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The Physiologist

A Publication for Physiologists and Physiology
Orr E. Reynolds, Editor

Volume 23, No. 6, December 1980

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PROPOSED AMENDMENT TO THE BYLAWS
FOR
EMERITUS MEMBERS

The following amendment to the Bylaws approved by Council, will be offered for vote at the Society Business Meeting, April 14, 1981. A two-thirds majority vote of the members present is required to amend the Bylaws.

ARTICLE III. *Membership.*

Current Bylaw

SECTION 6. *Emeritus Members.* A regular member or associate member who has reached the age of 65 years and/or is retired from regular employment may, upon application to Council, be granted emeritus member status.

Proposed Bylaw

SECTION 6. *Emeritus Members.* A regular or associate member may apply to Council for transfer to emeritus membership if that person (1) has reached the age of 65 and is retired from regular employment or (2) has been forced to retire from regular employment because of illness or disability. An emeritus member may be restored to regular membership status on request to Council.

AMERICAN PHYSIOLOGICAL SOCIETY
124th Business Meeting

Time: 4:30 p.m., Thursday, October 14, 1980
Place: Civic Ballroom, Toronto Sheraton Centre, Canada

I. CALL TO ORDER

The President, Dr. Earl H. Wood, called the meeting to order and welcomed the members to the 124th Business Meeting. The Ballot for Election of New Members and the agenda were distributed to the membership.

II. REPORT ON MEMBERSHIP

Dr. Francis J. Haddy, President-Elect, reported on the membership status and deaths since the last meeting.

A. Membership Status

Since the last meeting, the Society membership has increased bringing the total to 5,706. As of this report, there are 4,286 Regular members, 490 Emeritus members, eight Honorary members, 60 Corresponding members, 648 Associate members, and 214 Student members.

The Sustaining Associate members were identified by Dr. Haddy (p.i) This category of membership has grown recently due to the efforts of the Financial Development Committee Chairperson, Dr. William F. Ganong, who, in conjunction with the Career Opportunities Committee in Phsyiology, has been working hard to improve relations and open up opportunities for physiologists in industry.

B. Deaths Reported Since the Last Meeting

The names of those members whose deaths have been reported since the previous meeting were read by Dr. Haddy, who asked the members to stand for a moment of silence in tribute to them (p. 15).

III. ELECTION OF NEW MEMBERS

A. Appointment of Tellers

Dr. Wood appointed Drs. N. Banchero, I.J. Fox, and Erik Ritman as Tellers and asked them to collect the Ballots for Election of New Members.

B. Election of Members

Dr. Wood announced that all candidates on the Ballot for Election of New Members were elected (p. 15). He commended the Membership Committee as an extremely hardworking and conscientious Committee.

IV. ACTIONS OF COUNCIL

Dr. Wood reported that committee reports would not be presented at the Business Meeting but, instead, were posted in the registration area and would be published in *The Physiologist*. Dr. Wood proceeded to summarize actions taken by Council.

A proposed Bylaw concerning transfer to Emeritus membership was approved by Council. This change would eliminate the provision that any Regular or Associate member who "is retired from regular employment" regardless of age may retire and become an Emeritus member. However, the proposed amendment retains one intent that would permit transfer to Emeritus membership without regard to age if the member has been forced to retire from regular employment because of illness (p. ii).

The affairs of the Society are becoming a little more complex, and science seems to be changing more rapidly all the time. The tenure of Council members and officers are relatively short. Therefore, Council has established a Long-Range Planning Task Force to identify potential problems that may face the Society in the next few years and recommend solutions. It is anticipated that at the 1981 Spring Meeting, the Task Force will present Council with a more definitive statement of its goals.

For the first time in several years, the Society will operate in the black, and Dr. Wood assured the membership there would be no increase in dues. Council has been looking very closely at FASEB expenses, and the Federation has responded by cutting costs.

As announced at the previous meeting, a new Public Information Committee was organized with Dr. Marian Kafka as Chairperson. This new Committee will be in a position to assure dissemination of physiological information to the public which will be particularly important with the Society's Centennial approaching.

The Centennial Celebration Committee, headed by Dr. Peter Chevalier, has been very active in preparation of the Society's Centennial in 1987. Several projects are underway. The History of the Society for the last 25 years will be published with Drs. John Brobeck and Orr E. Reynolds serving as coeditors. Washington, D.C. has been recommended as the site of the 1987 Centennial Meeting. The Uniformed Services University of the Health Sciences has invited the APS to use its facilities in Bethesda, adjacent to the Naval Medical Center and across from the National Library of Medicine and the National Institutes of Health. The Centennial will need some financing, and special jewelry with the APS Logo will be available to individuals making contributions to the Society's Centennial.

Another Committee of importance is the Animal Care and Experimentation Committee chaired by Dr. Helene Cecil, who is organizing a symposium on "Bioethical Issues of Animal Experimentation" to be held during the 1981 FASEB Meeting in Atlanta as an intersociety symposium of the five Federated Societies. (Subsequently, the symposium was postponed till the 1981 APS Fall Meeting.

There has been discussion of arranging different types of meetings. The APS Task Force on Future Meeting Formats has developed a questionnaire for circulation to the membership in order to gain a better insight and understanding of the desires of the members. This questionnaire is of importance and all members are urged to respond promptly so the Task Force Chairperson, Dr. Arthur Vander, can make some firm recommendations according to the wishes of the membership concerning future Society meetings.

Another symposium on Careers in Physiology is being organized by the Committee on Career Opportunities in Physiology, headed by Dr. Walter Randall, highlighting opportunities offered by employment in industry, government, and academic and basic science departments will be held at the FASEB Meeting in Atlanta. In addition, a series of reports on various aspects of career opportunities in physiology will be produced by the Committee and published in *The Physiologist*.

Those members who attended the International Congress of Physiological Science would agree it was a success. In 1983, the IUPS Congress will be held in Sidney, Australia, August

28-September 3, and the 1983 Society Meeting is planned to occur prior to the Congress in Honolulu at the University of Hawaii, August 21-24, and hosted by the Department of Physiology.

The invitation from Canada that IUPS Congress in 1986 be held in Vancouver was supported by the US delegation and accepted by the IUPS General Assembly. Council has met with representatives of the Canadian Physiological Society to discuss the possible role of APS in the Congress. It has been agreed that the formal celebration of the Centennial Year of APS will be initiated at the Vancouver Congress.

The scientist registration for the Toronto Meeting was 1,539 with total registration reaching 1,639. This was the largest registration for a Fall Meeting and approximately half of the increase was in student registration. The abstract issue of *The Physiologist,* for the first time, was published in program order and indexed as requested at previous Business Meetings. Special attention was called to the 1981 Fall Meeting, originally scheduled for Boston, being changed to Cincinnati, October 11-16. The reason was the very high hotel rates that were demanded by the Boston Sheraton. The guaranteed rates in Cincinnati will be slightly less than half the Boston rates.

As a result of a resolution taken at the last Business Meeting that the APS support the ERA, Council was directed to take any appropriate steps supporting ERA. The APS representative on the FASEB Executive Committee, proposed that the 1986 meeting not be held in a state that has not ratified the ERA. This motion was defeated by vote of the other societies.

On a more positive note, the Caucus on Women in Physiology has accepted the responsibility to prepare a regular column in *The Physiologist.* There will be an announcement of this column in *The Physiologist* along with the history of the APS Task Force on Women in Physiology which has completed its mission.

A question was raised as to why meetings were not held in a more central location since meetings held in the mid and far West excluded many students and scientists from the East. Because of size, FASEB can only meet in a few cities - Anaheim, St. Louis, Chicago, Atlanta, Dallas and New Orleans. As previously reported, the 1981 Fall Meeting would have been in the East, but the costs were prohibitive. In addition to the large Spring Meeting, the Federation is looking at the multiple thematic type meetings, the first of these to be tried in Atlanta. These meetings could be scheduled in cities accommodating smaller groups and thereby allow more people to attend. In view of the fact that the FASEB Meeting is scheduled to follow a different format in 1986 or 1987, the APS Task Force on Future APS Meetings was established to consider possible changes and how it will affect APS Meetings. Such things to consider would be whether to have one Society meeting, with or without FASEB, smaller regional meetings, etc. Hopefully, members will assist the Task Force by promptly responding to the questionnaire being circulated.

Dr. Share asked about the $20 abstract handling fee charged by FASEB. Dr. Wood replied that the $20 fee to handle abstracts has been instituted by FASEB as a means of increasing revenue. Although the Federation has made tremendous efforts to keep costs down, it was necessary due to inflation costs of handling the FASEB Meeting. Dr. Share further asked whether there has been discussion by Council not to meet with FASEB. Dr. Wood said no decision has been made in that regard, but a decision such as this would be depend to a large degree on the responses to the APS questionnaire.

In response to a question as to how large a meeting must be to have a significant number of exhibits, Dr. Reynolds replied that he had been told that to be of financial benefit, a meeting of 3,000 attendees would attract sufficient exhibitors.

Dr. Hyatt asked if the Waxman Bill, pending in Congress, might have some influence on Federal funding and inquired concerning the Society's activities with respect to it. In response, it was stated that the APS Public Affairs Committee has been following these bills (covered in the Committee report p.6) as has been the FASEB Public Affairs office.

With no other business, the Business Meeting was adjourned at 5:15 p.m. October 16, 1980.

Francis J. Haddy
President-Elect

COMMITTEE REPORTS

PUBLICATIONS COMMITTEE: MID-YEAR REPORT FOR 1980

The first half of 1980 is made noteworthy for the publications program of the Society by:

1. The establishment in January of two new journals from an existing specialty journal: *American Journal of Physiology: Endocrinology and Metabolism* and *American Journal of Physiology: Gastrointestinal and Liver Physiology.* The number of new manuscripts received and subscriptions already indicate that this was a logical evolutionary step.
2. To serve neurophysiology and neuroscience better the *Journal of Neurophysiology* began to be published monthly in January. In the first six months more pages were published than in all of 1979.
3. The second volume in *The Cardiovascular System* Section of the *Handbook of Physiology, Vascular Smooth Muscle,* was published in April. This is the first time that information on the contractile system of the blood vessel walls has been brought together in such a comprehensive way.
4. *Secretory Diarrhea,* the fourth book in the Clinical Physiology Series was published in May. The book continues, as the previous books in the series, to tie together disease conditions and physiology in a useful fashion.
5. For the first time an entire issue of one of the specialty journals was devoted to articles from a symposium. *Biology of the Chloride Cell: Jean Maetz Memorial Symposium* was published as the March issue of the *American Journal of Physiology: Regulatory, Integrative and Comparative Physiology.* Separate sales of this issue have brought this important summary to people inexpensively and introduced them to this unique journal.

The Publications Committee is proud of the continuing innovation in the journals, the quality of the books, and the amount of information delivered to physiologists at affordable prices by the Society.

Alfred P. Fishman, Chairman

REPORT OF FINANCE COMMITTEE MEETING

October 12, 1980, 8:30 A.M.
Toronto, Canada

COMMITTEE MEMBERS PRESENT:

Arthur C. Guyton, Chairman
Jack Kostyo
Francis Haddy, President-Elect (ex officio)
Orr Reynolds, Executive Officer (ex officio)
Walter Sonnenberg, Financial Officer (ex officio)
Steve Geiger, Publications Manager (ex officio)
(Robert Forster contributed to deliberations via telephone)

GENERAL STATEMENT:

Because of the concerted effort of the Finance Committee and Council during the past few years to straighten out some of our financial problems, the Finance Committee had the least number of problems to consider in a number of years. Also, some of the financial problems of FASEB have been at least partially alleviated. For this reason, the financial status of the American Physiological Society's operating budget has been greatly improved. Therefore, for the first time in several years, the Society's operating budget is predicted to be in the black without any dues increase for the coming year.

SPECIFIC ITEMS CONSIDERED BY THE FINANCE COMMITTEE:

The Publications General Fund. The overall income to the Publications General Fund is predicted to be $2,130,000 for the 1981 budget year. The expenses, on the other hand, are predicted to be $2,325,000, leaving a deficit of approximately $194,000. The major cause of this impending deficit is a marked increase in printing and engraving costs, this combined with the usual inflation of other costs. The increase in printing and engraving costs is approximately half due to a predicted 10 per cent increase in published pages.

The subscription rates for the journals have been increased 10 per cent for the coming year. This will not be enough to cover the increased expenses. However, the Publications General Fund has had approximately a half a million dollar excess income during the past three years, so that there will be no difficulty in covering the deficit. It is expected that subscription rates will be increased appropriately during the following year to bring the Publications General Fund back into balance for the 1982 budget year.

Publications Special Projects Fund. The Publications Special Projects Fund covers the publication of the handbooks and monographs. One handbook of over 700 pages was published during the past year, and another, *Motor Physiology,* having a size of over 1500 pages will be published during the budget year of 1981. This will entail a large increase in printing costs. Also it will make the total cost of the handbook series minus income from this series since the beginning of the project in 1958 increase to approximately $340,000 by the end of the 1981 budget year. In 1958, Council gave the Publication Committee permission to reach as much as $250,000 cost over income for this publication project. Therefore, for the Publication Committee to continue its publication of handbooks, it needs permission from Council to increase the permissable cost over income beyond the $250,000 amount. (In a subsequent action of Council on the afternoon of October 12, 1980, this value was increased to $500,000.) The inventory of handbooks presently on hand, valued at cost, is about $650, 000, which is far more than enough to cover the net cost of this project to date.

One monograph was published during the past year, and two will be published during the coming year. All of the monographs thus far have been financial successes, and this continues to be so for the monographs presently being sold.

Society Operating Fund. The income to the Society Operating Fund for the 1981 budget year is projected to be approximately $491,000, and the expenses are projected to be approximately $453,000. Thus, the income is expected to exceed expenses by about $38,000. This is the first time in a number of years that this fund has been in the black.

The major improvement in the Society Operating Fund Budget has resulted from improvement of our financial relationships with FASEB. For instance, the reimbursement from the FASEB Spring Meeting in 1981 is budgeted to return $47,000 more to the Society than the amount budgeted for 1980. In addition, the dues to FASEB are budgeted to decrease by approximately $14,000. These changes in the FASEB financial position are caused by several factors: (1) The meeting will be held in 1981 at a place that is predicted to give greater income. (2) FASEB had a large non-recurring cost for an unsuccessful computer project that had to be covered in its 1980 budget. And, (3) a $20 abstract handling fee will be levied for all of the abstracts submitted to the 1981 Spring Meeting.

An additional important change in the Society Operating Fund expenses has been a reduction of program development costs to approximately one-half of those for the previous year, from $24,600 to $12,000.

Business Office Expenses. There have been no significant changes in operation of the Business Office. The increased operating cost of this office are only to cover inflation. At present, 15 per cent of the Business Office expenses are allocated to the Society Operating Fund and 85 per cent are allocated to the Publications Funds.

COMMITTEE ACTION ON THE 1980 PROPOSED BUDGET:

The budget as prepared by the Financial Officer, Walter Sonnenberg, was accepted in its entirety by unanimous vote of the voting members of the Finance Committee who were present.

A PROPOSED CHANGE IN FASEB OPERATING PROCEDURE THAT WILL BENEFIT APS:

In the past, the overhead charges for supporting services in FASEB have been charged to the functional programs of FASEB such as *Federation Proceedings,* the costs of the Spring Meeting, and so forth. In the case of the Spring Meeting, these costs have been borne by those societies that participate in the Spring Meeting. Since the American Society of Biological Chemists does not participate in many of these meetings, it, therefore, has not been sharing in payment for many of the supporting services. The Finance Committee of FASEB has approved a change in operation whereby these supporting services will be charged equally among the different societies on the basis of membership. If this passes the Executive Committee and the Board of FASEB, the American Physiological Society will benefit by more than $2.00 per member per year, making a total of over $10,000 per year. It is predicted that this will pass.

The net cost to the American Physiological Society for each member for us to belong to FASEB was over $13.00 per member last year. If the new operating procedure passes the FASEB Board, the net cost is projected to be about $5.50 for the coming year. If the new procedure does not pass, the net cost is projected to be about $7.65 per year per member. This net cost is calculated on the basis of total charges by FASEB minus the

return to our society from FASEB of our proportionate share of the profits from the Spring Meeting.

REVIEW OF THE FINANCIAL INVESTMENTS OF THE SOCIETY:

The Finance Committee reviewed and approved the status of the Financial investments of the Society. The total investments of the Society have a present market value of slightly greater than two and one-half million dollars. However, approximately one-half of this is to guarantee current operations such as publication of the journals that have already been paid for and to finance operation of the Society during the coming year.

SUMMARY:

Though there is a projected deficit in the operation of publications for the coming year, this will be covered by excess income that has been accumulated during the past several years. The Society Operating Fund Budget is in the black for the first time in several years. The financial status of FASEB has improved markedly, which has had a salutary effect on our own financial position as well.

MEMBERSHIP COMMITTEE

Summary of Meeting of October 13, 1980 and
Chairperson's Report to Council, October 14, 1980

Committee Meeting:

October 13, 1980 at 1:00 p.m., Kenora Room, Sheraton Centre, Toronto, Canada.

Present:

I.J. Fox, J.C.S. Fray, A.E.V. Haschemeyer, S. Cain, R.E. Hyatt (Chairman).

Absent:

M.C. Neville

1. Committee approved all Regular applications except one, recommending that this individual be offered Associate status. All corresponding and student applications were approved. All applications for Associate Membership were approved with one exception which was approved pending receipt of a bibliography since the application was incomplete. The Committee's actions were sent to Council as a motion for nomination with the exceptions noted.

Council seconded and adopted the Committee's nominations. All were subsequently elected at the business meeting of members on October 16, 1980.

Summary of the Election:

Eighty-nine of 90 Regular members, 8 of 8 corresponding members, 23 of 24 Associate members, and 16 of 16 student members were elected.

2. A proposal from one of the APS members suggesting that student members be automatically elevated to Associate membership was considered by the Membership Committee. The Committee felt it could not support this recommendation. It felt it important that former student members, when they are eligible for Associate membership, show their continuing interest in the Society by submitting a new application. It was also noted that some student members are undergraduates, which could lead to complications. It was also felt that review of the individual's progress at the time the person becomes eligible for Associate membership would ensure that the individual was still pursuing a career in Physiology.

3. The proposal from the Membership Committee regarding the modification of the Associate membership denying Associate members the privilege of sponsoring papers on which they are not authors was reaffirmed by the Committee. At the Council meeting this proposal was reported to be now in force and is being announced in the Physiologist.

4. The current concern of the Membership Committee regarding the role of women in the American Physiological Society was again discussed at the Committee meeting. The Council is aware of the problem and is actively seeking approaches to improve the representation and status of women in the Society.

R.E. Hyatt
Chairman

REPORT OF THE EDUCATION COMMITTEE

This report provides an update on selected important activities which are in flux and an announcement of new activities sponsored by the Committee.

I. *The Audiovisual Project*

The moratorium on the production of new slide tapes will go into effect, as scheduled, at the end of 1980, although the final commercial production of several of the tapes now being completed may extend into the first few months of 1981. We project that the deficit as of that time will be $150,000-$160,000, approximating the maximal value of $150,000 set previously by Council. The sales of all previously issued slide-tape programs are holding well, and we estimate that the income on them for 1980 will be approximately $50,000. It is predicted, therefore, that the full deficit incurred by the program should be paid off within the next 3-4 years. The slide-tape programs presently being completed include 4 on cardiac electrophysiology and 7 on peripheral circulation. A subcommittee to evaluate the program and make recommendations as to its possible future is being formed under the chairmanship of Joseph Szurszewski.

II. *Learning Resources Center at Meetings*

The fourth Learning Resources Center was held at the Spring FASEB meeting in Anaheim, California, in April 1980. Included were eleven educational exhibits and displays of slide/tapes developed by APS and other groups. The APS Education Office also presented a preview of slide/tape programs currently in development. The educational demonstrations involved members from different FASEB societies (APS 6; AIN 2; AAI 2; ASPET 1), the first time the Learning Resources Center has been extended to all FASEB societies. The Learning Resources Center was held for four full days, corresponding to the duration of the commercial exhibits. The attendance recorded at the LRC was the largest to date, due possibly to the extended exhibit time and to increased interest and participation in the exhibits. The approximate daily attendance at the educational exhibits was Monday, 600; Tuesday, 350; Wednesday, 300; and Thursday, 200. The total expenses for the Learning Resources Center was $1,184.

Members wishing to avail themselves of an opportunity to present educational material at future meetings should specify "teaching materials and methods" topic in the topic category list, provide an abstract on the regular abstract form for publication, and write an accompanying letter describing their equipment requirements. Presentations and abstracts in this category do not

constitute use of a franchise for research slide presentation or poster session.

III. *Programs on the Teaching of Physiology*

In the Fall 1980 meeting, a new mechanism for facilitating exchange of educational information is being tried. Three poster sessions are being presented: (1) John West has organized a session entitled "Teaching of Respiratory Physiology to Medical Students," in which four persons present their methods of teaching this material; (2) Terry Machen is describing the U-C Berkeley self-paced format for teaching introductory physiology to large undergraduate classes; (3) Paola Timiras has organized a session entitled "Innovations in Teaching on Aging: Integrative and Interventive Approaches" in which six persons describe their approaches to teaching material on aging. The committee welcomes suggestions concerning other areas to be covered in the future and individuals (self-nomination is completely appropriate!) to serve as organizers of such sessions.

IV. *Accreditation*

An application has been submitted to the Liaison Committee on Continuing Medical Education requesting that the APS be accredited for the granting of credits for continuing medical education. The site visit is to occur in Toronto. If forthcoming, such accreditation should increase the use by clinicians of our various educational materials (such as the slide-tapes) and their attendance at our meetings, particularly the refresher course and tutorial lectures.

