Hb inducibility in *Daphnia* have come to light, and she also gives some new results on production rates of hemocyanin, both in normal situations and in response to challenge. A. C. Taylor summarizes respiratory responses to diel changes in two intertidal prawns.

The section on ionic exchange, ammonia excretion, and acid-base regulation begins with an article by C. M. Wood and G. G. Goss in which single- and dual-substrate kinetic models are used to examine

the relations between ionic and acid-base fluxes in the gills. The complex analysis of largely original data poses some questions about evaluation, discussed below. An article by N. Heisler on ammonia excretion focusses on gradients for ionized and free ammonia and conforms to the short review format more than most of the other chapters. The article on sodium and H^+ transport in frog skin by J. Ehrenfeld and colleagues appears to be primarily original data; they present an interesting model of cellular interactions in the frog skin. M. Wiederholt and J. A. Zadunaisky argue for the study of the ciliary epithelium in the eye of the shark as a general transport model, presenting some new data from isolated preparations.

The editors' stated intent does not seem to match the articles themselves; i.e., much of the material discussed appears to be either original or a summary of the individual authors' recent work. Most of the articles are not reviews in the usual sense. The presentation of original data poses some problems since there is little or no discussion of methodology, and the usual critical evaluation, including statistical analysis, is lacking. There are some annoying inconsistencies as well, such as variable styles of citations from article to article and the lack of attribution in many of the figures and photographs.

Perhaps my most serious criticism is in the way the material from the Reims conference appears to have been split into minimum units for maximum profit for the publisher. At 188 pages, the book is not as thick as my little finger; this is volume 6 of how many? At $129, the book seems outrageously overpriced for what it contains. There are at least half a dozen books that have appeared in the past five years reviewing similar topics, most of which are two to three times as long and cost half as much, so it is difficult to recommend purchase of this one.

James N. Cameron
Departments of Zoology and Marine Science
The University of Texas at Austin

BOOKS RECEIVED

Muscle Fatigue: Biochemical and Physiological Aspects. Proceedings of the Second Scientific Meeting of the Muscle Fatigue Thematic Group of the French Association of Physiologists, Creteil Medical Faculty, Paris XII- Creteil, France. Guy Atlan, Louise Beliveau, and Phillippe Bouissou (Editors). Paris: S.A. Masson, 1991, 264 pp., illus., index, $45.00.

A Source Book of Practical Experiments in Physiology Requiring Minimal Equipment. IUPS Commission on Teaching Physiology. Teaneck, NJ: World Scientific Publishing Co. Pty Ltd., 1991, 193 pp., illus., index, $38.00 hardcover, $16.00 softcover.

Response and Adaptation to Hypoxia: Organ to Organelle. Sukhamay Lahiri, Neil S. Cherniack, and Robert S. Fitzgerald (Editors). Clinical Physiology Series, American Physiological Society. New York: Oxford University Press, 1991, 247 pp., illus., index, $65.00.

Longevity, Senescence, and the Genome. Caleb E. Finch. Chicago: The University of Chicago Press, 1991, 932 pp., illus., index, $49.95.

Techniques in the Behavioral and Neural Sciences, Vol. 4. J.P. Huston (Series Editor). New York: Elsevier Scientific Publishing Co., Inc., 1990, 293 pp., illus., index, $60.00.

Simulation and the User Interface. M. Andrew Life, Caren S. Narborough-Hall, and W. Ian Hamilton. New York: Taylor and Francis, 1990, 269 pp., illus., index, $71.00.

Education and Training in the Care and Use of Laboratory Animals: A Guide for Developing Institutional Programs. Committee on Educational Programs in Laboratory Animal Science, National Research Council. Washington, DC: National Academy Press, 1991, 139 pp., $7.95.

Biology of Aging: Observations and Principles. Robert Arking. Englewood Cliffs, NJ: Prentice-Hall, 1991, 420 pp., illus., index.

Cell Communication in Health and Disease. Readings from *Scientific American.* Howard Rasmussen (Editor). New York: W.H. Freeman and Company, 1991, 185 pp., illus., index, $13.95.

Cardiovascular Physiology. William R. Milnor. Cary, NC: Oxford University Press, 1990, 501 pp., illus., index, $40.13.

The Oxygen Status of Arterial Blood. R. Zander and F. Mertzlufft (Editors). Basel, Switzerland: Karger, 1991, 294 pp., illus., $63.25.

The Metastic Cell: Behaviour and Biochemistry. Clive W. Evans. New York, NY: Routledge, Chapman & Hall, 1991, 555 pp., illus., index, $115.00.

Development of the Visual System. Proceedings of the Retina Research Foundation Symposia, Vol. 3. Dominic Man-Kit Lam and Carla J. Shatz (Editors). Cambridge, MA: The MIT Press, 1991, 299 pp., illus., index, $65.00.

Muscles and Molecules: Uncovering the Principles of Biological Motion. Gerald H. Pollack. Seattle, WA: Ebner & Sons Publishers, 1990, 330 pp., illus., index, $55.00.

Physiology of Sports. T. Reilly, N. Secher, P. Snell, and C. Williams (Editors). New York, NY: Chapman and Hall, 1990, 495 pp., illus., index, $37.50.

The Lung: Scientific Foundations, Vol. 1 and Vol. 2 (A Two-Volume Set). Ronald G. Crystal and John B. West (Editors-In-Chief). Peter J. Barnes, Neil S. Cherniack, and Ewald R. Weibel (Associate Editors). New York, NY: Raven Press, 1991, 2224 pp., illus., index, $225.00.

POSITION AVAILABLE

APS Sustaining Associate Members

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

Abbott Laboratories
American Medical Asssociation
Axon Instruments, Inc.
Berlex Laboratories
*Boehringer Ingelheim
Burroughs Wellcome Company
Ciba-Geigy Corporation
Coulbourn Instruments, Inc.
Dagan Corporation
du Pont Pharmaceuticals
Fisons Pharmaceuticals
Genentech, Inc.
Glaxo, Inc.
Gould, Inc.
Grass Foundation
Harvard Apparatus
Hoechst-Roussel Pharmaceuticals, Inc.
*Hoffman-La Roche, Inc.
ICI Pharmaceuticals Group
Jandel Scientific
Janssen Pharmaceutica
R. W. Johnson Pharmaceutical Research Institute
Lederle Laboratories
Eli Lilly & Company
Lockheed Missiles & Space Company, Inc.
Marion Laboratories
McNeil Pharmaceutical
*Merck & Co., Inc.
Miles Institute for Preclinical Pharmacology
NARCO Bio-Systems
Norwich Eaton Pharmaceuticals, Inc.
Pfizer, Inc.
Pharmacia, Inc.
Procter & Gamble Company
Quaker Oats Company
*Sandoz, Inc.
*Schering-Plough Corporation
G. D. Searle and Company
SmithKline Beecham Laboratories
*Squibb Corporation
Sterling Drug, Inc.
Sutter Instruments Company
*The Upjohn Company
*Warner-Lambert/Parke Davis
Waverly Press
Wyeth-Ayerst Laboratories

*Second Century Corporate Founders

Peter Debije Prize 1992 on Aging of the Brain

The University of Limburg at Maastricht, The Netherlands invites nominations for the Peter Debije Prize of 20,000 guilders. The funds for the Peter Debije Prize are provided by the Edmond Hustinx Foundation in Maastricht. The prize is named after the physicist Peter J. W. Debije (1884-1966), a native of Maastricht, who was awarded the Nobel Prize for chemistry in 1936.

The prize will be awarded for the seventh time on January 10, 1992, to a person or group of persons (three as a maximum but preferably less than three) who are considered to have made a fundamental contribution to research in the field of aging of the brain, particularly with respect to the (patho)physiology, epidemiology, and clinical aspects.

Nominations (in English) should include a curriculum vitae, a survey of the achievements of the candidate(s) not exceeding 4 pages, and a list of publications. Nominations, as well as questions about the award, should be addressed to the University of Limburg, attn. E.H.S. Drenthe, Secretary of the Jury of the Peter Debije Prize 1992, Office of the Rector, PO Box 616, 6200 MD Maastricht, The Netherlands. Deadline for receipt of nominations is September 15, 1991.