V. *Anthologies from The Physiologist*

The committee is actively soliciting articles for the Physiologist in particular areas, with the aim of publishing anthologies of these articles. Drs. Tidball and Shelesnyak have already edited a forthcoming volume dealing with the use of computers and simulation in the teaching of physiology. Carl Rothe has agreed to oversee a collection of laboratory experiments. Collections of articles dealing with the history of physiology and with the use of clinical cases in the teaching of physiology are also being planned. Suggestions for additional topics would be welcome.

VI. *A Television Series on Physiology*

The committee is investigating the possibility of preparing a TV series on Physiology, with funding supplied by external sources. Suggestions would be welcome and should be sent to Robert Gunn.

A. J. Vander, Chairman	J. H. Szurszewski
J.B. Bassingthwaighte	P.S. Timiras
E.O. Feigl	B.M. Twarog
R.B. Gunn	J.B. West
J.C. Houk	O.E. Reynolds, Educa. Officer

PROGRAM COMMITTEE REPORT TO COUNCIL
October 1980

Committee Membership

Current members of the Program Executive Committee and Program Advisory Committee are listed at the end of the report.

1980 Fall Meeting

This year's meeting is composed of 993 abstracts, 166 more than were programmed in the 1979 New Orleans Meeting. Abstracts submitted by Canadian members of the participating societies numbered 199. CPS members submitted 77 abstracts while ASZ members submitted 39, and CSZ submitted 13.

1981 Spring Meeting

Initially, the Program Executive Committee approved 19 symposia with 22 half days of sessions. Of these, six for the Nervous System Section and one on Epithelial Function were transferred to FASEB as part of the thematic portion of the meeting. Subsequently, it was agreed by FASEB and the Nervous System Section that one of the symposia be dropped (Mechanisms of Sensory Transduction).

In addition to the APS sponsorship of 12 symposia (15 half days of sessions), Helene Cecil, Chairman of the Animal Care and Experimentation Committee, is organizing a FASEB symposium on The Ethics of Animal Care. Walter Randall, Chairman of the Career Opportunities in Physiology, is organizing a session on Careers in Physiology. The careers session is tentatively scheduled for the late afternoon of Wednesday, April 15, 1981, and the animal care session in the evening of the same day.

SEBM and BMES will participate as guest societies under APS sponsorship. The SEBM symposium is tentatively titled "Genetic Polymorphism and Regulation of Gene Expression" and is being organized by Paul A. Marks.

Relationship with the Section on Physiology in Clinical Science

At the April 1980 meeting of Council, it was reported that the Publications Committee offered to act as the sponsor/organizer for symposia organized by the clinical section. This would mean approving the topics for such symposia and funding approved requirements for authorized support of speakers. Since a principal purpose of these symposia is the publication of associated papers, the Program Executive Committee would concur in a redefinition of the Section's charter to provide for such an arrangement. It is recommended that the ex officio member of the Program Advisory Committee representing the Section be continued since it is imperative that the Program Executive Committee be the recipient of all program material.

It is the Program Executive Committee's understanding that a revision to the Section's charter will be presented at this meeting by the APS Executive Secretary.

Reorganization of the Program Advisory Committee

In the minutes of its April 1980 meeting, Council stated that Section representation on the Program Advisory Committee must be defined; that the responsibilities of Section representatives be clearly stated, and the individuals should be informed of their duties as members of the Program Advisory Committee.

Two documents designed to be useful for members of the Program Advisory Committee in discharging their responsibilities have been included in the APS Operational Guide. These are the "Guidelines for Programming Abstracts for Spring and Fall Meetings and Suggestions for APS Symposium Organizers."

In addition to guides for programming abstracts, the former document includes the selection of 30-minute speakers for Spring meetings, and the selection of Session Chairmen. The document on symposia discusses their purpose, the Program Executive Committee's approval schedule, and a number of other points critical to the conduct of these sessions.

Council is engaged in discussion of defining section representation on the Program Advisory Committee. The following are elements of this representation.

Relationship with the Program Advisory Committee

The APS Program Advisory Committee reports to the Program Executive Committee. The Program Advisory Committee is com-

posed of representatives of the Sections and such other special interest groups as may be named by the APS Council.

To discharge their program planning functions, the Program Advisory Committee meets twice each year during the Spring and Fall APS meetings. At each meeting, members of the Program Advisory Committee present their Sections's proposed symposia topics and organizers for the meeting to be held the following year. The recommendations of the Program Advisory Committee are furnished to the APS Program Executive Committee for decisions and subsequent submission to Council.

At these meetings, the Section's representative on the Program Advisory Committee may also propose changes to the list of topic categories used in soliciting abstracts for the meeting to be held the following year.

To discharge the programming function, members of the Program Advisory Committee are required to review abstracts submitted in their assigned area of interest and arrange the abstracts into sessions according to APS guidelines. This usually occurs shortly after the deadline for receipt of abstracts and must be accomplished by each Committee recipient within a four-day period.

In connection with the programming of abstracts, Program Advisory Committee members are required to name Session Chairmen and, for the Spring Meeting, 30-minute speakers for selected sessions.

At the discretion of the Section's governing authority, a Section Program Committee may be appointed to support the Section's representative on the APS Program Advisory Committee. The committee will be composed of representatives of the sub interests of the Section's constituency and be responsible for advising the Program Advisory Committee representative on the needs for special sessions and topics at the annual APS meetings. As required, Section Program Committee members will also be responsible for programming abstracts and naming session chairmen, etc. The names of the latter individuals and their special topic areas will be provided to the APS Executive Secretary, who will communicate directly with each named individual to furnish planning schedules and abstracts for programming.

Program Executive Committee

H. M. Goodman, Chairman
F. G. Knox
Brian Duling
H. V. Sparks, Jr., Ex officio

Program Advisory Committee

Circulatory Physiology (peripheral), vacant
Circulatory Physiology (heart), Eugene Morkin
Clinical Physiology, ex officio
Francois M. Abboud (1979-82)
Comparative Physiology, Bruce L. Umminger
Environmental, Thermal & Exercise Physiology,
Reynaldo Elizondo
Gastrointestinal Physiology, Michael J. Jackson
Membranes and Transport, E. M. Wright
Neural Physiology, M. J. Kushmerick
Neural Control of Circulation, J. W. Manning
Neuroendocrinology, Joseph Meites
Nervous System, Richard Orkand
Physiological Chemistry, T. B. Miller, Jr.
Renal Physiology, Edward G. Schneider
Respiratory Physiology, N. C. Staub

COMMITTEE ON PUBLIC AFFAIRS

Report to Council - September, 1980

Appropriations continues to be our major concern. The House passed a bill which gives NIH a 5% increase. Most of this is to go into extramural grants to preserve funding of 5,000 new and competing renewals. The really good news is the addition of 33.6 M for training; 24 M of that in NIGMS. There is no word of Senate action - last year the Senate finally went along with the House figures.

Authorization of NIH has been a hot issue this year with both Mr. Waxman and Mr. Kennedy posing as NIH's saviors from the legislative limbo that poor NIH has been forced to suffer over the last 40 years. Mr. Waxman pulled out all the stops to get his bill out of the House by a 292-48 vote. The bill sets the NIH, complete with a weak Director, into legislative concrete and gives all the Institutes the blessing of 3-year authorization cycles already enjoyed by NIHLB and NCI. Mr. Kennedy's bill is seemingly more benign - he adds a Presidential Commission to kibitz on Biomedical Research Appropriations. There is, regrettably, an excellent chance that some version of these two will become law in the final hurry to finish.

Reelection of the powerful seems to require money. I have received several invitations to attend receptions "honoring" the luminaries. A recent one for Warren Magnuson ran $250 for cocktails and $1000 for dinner. Since this is slightly beyond the usual APS per diem, I decided not to RSVP.

Presence of APS members in Washington continues to be a very important objective. We now have three former Congressional Fellows, L. Faulkner, C. Schotte and K. Gardner all with continuing interest in the Washington scene and a desire to represent APS. Two other members of the Public Affairs Committee have shown willingness in the past to do likewise. I encourage the Council to *set aside 1-3 thousand dollars* to enable APS Public Affairs Committee members to come to Washington at crucial times and to extend visits for other purposes.

Communication within the committee continues to be a problem since a majority of the committee are not regular attenders of APS meetings.

Cooperation with other Washington groups with similar legislative interests continues to be a high priority item. Via AAMC we have input into the largest and most sophisticated Biomedical Lobbying group. I believe we must continue to be active in the Council of Academic Societies. I have just been nominated for the Executive Committee of that group.

FASEB Public Affairs should be encouraged to likewise cooperate with others on the Washington scene. Many view the current policy of the FASEB staff as one of isolation and hence FASEB is ineffectual. Our representation to FASEB, including myself, should work hard to alter this view.

Brian A. Curtis
Chairman

ANIMAL CARE AND EXPERIMENTATION COMMITTEE

Report for April, 1980 - September, 1980

Committee Members: Malcolm Hast, Robert Hazelwood, David Robertshaw, Orville Smith, and Helene Cecil, Chairman.

The Animal Care and Experimentation Committee did not meet during this period. The activities of the Committee are:

I. *Symposium on "Bioethical Issues of Animal Experimentation"*

The Symposium was proposed by the APS to the FASEB Council and was approved as an intersociety symposium on June 12, 1980. Member societies were asked for input into the final planning of the symposium. In September the AAP appointed Carl Becker and the ASPET appointed T. Colin Campbell and Walter Freyburger, Jr. to assist the APS in finalizing the program. At this time the program *has not* been completed. The APS symposium outline as submitted to the FASEB Council is:

1. Historical Aspects of Regulation of Animal Use in Research and its Implications. R. D. French, historian and author of *Antivivisection and Medical Science in Victorial Society.*
2. Philosphical and Ethical Consideration of Laboratory Animals for Biomedical Research and Teaching.

   Bernard Rollin, Departments of Philosophy, Physiology and Biophysics, Colorado State University. Dr. Rollin, a philosopher, teaches a course in "Ethics in Animal Experimentation" to veterinary students.

   Michael Fox, Director, Institute for the Study of Animal Problems (a division of the Humane Society of the United States). Dr. Fox holds a degree in veterinary medicine from the Royal Veterinary College, London and is a strong proponent of alternatives to laboratory animals.
3. The Importance of Animals as Models for Humans. Lewis Thomas, President Sloan Kettering Cancer Center, was suggested but will be unable to attend the Federation meeting.

II. *Accreditation of Laboratory Animal Facilities*

Accreditation of laboratory animal facilities by the American Association for Accreditation of Laboratory Animal Care (AAALAC) has been accepted by the NIH as demonstration of proper animal care for grant applicants using research animals. The APS is currently represented by the FASEB delegate, Lloyd C. Faulkner. AAALAC is governed by a *Board of Trustees* comprised members from 24 scientific and professional organizations. The only expense to the membership organization is that of their representative, primarily the cost of attending the AAALAC Board of Trustees annual meeting in Chicago. To have greater input into the accreditation procedure the APS could:

1. Request to become a member organization of the AAALAC.
2. Canvas the APS rolls to determine those members who could serve as consultants to the AAALAC Council on Accredition. The curriculum vitae of qualitied APS members should be submitted to AAALAC for consideration as nominees for consultant positions to the AAALAC Council. (The AAALAC Council and the consultants are the people who make the site visits and determine the status of animal care for accreditation.)

Helene Cecil, Chairman

CENTENNIAL CELEBRATION COMMITTEE

Toronto, Ontario, Canada

The Centennial Celebration Committee (CCC) meeting was held at the Sheraton Centre at 12:00 noon on October 14, 1980 with the following members in attendance: Dr. Peter Chevalier, Chairman, Drs. Ralph Kellogg, Lee Langley, Earl Wood (ex officio), M.C. Shelesnyak, Task Force Director (ex officio). Also by invitation, Mr. Stephen Geiger (representing the Publications Committee on behalf of Dr. A.P. Fishman). Absent with permission, Drs. M.S. Kafka, J.D. Neill, S. Ochs, A.B. Otis, and O.E. Reynolds.

1. *History of the APS, 1887-1987:* The *History of the Society* will be made available by reprinting *History of the American Physiological Society Semi-centennial 1887-1937,* Baltimore, Maryland 1938, (the American Physiological Society during its first twenty-five years, by William H. Howell, and the American Physiological Society, History of the Second Quarter Century by Charles W. Greene, combined with History of the American Physiological Society) together with *The Third Quarter Century 1937-1962* by Wallace Fenn, Washington, D.C., and adding the *Fourth Quarter Century* Society History. Dr. John Brobeck has accepted the task of editing this fourth quarter and has invited Dr. Orr Reynolds to serve as co-editor. Dr. Reynolds has accepted.

   MOTION: The CCC extends its gratitude and appreciation to Drs. Brobeck and Reynolds for accepting responsibility for the preparation of the Fourth Quarter Century of the Society's history. Passed unanimously
2. *History of Physiology in America:* A history of American Physiology during the past century is under consideration by this committee. A meeting with Dr. Al Fishman, chairman of the Publications Committee, was held to explore the various types of publications that might be utilized. Members of the committee have met with various individuals interested in the history of physiology to explore the different approaches that may be taken in achieving this goal.

   In addition, a subcommittee will be formed consisting of representatives of the CCC and the Publications Committee along with representatives of different historical societies to aid in identifying appropriate topics and potential authors.
3. *Department Histories:* Dr. Reynolds has previously invited the heads of all Departments of Physiology in North America to prepare a history of itself. Some have been received and others are in various stages of completion. Dr. Otis has assumed responsibility for this activity, and has also sent a letter to all Department Chairmen, personally inviting them to prepare such a history of their department. These histories will be published in *The Physiologist* when appropriate. Dr. Horace Davenport has recently submitted a manuscript on 'Physiology at Michigan: 1850-1923.' Following review by members of the CCC, a motion was passed to refer it to the Publications Committee for consideration as an APS publication.
4. *Historical Vignettes:* The recently developed Historical Section of *The Physiologist* has become the medium for publication of vignettes. Dr. Kellogg is responsible for recruiting physiologists to prepare vignettes. Suggestions for authorship are always welcome.
5. *Smithsonian Institution:* The Smithsonian Institution has expressed its interest in contributing to the APS's centennial

celebration. Dr. Audrey Davis of the Smithsonian Institution has had preliminary discussions with Dr. Shelesnyak regarding her interest in undertaking the writing of a monograph, in conjunction with a planned exhibition of instrumentation at the Smithsonian to commemorate 100 years of APS. In addition, the Office of Symposia and Seminars has offered to serve as a clearing house to help mobilize Smithsonian resources that should be brought into play during the Centennial of the APS. An ad hoc committee has been formed to carry this out.

6. *Biographical Directory of APS Members:* Dr. Shelesnyak has been in contact with Mr. Steve Nichols, General Manager, The Jacques Cattel Press, and a tentative agreement has been reached that the Press will produce this Directory utilizing their material from the American Men of Science (now American Men and Women of Science). The APS will supply thier membership lists and wherever necessary, biographical data as in the AMWS. The APS should be in position to make the list (including deceased, resigned and dropped) of members available by early 1981. This list may also be a roster used as an appendix to the Society's Centennial History.

7. *Centennial (1987) Meeting Site:* The Executive Committee of the CCC (Drs. Chevalier, Reynolds, and Shelesnyak), after consideration of a number of factors, recommended to the full CCC that Washington, D.C. be selected as the site of the 1987 Centennial Meeting of the APS. The Uniformed Services University of the Health Sciences has formally invited the APS to use its facilities in Bethesda, adjacent to the National Naval Medical Center, and across the street from the main campus of the National Institutes of Health, for this meeting. This recommendation was presented to Council as a motion (unanimous) from the CCC.

8. *Committee Membership:* Drs. Chevalier and Shelesnyak recommended that Dr. Robert J.T. Joy, Professor and Chairman, Department of Military Medicine and History at the Uniformed Services University of the Health Sciences, Bethesda, Maryland, be invited to become a regular member of the CCC. Motion passed unanimously. Dr. Joy's appointment as a regular member of the CCC was subsequently approved by Council.

9. *Historical Lecture Series:* The CCC considered a proposal from Dr. Ochs for a Historical Lecture Series which would include speakers at the two APS meetings each year in addition to presentations at meetings of related societies. The Committee supported enthusiastically the overall proposition, and in particular, of having one lecture devoted to the history of physiology presented at every APS meeting from now through the Centennial Meeting in 1987. The informative and enlightening lecture on the 'Review of the History of Respiratory Gases' presented by Dr. Ralph Kellogg at this fall (1980) meeting was very well attended and indicative of attendees interest.

The meeting was adjourned at 3:15 p.m.

Minutes of the Meeting of the FINANCIAL DEVELOPMENT COMMITTEE

October 14, 1980
Toronto, Canada

Current progress and future plans for financial development activities were discussed with Orr Reynolds, Walter Sonnenberg and Herbert Brownstein. Letters will again be sent to existing and potential Sustaining Associates inviting their contributions. A letter has already been sent to current Sustaining Associates. A letter inviting companies who are not current Sustaining Associates to participate will be sent out in early January. This change in the date of solicitation was felt to be wise because most industrial organizations are on a calendar year, and they plan their budget, including giving, in the early months of the year.

A meeting of interested representatives of the Sustaining Associates with officers of the American Physiological Society will be held again this year at the time of the Federation Meetings in Atlanta. The tentative date is Monday, April 13, and the tentative time is 4:45 p.m. The program will be kept simple, with introductory remarks by Dr. Ganong, a short presentation by the President of the Society, a summary by Dr. Ganong of actions taken as a result of the meeting last year, and discussion of matters that concern the Sustaining Associates. There was general agreement that if the Sustaining Associates wished, establishment of a standing liaison committee with APS should proceed.

To accomodate senior physiologists and others who are interested in making bequests to the American Physiological Society, a short article on Living Trusts will be published in *The Physiologist* (see p.13). The APS staff felt, and the Committee agreed on the desirability of getting an adequate number of bequests so that the costs to the society would not defeat the benefits of the arrangement.

Supplementing the mailing last year, foundations will be approached on an individual basis. There was agreement that appointment of a Financial Development officer working out of APS Headquarters would be desirable, but there was also general recognition of the fact that no funds could be made available for this purpose. Consequently, it was suggested that many senior members of the Society be encouraged to develop their own individual contacts and encourage contributions.

There will be no dues increase this coming year. However, it was agreed that inflation continues to be a problem and that every effort should be made to encourage active members to make voluntary contributions at the time they pay their dues.

William F. Ganong, M.D.
Chairman, Financial Development Committee

REPORT OF COMMITTEE ON CAREERS IN PHYSIOLOGY

GRADUATE TRAINING IN PHYSIOLOGY AND ITS RELATIONSHIP TO CAREER OPPORTUNITIES

A. OVERVIEW AND OBJECTIVE OF COMMITTEE REPORT

The Committee on Careers in Physiology is a sub-committee of the Council of the American Physiological Society. It is charged with the responsibility to review and draw attention to important aspects that may influence career opportunities for individuals in the discipline of physiology. The Committee has developed this formal report summarizing important aspects related to predoctoral and postdoctoral training programs and career opportunities in physiology.

B. PRIMARY CAREER OPPORTUNITIES IN PHYSIOLOGY

Seven general areas in which individuals training in the discipline of physiology usually develop a career are identified:

1) *Full-time academic responsibilities in a basic science physiology department within a medical school with emphasis on both teaching and research.*

This includes individuals with teaching responsibilities which often include physiology instruction to medical, dental, pharmacy, nursing, as well as Ph.D. graduate students. Research activities usually involve the development of an independent research program as well as additional collaborative research investigations with other individuals in physiology as well as other departments in the medical school. On a percentage basis, very few physiologists whose primary appointment is in a physiology department have major patient care responsibilities, even though they may have M.D. training. They often have a third area of academic responsibility such as institutional committee responsibilities, i.e., Admissions Committee, Promotions Committee, etc. Many also have outside committee activities, i.e., NIH study sections, national society committees, etc. Most individuals on a fulltime basis in physiology departments have a Ph.D. in physiology, but also this group includes many individuals with M.D. training who have had physiologic research training with a postgraduate setting. This group also includes individuals (Ph.D. and M.D.) who may be in the physiology department but have most of their effort devoted to research. Such individuals, for example, may be salaried by research grants, young investigators awards or career development awards.

2) *Full-time academic responsibilities within a clinical department within a medical school with primary, if not exclusive, emphasis on research.*

Individuals with the Ph.D. often have a joint appointment in a basic science department, but with limited obligation to the teaching programs of the basic science departments, although this varies greatly among different institutions. Scuh individuals are usually salaried through clinical department income funds or perhaps on outside research grant funds, but usually not salaried through the basic science department. Individuals within this setting often have a primary responsibility to a very defined research program, which is usually an applied physiologic program and done in conjunction with other M.D. clinical staff in the department.

3) *Full-time research responsibilities within a research institution setting, private or governmental, which may or may not be affiliated with an academic organization.*

These are individuals whose major focus of responsibility is basic as well as applied research with very little emphasis on teaching, patient care or institutional committee responsibilities. Such individuals have either the Ph.D. or M.D. degree and often have a high percentage of their available time for investigative study. While such individuals do not have responsibilities for teaching of students in the health professions, there is often a responsibility to some aspects of graduate Ph.D. research training or postdoctoral research training. These individuals are also active on society committees, editorial boards, etc.

4) *Full-time research and development responsibilities in an industrial setting.*

This setting usually involves association with corporations which are more goal-oriented and may involve a close association with corporate structure and management that is intermixed with applied research. Activities might include the testing of new drugs or development of equipment to be utilized primarily in the health or science professions. The last ten years has seen the entry of a larger number of physiologists into the industrial setting than previously. One of the reasons is a strong interest of industry in pursuing more basic research. Previously only pharmacologists "need apply" because of the more pragmatic orientation towards applied research. Over the past few years more emphasis has been placed on fundamental mechanisms of biological systems. Thus physiologists, because of their broader expertise and training, are being hired at an accelerated rate especially within research and development departments. Because of the usual breadth of training of many physiologists, which includes pharmacology and biochemistry, they are also recruited by small companies with a limited staff size as well as by some research foundations. Such individuals usually do not have appointments on an academic staff. If so, they are usually courtesy in nature with no major responsibilities for training of health professionals or Ph.D. graduate student training.