New NIH/ADAMHA Computerized Consultant File

The National Institutes of Health (NIH) and Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) are establishing a new consultant file of peer reviewers/advisors, selected from a national pool of scientists engaged in basic or applied research. Data will be entered into a new computerized NIH/ADAMHA database. This unique database will be used as one source from which candidates for membership on NIH/ADAMHA committees and for other advisory activities are drawn. All qualified scientists are requested to participate. Qualified women and minority scientists are encouraged to apply.

A Consultant File Information Form has been sent to every PHS grantee and to study section members. Other scientists who are interested in participating should respond by letter requesting a copy of the NIH/ADAMHA Consultant File Information Form.

The new file will be established based solely on positive responses. Your response is needed even if you are already a consultant or are a member of a PHS Reviewer's Reserve. This file is independent of other consultant files. Send requests to NIH/ADAMHA Consultant File, 4733 Bethesda Ave., Suite 735, Dept. 03, Bethesda, MD 20814.

Guidelines for the Assessment and Management of Iron Deficiency in Women of Childbearing Age

The Life Sciences Research Office has completed a report entitled "Guidelines for the Assessment and Management of Iron Deficiency in Women of Childbearing Age." The report, prepared for the Center for Food Safety and Applied Nutrition of the Food and Drug Administration, is based on the discussions of an ad hoc Expert Panel that developed guidelines targeted to primary health care providers. Particular physiological and sociodemographic factors increasing the likelihood that individual women will develop iron deficiency and anemia during their reproductive years were identified. A two-step approach for screening and etiologic diagnosis of iron deficiency anemia was recommended as a part of general health maintenance examinations. Recommendations for treatment with oral iron and dietary counseling were made together with recommended strategies for follow-up of individuals receiving oral iron treatment.

The report is available for $12.00 prepaid from the FASEB Special Publications Office, 9650 Rockville Pike, Bethesda, Maryland 20814. (Maryland residents please add 5% sales tax.)

Proposed Committee _____

Nominee's Last Name _____

Date _____

NOMINATION FORM

FOR

APS COMMITTEE APPOINTMENTS

(Use this form for yourself or another individual)

Name of Nominee _____
First Middle Last

Position/Title _____

Mailing _____

Address _____

Telephone No: _____ Fax No: _____

Is the nominee an APS member who actively participates in APS meetings?

Is the nominee willing to devote the time and effort to carry out the committee's charge?

What special expertise qualifies the nominee for the committee specified above?

With which section is the nominee affiliated?

Nominator (please print) _____ ☐ self

Nominator's Institution _____

Address _____

_____

_____

Mail Completed Form To:
American Physiological Society
9650 Rockville Pike, Rm 4402
Bethesda, MD 20814
Telephone: 1-301-530-7165
Fax: 1-301-571-1814

_____
Signature

0605-90

INSTRUCTIONS FOR APPLYING FOR APS MEMBERSHIP

One application form serves all membership categories. There are, however, specific sets of instructions for each category. Therefore, it is essential that sponsors and applicants carefully follow the specific instructions in their desired category.

GENERAL INSTRUCTIONS

Check the box indicating the category of membership for which you are applying. Type the requested information on the application. Fill out all applicable spaces. Only completed applications will be reviewed. **Do NOT include a curriculum vitae or reprints.**

Alien Residents. Alien residents of the United States must enter the Alien Registration Receipt Card number under the address block on the application. Canadian residents should furnish a copy of "Landed Immigrant Status" form. Mexican residents should furnish a copy of their form FM-2. Central and South American residents must provide documentation as required by their country/government.

The Bibliography must be submitted in the form found in the Society's journals. An example of the current form is:

JONES, A. B., and C. D. Smith. Effect of organic ions on the neuromuscular junction in the frog. Am. J. Physiol. 220:110-115, 1974.

DEADLINE DATES

Completed applications for Regular and Corresponding membership received between February 1 and July 1 are considered for nomination by the Council in the Fall. Regular and Corresponding membership applications received between July 1 and February 1 are considered for nomination by the Council at the Annual Spring Meeting. Associate, Associate Corresponding and Student applications are accepted monthly upon approval of the Executive Director of the Society. Applications are not complete until all materials, including sponsors' letters, are received.

QUALIFICATIONS (Except Students)

The following categories are used when evaluating an application:

1. **Educational History.** Academic degree and postdoctoral training are evaluated and assessed with regard to how closely the applicant's training has been tied to physiology.

2. **Occupational History.** Particular emphasis is given to those applicants who have a full-time position in a department of physiology, or closely allied field. Relatively high ratings are given to individuals with positions in clinical departments and to those functioning as independent investigators in commercial or government laboratories.

3. **Interest in the Society.** Evaluation of this category is based on attendance at APS meetings and the applicant's remarks in the statement of "Interest in the Society."

4. **Interest in and Commitment to Teaching Physiology.** This evaluation is based on: (1) the fraction of the applicant's time devoted to teaching, (2) publications related to activities as a teacher including production of educational materials, and (3) special awards or other recognition the applicant has received for outstanding teaching effectiveness.

5. **Contributions to Physiological Literature.** This category is of major importance. The applicant's bibliography is evaluated on the basis of publications in major, referred journals which are concerned with problems judged to be primarily physiological in nature. Emphasis is given to papers published as the result of original research. Publications on which the applicant is sole author or first author are accepted as clear evidence of the applicant's independence.

6. **Special Considerations.** This category permits the Membership Committee to acknowledge unique accomplishments of an applicant. Such accomplishments may be excellence in a specific area, unusual contributions to physiology resulting from talents, interest or background substantially different from the average.

In general, persons who qualify for **Regular membership** will have a doctoral degree in physiology or related area and will have published several papers in referred journals. It should be clear that they have played a major role in research. They should have a position other than as a trainee in physiological research, teaching, administration, or related area.

Individuals who qualify for **Corresponding membership** should meet the requirements for Regular membership and live outside of The Americas.

In general, applicants will be considered for **Associate membership** if they have an advanced degree in physiology or related area and are doing research and/or teaching of physiology. Professional historians are eligible for Associate membership. Associate members may later be proposed for Regular membership.

Individuals considered for **Associate Corresponding membership** should meet the requirements for Associate membership and live outside of The Americas.

Applicants will be considered for **Student membership** if they are actively engaged in physiologic work which should lead to an advanced degree in physiology or related area. No individual may remain in this category for more than five years, without reapplying.

SPONSORS

Each of the two sponsors are required to write a confidential letter concerning the candidate's qualifications, using the criteria described above. Only one letter is required for evaluating applicants for Student membership.

Primary responsibility for membership rests with the two sponsors who must be Regular members of the Society or, for applications for Corresponding member category, a Corresponding member and a Regular member. Emeritus and Honorary members also may serve as sponsors. Sponsors should discuss the appropriateness of the class of membership with prospective applicants.

Each sponsor must write a confidential letter concerning the candidate which addresses the six categories listed above. An original and seven copies should be sent to the Membership Secretary. In the case of student applicants, two sponsors must sign the application form however, only one sponsor letter is required.

CHECK LIST

1. Original copy of the application signed by both sponsors.
2. Application form, including bibliography (1 original and 7 copies.
3. Mail the original, signed by two sponsors, plus 7 copies to: Membership Secretary, American Physiological Society, 9650 Rockville Pike, Bethesda, Maryland 20814.