5) *Full-time academic responsibilities in a clinical department within a a medical school with emphasis on teaching, research and patient care responsibilities.*

These are individuals with M.D. training, who may have had postdoctoral research training in either a basic or clinical research setting. This most often includes individuals who have completed their M.D. and also, in addition to their typical postgraduate clinical residency experience, have obtained an additional one or two years of physiological research training. This category also includes individuals with combined M.D. -Ph.D. training who have selected to be in an academic setting but primarily in a clinical department. These individuals often will have less focus on basic research, increased patient care and/or clinical teaching responsibility and little involvement in Ph.D. training programs. They may, however, have active postdoctoral training programs with applied research programs although great variations exist.

6) *Full-time academic responsibilities in a Biological Science Department on an undergraduate campus setting.*

These are individuals with both teaching and research responsibilities, who are most often within the setting of a biology or zoology department. The main characteristic of such departments is a high teaching load, in comparison to that common within a medical school. However, research is often a less emphasized aspect of this professional career except for those periods when teaching responsibilities may diminish, i.e., summer period. Such individuals most always

have a Ph.D. degree and the graduate program is usually directed around a Ph.D. in biological sciences or cellular, comparative or environmental physiology.

7) *Full-time health science administration.*

These individuals select an administrative career in situations outside of the typical academic setting. Most often, this career opportunity takes place after previous experience in either a basic science or clinical department setting and typically an indepth research experience prior to appointment. Candidates for such positions usually have professional training at the Ph.D. or M.D. level. These positions are often with governmental organizations such as the National Science Foundation, The National Institutes of Health, or the Office of Naval Research. Responsibilities in these positions often require the administration or review of research grants, training grants, or contracts. Executive full-time health science administrative positions are often quite competitive and provide an important element of the biomedical research and training programs from the standpoint of ongoing review, quality control, and stability. Highly qualified individuals in these positions, often include physiologists.

Of the above opportunities, most individuals with Ph.D. training in physiology who derive their graduate training in a physiology department, are employed within a physiology department in medical schools. M.D. trained individuals actively involved in physiology research may be in either clinical or basic science departments. This collective group of individuals, especially those in physiology departments, comprise the major full-time active members of the American Physiological Society and thus represent a key segment of the Ph.D. and postdoctoral training staff for young physiologists. In view of this reality, an essential aspect of the long-term stability of the discipline, is to insure the production of a highly qualified pool of candidates who can assume the obligations of full-time employment in physiology departments. Appropriate training opportunities must also be available for individuals who wish one of the alternate career opportunities.

C. PREDOCTORAL TRAINING PROGRAMS IN PHYSIOLOGY

An element of great importance for the continuity of the discipline as well as availability of adequate career opportunities in physiology is to insure that Ph.D. training programs in physiology provide appropriate background and training for careers in academic departments, research institutes, etc. This, in turn, leads to a greater institutional appreciation of the discipline of physiology, greater institutional support for departments of physiology and a greater apparent success on the part of individuals in physiology. Such appreciation should blunt the disenchantment expressed by many young individuals in terms of selecting physiology as a career. Physiologists trained in a "traditional sense" with emphasis on being qualified to develop an independent biomedical research career would appear to be the most qualified for any of the multiple career opportunities identified. While there is a large applicant pool from which to select staff for positions in departments of physiology, some of these individuals are not appropriately trained to assume full-time responsibilities as a faculty member or, indeed, to pursue full-time research as an independent biomedical scientist. Great variation in preparation of young applicants looking for full-time academic appointments reflects the great heterogeneity in training programs which may relate to selection of candidates, the applicant pool, review of performance by Ph.D. candidates and training provided to such candidates. There often appears imbalance in their training in relationship to the long-range career responsibilities they will have, especially if they join a physiology department in an academic medical center. Every attempt should be made to identify important components which should become part of all physiology Ph.D. training programs. Some characteristics of particular interest are:

1) *The ability to develop an independent research program with credentials as a biomedical scientist.*

This includes an emphasis on formulation of an hypothesis, designing experiments, analyzing experimental data and eventually communication in both verbal and written fashion in peer review journals. Additionally, for those individuals projecting careers as professional physiologists in medical schools, an appreciation for concepts related to pathophysiology may be helpful.

2) *The ability to assume teaching responsibilities and present physiological concepts to others by verbal communication.*

While it is recognized that some graduate programs do not have large opportunities for Ph.D. students to be involved in a teaching setting, supervised experience, at perhaps laboratory and conference teaching, help to mature this talent. It is difficult to develop a method by which the talent of being a good teacher can be "taught." However, teaching experience and responsibilities for graduate students and indeed staff is a powerful incentive to learn the subject. Indeed, most individuals come to better understand or deeply comprehend a subject when they have the responsibility to verbally communicate the subject to other students or their peers. Involvement in research is important to maintain the quality of teaching. In essence, research is a form of continuing education and serves as a baseline for currency of information relative to teaching responsibilities.

3) *The provision of a realistic perspective on the responsibilities that must be assumed as full-time faculty members.*

Such a career may involve multiple responsibilities at one time which include teaching, research and some type of service and/or administrative responsibility. In essence, we should train our graduate students to do several things at one time so that an active research program does not have to come to a "halt" during the period when a faculty member may have key lecture responsibilities. Limited growth, as anticipated in many academic medical centers in the future, will influence basic science departments. There may be greater pressure for each faculty member to assume increased responsibility. This, coupled with the need to maintain an independent research program, emphasizes the need for individuals trained in the discipline of physiology to have the intellectual capabilities and capacity to assume multiple responsibilities in an appropriate balance.

There is an element of hard work, competition and dedication to biomedical research that will become a very essential element of ones ability to initiate and sustain an active research program. As such, students should be taught essentials of "grantsmanship" and the processes involved in the formulation and preparation of a competitive research application in their graduate training programs.

4) *Direction primarily toward training those students who have a sincere commitment toward teaching and/or biomedical research.*

Graduate programs may have to become more selective in their acceptance procedures, more rigorous in terms of their

standards and more demanding in terms of the quality of their product in order to insure that each individual completing such advanced training has the capability for making a definite contribution in terms of teaching of physiology and/or research in the disicpline of physiology. This will be, in the long run, an important factor in preserving good and multiple opportunities for careers in physiology.

D. POSTDOCTORAL TRAINING PROGRAMS IN PHYSIOLOGY (Ph.D. and M.D.)

The Committee discussed the relationship of postdoctoral training programs in physiology to the long-range topic of careers in physiology. While much emphasis has been placed on graduate Ph.D. programs in physiology, as related to long-range careers for physiologists, postdoctoral training programs also have important implications in terms of career development. Unlike graduate Ph.D. programs which have a tendency to be discipline-oriented, i.e., a broad base in human or mammalian physiology, postdoctoral training programs appropriately may be theme-oriented or topic-oriented with a greater emphasis on full-time research and minimal emphasis on teaching and/or course requirements. As such, postdoctoral training programs should provide young M.D. and/or Ph.D. candidates an ideal opportunity to focus on a major area of investigative study. Thus, postdoctoral training programs in physiology are a form of postgraduate specialty training where the primary focus may be in a specific organ system or a disease process. It is from the postdoctoral pool of applicants that the next generation of professional physiologists will develop. Thus, the quality of postdoctoral training programs relate directly to long-range career goals for physiologists.

There is often a great variability between departments, in terms of the relationship of the postdoctoral training to other activities within the department. In many cases, a postdoctoral fellow or trainee has responsibilities confined to the research setting of a particular laboratory. In other settings, a postdoctoral fellow may be actively in touch with other aspects of graduate training and teaching programs within the department. Postdoctoral programs should provide the trainee the opportunity to develop credentials for independent research and experience in preparation of research manuscripts, presenting of findings at national meetings, and working as a junior co-investigator on research programs. This period should provide individuals an appropriate time to focus on their long-range research goals and develop credentials to assume full-time responsibilities. Continual effort must also be made in attracting M.D. trained individuals to the discipline of physiology for basic research training so that they may have an adequate scientific background to develop full-time academic careers with a balance between patient care, teaching and research. This is a major goal of academic medical centers as teaching institutions and also to the long-term aspects of undergraduate medical education and graduate specialty education. Departments of Physiology and the American Physiological Society can contribute greatly to the achievement of this goal. Indeed, they have been a focus for such training in the past. The mixture of Ph.D. -trained and M.D. -trained postdoctoral fellows in a research program adds perspective and balance.

E. MATCHING OF APPLICANT POOL WITH CAREER OPPORTUNITIES

The Committee is confident and optimistic of the future of physiology, both as a discipline with respect to research as well as to the more global aspects of faculty participants in medical and dental schools. Physiology must continue to be a focus of institutional interest, especially within an academic medical center where the elements of teaching, research and education interact to provide the best training of health care professionals and scientists.

For some young individuals contemplating a career in physiology there is some current disenchantment in terms of career opportunities. This view may be related, in part, to what they perceive even though numerous success examples can be cited. This view also relates to factors such as the large salary differential between basic science and clinical faculty as well as the imbalance between the applicant pool and faculty positions available. Most notable is the inability for many individuals trained at the doctoral level to become active independent scientists within the context of a full-time academic position. This may relate to their environment, the support they may or may not have had from their supervisors, the institutional commitment to the discipline of physiology, the competition for basic research funds, as well as their own skills and competence to develop and sustain an active research program. In view of this last aspect which is all too common, it is felt that Ph.D. training programs in physiology should be perhaps more uniform in structure, more selective in terms of trainees and limited in size to programs that are demanding and of high standards. The end result would be the production of a smaller quantity of highly qualified Ph.D. graduates who would be able to compete successfully and develop independent research programs. Their success will improve the image of the discipline, increase institutional support for the discipline, and keep available a large number of career opportunities for younger individuals. In parallel with this suggested effort by Physiology Departments, the American Physiological Society must increase its activities on behalf of all physiologists to make sure that attractive and competitive salaries are paid to professional physiologists by academic institutions, research institutes, etc., so that the discipline can continue to be attractive to "gifted" individuals over the next decade.

There are important differences in the structure and emphasis of Ph.D. programs between various departments. The unique research directions emphasized by various departments is a key element to the continuing success of science and should be supported and encouraged. However, there are some fundamental aspects of a graduate Ph.D. program in physiology which should perhaps be common to all departmental Ph.D. programs. Thus, the American Physiological Society should consider standards within graduate programs since this may be essential to the long-range stability of the discipline of physiology. Indeed, this might be of definite benefit to those departments, which wish to develop or perhaps improve their current program, but which lack institutional support and/or guidance for such changes.

F. RELATIONSHIP OF AMERICAN PHYSIOLOGICAL SOCIETY TO PREDOCTORAL AND POSTDOCTORAL TRAINING PROGRAMS

In summary, it is recommended that greater concern be expressed by the American Physiological Society with respect to predoctoral and postdoctoral training in physiology. This is important to maintenance of uniformly high standards in the profession as well as to insure the background of young professionals trained in relationship to their career duties. Physiology as a discipline will maintain its importance and relevance within the field of biology and medicine. Moreover, numerous career opportunities exist for physiologists, i.e., basic science departments, clinical departments, research institutes, government and industrial research settings. We should be able to provide a common base for training which is relevant to any of these profes-

sional directions while maintaining unique aspects of individual training programs with high achievement standards. In contrast to the discipline-oriented nature of Ph.D. training programs, the postgraduate training programs are often non-discipline oriented with a focus around a specific topic or theme. Their emphasis is justifiably more toward research as opposed to a broad educational training and should serve as a time for an individual to focus on an area and gain the necessary indepth talents to assume a full-time position, i.e., academic, research, etc.

The Committee is well aware of the fact that continuity and often quality of predoctoral, as well as postdoctoral, training programs is very much dependent upon institutional as well as federal support. Continuing efforts should be made at both local and national levels to insure the long-term commitment for federal support of institutional predoctoral and post training grants. Great concern is expressed for programs which have taken years to mature in terms of quality and which are presently being disrupted due to limitation of training grant funds or withdrawal of internal instructional support at the departmental level. The organization of an active and coordinated graduate training faculty takes years to develop. Steps need to be taken which insure stability and eliminate the dangerous potential for their acute disruption. Predoctoral trainees often provide a service to the teaching programs, are important participants in ongoing research programs, and in many aspects stimulate the scientific environment of physiology departments. We must insure their ongoing quality and stability.

There will be a continuing need for Ph.D.s in physiology to staff present institutions as well as future institutions. A similar concern can be expressed in terms of a number of M.D. -trained individuals who are needed to develop academic careers and the participation of physiologists in their scientific training. We must focus on a higher quality with a greater uniformity between Ph.D. programs. At a minimum, every major program must be structured to provide the best possible skills which will foster the ultimate development of an independent biomedical career as a physiologist. Whether the American Physiological Society should have periodic review of training programs or provide guidelines to the program directors emphasizing common standards remains to be defined and carefully discussed since the unique aspects of individual programs are an element which must be preserved.

COMMITTEE MEMBERSHIP

Name	Title	Role
Thomas M. Saba, Ph.D.	Professor and Chairman Dept. of Physiology Albany Medical College Albany, New York	Author of Committee Report
Walter C. Randall, Ph.D.	Professor Dept. of Physiology Loyola University Stritch School of Medicine Maywood, Illinois	Chairman, Committee on Careers in Physiology
David Bohr, M.D.	Professor Dept. of Physiology University of Michigan Ann Arbor, Michigan	Charge to Committee and Committee Member
James E. Blankenship, Ph.D.	Associate Professor Dept. Physiology & Biophysics Marine Biomedical Inst. Univ. of Texas Med. Br. Galveston, Texas	Committee Member
Donald M. MacCanon, Ph.D.	Chief, Research Training & Development Branch Div. of Heart and Vascular Diseases, Natl. Heart, Lung and Blood Inst., Bethesda	Committee Member
David J. Ramsay, B.M., D. Phil.	Professor Dept. of Physiology Univ. of California Sch. Med. San Francisco, California	Committee Member
Peter T. Ridley, Ph.D.	Deputy Director of Research Smith, Kline & French Labs Philadelphia, Pennsylvania	Committee Member
Orr E. Reynolds, Ph.D.	Executive Secretary- Treasurer, American Physiological Society Bethesda, Maryland	Committee Member/ex officio

PLANNED GIVING TO THE AMERICAN PHYSIOLOGICAL SOCIETY

A number of people have recently inquired about making bequests to the American Physiological Society in their wills. Others have asked if it would be possible to set up some sort of Living Trust arrangement similar to those provided by various charitable organizations. The Society has consulted an attorney and financial advisors, and has determined that arrangements of the types shown could be made provided the relationship between cost and benefits to the Society are suitable. The attorney prepared the following summary of possible financial arrangements, along with the benefits of each to the donor or the donor's estate.

William F. Ganong, M.D., Chairman
Financial Development Committee

DEFERRED GIFT ARRANGEMENTS WHICH RESULT IN TAX AND INCOME BENEFITS TO DONORS DURING THEIR LIFETIMES OR TO DONOR'S ESTATES

ARRANGEMENT	*DONOR'S BENEFITS*
1) *Gift Annuity:* Donor signs an annuity contract in exchange for a gift. Assets of the Society stand behind the annuity contract.	a) *Income:* An immediate annuity at rates up to 10 per cent, depending upon donor's age. Most of the annuity is tax-exempt. b) *Tax Relief:* Around half of the gift is deductible from the donor's current income taxes. From a quarter to a half of capital gains tax is avoided when long-term appreciated property is used as the gift. The payable part is reported ratably over the donor's life expectancy.
2) *Deferred Payment Gift Annuity:* Donor signs a contract for an annuity to begin at a specified later date in exchange for a gift. Assets of the Society stand behind the contract.	a) *Income:* A delayed annuity at rates up to 15 per cent, depending on donor's age and length of deferral period. Usually less than half but more than a quarter of the annuity income is tax-exempt. b) *Tax Relief:* Approximately the same as with gift annuity.
3) *Charitable Remainder Annuity Trust and Unitrust:* Donor irrevocably commits assets to a trust which pays donor and/or beneficiary an income for life or for a term of years.	a) *Income:* Immediate annuity payments of either a fixed dollar amount or a fixed percentage of the annually revalued trust assets. b) *Tax Relief:* Usually between 1/2 to 1/4 of the amount put into trust is deductible from donor's current income taxes, spreadable over six years. *All* capital gains tax on trust assets is avoided.
4) *Reversionary or "Comback" Trust:* Donor puts income-earning assets into a trust for a specified number of years. Trust earnings go to the Society during those years; trust then automatically expires and assets revert to donor, donor's survivor, or beneficiary	a) *Income:* None b) *Tax Relief:* Donor gets income tax deduction in year trust is set up for calculated value of the Society's income from the trust; otherwise donor simply escapes paying income tax on the earnings of the assets during the trust years.
5) *Gifts of Life Insurance Proceeds:* Donor names the Society as both the beneficiary and owner of a policy.	a) *Income:* None b) *Tax Relief:* Donor gets income tax deduction in year of gift for the cash surrender value of the policy and in subsequent years for amounts of premiums paid.
6) *Gift of Cash or Securities:* Donor transfers cash or securities to the Society.	a) *Income:* None b) *Tax Relief:* Donor gets income tax deduction in year of gift for amount of cash and/or value of securities. No capital gains tax on appreciated securities if held for more than one year.
7) *Bequest in Will:* Donor provides for bequest to the Society in his will.	a) *Income:* None b) *Tax Relief:* Donor's estate gets deduction for value of bequest for estate tax purposes.

REPORT ON THE COUNCIL OF ACADEMIC SOCIETIES MEETING

Washington, D.C., October 26-27, 1980

The American Physiological Society was well represented at these meetings, with Doctors Knox and Berne representing the APS, as well as Doctor Curtis as the Public Affairs officer. Doctors Preston and Ganong also represented our interests on behalf of the ACDP. The American Physiological Society was also well represented in regard to appointments on the Administrative Board. Doctors Ganong and Curtis were elected to full and partial terms respectively.

There were four discussion groups. The first dealt with increasing interspecialty cooperation in graduate medical education. The major issue is providing a postgraduate year 1 for individuals who are ultimately entering a subspecialty. Redefinition of this first year with specified interspecialty cooperation was recommended.

The second issue dealt with development of faculty leaders for research careers. Much previously plowed ground was covered again in regard to the reasons for declining interest of M.D.s in research careers. It was generally recognized that the undergraduate science curriculum has become compressed at a time when there is increased biomedical knowledge. This crunch has made the presentation superficial. It is also recognized that there is very little laboratory exposure in the medical school curriculum. Remedies included planning research careers to integrate the clinical and research training rather than have it occur on an ad hoc basis. In regard to funding mechanisms, it was recommended that the Research Career Development Award should be renewable.

The third area considered was competitive marketing of medical services and its potential effect on medical education. Health Maintenance Organizations were considered a potential threat to academic health centers as well as competitive marketing diverting attention away from academic affairs.

The fourth area is one of considerable concern regarding faculty responsibilities and accountability for research activities. A general move from scientific to fiscal accountability is recognized. Indirect cost calculations, through Circular A-21, require that faculty must account for 100% of time and effort. It is noted that increased regulatory demands are elevating the indirect costs borne by institutions. Particular difficulties in allocating percentage as compared with absolute hours of time are recognized. Another difficulty related to the "multiproduct environment" in which more than one end can be achieved in research and education simultaneously. It was noted that although the current regulations are in effect as of July 1, 1980, it is possible for these regulations to be renegotiated and that the Office of Management and Budget is conducting some experimental plans concerning this effort reporting. It was considered extremely important for faculty and medical schools to have input to these experiments for satisfactory accountability. Each of the previous revisions of the Office of Management and Budget in this area has moved further from scientific accountability toward strict fiscal accountability of time and effort.

The Graduate Medical Educational National Advisory Committee's report was discussed. The AAMC is adopting a go-slow policy in recognizing that an 18% reduction in student enrollments in the period 1982 through 1984 is a too precipitous drop. The general softness of the assumptions underlying the GMENAC report was discussed.

It was noted that the New York Board of Regents has decided to accredit the Caribbean medical schools. A resolution was passed strongly recommending reconsideration of this action.

In regard to the general legislative scene, it was noted that we will lose helpful senior statesmen in Congress. The Congress then will be characterized as having little seniority, a lack of party discipline, and no institutional memory. It is particularly important, therefore, that the new members of Congress be informed of our constituent interests.

It was reported that a new era of detente has been formed between the American Medical Association and the American Association of Medical Colleges. Accreditation procedures are proceeding under altered terminologies.

The Spring meeting of the Council of Academic Societies will deal with testing issues and the National Board examinations.

Franklyn G. Knox, Chairman

HONORS AND AWARDS

Three APS members were elected to the Institute of Medicine, their terms beginning January 1, 1981.

Jack D. Barchas, Pritzker Professor of Psychiatry and Behavioral Sciences, Stanford University School of Medicine.

David R. Challoner, Dean and Professor of Medicine, St. Louis University School of Medicine.

Leah M. Lowenstein, Associate Dean, Boston University School of Medicine.

Candidates are chosen for major contributions to health and medicine, and make a commitment to devote significant amount of time to work on Institute committees engaged in a broad range of health policy studies.

Dr. **John C.S. Fray** was selected by the class of 1982 at the University of Massachusetts Medical School to be honored as an outstanding medical educator of their preclinical years, recognizing him for his teaching skills and human qualities. Dr. Fray is a former Porter Development Fellow and currently a member of the Membership Committee of APS.

MEMBERSHIP STATUS

Regular Members	4,286
Emeritus	490
Honorary	8
Corresponding	60
Associate	648
Student	214
Total	5,706

DEATHS REPORTED SINCE THE 1980 SPRING MEETING

Clifford Angerer (E) - 8-14-80 - Ohio State Univ., Columbus
Keith E. Bignall (R) - - - Univ. of Rochester
W. Horsley Gantt (E) - 2--80 - Perry Point, MD
Charles Haig (E) - 6-29-80 - Pulborough, Sussex, England
Dennis E. Jackson (E) - 3-24-80 - Annandale, VA
George P. Mayer (E) - - - Oklahoma State Univ., Stillwater
Ann S. Minot (E) - 2-27-80 - Nashville, TN
S. Frederick Rabiner (A) - - Good Samaritan Hosp., Portland, OR
William J. Reddy (R) - 9-2-80 - Univ. of Birmingham
Frederick Sargent (R) - 3-3-80 - Univ. of Texas, Houston
Ronald E. Scantlebury (E) - 3-9-80 Gaithersburg, MD
P.F. Scholander (R) - 6-13-80 Univ. of California, La Jolla
V. Brown Scott (E) - 4-14-80 - Shelbyville, IN
Richard E. Weitzman (R) - 5-31-80 - UCLA Med. Ctr., Torrance
Herbert S. Wells (E) -4-21-80 - Fayetteville, AR
Isolde T. Zeckwer (E) - 4-10-80 - Meadowbrook, PA

(E) Emeritus
(R) Regular
(A) Associate

NEWLY ELECTED MEMBERS

The following, nominated by Council, were elected to membership in the Society at the Fall Meeting, 1980.

REGULAR MEMBERS

ABRAHAM, William M.: Res. Assoc., Mt. Sinai Med. Ctr., Miami Beach
ALBERT, Richard K.: Asst. Prof., VA Hosp., Seattle
ALBRECHT, Ronald F.: Dept. Anesthesiol., Michael Reese Hosp., Chicago
ALTOSE, Murray D.: Dir., Cleveland Metro. Hosp.
ANDERSON, Robert J.: Div. Renal Dis., Univ. Colorado Hlth. Sci. Ctr., Denver
ARECHIGA, Hugo: Prof., Cent. Invest., Estud. Avanzados, Mexico
ASHE, John H.: Dept. Physiol., Univ. California, S.F.
ASKANAZI, Asst. Prof., Columbia, Univ. New York City
BAKER, Theodore L.: Dept. Psychiat., Stanford Univ. Sch. Med.
BALABAN, Robert S.: Dept. Biochem., Univ. of Oxford, England
BERECEK, Kathleen H.: Dept. Pharmacol., Univ. of Iowa, Iowa City
BLACKWELL, Leo H., Jr.: Dept. Physiol., Univ. Detroit Dental Sch.
BLAND, Richard D.: Cardiovascular Res. Inst., Univ. of California, S. F.
BORON, Walter F.: Dept. Physiol., Yale Univ. Sch. Med., Newj Haven, CT
BOUSHEY, Homer A.: Cardiovascular Res. Inst., Univ. of California, S.F.
BRADLEY, Timothy J.: Dept. Devel. & Cell Biol., Univ. of California, Irvine
BRAZY, Peter C.: Duke Univ. Med. Ctr., Durham, NC
BRUCE, Eugene N.: Pulmonary Div., VA Med. Ctr., Cleveland
BULKLEY, Gregory B.: Johns Hopkins Hosp., Baltimore
BURNS, Alastair H.: Dept. Physiol., Louisiana State Univ. Med. Ctr., New Orleans
CARLSON, Carl J.: Dept. Cardiol., San Francisco Gen. Hosp.
CASSIDY, Sharon S.: Asst. Prof., Univ. of Texas Hlth. Sci. Ctr., Dallas
CASTRANOVA, Vincent: Dept. Physiol., West Virginia Med. Ctr., Morgantown
CHA, Chung-Ja Mo: Assoc. Prof., Rhode Island Hosp., Providence
CHEN, Hsien-Jen J.: Neuroendocrinol., Barrow Neurological Inst., Phoenix
CHEN, Richard Yuan-Zin: Dept. Anesthesiol., Columbia-Presbyterian Med. Ctr., New York
CHUA, Balvin H.L.: Dept. Physiol., Hershey Med. Ctr., Penn State Univ.
CORNFORD, Eain M.: Dept. Physiol., UCLA
CORR, Peter B.: Cardiovascular Div. Washington Univ., St. Louis
CRAWFORD, Isaac L.: Neurophysiol. Lab., Southwestern VA Epilepsy Ctr., Dallas
DAUBENSPECK, J. Andrew: Dept. Physiol., Dartmouth Med. Sch., Hanover, NH
DUDEK, F. Edward: Dept. Physiol., Tulane Univ. Sch. Med., New Orleans
EATON, Douglas C.: Dept. Physiol. & Biophys., Univ. of Texas, Galveston
EDDY, Lynne J.: Dept. Pharmacol., Univ. of South Alabama, Mobile
FEWELL, James E.: Nuffield Inst. Med. Res., Oxford, England
FOLINSBEE, Lawrence J.: Inst. Environ. Stress, Univ. California, Santa Barbara
GAUGL, John F.: Dept. Physiol., Texas Coll. Osteopathic Med., Fort Worth
GELLAI, Miklos: Dept. Physiol., Dartmouth Med. Sch., Hanover, NH
GIBORI, Geula: Dept. Physiol. & Biophys., Univ. of Illinois, Chicago
GOODMAN, David B.P.: Dept. Pathol., Hosp. of Univ. Pennsylvania, Philadelphia
GOODMAN, Michael N.: Asst. Prof., Univ. Hosp., Boston
GREEN, Howard: Dept. Physiol., Harvard Med. Sch., Boston
HAMRELL, Burt B.: Dept. Physiol. & Biophys., Univ. of Vermont, Burlington
HOCKEL, Gregory M.: Res. Sci., Pfizer Central Res., Groton, CT
HOLLOMAN, Thomas L.: Appl. Math. & Computer Sci., Univ. of Louisville

HYERS, Thomas M.: Asst. Prof., VA Med. Ctr., Denver
JONES, Melvin D., Jr.: Dept. Pediat., Johns Hopkins Hosp., Baltimore
JOSHI, Madhusudan S.: Dept. of Anat., Univ. of North Dakota, Grand Forks
KASTING, Norman W.: Neurol. Res. Lab., Mass. Gen. Hosp., Boston
LAUGHLIN, Maurice H.: Dept. of Physiol., Oral Roberts Univ., Tulsa
LAWSON, Edward E.: Dept. Pediat., Univ. of North Carolina, Chapel Hill
LINDSEY, Bruce G.: Dept. Physiol., Univ. South Florida, Tampa
LINSHAW, Michael A.: Dept. Pediat., Univ. of Kansas Med. Ctr., Kansas City
LOKHANDWALA, Mustafa F.: Dept. Pharmacol., Univ. of Houston
LOPATA, Melvin: Dept. Med., Univ. of Illinois, Chicago
LOPEZ, Genaro A.: Loyola Univ. of Chicago
LYDIC, Ralph B., Jr.: Dept. Physiol., Harvard Med. Sch., Boston
McNAMEE, James E.: Dept. Physiol., Univ. of South Carolina, Columbia
MILETICH, David J.: Dept. Anesthesiol., Michael Reese Hosp., Chicago
MOHLA, Suresh: Dept. Oncology, Howard Univ. Cancer Ctr., Washington, DC
MOORE, Lorna G.: CVP Res., Univ. of Colorado Hlth. Sci. Ctr., Denver
MUKHERJEE, Amal: Dept. Med., Univ. of Texas Hlth. Sci. Ctr., Dallas
MUNCH, Douglas F.: Res. Assoc., Mobile, AL
NATHAN, Richard D.: Dept. Physiol., Texas Tech Univ., Lubbock
NAUGHTON, Brian A.: Assoc. Res. Scientist, Hunter-Belleview Sch. Hlth. Sci., NY
NEUFELD, Gordon R.: Dept. Anesthesia, Univ. of Pennsylvania, Philadelphia
NEWELL, Jonathan C.: Ctr. Biomed. Eng., Rensselaer Polytech. Inst., Troy, NY
NEWTH, Christopher J.: Resp. Physiol., Hosp. for Sick Children, Toronto
NOBLE, Nancy L.: Dept. Biochem., Univ. of Miami Sch. Med.
NORTHRUP, Thomas E.: Dept. Physiol., Eastern Virginia Med. Sch., Norfolk
PETTEGREW, Raleigh K.: Assoc. Prof., Denison Univ., Granville, OH
PIETRA, Giuseppe G.: Div. Pathol., Hosp. Univ. of Pennsylvania
ROGERS, Quinton, R.: Dept. Physiol. Sci., Univ. of California, Davis
SACKIN, Henry J.: Dept. Physiol., Yale Univ. Sch. Med., New Haven
SANTIAGO, Teodoro V.: Rutgers Medical Sch., Piscataway, NJ
SCHEID, Cheryl R.: Dept. Physiol., Tufts Univ. Sch. Med., Boston
SCHWEISTHAL, Michael R.: Dept. Anat., Oral Roberts Univ., Tulsa
SCOTT, Cheryl F.: Temple Univ. Thrombosis Ctr., Philadelphia
SCREMIN, Oscar U.: Dept. Physiol., UCLA Sch. Med.
SIMPKINS, James W.: Univ. of Florida, Gainesville
SRIDARAN, Rajagopala: Dept. Physiol. & Biophys., Univ. of Illinois, Chicago
STRAUSS, Richard H.: Asst. Prof., Ohio State Univ., Columbia
TYLER, Julia L.: Dept. Biol. Sci., Northwestern Univ., Evanston, IL
TZANKOFF, Stephen P.: Human Performance Lab., Pennsylvania State Univ.
WARSHAW, David M.: Dept. Physiol., Univ. Massachusetts Med. Sch., Worcester
WATT, Edward W.: Dept. Med., Georgia Baptist Med. Ctr., Atlanta
WEISS, Roy E.: Univ. of Southern California, Los Angeles
WINN, H. Richard: Dept. Physiol. & Neurosurg., Univ. of Virginia, Charlottesville
YIN, Frank Chi-Pong: Dept. Physiol., Johns Hopkins Sch. Med., Baltimore

ASSOCIATE MEMBERS

ANDERSON, Debra F.: Dept. Physiol., Univ. of Oregon Hlth. Sci. Ctr., Portland
BAKER, Rex: Dept. Physiol., Univ. of Arizona Coll. Med., Tucson
BECKMAN, David A.: Stein Res. Fellow, Philadelphia
CHEN, Wen Yuan: Natl. Asthma Ctr., Denver
CULPEPPER, Roy M.: Div. Nephrol., Univ. of Texas Houston
FLESHMAN, James W.: Dept. Neurosci., Univ. of Florida Coll. Med., Gainesville
GORMAN, Mark W.: Dept. Physiol., Michigan State Univ., East Lansing
HARAMATI, Aviad: Dept. Physiol., Mayo Clinic & Fndn., Rochester, MN
HARTUPEE, Dale A.; Dept. of Physiol., Mayo Clinic, Rochester, MN
HECTOR, Dwight H.: Anatomy Section, Indiana Univ., Bloomington
JACKSON, William F.: Dept. Physiol., Michigan State Univ., East Lansing
LIVNAT, Avi: Dept. Physiol. & Biophys., Univ. of Illinois, Urbana
MARCOUX, Frank W.: Dept. Physiol. & Biophys., Univ. of Vermont, Burlington
MARTIN, Francis G.: Dept. Physiol., Temple Univ. Sch. Med., Philadelphia
MAYER, Loren R.: Dept. Med. Physiol., Texas A&M Coll. Med., College Station
McKENZIE, Jack E.: Dept. Physiol., Uniformed Services Univ., Bethesda, MD
McINERNEY, Joseph J.: Res. Assoc., Hershey Med., Ctr., Pennsylvania State Univ.
MULLINS, Margaret M.: Dept. Physiol., Wright State Univ., Dayton, OH
PARKER, Richard E.: Vanderbilt Univ. Med. Ctr., Nashville, TN
SCHLENKER, Evelyn H.: Dept. Physiol., Univ. of Florida, Gainesville
SCHULTZ, Harold D.: Div. Exptl. Med., St. Lukes Hosp., Kansas City, MO
SILBAUGH, Staven A.: Inhal. Tox. Res. Inst., Albuquerque, NM
STRAHLENDORF, Howard K.: Dept. Pharmacol., Texas Tech Univ., Lubbock
VAN BENTHUYSEN, Karyl M.: Univ. Colorado Hlth. Sci. Ctr., Denver
VERRETT, Joyce M.: Div. Natural Sci., Dillard Univ., New Orleans
WIDEMAN, Robert F.: Dept. Physiol., Univ. of Arizona, Tucson
ZABARA, Jacob: Dept. Physiol. & Biophys., Temple Univ., Philadelphia

CORRESPONDING MEMBERS

ASHKAR, Edmundo: Inst. Fisiologia, Univ. of Buenos Aires, Argentina
COMSA, Jean: Medical School, Homburg/Saar, W. Germany
ITO, Katsuki: Surgical Dept., New York Med. Coll., Valhalla
KANNO, Tomio: Dept. Physiol., Vet. Med., Hokkaido Univ., Sapporo, Japan
KEMPSON, Stephen A.: Dept. Physiol., Mayo Clinic, Rochester, MN
MOTTA, Marcella: Dept. Endocrinol., Del Sarto, Milan, Italy
PASYK, Stanislaw: Klin. Kardiol. Med., UL Sklodowskiej-Curie Zabrze, Poland
SANDOR, Peter: Exptl. Res. Dept., Semmelweiss Univ. Med. Sch., Budapest, Hungary

STUDENT MEMBERS

BLACK, Jessie K.: Boston Univ. Med. Ctr., Boston
BLANCHARD, Edward M., Jr.: Dept. Physiol., Univ. of Cincinnati
BUCO, Paul J.: Dept. Physiol. & Biophys., Univ. of Louisville
EZRIN, Alan M.: Dept. Pharmacol., Univ. of Miami Sch. Med.
FLESHMAN, Karen R.: Rutgers Univ., Newark, NJ
HESTER, Robert L.: Univ. Mississippi Med. Ctr., Jackson
KLINE, Joseph: Dept. Physiol. & Biophys., Univ. of Louisville Sch. Med.
LUST, Robert M., Jr.: Dept. Physiol., Texas Tech Univ., Lubbock
MANAKER, Scott: Dept. Biol., Univ. of Pennsylvania, Philadelphia
NIELSEN, Ann M.: Iowa State Univ., Ames
NORRIS, Stephen H.: Dept. Physiol., George Washington Univ., Washington, DC
OLSON, Lynne E.: Dept. Physiol., Michigan State Univ., East Lansing
PETERSON, Cobern V.: Dept. Physiol., Univ. of Florida, Gainesville
SCHNEIDKRAUT, Marlowe J.: Dept. Physiol., Albany Med. Coll.
STEINHART, Corklin R.: John Hopkins Med. Inst., Baltimore
TAI, Chung-Yui Betty: Dept. Physiol., George Washington Univ., Washington, DC

1981 FASEB MEETING

APS (& GUEST SOCIETY) SPRING SYMPOSIA SCHEDULE

SUNDAY PM APRIL 12

Correlation of microcirculation and macrocirculation - co-sponsored by the Microcirculatory Society and the Cardiovascular Section of APS

MONDAY AM APRIL 13

The role of hormones and protein phosphorylation in metabolic regulation - T.R. SODERLING

Clinical symposium on receptor mechanism. Session 1. J.D. WILSON

Cardiopulmonary dynamics - K.T. WEBER

MONDAY PM APRIL 13

Comparative studies of the control of renal function - P.K.T. PANG

(SEBM) Genetic polymorphism and regulation - P.A. MARKS

Cardiopulmonary dynamics - K.T. WEBER

4:30-6:30 Physiology Career Opportunities - W. RANDALL

TUESDAY AM APRIL 14

Regulatory role of calcium in the kidney - J.C.FRAY

Physiology of the mammalian gastric mucosa - L.L. SHANBOUR

Clinical symposium on receptor mechanisms. Session 2. J.D. WILSON

BMES President's symposium: Human factors in biomedical engineering.

TUESDAY PM APRIL 14

Pathogenic mechanisms in hypertension - J.O. DAVIS

Prostaglandins and the gastrointestinal tract - A. ROBERT

4:30 (BMES) ALZA Lecture - G. WELTMAN

WEDNESDAY AM APRIL 15

Skinned fibers from various kinds of muscles - A. FABIATO

Clinical Symposium on receptor mechanisms. Session 3. J.D. WILSON

(BMES) Legal and engineering interfaces of surgical implants. C.F. SMITH, et al.

WEDNESDAY PM APRIL 15

Cellular dynamics of insulin action - M.P. CZECH

THURSDAY AM APRIL 16

Lung neuroendocrine cells and regulatory peptides. Session 1. J.A. WILL, et al.

Dehydration induced thirst - J.E. GREENLEAF

THURSDAY PM APRIL 16

Lung neuroendocrine cells and regulatory peptides. Session 2. J.A. WILL, et al.

What roles do nerves play in renin release? - A.C. BARGER and J.W. MANNING

PLACEMENT SERVICE

FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

Hall A, Georgia World Congress Center
Atlanta, GA
April 12-16, 1981

REGISTRATION

Sunday, April 12 ..... 2:00 PM-8:00 PM
Mon.-Wed., April 13-15 ..... 8:30 PM-5:00 PM
Thursday, April 16 ..... 8:30 AM-12 Noon

INTERVIEWS

Monday, April 13 ..... 2:00 PM-5:00 PM
Tues.-Thurs., April 14-16 ..... 9:00 AM-5:00 PM

ADVANCE REGISTRATION DEADLINE
FASEB MEETING — MARCH 13, 1981

AMERICAN SOCIETY OF BIOLOGICAL CHEMISTS

Hall A, Cervantes Convention Center
St. Louis, MO
May 31-June 4, 1981

REGISTRATION

Sunday, May 31 ..... 2:00 PM-8:00 PM
Mon.-Wed., June 1-3 ..... 8:30 AM-5:00 PM
Thursday, June 4 ..... 8:30 AM-12 Noon

INTERVIEWS

Monday, June 1 ..... 2:00 PM-5:00 PM
Tues.-Thurs., June 2-4 ..... 9:00 AM-5:00 PM

ADVANCE REGISTRATION DEADLINE
ASBC MEETING — MAY 1, 1981

GENERAL INFORMATION

EMPLOYERS

Annual fee
- Commercial organizations $250.00
- Academic and other nonprofit institutions $125.00
- ASBC Surcharge ..... $ 25.00

The annual fee includes:
1. One copy of the LIST OF CANDIDATES (published in February)
2. Use of the interviewing facilities at the FASEB Annual Meeting, including posting position vacancy descriptions and a copy of the application of each candidate in attendance

To use the interviewing facilities at the ASBC Meeting, including posting position vacancy descriptions and a copy of the application of each candidate in attendance, employers must pay the annual fee plus the ASBC surcharge of $25.00.

Interviewers must be authorized by the subscriber. A maximum of FOUR interviewers may be authorized per employer subscription. Authorization of TWO interviewers is included in the annual fee; TWO additional interviewers may be authorized. If additional interviewers are named, the fee of $10.00 each must accompany authorization.

Employers **not registered** with the Placement Service who wish to post a position vacancy notice at a meeting, in the "NO INTERVIEWS GRANTED" section of posted positions, may do so for a fee of $25.00 per position posted. **PAYMENT MUST ACCOMPANY POSITION DESCRIPTION.**

CANDIDATES

Annual fee $10.00
LIST OF POSITIONS (published in March) ..... $ 7.00
The annual fee includes:
1. Publication of application in the LIST OF CANDIDATES (published in February)
2. A 50-word resume in one issue of FEDERATION PROCEEDINGS
3. Use of the interviewing facilities at the FASEB and/or ASBC Meeting, including review of job opportunity listings posted at the meeting
4. Availability of application for review by employers visiting the FASEB campus or by FASEB staff conducting searches on behalf of employers

ADVANCE REGISTRATION

Candidates and employers may register for the Placement Service at the meetings; however, advance registration is strongly recommended.

PLACEMENT SERVICE ADVANCE REGISTRATION DEADLINES
FASEB MEETING, MARCH 13, 1981
ASBC MEETING, MAY 1, 1981

EMPLOYERS and **CANDIDATES** using the interviewing facilities at the FASEB Annual Meeting and/or the ASBC Meeting must register for the meeting as well as with the Placement Service and must be in attendance at the meeting.

Placement Service forms and instructions will be mailed upon request. Direct all correspondence to:

Billy M. Clement, Manager
Placement Service
9650 Rockville Pike
Bethesda, MD 20014
301/530-7020

From the Publications Desk

HAIL AND FAREWELL

Alfred P. Fishman
Chairman, Publications Committee

Four years ago the journals of the American Physiological Society underwent dramatic reorganization (1). The time seems appropriate now to review the consequences of this move not only because enough time has elapsed for this type of appraisal but also because my term of office on the Publications Committee is drawing to a close. By July 1981, in one capacity or another, I will have spent fourteen years as a member of this Committee. This must be some sort of a record. My career on the Publications Committee began in 1967 when, as an ex-offcio member, my job was to represent the Handbook Editorial Committee of which I was Chairman. In 1972, I graduated to voting membership on the Committee; in 1974 I became Chairman. This long tenure has provided me with a unique opportunity to examine the recent burst of activity in the Society's publications, to relate it to the previous history of the publications, and to speculate about what is apt to happen to the publications during the next few years.