RIGHTS AND PRIVILEGES OF EACH MEMBERSHIP CATEGORY

REGULAR MEMBERSHIP

1. Hold elective office.
2. Vote at Society meetings.
3. Serve on committees, boards and task forces.
4. Serve on Federation boards and committees.
5. Serve as sponsor on membership applications.
6. May present only one contributed paper, but may co-author and/or sponsor more than one contributed paper by a non-member at the Annual Spring (FASEB) and Specialty Meetings of the Society.
7. Receive *The Physiologist, NIPS,* and *Advances in Physiology Education.*
8. Receive the *FASEB Journal,* the FASEB Public Affairs Newsletters, and the annual FASEB Membership Directory.
9. Subscribe to books and periodicals published by the Society at member rates.
10. Register to attend scientific meetings of FASEB and APS at membership rates.
11. Participate in FASEB Member's Life Insurance Program, Disability Program and Hospital Protection Plan. (For residents of the United States, it territories or possessions).
12. Eligible to receive the Daggs Award.
13. Eligible to be selected as Bowditch Lecturer (members under 40 years of age).

CORRESPONDING MEMBERSHIP

1. Serve on Society committees, boards, and task forces.
2. Serve as one sponsor for a Corresponding membership application (one Regular member must be the other sponsor of a Corresponding member).
3. May present only one contributed paper, but may co-author and/or sponsor more than one contributed paper by a non-member at the Annual Spring (FASEB) and Specialty Meetings of the Society.
4. Receive *The Physiologist, NIPS* and *Advances in Physiology Education.*
5. Receive the *FASEB Journal* and annual FASEB Membership Directory.
6. Subscribe to books and periodicals published by the Society at member rates.
7. Register to attend scientific meetings of FASEB and APS at member rates.

ASSOCIATE MEMBERSHIP

Same as for Regular members with the following exclusions:

1. Holding elective office, or membership on certain committees.
2. Voting at Society meetings.
3. Sponsoring membership applications.
4. Eligibility for receiving the Daggs Award.
5. Privilege of selection as Bowditch Lecturer.
6. May sponsor only those abstracts on which they are listed as first author or co-author.

ASSOCIATE CORRESPONDING MEMBERSHIP

Same as for Associate members with the exception of receiving the FASEB Public Affairs Newsletter.

STUDENT MEMBERSHIP

1. Present one contributed paper at the FASEB and APS Meeting with the endorsement of the student's advisor.
2. Receive *The Physiologist, NIPS* and *Advances in Physiology Education.*
3. Subscribe to books and periodicals at member rates.
4. Register to attend scientific meetings of FASEB and APS at student rates.

THE AMERICAN PHYSIOLOGICAL SOCIETY

THE AMERICAN PHYSIOLOGICAL SOCIETY

9650 Rockville Pike, Bethesda, MD 20814

Date _____ LAST NAME _____

MEMBERSHIP APPLICATION

Submit original and 7 copies of application and supporting documents

REGULAR	☐	ASSOCIATE	☐
CORRESPONDING	☐	ASSOCIATE CORRESPONDING	☐
		STUDENT	☐

Current Membership and year elected _____

Refer to Instructions Before Continuing

Name of Applicant: _____

First Middle Last

Mailing _____ Birth Date: _____

Address _____ Citizenship: _____

_____ *Country of Permanent Residence:

_____ _____

*Alien Residents of The Americas enter proof of permanent residency or attach documentation. _____

1. EDUCATIONAL HISTORY

Dates	Degree	Institution	Major Field	Advisor

Doctoral Dissertation Title (if any): _____

_____

Postdoctoral Research Topic: _____

_____

SPONSORS

#1. Name: _____ #2. Name: _____

Mailing Address: _____ Mailing Address: _____

_____ _____

_____ _____

_____ _____

Telephone No. Telephone No.

I have read the guidelines and this application and attest that the applicant is qualified for membership.

#1 Signature _____ #2 Signature _____

Each sponsor must submit an original and 7 copies of a confidential letter of recommendation to the Society.

NAME _____

2. OCCUPATIONAL HISTORY

Present Position: _____

_____

Prior Positions:

Dates	Title	Institution	Department	Supervisor

3. INTEREST IN THE SOCIETY

a. Have you attended meetings of the APS (Y/N)? _____

b. In the space provided state why you want to join the Society.