The American Journal of Physiology

Without question, the reorganization of the *American Journal of Physiology* was the most dramatic step taken by the Publications Committee since the Journal began. The change was not simply a matter of repackaging. Instead, the *American Journal of Physiology* was partitioned into five discrete specialty Journals, each devoted to a separate aspect of physiology and each directed by a distinguished editor and editorial board. Each editor was encouraged to mold his journal according to the needs of his scientific constituency. Excellence and critique remained guiding principles. But, provision was made for editorial pages and for special features, including abstracts, brief reviews of papers appearing elsewhere, and book reviews. Three of the five specialty Journals that were created were naturals: *AJP: Heart and Circulatory Physiology; AJP: Renal, Fluid and Electrolyte Physiology;* and *AJP: Endocrinology, Metabolism and Gastrointestinal Physiology.* The other two anticipated publication outlets that the Society would require in the immediate future: *AJP: Cell Physiology;* and *AJP: Regulatory, Integrative and Comparative Physiology.* Each month, the specialty journals are collated to re-form the *American Journal of Physiology.* This artifice of splitting the parent journal into specialty journals while preserving the *American Journal of Physiology* allows subscribers to choose the publications that best suit their needs. For the generalist or library the choice may be the parent journal, for the department library it may be several of the specialty journals, whereas for the individual it may be any of the specialty journals.

By all criteria the experiment has been a success: the new journals have been extraordinarily well received by the scientific community and have quickly taken their place among the outstanding physiological journals of our times; the parent journal has improved in quality, the number of excellent manuscripts submitted has increased steadily, the readership has expanded, and both the parent journal and the specialty journals have assumed distinctive identities and have acquired special constituencies.

Not all of the journals are at the same stage of development. This non-uniformity was to be expected: three of the new journals dealt with themes that were time-honored in the parent journal and were delivered into the arms of an expectant body of physiolgists; no such dedicated throng was waiting for the *AJP: Regulatory, Integrative and Comparative Physiology* or *AJP: Cell Physiology.* Moreover, once the original subdivisions proved viable, pressures mounted for the creation of new journals. In 1980 the *AJP: Endocrinology, Metabolism and Gastrointestinal Physiology* was split into the *AJP: Endocrinology and Metabolism* and the *AJP: Gastrointestinal and Liver Physiology.* Despite differences in maturity, all six of the specialty journals are thriving.

What has this reordering of the *American Journal of Physiology* contributed to the publications of the Society? On the one hand, the original distinguished journal, the *American Journal of Physiology,* has been revitalized and modernized through the efforts of the individual editors and editorial boards of the separate journals that provide its substance. On the other hand, the Society now has a series of specialty journals that deal not only with the traditional aspects of physiology but also with new directions. Moreover, as the split in the *AJP: Endocrinology, Metabolism and Gastrointestinal Physiology* into two journals illustrates, a mechanism now exists for creating new journals in accord with changing scientific needs of the Society or for modifying exisiting specialty journals.

The Other Journals

During this explosive time for the *American Journal of Physiology,* the other journals of the Society have been undergoing more gradual transformation. New and vigorous leadership has sharpened the range of scientific interests and has secured for the *Journal of Applied Physiology: Respiratory, Environmen-*

tal and Exercise Physiology a vaunted place in contemporary scientific publication. The *Journal of Neurophysiology,* highly respected in its field, is undergoing a period of self-appraisal with respect to its future role in accommodating the burgeoning interests of neurophysiologists and neurobiologists. One step in accommodating the increase in neurophysiological research has been the conversion of the *Journal of Neurophysiology* from a bimonthly to a monthly publication. Finally, *Physiological Reviews* has been revitalized in recent years by strong leadership and an infusion of papers from abroad gathered and monitored by the European Editorial Committee.

The publications of the Society are no small venture. They involve many people and require sound financial management. About 350 scientists serve on the Editorial Boards and more than 1000 serve each year as guest referees. The number of text pages continues to escalate, increasing from 8100 in 1976 to about 14,000 in 1980. Despite rising costs and inflation, the journals have maintained their quality and have been operated in the black with minimal increases in subscription prices.

Handbooks of Physiology

One of the outstanding triumphs of the Publications Committee has been the *Handbooks of Physiology.* These volumes have now been appearing for more than twenty years. Close to 150,000 copies of the Handbook have been sold. They are universally respected for their quality and enjoyed because of an attractive format. Each new edition provides students and teachers with a fresh appraisal of a specialized aspect of physiology prepared in scholarly fashion by experts. There is little question that this series is an important contribution of the American Physiological Society to contemporary physiology. At present several new volumes are in prospect. Unfortunately, Handbooks are a costly affair. The Publications Committee is now trying to decide whether the style and nature of these publications should continue in the traditional mold or whether a fresh approach should be undertaken.

Physiology in Medicine

One of my "side jobs" while on the Publications Committee was the editorship of "Physiology in Medicine," which was a regular feature in the *New England Journal of Medicine* from 1970 to 1978. The purpose of this series was to emphasize how understanding physiology helped to appreciate mechanisms of disease and to make therapy more rational and scientific. The series was well received by the readers of this prestigious medical journal. In 1978, the editorship of the *New England Journal of Medicine* switched hands. The new editor favors enlarging the concept of physiology in medicine to the broader one of "Basic Science in Medicine."

Clinical Physiology Series

A few years ago the Society began to publish the Clinical Physiology Series. To date four volumes in this series have appeared, each an outgrowth of a symposium held at the annual meeting of the American Phsyiological Society. Sales have been brisk and the series has proved attractive both to physiologists and to clinical investigators. The range of topics covered by the series is already broad. These books are not only of interest to physiologically-oriented physicians, but are also useful to teachers of physiology in medical schools where there is a continuing interest in pathophysiology as a basis for understanding human disease.

Indexes

One continuing interest of the Publications Committee has been in making the journals easier to use for reference. For a long while, cumulative indexes had fallen out of style. But, in 1976, the Publications Committee remedied a large defect by bringing out cumulative author and subject indexes for the *American Journal of Physiology* and the *Journal of Applied Physiology.* These were followed in 1979 by an index for the *Journal of Neurophysiology.* Each index was distributed to all journal subscribers as part of their regular subscription, so that maximum distribution and accessibility would be achieved.

The Printing Process

During my fourteen years on the Publications Committee dramatic changes occurred in printing technology. Seizing upon the prospects and implications of the new technology, the journals of the Society were switched from hot metal composition and letterpress printing to electronic digital composition and offset printing. This step was not taken lightly. Fears were rampant that the move would compromise legibility and appearance. Fortunately none of the fears have materialized: legibility is excellent; illustrations are first rate; and the overall appearance is unchanged. It was the savings that were accomplished by these timely changes in the printing process that made it possible for the journals to retain their quality and to increase their size without insufferable increase in expense to subscribers.

Summary

From what has been said above, it should be clear that the American Physiological Society currently sponsors a diverse series of physiological publications of high quality. The titles of these publications reflect the major commitment to original research and critical reviews. The publications of the Society contribute importantly to its reputation as a scholarly organization. The success in reorganizing the *American Journal of Physiology* has attracted considerable attention both in this country and abroad and it now seems likely that other societies will follow this lead. The publications are healthy and it seems reasonable to anticipate that they will continue to prosper and to enhance the role of the Society in furthering research and teaching in physiology.

In the last few years, it has also become increasingly clear that a new period of ferment and change is upon the Publications Committee. A new line of historical publications will accompany the Society's celebration of its centennial. These volumes will enlarge considerably the start made recently in this direction by *The Physiologist.* It also seems likely that *The Physiologist,* currently run independently out of the Executive Secretary-Treasurer's office, will soon become a responsibility of the Publications Committee. The Society also seems destined to enlarge its commitment to educational and instructional materials and the Publications Committee will undoubtedly become deeply involved in fulfilling this obligation. There are new frontiers to be explored while the innovations of recent years gradually lose their novelty and luster and come to be regarded as traditional activities of the Publications Committee.

Exit

The personal impressions cited above are based on my view of what has happened during the last fourteen years. Unfortunately, although I sense that my predecessors on the Publications Committee paved the way for the important changes in the journals that I have described, I cannot identify individual contributions by

name. However, I can state that five individuals were deeply involved during my time for conceptualizing and implementing the changes that led to the present state of the journals: Paul Horowicz and F. Eugene Yates during the initial phase, and subsequently Robert W. Berliner, Robert M. Berne, and Howard E. Morgan. The Society is greatly indebted to them. The Society should also recognize that the Publications Committee could not have accomplished its goals without the unswerving dedication of Stephen R. Reiger, Publications Manager and Executive Editor. Finally, it would be an oversight to ignore the consistent dedication of Brenda B. Rauner, the Production Manager, and the copy editors to the quality of the publications: through the thick and thin in changes of printing technology and in the face of the reorganization of the journals, they have continued to monitor the manuscripts and to ensure the flawless presentation of scholarly material that continues to be the hallmark of the Society's publications.

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BOARD CERTIFICATION PROGRAM FOR AEROSPACE PHYSIOLOGY

A certification program for Aerospace Physiology has been established by the Aerospace Medical Association. The purpose of the program is to: 1) encourage the study, improve the practice and elevate the standards of experience in aerospace physiology; and (2) to provide an avenue for professional and peer recognition. The program is administered by the Aerospace Physiology Certification Board, which determines eligibility and arranges for the examination of candidates.

Admission to the examination is by application to the Certification Board. Eligibility is based on academic or professional preparation, and five years of experience in aerospace physiology. The certification examination is offered annually in conjunction with the meeting of the Aerospace Medical Society (next meeting: May, 1981, San Antonio, Texas). Successful completion of the program is recognized by a suitable certificate. Since its inception in 1977, 22 individuals have been certified.

Further information on the program may be obtained from the Chairman of the Certification Board: Colonel D.C. Choisser, USAF, BSC, Chief of Aerospace Physiology, Office of the Surgeon General, P.O. Box 35416, Brooks AFB, Texas 78235.

Abstracts Invited for Fourth Annual Workshop on PULMONARY PHYSIOLOGY AND FUNCTION TESTING IN SMALL LABORATORY ANIMALS

Satillite Conference to the Annual Meeting of the
AMERICAN THORACIC SOCIETY

Co-sponsored by
AMERICAN PHYSIOLOGICAL SOCIETY
U.S. ENVIRONMENTAL PROTECTION AGENCY
in cooperation with
Lifelong Education Programs, MSU
May 9, 1981

The Kellogg Center for Continuing Education
Michigan State University
East Lansing, Michigan

The one day program will concern the current state of the art in pulmonary function testing in small laboratory animals (rodents and lagomorphs). Abstracts are requested for a poster symposium which will focus on data obtained during exposure to environmental or occupational pollutants. Emphasis should be given to techniques and data interpretation in order to stimulate discussion. If a large number of abstracts are submitted, abstracts will be selected which are of good quality and contribute to the above theme. Presentation of material at the American Thoracic Society Meeting does not preclude presentation at this symposium. Presentation of work in progress is encouraged.

Abstracts should be typed (double spaced) and should not exceed one 8 1/2" x 11" sheet with 1 1/4" margins. Deadline for abstract submission to Dr. N.E. Robinson is March 15, 1981.

The poster symposium will be followed by invited presentations on interpretation of data and scaling of pulmonary function measurements. Ample social time will be allowed for informal discussion among registrants.

Further information can be obtained from:

N.E. Robinson	Sandy Iannotta
Department of Physiology	American Thoracic Society
Michigan State University	1740 Broadway
East Lansing, MI 48824	New York, NY 10019
(517) 353 – 5978	(212) 245-8000

The workshop will be held at Kellogg Center on the Michigan State University campus. Taxi and limousine service is available between Lansing Airport and the campus. Overnight accommodations are available at the center ($27.00 single, $16.00 each for shared double) Buses will be provided to the ATS convention in Detroit after the workshop on May 9th. Registration fee ($25.00) includes continental breakfast, lunch and bus fare to Detroit.

SHORTCOMINGS IN DATA REPORTING AND A PROPOSAL FOR NEW EDITORIAL STANDARDS

Carl R. Honig
and
Charles L. Odoroff
Dept. of Physiology
and
Div. of Biostatistics
University of Rochester
School of Medicine and Dentistry

The following paper raises a number of issues on which the Publications Committee wishes input from members of the Society. Would you be kind enough to send them to me?

Alfred P. Fishman, Chairman
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The most convenient and least costly experiment is one which is already done. Most experienced investigators know of published work which could have provided useful information if only the raw data--*oscillographic recording or the individual values of measured quantities*--were available. Unfortunately, physiologists, in accordance with current editorial policy, generally report only statistical summaries and/or derived variables.

Summary statistics are essential for description and for reporting the inferences (based on tests or confidence intervals) of interest to the investigator. They are seldom useful for other purposes, however. In contrast, the raw data often contains information beyond the narrow scope of the paper in which it is summarized. Accurate measurements are *always* useful. In this era of costly experiments and cheap electronic data storage it is inefficient to use measurements for only a single, often ephemeral, application. Unfortunately, the retrospective analysis of data is often depreciated by experimentalists. This prejudice appears to reflect lack of understanding of the statistical concepts which underlie the analysis of both planned experiments and observational studies. We will comment on these concepts after considering some examples.

Lost Data

Values of measured quantities

One of our colleagues wanted to study the equilibrium of creatine phosphokinase and adenylate kinase in living muscle. The study required knowledge of the content of adenine nucleotides, creatine phosphate and creatine in frog muscle at rest, during work, and after blockade of certain enzymes. It would have been prohibitively expensive to make enough measurements for his limited purpose, but given the extensive work on energy balance in frog muscle, the information required for his calculations should be available in the literature. Unfortunately, much of the data has been reported as the *difference* in "phosphagen" content between an experimental muscle and its contralateral, paired control, or as a *ratio* of chemical constitutents; see for example (6,8). Writers on this topic have been concerned with relationships among heat, work and chemical change. It was therefore highly appropriate to their objectives to summarize the data as they did. Nevertheless, the individual values of their measurements are unavailable for other purposes, such as the one our colleague had in mind.

Distributional structure

Physiologists tend to think of variability in terms of sampling or measurement error--i.e. additive errors which obscure inferences. In fact, variability can also arise from the physiologic properties of the preparation. Where this is the case an analysis of the frequency distribution of the data can yield information unobtainable from summary statistics such as means. Perhaps the most familiar example is the analysis used by del Castillo and Katz (4) to establish the quantal nature of release of a neurotransmitter. This classical analysis of "noise" depends on fitting probability distributions (normal and Poisson) to individual voltage measurements and assessing the quality of the fit.

It appears to us that there are many missed opportunities to perform analyses on the frequency distributions of physiological data and that reporting policies of journals inhibit others from filling in the missing analyses. Such analyses can be related to the main goal of the original work or be unrelated. An example may clarify this point.

Honig and Odoroff (7) have modelled the probability distributions of transit times of red cells in muscle capillaries (Am. J. Physiol. submitted). It is presently not possible to measure transit times directly, but using available data on red cell velocity and capillary length an estimate of the transit time distribution can be constructed. Mean values of length and velocity, their standard errors, and sometimes summary histograms have been reported for many muscles. These statistical summaries are appropriate to describe normally distributed variates but if one wishes to assess departures from normality the requisite information is lost in the summary statistics. Our analysis of a few muscles based on data resurrected from colleagues' project books indicates that a skewed distribution such as the 2-parameter gamma distribution is appropriate. Consequently, the extensive summary statistics on lengths and velocities in various muscles are of no value for our purpose, or for other statistical modelling.

Frequency analysis is particularly important for microcirculation because the variables of interest must be evaluated on the basis of large numbers of individual measurements (lengths, velocities, pressures) sampled from temporally and spatially heterogeneous populations. This is not the case for many other categories of physiologic data, for which summaries based on the assumption of normality, or on non-parametric tests, are acceptable. More often than commonly believed, however, deeper insights can be obtained by fitting probability models to the individual observations and assessing the residuals.

Retrospective Analyses

Colligative properties of data

The whole is often greater than the sum of the parts: By pooling data sets collected for different purposes one can often reach conclusions impossible to deduce from a single data set, however complete. Our example of capillary transit times illustrates this. Our mathematical model assumes that lengths have a 2-parameter gamma distribution. We validated the assumption for rat gracilis, the preparation used in our laboratory. Is it valid for muscle generally? It is impossible for a single laboratory to become familiar with the use of all muscles suitable for microcirculatory studies (cat sartorius, cat tenuissimus, rabbit tenuissimus, bat wing muscle, rat extensor digitorum longus, rat spinotrapezius, rat gracilis, rat and hamster cremaster, chicken latisimus dorsi, frog sartorius, frog recturs, etc.). If, however, the experts who use these preparations had reported their individual values, and all were fitted by 2-parameter gamma distributions, our conclusions about transit times could be generalized with some confidence.

Additional or alternative analyses

It seems presumptuous for one to assert that he alone can extract all the information in a data set. Even if the analysis chosen by an author were optimal, newly discovered facts or new or unrelated hypotheses may justify re-analysis. Such retrospective use of data may well depend on distributional structure, and hence on the availability of individual values of measured quantities. Alternatively, insights may involve temporal relationships among variables, for which oscillographic recordings are required. A useful sample is almost never published, and the original records are usually destroyed or consigned to dead storage in uninterpretable form. Increasingly, time-variant parameters are being recorded on magnetic tape. If suitable comments and calibration factors were provided, duplicate tapes could be made available for retrospective application to unrelated problems.

Physiological modelling

Modellers are perhaps the most avid consumers of other peoples' data. Analytical as well as statistical models of microcirculation have provided useful insights into transcapillary fluid exchange, oxygen transport, and hemodynamics of vascular networks. There is general agreement that these models are limited not by mathematical complexity but by lack of knowledge of a) numerical values of parameters, b) relationships among parameters, and c) spatial and temporal heterogeneity of parameters. Thus progress in modelling awaits the data base which only extensive reporting of individual values of variables and covariates can provide. We cite the microcirculation merely because of our parochial interests. We have no doubt that greater availability of raw data would promote progress across the entire spectrum of physiologic research.

Covariates

Covariates are an indispensible component of raw data. Common ones for cardiovascular physiology include temperature, pH, PCO_2, PO_2, hemoglobin concentration, arterial pressure, etc. Covariates are generally essential in judging the compatibility of independent data sets. Journal policies should therefore encourage (but never require) reporting covariates which might be of value to future analysis of the data, even if they are not essential to the author's arguments. Where possible, covariates should be reported not only in summary form, but for the individual observations as well.

Some Limitations and Dangers

Applicability of other peoples' data

The retrospective analysis of transit times cited above is unusual in that each data set was to be treated individually and in the form in which it was collected. More commonly conclusions are derived from a single large data set pooled from several independent experiments. The principal criteria for such pooling are compatibility of expermental methods, and similarity of covariates, protocols, and conditions. Statistical techniques for assessing compatibility, adjusting for differences in experimental conditions, and judging limitations of conclusions drawn from retrospectively collected data are available (2). We emphasize that more frequent use of data by analysts who have not collected them places greater responsibility on authors to: a) describe methods and experiments fully, and b) document thoroughly materials deposited in data banks. Additional responsibility also falls on editors and referees to monitor completeness and clarity in reporting measurements, and to assess pitfalls in manuscripts containing data analyzed retrospectively.

Problems of priority

One must produce a data base before theorizing or modelling. If data must be made public in its entirety (not just in summary form), an experimentalist might find his theoretical notions in print before his own modelling is complete. This is especially likely if the experimentalist, aware of limitations or defects in the data, defers modelling until additional facts are gathered. Thus by requiring publication of raw data we may encourage premature theory and deprive careful investigators of legitimate proprietary interests in their observations. It has been pointed out by one of our colleagues that recommendations similar to those listed at the end of this paper were made in a report on management of weather resources (1). The difficuties in implementation cited in that report are almost identical to our own concerns.

On reflection, we feel abuses will prove to be of little importance in practice. In the first place, an experimentalist has at least a year between the time his observations are completed and their appearance in print. He therefore has a substantial lead. If he chooses to withhold his results for a time while modelling proceeds and/or additional data are collected the research community, already deluged with information, can only benefit from the higher quality of the manuscript which eventually results. Finally, a unique application or interpretation of physiological data is seldom possible; one is much more likely to be stimulated by the thinking of others than "scooped." If, on the other hand, we continue to bury data in summaries, experience proves that even the original author seldom makes full use of them.

Sufficient Statistics are Insufficient

For normally distributed random variables the means, standard deviations, and correlation coefficients can, in a rough sense, be interpreted to summarize all the information about the unknown parameters. This is the concept of a sufficient statistic. The foregoing are powerful descriptors if one can accept the assumptions, but they can also obscure. Most physiologists do accept them; review of *American Journal of Physiology* indicates that summaries are used almost exlcusively. Dependence on summaries alone may be a legacy of an era in which computational barriers limited data analysis. As a consequence, it was necessary to accept Fisher's (3,5) paradigm that experiments be planned in accordance with the principle of randomization, to impose a probability structure on the data. Similarly, the ideal of the test of hypothesis set forth by Neyman and Pearson (9) became widely

accepted as a necessity for proper analysis. The above notions (appropriately) are so firmly embedded in the thinking of physiologists that it is virtually impossible to persuade an editor to accept a paper in which summary statistics and hypothesis tests are not provided. Unfortunately, it is far less common to find insistance on randomization.

We do not advocate abandoning the above principles. However, much of physiologic research does not meet the assumptions implicit in the summary statistics, and does not fit the pardigm of the randomized, controlled experiment. We argue that advances in statistical methods and the development of high capacity computers have made available new techniques which allow relaxation of former constraints, and can greatly increase the amount of information extracted from data. We are convinced that valuable information is lost and error introduced by editorial policies which encourage over-simplifed assumptions and prevent retrospective analyses. These same policies encourage tests of hypothesis rather than estimates of the structural relationships in data. The tendency in modern statistics is toward precisely the opposite emphasis.

Freed of computational constraints, analyses are now limited mainly by the imagination of the investgator and his statistical colleagues. Nevertheless, analyses published in *American Journal of Physiology* this year are not much different from those of the mid-fifties, because of the outmoded ways authors analyse and report their data.

Recommendations

1) The practice of reporting only derived quantities should be discontinued.

2) In most instances authors should report measured quantities and covariates on each and every biologic preparation (animal, organ, etc.).