4. TEACHING

a. Do you teach physiology (Y/N)? _____

b. What percentage of your time/effort is devoted to teaching (lectures, conferences, etc.) physiology? _____

c. Do you supervise graduate and/or postgraduate students (Y/N)? _____

d. Have you produced teaching aids (textbook chapters, films, computer assisted instruction, etc.) (Y/N)? _____

5. RESEARCH

a. What percentage of your time/effort is devoted to research? _____

b. If your research is funded state source: _____

Are you a principal _____ or co-principal investigator _____ ?

6. BIBLIOGRAPHY

On a **separate sheet** list your publications reported during the past 5 years. Star those in refereed journals.

THE AMERICAN PHYSIOLOGICAL SOCIETY
9650 Rockville Pike, Bethesda, MD 20814

MEMBERSHIP RECORDS QUESTIONNAIRE

PLEASE MARK ALL ENTRIES IN RED.

CURRENT MAILING LABEL OR
PRINT NAME & ADDRESS

DATE _____

DATE OF BIRTH
Month Day Year

EMERITUS MEMBERS:
Check, if you would consider temporary or part time employment ☐

OPTIONAL PERSONAL DATA

SEX
☐ Female ☐ Male

A ☐ American Indian or Alaskan Native
B ☐ Asian or Pacific Islander
C ☐ Black
D ☐ White E ☐ Hispanic

POSITION TITLE CODE (SEE REVERSE) ☐☐

TYPE OF INSTITUTION Check one. (If retired, or unemployed check descriptors appropriate to last position held.)

MEDICAL SCHOOLS
33 _____ Physiology Departments
34 _____ Other Preclinical Departments
35 _____ Clinical
36 _____ Administration

OTHER
37 _____ Hospitals and Clinics
38 _____ Veterinary Schools
39 _____ Dental Schools
40 _____ Public Health and Graduate Schools
41 _____ College or University

42 _____ Commercial Companies
43 _____ Government (Inc. V.A.)
44 _____ Institutes and Foundations
45 _____ Private Practice
99 _____ Other (Specify)

EARNED DEGREE CODE (SEE REVERSE) NOT MORE THAN TWO ☐☐

Keyline: _____ (from mailing label)

MAJOR TYPE OF WORK (Check not more than one.)

04 _____ Research 05 _____ Teaching 06 _____ Administration 07 _____ Clinical

SECONDARY TYPE OF WORK (Check one only if it represents a significant portion of time and is different from your major type of work.)

04 _____ Research 05 _____ Teaching 06 _____ Administration 07 _____ Clinical

PRIMARY INTEREST AREA: (Enter the appropriate number from the list of interest area codes on the reverse also enter the letter under the area selected which best describes your specific interest.)

☐☐ MAJOR AREA ☐ SPECIFIC INTEREST

SECONDARY INTEREST AREA (If appropriate)

☐☐ MAJOR AREA ☐ SPECIFIC INTEREST

IF YOU HAVE SERVED ON A GROUP OR COMMITTEE WHICH IS ADVISORY TO THE GOVERNMENT CHECK AS APPROPRIATE.

A _____ Presidents Scientific Advisory
B _____ National Academy of Sciences
C _____ National Institutes of Health
D _____ Nat'l Aeronautical and Space
E _____ Dept. of Interior
F _____ Dept. of Defense (or Constituent Dept.)
G _____ Dept. of Agriculture
H _____ Congressional (Specify)

APS Sections

Please identify and rank those sections to which you desire affiliation (i.e., 1 = primary affiliation, 2 = secondary affiliation, 3 = tertiary affiliation). Only one section can be selected for primary affiliation.

A ___Cardiovascular Section
B ___Cell & General Physiology Section
C ___Comparative Physiology Section
D ___Endocrinology & Metabolism Section
E ___Environmental, Thermal & Exercise Physiology Section
G ___Gastrointestinal Section
J ___Section on the Nervous System
K ___Neural Control & Autonomic Regulation Section
L ___Renal Section
M ___Respiratory Section
N ___Teaching of Physiology Section
O ___Section on Water & Electrolyte Homeostasis

APS Groups

Select any or all by placing an "x" next to the group

F ___Epithelial Transport Group
H ___History of Physiology
I ___Muscle Group

IF YOU HAVE EVER SERVED ON THE FOLLOWING APS GROUPS PLEASE CHECK AS APPROPRIATE.