3) In the case of measurements based on multiple observations on a particular preparation--i.e. microcirculatory data--each individual observation should be submitted. The biochemists have already adopted this policy. Papers concerned with high resolution crystallography, for example, must be accompanied by a list of atomic coordinates for submission to the Protein Data Bank, Brookhaven National Laboratory.

4) Published papers need contain only summaries, unless an author requests otherwise. If the individual observations are not printed, however, authors should be required to submit them to the National Auxilliary Publications Service of the American Society for Information Science, preferably in a form directly accessible by computer.

5) If time dependent variables have been recorded on magnetic tape authors should be encouraged to retain tapes of each experiment, suitably annotated, for retrospective analysis by themselves or others. Access should be controlled by those who collected the data.

6) Materials to be deposited in a data bank must be thoroughly calibrated and documented. Adequacy of this documentation should be judged by those who review the manuscript.

7) The nature of the information stored in a data bank or retained by authors should be explained in the published text.

8) If information retrieved from a data bank is to be used in a manuscript, the applicability of the data should be discussed with the original author, even though his permission need not be obtained. Evidence that a retrospective analysis is appropriate should be included in the manuscript.

ACKNOWLEDGEMENT

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SHORT COURSES AT MARINE BIOLOGICAL LAB

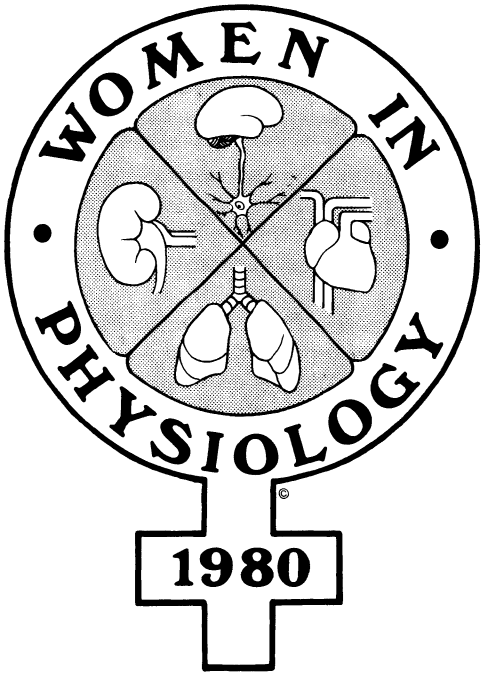
The Marine Biological Laboratory, Woods Hole, Massachusetts will conduct a series of residential laboratory courses in the Spring of 1981 as follows:

April 26-May 1, 1981 - Freeze-Etching in Electron Microscopy. Instructor in Chief, Russell Steere, USDA, Beltsville, Maryland;

May 3-5, 1981 - Electron Microscopy in the Biological Sciences. Blair Bowers, NIH and Morton Maser, Marine Biol. Lab;

May 10-16, 1981 - Analytical and Quantitative Light Microscopy in Biology, Medicine, and Materials Sciences. Shinya Inoue, Marine Biol. Lab;

May 17-23, 1981 - Mariculture: Culture of Marine Invertebrates for Research Purposes. Carl Berg, Jr., Harvard/Marine Biol. Lab.



Caucus on Women in Physiology

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At the FASEB meeting in Anaheim, California in April 1980 a group of concerned women members of the APS met to discuss the relative lack of participation of women physiologists in Society activities. An ad hoc caucus was formed to address these problems and implement solutions. The Society Headquarters and Council have been receptive to our recommendations for increasing the visibility, participation and representation of women in the Society. Plans have been drawn up to develop a more comprehensive data base or profile on women physiologists and to stimulate membership, interest, and participation in the Society by functioning women physiologists.

This column is a direct result of that first meeting, and over the course of the next year it will serve to inform the membership about the activities of the Women's Caucus, to discuss the present status and future prospects of Women in Physiology, and most important, to elicit interest and solicit input and feedback from the entire membership, regardless of gender (creed or national origin). Visibility rather than a lack of talent, merit or persistence appears to play a large role in the exclusion perceived by women scientists. We hope that this effort will at least ameliorate that problem. The Women's Caucus solicits members (of any gender) who wish to take an active part in the effort to advance the role of their female colleagues in the Society. Please contact any of the members of the caucus with enquiries, suggestions and even criticisms.

Marie M. Cassidy

Biographical Note - CAROLINE TUM-SUDEN

A continuing feature of the Women in Physiology column will be a biographical sketch of one of our colleagues that has contributed or is contributing in a special way to the Society or to the physiological sciences. We could think of no one who deserved the honor of being the first more than Dr. Caroline Tum-Suden, who in her will, left a generous bequest (more than $100,000) to the Society. These funds help to underwrite important Society Activities such as the Bowditch Lecture.

Caroline Tum-Suden (1900-1976) was born in San Francisco, California in 1900, and obtained her MA from Columbia University in 1927 and a Ph.D. degree in Physiology from Boston University in 1933. Her thesis concerned reactions of the rat uterus to histamine and anaphylaxis. She remained at the Physioloigical Laboratory of the Boston University School of Medicine and the Evans Memorial Hospital for twenty years (1927-1947), first an Evans Fellow and then an instructor. With Leland C. Hyman, her thesis advisor, as senior author, she published many papers on the function of the adrenal gland. These included studies on temperature regulation, blood volume, blood sugar and vasomotor responses, of totally and of partially adrenalectomized rats. One of the long continuing concerns of Dr. Tum-Suden and Professor Hyman was with homotransplantation of adrenal cortical tissue. In a publication in *Science* on this matter they were able to show that the growth of transplanted adrenocortical tissue in rats is determined and limited by the available adrenotropic hormone from the anterior lobe of the hypophysis. Thus, the larger percentages of "takes" in females might well depend on the greater amount or greater availability of adrenotropic hormone in the female. They also demonstrated that transplanted adrenal cortical tissue, though capable of maintaining life and some resistance to stress, is not able to function as efficiently as the normal gland in acute emergencies such as histamine poisoning.

In 1947, after many years of being an Instructor at Boston University, Caroline Tum-Suden moved on to Mt. Holyoke College. Then as now, Mt. Holyoke was a mecca for young women particularly interested in science, but her rank remained Instructor. One of her former students at Mount Holyoke was Elizabeth Tidball, now Professor of Physiology at George Washington University Medical Center. She remembers Caroline Tum-Suden well as a teacher who, though demanding, was both energetic and enthusiastic. Students found her ability to write on the chalk board behind her back with one hand while erasing with the other, fascinating, if not frustrating. All the members of the small class she taught in cardiovascular and respiratory physiology came to enjoy this unusual instructor for her ever present sense of proportion and good humor.

In 1950, after only three years at Mt. Holyoke, she joined the Neurology Branch at the U.S. Army Chemical Center at the Edgewood Arsenal in Maryland. Not all of her work there was classified and papers appeared in the Journal of Pharmacological and Experimental Therapeutics on the blocking by atropine of responses of voluntary muscle to electrical stimulation and acetylcholine injection. In another paper, with R.M. Stoufer, she showed that symptoms of myotonia congenita in goats could not be explained by either lowered cholinesterase activity or some other direct abnormality of the chemical mediator system.

Bruce Dill, who was Scientific Director of the Medical Laboratories at the Army Chemical Center wrote of Caroline Tum-Suden: "She was devoted to her research and diligent in seeking solutions of the problems that arose. Perhaps conscientiousness was her most outstanding characteristic." Certainly her papers show a scientific ability and meticulousness of high order.

Dr. Tum-Suden became a member of the Society in 1936 and submitted abstracts and presented papers at Society meetings. She died on January 24, 1976, having devoted most of her life to research in the physiological sciences.

The Women's Caucus would like to convince the APS to use her bequest in a way that will both honor her and benefit the present and future female membership of the Society. For this, we particularly solicit your advice.

Rita Guttman

Report from the IUPS Meetings in Budapest

From a women's point of view, the meetings this summer in Budapest were both an improvement and the "same old thing" in comparison to the meeting three years ago in Paris. On the positive side - but without benefit of actual counts and calculation of statistical significance - the "non-invited" participation of women has increased enormously. The audiences were liberally sprinkled with female physiologists - from bright eyed, full faced graduate students to more sedate and distinguished grey haired wrinkled-faced professors -- and all phases in between. In addition, at the free communication sessions, it was not at all unusual to hear a female presentation. Despite the large number of female scientists in attendance, only a miniscule fraction of the invited symposium speakers and almost none of the chairs of the various scientific sessions were women. If Chairmen were chosen for their demonstrated talent for running a meeting, and if all symposia speakers were first rate in terms of both form and substance and hardly any first-rate women physiologists existed -then these conditions would not be so deplorable.

The lack of women participants in the IUPS meetings is due very simply to failure of the organizers to bring their female colleagues into the planning groups. I did have an extended conversation on these "social" issues as well as scientific topics with one of the members of the Hungarian Physiological Society who served on the organizing committee for the meetings. When I expressed my discontent to him, he admitted that no one had even suggested that anything be done about female participation. In the private scientific discussion on synaptic function which he arranged in his laboratory, however, the ratio of females to males was two to three.

One of the first actions of the ad-hoc caucus on Women in Physiology that formed at the Spring 1980 Meetings of FASEB was to draft a letter to the Secretary, Anges Rubanyi, of the Congress Secretariat requesting assistance in arranging a meeting of Women Physiologists to be held during the IUPS meeting in Hungary. Although the request was air-mailed on May 6th, no response was received. Perhaps the mail service to Eastern-block countries can be blamed - but we will obviously have to begin planning now for the 1983 International Meeting in Australia. While no formal meeting of women physiologists was held in Budapest in July, there were certainly many animated discussions about the future by women scientists from many countries.

Janett Trubatch

THE IMPORTANCE OF BEING A *REGULAR* MEMBER OF THE AMERICAN PHYSIOLOGICAL SOCIETY

The APS has several categories of membership, regular, corresponding, honorary, associate, emeritus and sustaining. It has been traditional for young scientists to enter the Society as Associate Members and after two or more years transfer to regular membership. The major difference between these two classifications is that Associate Members are "engaged in research in physiology" while Regular Members "have conducted and *published* meritorious original research in physiology." An Associate Member may, at any time, petition for reclassification as a Regular Member by simply filling out a new Membership Application. These can be obtained directly from the Society office and are usually found in each issue of the *Physiologist*. The application must be sponsored by two Regular Members willing to submit letters of recommendation. Since the criteria for Regular Membership is based on publication "in physiology," it is important to make clear the relationship of one's work to physiology. *ONLY REGULAR MEMBERS CAN HOLD OFFICE OR VOTE AT THE BUSINESS MEETINGS.*

As of May 1980 there were 5,610 members of the APS, less than 10% (481) of which are women. However, while of the overall membership 12% are Associate Members, when analyzed by gender, 20% of the female members but only 11% of the male members are in this category. Now is the time for all eligible women to give consideration to upgrading their membership. Since Associate Members can submit papers at meetings it may not seem worth the effort. However, women will never be an active part of the American Physiological Society unless they can vote on financial and policy matters, serve on committees, chair sessions, and hold office. This one aspect of "second class citizenship" or "second class membership" can be easily remedied by a small amount of effort. Please pull the Membership Application from this issue of the *Physiologist* today, and upgrade your membership or sponsor a female colleague for Regular Membership in the APS. The Society can only benefit from adequate representation of all its members. In addition, once achieved, the rights of Regular Membership need to be exercised to be effective. Women scientists should volunteer and be actively willing to serve on committees to attend Business Meetings and to vote. Within a few years a very significant difference could be made in the operations of the Society if women would take a more active role. Join the effort to make the Society more representative of women scientists in physiological research.

Paula Beall

Special Note: The logo was designed by Ms. Julie Rotta of New York Medical College.

FUTURE MEETINGS

SPRING

April 12-17, 1981	—	Atlanta, GA
April 18-23, 1982	—	New Orleans, LA
April 10-15, 1983	—	Chicago, IL
April 1- 6, 1984	—	St. Louis, MO
April 21-26, 1985	—	Anaheim, CA
April 13-18, 1986	—	St. Louis, MO

FALL

October 11-16, 1981	—	*Cincinnati, OH*
October 10-15, 1982	—	*San Diego, CA*
August 21-25, 1983	—	*Honolulu, HI*

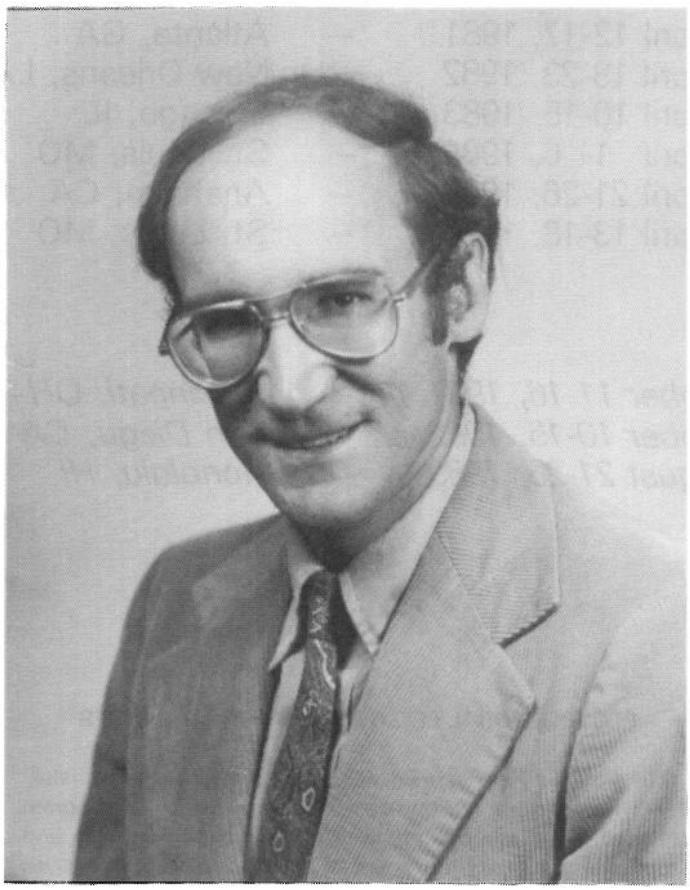
POSTDOCTORAL FELLOWSHIPS FOR MINORITIES

The National Research Council plans to award approximately 35-40 Postdoctoral Fellowships for Minorities in a program designed to provide opportunities for continued education and experience in research to American Indians and Alaskan Natives (Eskimo or Aleut), Black Americans, Mexican Americans/ Chicanos, and Puerto Ricans. Fellowship recipients will be selected from among scientists, engineers, and scholars in the humanities who show greatest promise of future achievement in academic research and scholarship in higher education.

In this national competition sponsored by the Ford Foundation, with additional support from the National Endowment for the Humanities, citizens of the United States who are members of one of the designated minority groups, who are engaged in college or university teaching, and who hold doctoral degrees may apply for a fellowship award of one year's duration.

Awards will be made in the areas of behavioral and social sciences, humanities, EMP fields (engineering sciences, mathematics, physical sciences), life sciences, and for interdisciplinary programs of study. Awards will not be made in professions such as medicine, law, or social work, or in such areas as educational administration, curriculum supervision, or personnel and guidance. Tenure of fellowship provides postdoctoral research experience at an appropriate nonprofit instution of the Fellow's choice, such as a research university, government laboratory, national laboratory, privately-sponsored nonprofit institute, or a center for advanced study.

The deadline date for the submission of applications is February 2, 1981. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, D.C. 20418.



FRED J. KARSCH

Dr. Karsch, born in New York City in 1942, has been a member of APS since 1974. He received the Ph.D. from the University of Illinois, Urbana, in 1970. He then undertook postdoctoral study in the Department of Physiology at the University of Pittsburgh School of Medicine. In 1972, Dr. Karsch joined the Reproductive Endocrinology Program at The University of Michigan, Ann Arbor, where he is currently Associate Professor of Physiology in the Department of Pathology.

Dr. Karsch's selection as the Bowditch Lecturer is his latest honor. He is a member of the Society for the Study of Reproduction (Charter member), The Endocrine Society, and is currently an Editor of the journal *Endocrinology*.

His family consists of his wife, Norah, and two children, Douglas and Sarah.

TWENTY-FIFTH ANNUAL BOWDITCH LECTURE

SEASONAL REPRODUCTION: A SAGA OF REVERSIBLE FERTILITY

Fred J. Karsch, Ph.D.

Perhaps it is best to begin a discussion of seasonal breeding with a few words on the widespread distribution and biological impact of the process. Each year, the vast majority of animals living in their natural habitat utilize information from their environment to turn their reproductive system on and off. From an *adaptional* point of view, this is enormously important because it ensures that offspring are born under environmental conditions which are favorable to their survival. *Practically* speaking, our understanding of the physiology of the process could provide a tremendous boost to optimizing reproduction in the domestic animals used for our food, and perhaps even for developing new approaches to human fertility control. *Conceptually,* seasonal breeding is fascinating, representing a truly natural process of reversible fertility.

During the past decade, important strides have been made toward understanding the endocrinological mechanisms which animals use to turn their reproductive system on and off. In the overview which follows, these endocrine mechanisms will be described for one seasonal breeder, the domestic female sheep. It must be emphasized at the outset that seasonal reproduction is so very vital to perpetuation of a species that the process is likely to have arisen on numerous occasions in the evolution of modern day animals. It would be naive to assume, therefore, that the hormonal regulatory systems to be described here for female sheep will be strictly applicable to all seasonal breeders.

GENERAL CHARACTERISTICS OF THE REPRODUCTIVE PROCESS IN FEMALE SHEEP

The seasonal reproductive cycle of the Suffolk ewe (the domestic breed used in our studies) is composed of a breeding and an anestrous season, each persisting approximatley 6 months (Fig. 1, top) (23, 39). The breeding season is confined to the autumn and winter which, in view of the relatively long pregnancy, ensures that offspring are born under the favorable environmental conditions of spring. As in many but not all seasonal breeders, the primary environmental cue is provided by the annual cycle of photoperiod (23, 46, 68). The ewe is classified as a "short-day breeder" because her breeding season begins when the amount of light each day decreases, and it ends as photoperiod increases. Indeed, when sheep are transferred across the equator such that the new photoperiodic cycle is 6 months out of phase, the seasonal reproductive rhythm shifts, after a brief period of adjustment, by 6 months (44).

During the breeding season (Fig. 1, left), the ewe has repeated 16-17 day estrous cycles (43). The cycle begins with sexual receptivity (estrus) and ovulation of one or two fertilizable ova. Each cycle is earmarked by characteristic swings in the secretion of reproductive hormones. Four of these hormones will occupy the center stage in the discussion which follows: gonadotropin-releasing hormone (GnRH) produced by endocrine neurons in the hypothalamus, luteinizing hormone (LH) secreted by the anterior lobe of the pituitary gland, and estradiol and progesterone produced by the ovaries. This selection is not intended to reduce the potential importance of other hormones - follicle-stimulating hormone (FSH) from the pituitary and melatonin from the pineal to list a few. Rather, the specific contributions of such hormones in the ewe still remain to be elucidated. Further, it has proven to be extremely difficult to monitor the secretion of one of the selected hormones, GnRH. Its pattern of release, therefore, must be inferred from the pattern of LH, a serious limitation to our understanding of the role played by this hypothalamic hormone. Our consideration of the contributions of GnRH, therefore, will be restricted to the latter portion of this review in an attempt to avoid building the conceptual framework for this discussion on a hormone which cannot be monitored directly.

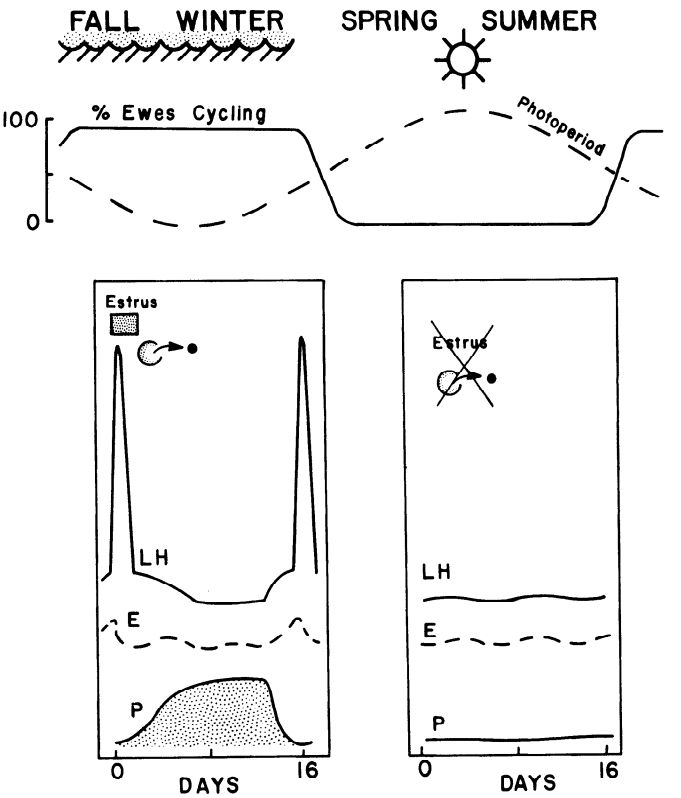


Fig. 1. Seasonal reproductive cycle of the Suffolk ewe. LH, E and P identify luteinizing hormone, estradiol and progesterone. See text for details.

LH is secreted from the pituitary in two distinct and functionally separable modes (15, 61). The surge mode produces a massive discharge of the gonadotropin at estrus; this causes ovulation (Fig. 1, bottom). As will become evident below, the surge is governed by the stimulatory, or positive, feedback action of ovarian steroids (16, 53, 61). The tonic mode of secretion, which accounts for all release of LH between surges in successive cycles, is necessary for normal development of the ovaries and for the secretion of both estradiol and progesterone (4, 42, 50). Tonic LH secretion, in turn, is regulated by the inhibitory, or negative, feedback effects of the ovarian steroids (2, 30, 32).

Estradiol, in the ewe, is secreted nearly exclusively by large follicles contained within the ovary (3, 47). Progesterone, in contrast, is produced primarily by the corpus luteum (62), the temporary endocrine gland formed from the remnants of a follicle after it ovulates. By far, the largest portion of the sheep estrous cycle (about 80%) is composed of luteal phase during which the corpus luteum develops and secretes copious quantities of progesterone (25, 27, 43). During the remainder of the cycle, the 2-3 day follicular phase, the corpus luteum regresses while the follicles destined to ovulate enlarge and secrete a progressively increasing quantity of estradiol (1, 2, 30, 63).

During the anestrous season of spring and summer (Fig. 1, right), there are no estrous cycles; there is no estrus; there is no ovulation (23, 68). Although LH and estradiol are still secreted (60, 69), their characteristic cyclic swings are absent. This leads to the major question to be addressed here: What mechanism does the ewe call into play each year to turn her reproductive system on and off, in phase with the annual cycle of photoperiod?

Conceptually, we may approach this question by dividing it into three smaller ones. First, since each estrous cycle is composed of a series of causally related events, each being obligatory for successful reproduction, we may begin by asking: what are the hormonal steps which lead to ovulation in the breeding season? Secondly, since interruption of any link in the chain of events would break the cycle, we may next ask: which of these steps fail to occur in anestrus and why? Thirdly, having thus identified the endocrine basis of seasonal breeding, we may ask: how does environmental photoperiod cause this primary change? Each of these questions is now considered separately.

BREEDING SEASON: WHAT HORMONAL STEPS LEAD TO OVULATION?

The profiles of LH, estradiol and progesterone which normally circulate during the late-luteal and follicular phases of the sheep estrous cycle are illustrated in Fig. 2 (concentrations of a second gonadotropin, FSH, are also shown but this will not be discussed here other than to indicate that we view it as being permissive to development of ovarian follicles). The chain of endocrine events which leads to ovulation is depicted in the upper portion of Fig. 2. This sequence will now be described; experimental support for it will then be given.

The sequence.

The preovulatory period begins with the demise of the corpus luteum, resulting in a precipitous drop in circulating progesterone (Fig. 2, bottom). Prior to this, in the luteal phase, the elevated progesterone exerts a potent negative feedback suppression of tonic LH secretion. This check on LH is removed as progesterone declines, reflected by a gradual *but sustained* increase in the serum LH concentration (2-3 days before the LH peak in Fig. 2.). The rising tide of LH stimulates follicular estradiol secretion, and the two hormones rise in parallel for approximately 48 hours. Eventually estradiol reaches threshold for triggering two events, estrous behavior and the LH surge. The latter causes ovulation and formation of a new corpus luteum, and the next estrous cycle begins. One added feature of this scheme is noteworthy with regard to seasonal reproduction; estradiol has some inhibitory influence on tonic LH secretion but this is not strong enough to prevent the sustained LH rise which follows progesterone withdrawal.

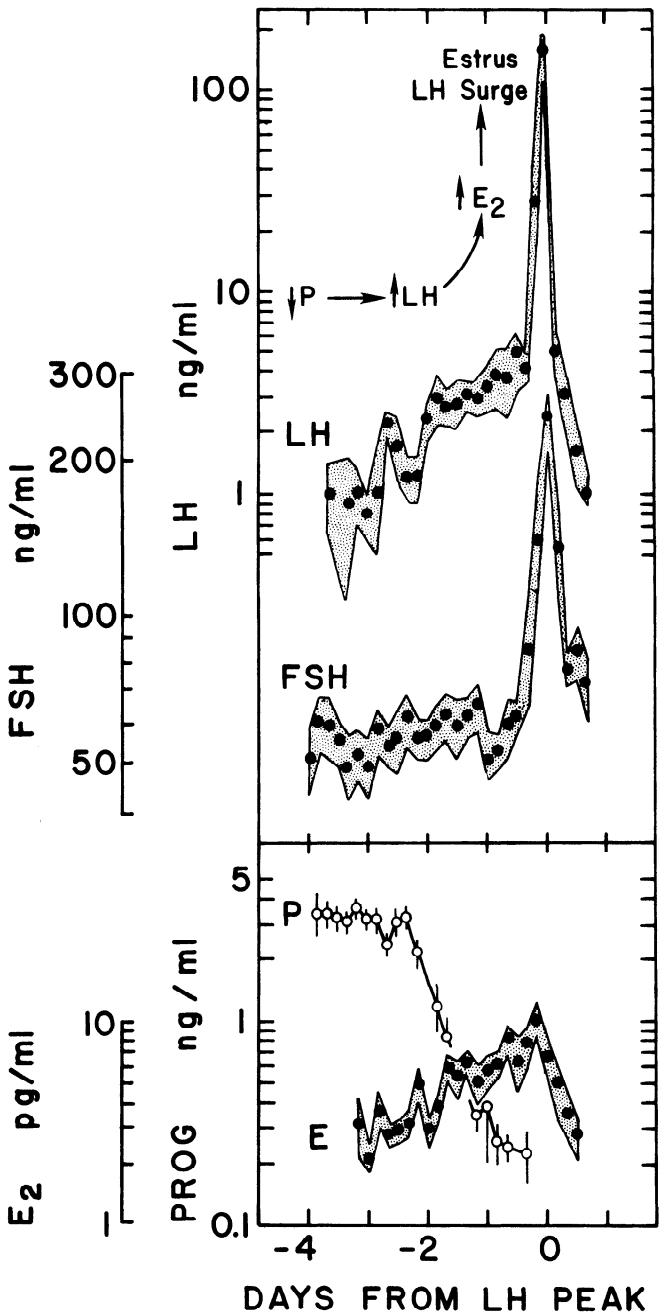


Fig. 2. Concentrations of luteinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol (E_2), and progesterone (P) during the preovulatory period of the estrous cycle of the ewe. Hormones were measured in sequential samples of peripheral serum obtained every 4 hours from 6-10 ewes. Data are normalized to the time of the preovulatory LH peak and are expressed logarithmically as mean ± SEM (shaded areas or vertical lines). The sequence of steps leading to the LH surge which causes ovulation is indicated in the upper portion. Redrawn from (22).

Supporting evidence.

Many lines of evidence give credence to this chain of events, evidence reflecting complementary efforts from many laboratories. Rather than providing an exhaustive review here, one line of support will be described for each step.

Progesterone withdrawal permits sustained tonic LH rise: Perhaps the most direct test of this step was provided in an experiment in which the corpus luteum, the primary source of progesterone, was removed surgically in the mid-luteal phase of the cycle, day 8 after estrus (30). The resultant premature drop in progesterone promptly initiated the full preovulatory sequence

-the sustained tonic LH rise accompanied by a parallel estradiol increase, and 48 hours later, by the preovulatory LH surge and estrous behavior. In another group of animals, the fall in progesterone was prevented by means of progesterone-containing Silastic implants inserted subcutaneously at the time of surgery (Fig. 3). These implants maintained circulating progesterone at a level indistinguishable from that produced by the corpus luteum before its removal. In response to the artificially maintained concentration of progesterone, LH and estradiol remained within the range seen in control ewes subjected to sham enucleation of the corpus luteum (Fig. 3, left). Subsequent removal of the progesterone implants at the time the corpus luteum would have regressed, had it not been excised, restored the full preovulatory sequence (Fig. 3, right).

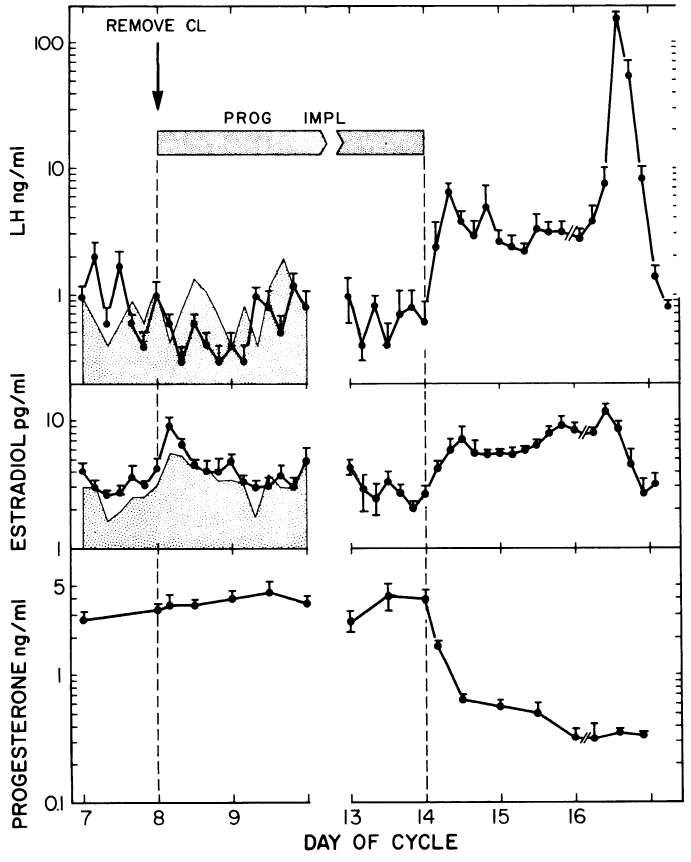


Fig. 3. Serum concentrations of LH, estradiol, and progesterone in ewes in which the corpus luteum (CL) was removed surgically, and a Silastic implant containing progesterone inserted subcutaneously (horizontal bar) on day 8 after estrus. The progesterone implants were then removed on day 14. Shaded areas for LH and estradiol depict hormone concentrations in control ewes subjected to sham removal of the corpus luteum on day 8. Hormones were measured by radioimmunoassay in sequential samples of peripheral serum obtained every 4 hours from 6-11 ewes. Data are plotted logarithmically as mean ± SEM. Redrawn from (30).

Comparable results were obtained in an earlier study in which the corpus luteum was eliminated pharmacologically, rather than surgically, by the administration of an agent which induced premature regression of the corpus luteum (2). Such observations lend strong support to the hypothesis that progesterone holds tonic LH secretion in check during the luteal phase, that progesterone withdrawal permits the sustained LH rise, and that this initiates the remaining steps in the sequence.

Tonic LH rise drives preovulatory estradiol rise: Direct evidence for this step is presented in a subsequent section because the experiment to be described is more appropriately considered in the context of seasonal anestrus. It might be mentioned at this juncture, however, that under conditions in which the LH rise is induced experimentally, there is also an estradiol rise (e.g., Fig. 3, right). Further, each discrete pulse of tonic LH secretion which occurs during the estrous cycle (to be described below) is followed within minutes by a brief increment in estradiol secretion (1, 4).

Estradiol rise elicits the LH surge and estrus: One experiment documenting the existence of this step is illustrated in Fig. 4. In this study (21), Silastic implants containing progesterone were inserted during the mid-luteal phase of the estrous cycle. They were left in place beyond the normal life span of the corpus luteum, such that the implants ultimately provided the only substantial source of circulating progesterone. The implants were then removed to mimic corpus luteum regression; the ovaries were removed to eliminate endogenous estradiol; and Silastic implants containing estradiol were inserted. By providing different numbers and sizes of estradiol implants, serum estradiol was clamped either at a basal or a peak concentration. When it was clamped at a basal value, neither an LH surge nor estrus was observed (Fig. 4, left). When the estradiol peak was provided, however, a perfectly normal LH surge and estrous behavior occurred (Fig. 4 right).

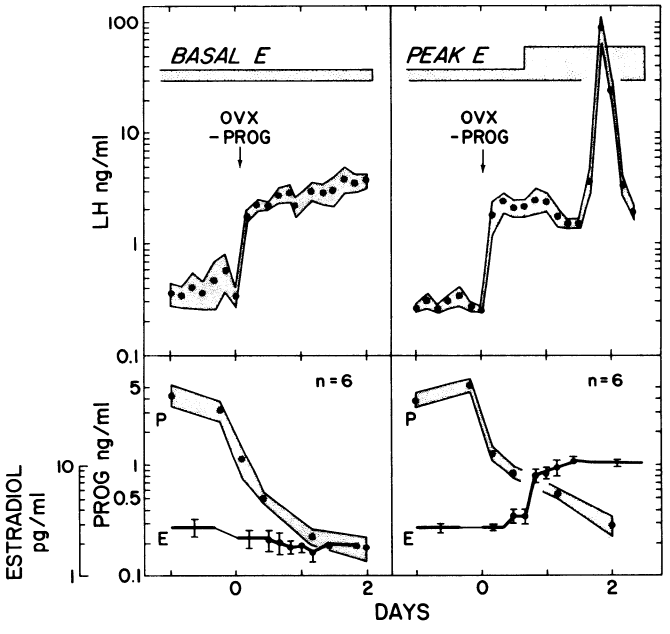


Fig. 4. Concentrations of LH, estradiol (E) and progesterone (P) in ewes following ovariectomy (OVX), removal of progesterone implants (-PROG), and treatment with estradiol implants which produced either a basal (left) or a preovulatory peak (right) concentration of the steroid. The progesterone implants had been inserted in the mid-luteal phase of the estrous cycle and removed after the corpus luteum had regressed. Each point depicts the mean ± SEM concentration of hormone in peripheral serum obtained every 4 hours from 6 ewes. Redrawn from (21).

This experiment, in conjunction with results from many other studies (16, 29, 51, 53, 61), provides direct evidence that estradiol is both a necessary and a sufficient ovarian stimulus for the preovulatory LH surge and estrous behavior. In addition, it permits an important conclusion concerning control of the sustained tonic LH rise. Namely, during the breeding season, the tonic LH

rise can occur regardless of whether estradiol circulates at a basal or a peak level (Fig. 4). In the next section, it will become evident that this relationship is crucial with regard to seasonal reproduction.

This brings an end to our consideration of the events leading to ovulation during the breeding season. The following steps have been indentified as constituting at least part of the preovulatory sequence: 1) decreased progesterone which permits, 2) sustained tonic LH rise which drives, 3) preovulatory estradiol rise which induces, 4) estrus and the LH surge which causes, 5) ovulation. Each and every step in this sequence is essential for the successful completion of a given cycle as well as for transformation of one cycle to the next. Interruption of any step, or steps, would thus break the cycle and cause anestrus.

ANESTROUS SEASON: WHERE IS THE SEQUENCE BROKEN AND WHY?

During the long days of spring and summer, regular estrous cycles cease (23, 68). Nevertheless, the reproductive system does not lie dormant. In fact, each component part seems functional. Ovarian follicles develop, secrete estradiol, and can ovulate if presented with a gonadotropin surge (7, 24, 27, 45, 60, 69). Gonadotropic hormones are secreted, and both positive and negative feedback actions of ovarian steroids are readily demonstrable (16, 29, 45, 57, 66, 69). The mystery thus becomes one of determining which step, or steps, in the preovulatory sequence becomes functionally impaired, and why.

The clue.

The first clue came from the demonstration that there is an enormous seasonal change in the capacity of estradiol to inhibit tonic LH secretion (39). This was disclosed in a study (Fig. 5) in which ewes were ovariectomized to eliminate the negative feedback influence of the ovaries. Half of the ewes received no further treatment; the remainder each received a Silastic implant containing estradiol. Since the implant clamped circulating estradiol at a fairly stable level within the physiological range (Fig. 5, bottom), the concentration of serum LH provided an ongoing index of response to estradiol negative feedback. Between September and January, circulating LH remained elevated despite the continued presence of estradiol. In February, LH plummeted more than 20-fold to a level which was uniformly undetectable, and it remained there until August when the gonadotropin increased more than 20-fold back to its elevated concentration (Fig. 5, ovx + E). Comparable changes in LH failed to occur in the ovariectomized ewes not treated with estradiol (Fig. 5, ovx). The striking seasonal shift in LH in the estradiol-treated ovariectomized ewes coincided with the transitions between breeding and anestrous seasons in ovary-intact ewes (Fig. 5, histogram). LH was elevated during the breeding season and undetectable in anestrus.

These observations lead to the conclusion that the response to estradiol negative feedback is low during the breeding season (high LH), whereas in anestrus it is extremely high (low LH). Other studies have revealed that this seasonal shift is a consequence of fluctuations in photoperiod, the major environmental variable controlling seasonal reproduction in the ewe (23, 46, 68). Short days which lead to the breeding season cause the decreased response to estradiol; long days which lead to anestrus heighten its capacity to inhibit LH (38).

The hypothesis.

Discovery of the seasonal change in response to estradiol negative feedback was instrumental in identifying the link in the

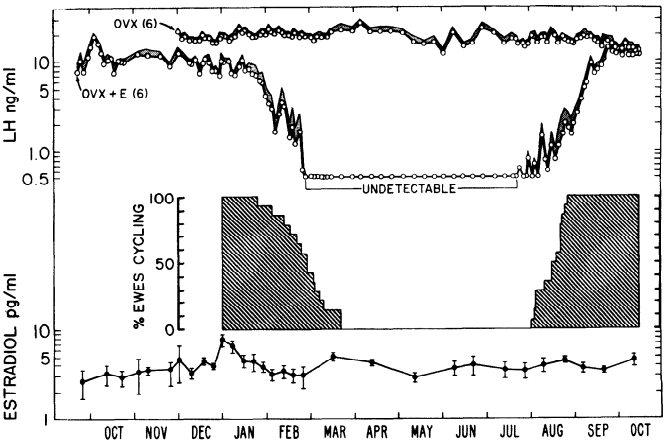


Fig. 5. Serum concentration of LH throughout the year in ovariectomized ewes with or without treatment with estradiol implants (OVX + E and OVX, respectively). The serum concentration of estradiol in OVX + E ewes is indicated in the lower portion. The histogram illustrates the timing of the breeding and anestrous season in a group of 14 ovary-intact ewes maintained outdoors with the ovariectomized ewes. Hormone concentrations plotted on logarithmic scale as mean and SEM of 6 observations. Adapted from Legan *et al.* (39) and taken from (17).

preovulatory chain which is broken to cause anestrus, and it promptly led to formulation of the working hypothesis which is illustrated in Fig. 6. The left panel illustrates the situation in the breeding season when response to estradiol negative feedback is low. As described in a previous section, the *sustained* increase in tonic LH secretion occurs despite the concomitant parallel increase in estradiol (see Figs. 2-4). The right panel predicts where the sequence is broken at the transition into anestrus when the response to estradiol increases. Specifically, it is predicted that, once the corpus luteum of the last cycle of the breeding season begins to regress, tonic LH again begins to rise thus promoting estradiol secretion. Due to its recently acquired capacity to inhibit LH, however, estradiol can feed back to curtail the LH rise, thereby preventing the necessary gonadotropic thrust to the follicle. As a consequence, estradiol fails to reach the threshold for eliciting estrus and the LH surge, and a highly effective negative feedback loop between estradiol and LH is established. The anestrous season thus begins and continues so long as this negative feedback loop remains functionally intact. In the late summer when response to estradiol diminishes, this loop is broken and cyclicity is restored.

It should be stressed that, according to this scheme, the full preovulatory sequence fails to occur during anestrus, but the physiological deficit is localized to a single link in the chain - the sustained tonic LH rise. Subsequent steps in the sequence, although not activated, need not become functionally impaired for estrous cyclicity to cease.

Test of the hypothesis.

Rigorous tests of this working hypothesis, including the hormonal profiles at the onset of anestrus, are described in detail elsewhere (17, 31, 37). Here, one of these tests (17) will be reviewed, one in which the *functional status* of each step was assessed during anestrus. For these studies, artificial luteal phases were produced during the middle of the anestrous season by inserting progesterone implants into ewes with intact ovaries. Since corpora lutea are normally absent during anestrus, the implant provided the only substantial source of progesterone. After an interval equivalent to the luteal phase (14 days), the progesterone implant was removed to mimic regression of the corpus luteum and one of several additional manipulations was per-

formed to answer three questions: 1) Is there a normal sustained tonic LH rise; if not, does estradiol prevent it? 2) If presented with such an LH rise, can the ovarian follicle respond by producing an estradiol rise? 3) If presented with a normal estradiol rise, can the hypothalamo-hypophyseal axis respond with an LH surge; and if it can, will this cause ovulation? If the working hypothesis is tenable, then the first step in the sequence (sustained tonic LH rise) should be blocked by estradiol during anestrus. The remaining steps, however, should be capable of being activated by appropriate stimuli.

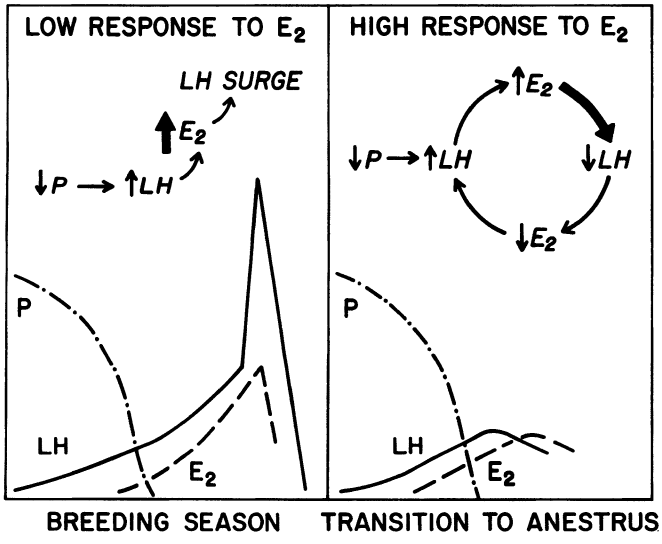


Fig. 6. Working hypothesis for how a change in response to estradiol negative feedback causes transition into anestrus in the ewe. E_2 and P denote estradiol and progesterone, respectively. See text for details. From Legan *et al.* (39).