A _____ Council
B _____ Education Committee
C _____ Finance Committee
D _____ Membership Committee
E _____ Program Committee
F _____ Publications Committee
G _____ Editorial Board (Specify)
H _____ Session Chairman
I _____ Symposia Speaker
J _____ Public Affairs
K _____ Public Information
L _____ Senior Physiologists
M _____ Porter Development
N _____ Animal Care & Experimentation
O _____ Committee on Committees
P _____ Centennial
Q _____ Financial Development
R _____ Career Opportunities in Phys.
S _____ Educational Materials Review Board

I AM A MEMBER OF THE FOLLOWING NATIONAL PROFESSIONAL SOCIETIES: Outside of FASEB:

A _____ American Association of Anatomists
B _____ American Institute of Biological Sciences
C _____ American Chemical Society
D _____ American Society for Cell Biology
E _____ American Society for Clinical Investigation
F _____ American Society of Mechanical Engineers
G _____ American Society of Microbiology
H _____ American Society for Neurochemistry
I _____ American Society of Plant Physiologsts
J _____ American Society of Zoologists (DCP&B)
K _____ Association of Chairmen of Departments of Physiology
L _____ Biomedical Engineering Society
M _____ Biophysical Society
N _____ Endocrine Society
O _____ Institute of Electrical and Electronic Engineers
P _____ Society of General Physiologists
Q _____ Society for Neuroscience
R _____ Canadian Phys. Society
S _____ American Medical Association
Z _____ Other (Specify)_____

POSITION TITLE CODES (use most closely related description)

A. Director or Deputy
B. Chairman
C. Professor
D. Research Associate
E. Sr. Research Associate
F. Associate Professor
G. Assistant Professor
H. Laboratory or Research Director
I. Institute Director
J. Dean or Associate Dean
K. Executive Secretary
L. Academician
M. Corresponding Academican
N. Private Practice or Consultant
O. Researcher
P. Medical Intern
Z. Other

EARNED DEGREE CODES

CODE	DESCRIPTION
01	PH.D. or Dr. Phil.
03	M.D. or Dr. Med.
05	D.V.M. or Dr. Vet.
06	ScD.
07	D.D.S., D. Odont or D.O.
10	ED.D or Dr. Ed.
25	Cand. Med.

INTEREST AREA CODES

01. Anesthesia

02. Anatomy and Embryology
A. Microscopic
B. General
C. Fetal physiology

03. Anthropology

04. Biochemistry
A. General
B. Clinical

05. Biophysics

06. Biomedical Engineering

07. Blood
A. General
B. Erythrocytes
C. Hematology
D. Cell formation
E. Volume
F. Coagulation
G. Platelets
H. Plasma proteins
I. Rheology

08. Cardiovascular
A. General
B. Heart
C. EKG
D. Cardiac output
E. Artificial heart
F. Coronary
G. Cardiac dynamics
H. Cardiology
I. Blood flow
J. Peripheral circulation
K. Hemodynamics
L. Hypertension
M. Blood pressure
N. Atherosclerosis
O. Hemorrhage
P. Blood capillaries
Q. Venous return
R. Shock
S. Pulmonary circulation
T. Splanchnic circulation
U. Control

09. Cellular and Tissue
A. Cytology
B. Mitochondria
C. Protoplasm
D. Cell membranes
E. Cell surface chemistry
F. Histochemistry
G. Electron microscopy
H. Tissue culture
I. Tissue metabolism
J. Tissue elasticity
K. Connective tissue

10. Comparative Physiology
A. General
B. Insects
C. Fish
D. Reptiles
E. Avian
F. Plants
G. Marine biology
H. Crustacean
I. Mammalian

11. Electrolytes and Water Balance
A. General
B. Active transport
C. Ion transport
D. Body fluids
E. Lymph
F. Salt and water balance

12. Endocrines
A. General
B. Neuroendocrines
C. Pituitary
D. Thyroid
E. Parathyroid
F. Insulin
G. Adrenal/Medulla
H. Adrenal cortex
I. Sex hormones

13. Energy Metabolism & Temperature Regulation
A. Energy metabolism
B. Calorimetry
C. Exercise
D. Fatigue
E. Temperature regulation

14. Environmental
A. Aviation
B. High Altitude
C. Space Medicine
D. Underwater
E. Bioclimatology
F. Hypothermia and cold
G. Hibernation
H. Shivering
I. Adaptation
J. Hyperthermia and heat
K. Sweating
L. Industrial health
M. Air pollution

15. Enzymes
A. General
B. Kenetics
C. Antienzymes
D. Digestive enzymes

16. Gastrointestinal
A. General
B. Deglutation
C. Gastric secretion
D. Gastric mucosa
E. Gastroenterology
F. Pancreatic juice
G. Absorption
H. Intestinal motility
I. Digestion
J. Gastrointestinal surgery
K. Salivary secretion
L. Intestinal secretion
M. Gastric Motility

17. General Physiology

18. Gerontology
A. Aging
B. Degenerative diseases
C. Geriatrics

19. Immunology

20. Liver and Bile

21. Lipids and Steroids
A. General
B. Fat metabolism
C. Cholesterol metabolism
D. Obesity
E. Fatty acids
F. Other (Specify)

22. Microbiology
A. General
B. Bacteria
C. Viruses
D. Yeasts
E. Cancer cells

23. Minerals, Bone and Teeth
A. General
B. Bone
C. Calcium metabolism
D. Calcification
E. Dental caries
F. Mineral metabolism

24. Muscle and Exercise
A. General
B. Muscle metabolism
C. Muscular contraction
D. Skeletal muscle
E. Heart muscle
F. Smooth muscle
G. Muscle cells
H. Muscle chemistry
I. Muscle enzymes
J. Muscle-physical processes

24. Muscle and Exercise (Cont'd)
K. Muscle-nerve
L. Exercise

25. Neurosciences
A. General
B. Brain
C. EEG
D. Cerebral cortex
E. Mid brain
F. Brain stem
G. Spinal cord
H. Autonomic regulation
I. Peripheral nerve
J. Nerve cells
K. Vision and optics
L. Hearing and acoustics
M. Taste
N. Speech
O. Other senses
P. Sleep
Q. Learning
R. Behavior
S. Conditioned responses
T. Comparative
U. Neurological diseases
V. Psychiatry
W. Psychology
X. Cerebellum
Y. Hypothalamus
Z. Pain
Reflexes

26. Nutrition and Food
A. General
B. Diet
C. Nutritional value of foods
D. Chemistry of foods
E. Vitamins
F. Digestion
G. Carbohydrate metabolism
H. Protein metabolism
I. Fat metabolism
J. Nutritional diseases

27. Pathology

28. Pharmacology
A. Pharmacodynamics
B. Evaluation of drugs
C. Autonomic drugs
D. Cardiac drugs
E. Anticonvulsant drugs
F. Analgesics
G. Toxicology
H. Therapeutics
I. Chemotherapy
J. Antibiotics
K. Neuropharmacology

29. Radiology
A. Radiobiology
B. Ionizing radiation
C. Ultra-violet
D. Thermal burns
E. Cosmic rays

30. Renal
A. General
B. Tubular
C. Urinary tract
D. Renal disease
E. Comparative
F. Diuretics
G. Artificial Kidney

31. Reproduction
A. Fertilization
B. Pregnancy
C. Fetal physiology
D. Lactation
E. Obstetrics & Gynecology

32. Respiration
A. Pulmonary physiology
B. Respiration mechanics
C. Pulmonary diffusion
D. O_2 and CO_2 transport
E. Tissue respiration
F. Anoxia
G. O_2 poisoning
H. Asphyxia
I. Respiratory diseases
J. Chest diseases
K. Hypercapnia
L. Artifical lungs
M. Resuscitation
N. Control

99. Other
Z. Other