Does a sustained LH rise occur in anestrus? The patterns of circulating LH, estradiol and progesterone following removal of the progesterone implant in anestrus are illustrated in Fig. 7 (left panel). Clearly, a sustained LH rise was not produced by the withdrawal of progesterone; only a brief increase in LH was observed, much as predicted from the working hypothesis. As expected, the remaining steps in the sequence also failed to occur. This stands in marked contrast to the situation in the breeding season when similar treatment promptly initiates the sustained LH rise plus the remaining preovulatory steps (Fig. 3). Another study (not illustrated) indicates that absence of the sustained LH rise in anestrus can be accounted for by the negative feedback effect of the basal serum concentration of estradiol (17).

Can the follicle produce an estradiol rise? The competence of the ovarian follicle to produce the estradiol rise in anestrus was tested by continuously infusing purified ovine LH beginning just after progesterone implant removal. As illustrated in Fig. 7 (right panel), the artificially-produced sustained rise in LH stimulated a preovulatory-like increase in circulating estradiol. This result permits several conclusions. First, with regard to the breeding season, it provides direct evidence that the sustained tonic LH rise drives the preovulatory estradiol rise. Second, the follicle of the anestrous ewe can respond to a physiological LH rise, thereby indicating that this step in the sequence is not functionally impaired. Finally, the induced estradiol rise elicited an LH surge followed by ovulation and corpus luteum formation in 4 of 7 ewes in this experiment (Fig. 7, upper right). Thus, the 48-hour rise in

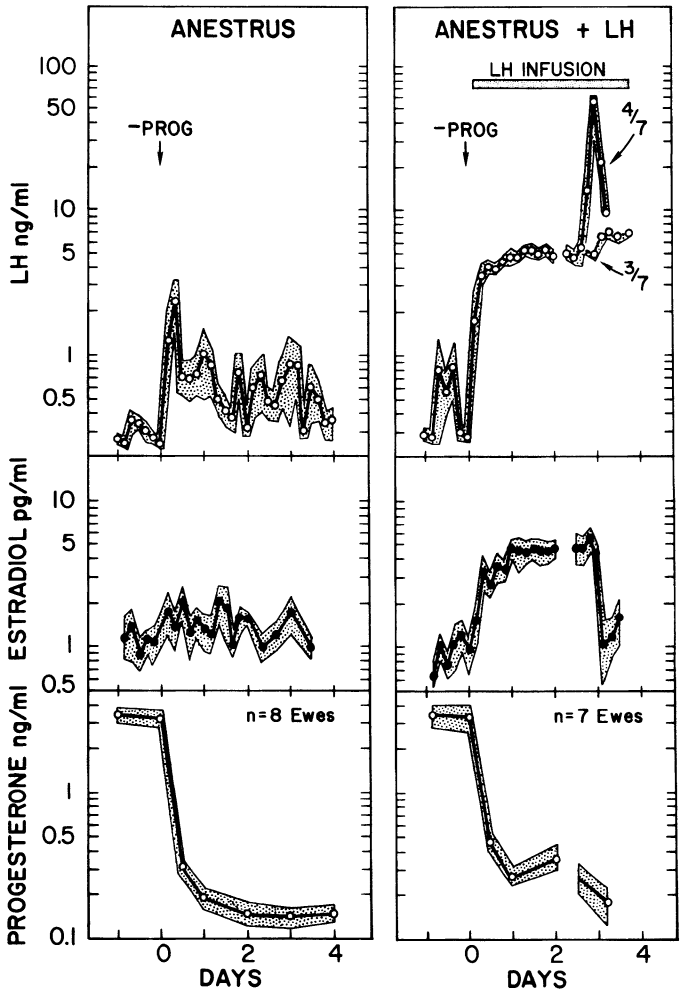


Fig. 7. Serum concentrations of LH, estradiol, and progesterone in anestrous ewes with (right) or without (left) infusion of LH (horizontal bar) beginning at the time of removal of progesterone implants (-PROG) on day 0. Hormone concentrations plotted on logarithmic scales as mean ± SEM. Redrawn from (17).

LH was all that was needed to break the anestrous state and restore the full preovulatory sequence in these ewes.

The latter conclusion lends strong support to the hypothesis. Nonetheless, it is necessary to explain why 3 of the 7 ewes failed to respond with an LH surge and ovulate. Methodological difficulties provide one explanation. Alternatively, the LH surge system may become less responsive to the positive feedback effects of the estradiol rise in anestrus, a possibility receiving some support from earlier observations in long-term ovariectomized ewes (35).

Can estradiol elicit an LH surge and estrous behavior? To determine whether estradiol becomes less effective in eliciting the LH surge in anestrus, the steroid was clamped at one of six different concentrations spanning the physiological range (1 to 10 pg/ml) by inserting estradiol implants at the time of progesterone withdrawal. In this manner, the threshold serum estradiol concentration for inducing estrus and the LH surge was determined in each of 4 seasons: mid-breeding season, transition to anestrus, mid-anestrus, transition to breeding season (21).

With regard to the LH surge, no seasonal difference was observed, results for the breeding and anestrous seasons being compared in Fig. 8 (left). Further, an estradiol concentration equivalent to its preovulatory peak (6-10 pg/ml) induced the surge in all ewes regardless of season. One is compelled to con-

clude, therefore, that this step in the preovulatory sequence is not functionally impaired during anestrus.

With regard to estrous behavior, the sensitivity to estradiol was slightly greater during the breeding season than during anestrus (Fig. 8, right), a finding consistent with numerous earlier reports (10, 14, 54, 55). Nonetheless, this difference was evident only for an extremely low estradiol concentration (1-2 pg/ml). Importantly, no seasonal difference was observed with an estradiol concentration approaching that which circulates at the time of estrus during the breeding season, thus suggesting the behavioral response to estradiol is not limiting in anestrus.

This completes our consideration of the endocrine step which fails, thereby causing ovarian cycles to cease during the anestrous season. The crucial element seems to be the sustained increase in tonic LH secretion. When such an LH increase occurs, so does the breeding season; when it fails to occur, anestrus prevails. Whether or not the LH increase can occur depends upon response to the negative feedback action of estradiol. Thus, although the full preovulatory sequence is absent during anestrus, the primary functional deficit appears to be localized to a single early step, the sustained tonic LH rise. Keeping this in mind, we may move to the final topic and examine the mechanism by which photoperiod produces this primary change.

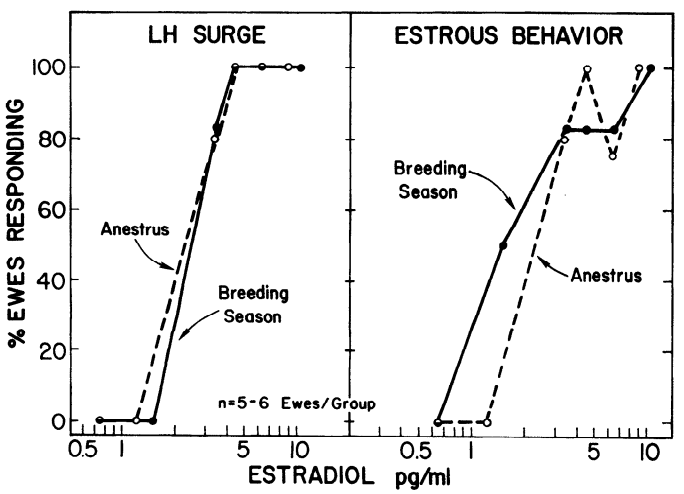


Fig. 8. Dose-response curves for the positive feedback and behavioral effects of estradiol during the breeding season (●) or mid-anestrus (o). Data are plotted as percent ewes showing an LH surge (left) or estrus (right) versus the mean serum estradiol concentration produced by the estradiol implant. The ewes were pretreated with progesterone implants to mimic a luteal phase and then ovariectomized at progesterone withdrawal, just prior to insertion of estradiol implants. Each point is based on results from 5-6 ewes. Redrawn from (21) and taken from (17).

HOW DOES PHOTOPERIOD GOVERN RESPONSE TO ESTRADIOL NEGATIVE FEEDBACK?

Although there is rather firm experimental support for the feedback basis of seasonal breeding in the domestic ewe, as just described, we are much less certain as to the pathways for reception, transmission and transduction of photoperiodic cues into the change in response to estradiol negative feeback. If we call upon evidence from both sexes of sheep, and from other seasonal breeders, it would seem that this process may involve photoreceptors in the retina, a neural tract from there to the pineal by way of the hypothalamus and the superior cervical ganglion, a rhythmic day/night pattern of pineal melatonin secretion, and the use of circadian rhythms to measure the duration of light each day (9, 12, 26, 36, 41, 48, 49, 56, 58, 59, 65, 67, 70). Rather than focus on these issues, which are of central importance but which depart somewhat from the theme of this review (the endocrinological basis of seasonal breeding), let us turn to the alterations in hypothalamic function which underlie the change in response to estradiol negative feedback.

The LH-pulse generator.

To begin, the concept of the LH-pulse generator must be introduced. This concept was developed about 10 years ago based on observations in rhesus monkeys (33). It has since been applied to a wide variety of animals including sheep. The operation of the LH-pulse generator in the ewe is illustrated in Fig. 9. The left portion describes the pattern of serum LH in a typical ovariectomized ewe sampled every 12 minutes for 8 hours. Clearly, LH is not steady but oscillates rhythmically. The oscillation is extremely regular. Further, LH generally rises from nadir to peak within one 12-minute sampling interval, and little or no LH is secreted between peaks (5). Such observations have led to the concept that, in the absence of steroid-negative feedback, LH is released as discrete rhythmic pulses with a periodicity of about 1 pulse per hour (5, 33).

The episodic pattern of LH secretion has been attributed to the activity of an LH-pulse generator located in the central nervous system (Fig. 9, right). Not much is known about its neurophysiology except that it probably resides in the medial-basal hypothalamus (28, 34, 52, 64), and by analogy with the systems which govern the release of posterior pituitary hormones, it may well reflect synchronous bursts of electrical activity in discrete units of hypothalamic neurons (8, 40). This produces an episodic discharge of gonadotropin-releasing hormone (GnRH) which, in turn, acts upon the anterior pituitary to drive the LH-pulse pattern (6).

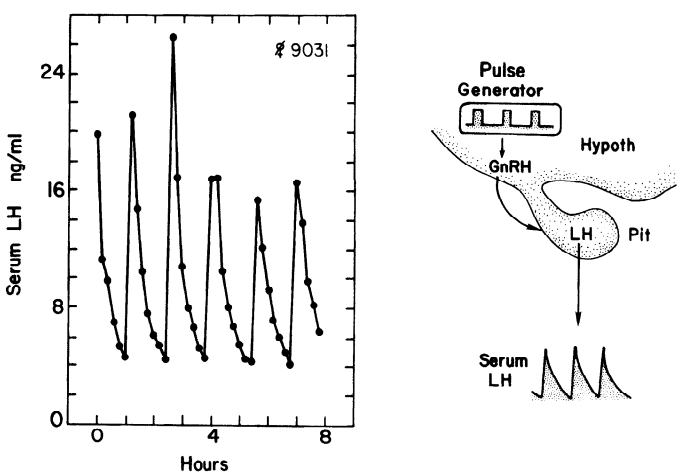


Fig. 9. Left. LH-pulse pattern observed in a typical ovariectomized ewe from which serum samples were obtained every 12 minutes for 8 hours. Right. Proposed neural control of the LH-pulse pattern. A pulse generator located in the hypothalamus (Hypoth) produces rhythmic release of gonadotropin-releasing hormone (GnRH) which acts on the anterior pituitary (Pit) to stimulate LH release. From Goodman and Karsch (20).

How does the activity of the LH-pulse generator relate to seasonal breeding? The first point to make is that the pulse generator normally operates in the presence of the ovaries, such that tonic secretion of LH is actually composed of discrete episodic discharges of the gonadotropin (4, 13, 25, 45, 60).

Secondly, the activity of the pulse generator is controlled by both neural and hormonal inputs. Each of these is considered below. (Before describing these inputs, however, it should be stressed that the activity of the pulse generator must be inferred from the pattern of LH secretion. Therefore, until it becomes possible to monitor secretion of GnRH directly, the following concepts must be considered as tentative.)

Hormonal control of the LH-pulse generator.

The regulation of the pulse generator by ovarian steroids is clearly evident from the characteristic changes in the LH-pulse pattern during the normal estrous cycle (1, 13, 20). These changes are illustrated in Fig. 10 which depicts theoretical LH pulses calculated from the data of Baird (1). During the luteal phase (top), when circulating progesterone is maximal and estradiol is low, LH pulses are large but infrequent (typically, 1 pulse every 3-4 hours). Two days prior to the LH surge (middle), when progesterone is declining and estradiol is rising, LH pulses are small but they occur more frequently (nearly 1 pulse/hour). One day before the LH surge, the frequency increases still further to more than one pulse an hour (bottom).

Two important points emerge from this pattern. First, the sustained increase in tonic LH secretion, which is so very crucial to determining the seasonal reproductive state, actually reflects an increase in the *frequency* of LH pulses to hourly. Secondly, frequency is lowest when progesterone is highest; conversely, amplitude is lowest when estradiol is highest. This suggests that progesterone and estradiol differentially inhibit LH-pulse frequency and amplitude, respectively.

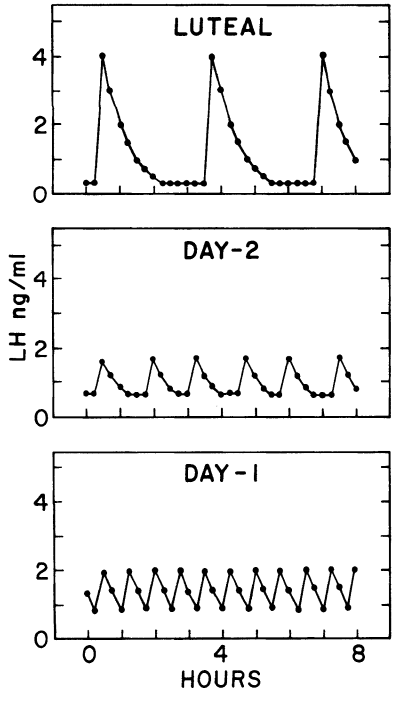


Fig. 10. Average LH-pulse pattern at 3 different times during the estrous cycle of the ewe: luteal phase, 2 days before preovulatory LH peak (day -2), and 1 day before LH peak (day -1). Values represent theoretical LH pulses calculated from the data of Baird (1).

The possibility that pulse frequency and amplitude are differentially regulated by progesterone and estradiol was tested in the study illustrated in Fig. 11 (design on top). Ewes were ovariectomized two days after estrus in the mid-breeding season and allocated to one of three groups: 1) no further treatment (control); 2) treatment with Silastic implants which produced a luteal phase level of progesterone; 3) treatment with estradiol implants which maintained a physiological level of estradiol. LH pulses were analyzed 10 days later. The results clearly indicate that the two steroids inhibit different aspects of pulsatile LH secretion, progesterone reducing only the frequency and estradiol selectively limiting the amplitude (Fig. 11, bottom). Other data (not illustrated) reveal that the effect of estradiol on amplitude is exerted, at least in part, at the level of the anterior pituitary gland where it diminishes the response to GnRH (18).

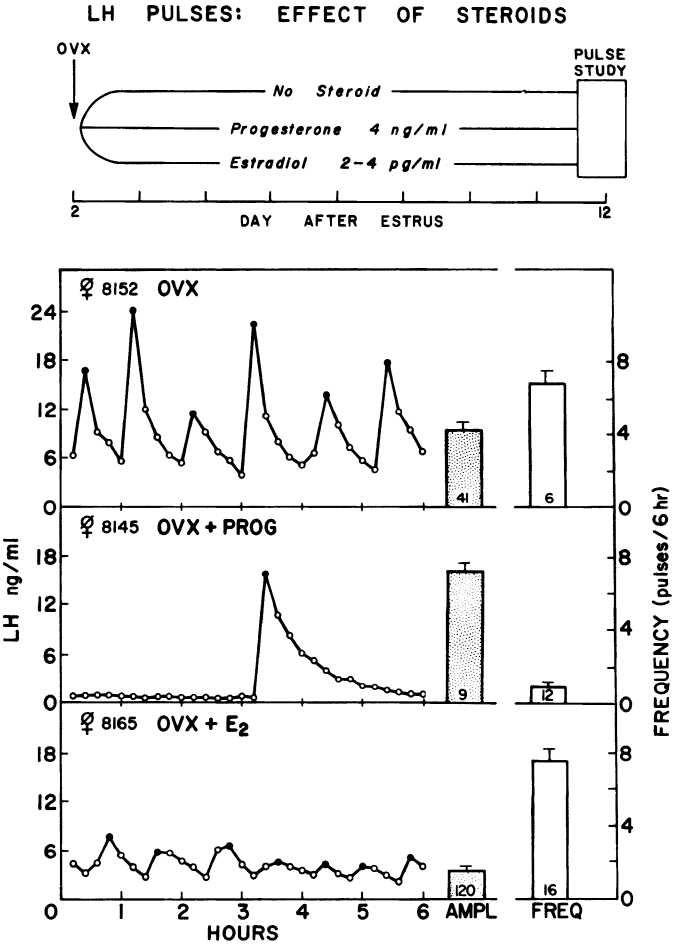


Fig. 11. Top. Design of study to determine effects of steroids on LH pulses in ewes following ovariectomy (ovx) on day 2 after estrus.
Bottom. LH-pulse pattern on day 12 after estrus in representative ewes receiving no steroid treatment (OVX), or treated with progesterone (OVX + P) or estradiol (OVX + E_2) from the time of surgery. Samples were obtained every 12 minutes for 6 hours. Bars at right depict mean frequency and amplitude (peak less preceding nadir) of LH pulses. Numbers within bars indicate numbers of pulses (amplitude) or number of observation periods (frequency). From Goodman and Karsch (18).

With this information, a working hypothesis has been formulated (20) for how steroidal regulation of the pulse generator controls ovulation during the breeding season of the ewe (Fig. 12). This hypothesis has at its core the observation that the sustained increase in tonic LH secretion, which drives the estradiol rise, reflects a switch from low to high frequency pulses of LH (1, 13, 20, 25). During the luteal phase of the cycle, progesterone acts within the central nervous system to hold the pulse generator in check, thereby decreasing the frequency of GnRH discharge from hypothalamic neurons (Fig. 12, left). The resulting LH pulses, because they are too infrequent to *sustain* a rise in circulating LH, are insufficient to set in motion the chain of events which leads to ovulation. When the corpus luteum

regresses and progesterone falls (follicular phase), this check on the pulse generator is removed. The resulting high-frequency LH pulses are sufficient to generate the sustained rise in circulating LH needed to initiate the remaining steps in the preovulatory sequence (Fig. 12, right). The rising tide of estradiol which occurs in the preovulatory period can limit the amplitude of LH pulses by acting at least in part within the anterior pituitary gland, but importantly, estradiol cannot act upon the LH-pulse generator to *reduce* frequency. This inability to decrease frequency provides an attractive explanation for why the preovulatory estradiol rise cannot block the progressive increase in tonic LH secretion during the breeding season (see Figs. 2, 3, 4).

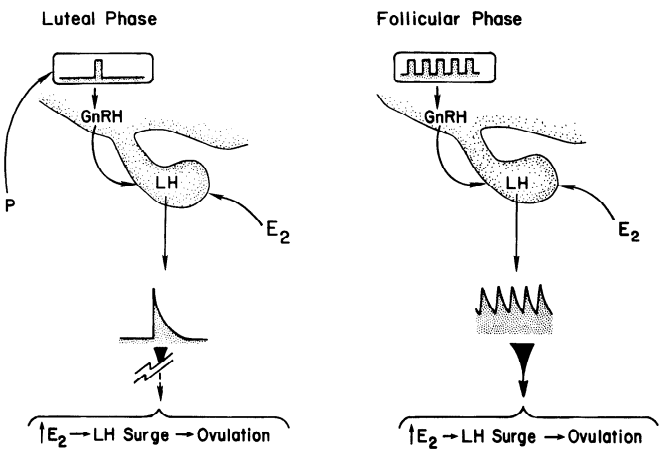


Fig. 12. Working hypothesis for how steroidal modulation of the LH-pulse generator controls ovulation during the breeding season. See text for details. From Goodman and Karsch (20).

Seasonal control of the LH-pulse generator.

The foregoing model for control of the pulse generator during the estrous cycle raises an intriguing question. Given that progesterone inhibits LH-pulse frequency during the breeding season, what happens in anestrus? Two predictions seem logical. Since there is no corpus luteum and thus minimal progesterone in anestrus, one might expect high frequency pulses to prevail. On the other hand, high frequency pulses ultimately lead to ovulation, and because ovulation does not occur, one might equally well predict low frequency pulses during anestrus. The answer to this question is quite simple; LH-pulse frequency is extremely low in anestrus (60), even lower than that during the luteal phase of the cycle.

In addition to underscoring the importance of LH-pulse frequency in determining ovulation, this finding is of considerable interest conceptually because it imples that the neural input provided by an inhibitory photoperiod is relayed to the endocrine system via mechanisms which include *frequency* modulation of the pulse generator. This conclusion, which has also been reached based on studies in the ram (41), leads to another intriguing question. What holds LH-pulse frequency in check in the absence of progesterone?

There are two schools of thought concerning the answer to this question. One proposes that an inhibitory photoperiod imposes a direct neural inhibition of the pulse generator, independent of sex-steroid feedback (11, 19, 41, 67). This is often referred to as direct photoperiodic drive. The other school proposes that inhibitory photoperiods produce certain neuronal changes which heighten the response to steroid-negative feedback (19, 39, 67). In the case of the ewe, an inhibitory photoperiod would permit estradiol to gain access to the LH-pulse generator. There is evidence to suggest that both factors may contribute to the infrequent LH pulses produced by an inhibitory photoperiod, the relative importance of each varying considerably among the different species of seasonal breeders (19).

With regard to the situation in the domestic ewe, our initial approach to clarify the basis for the infrequent LH-pulses during anestrus was to determine whether an ovarian hormone is required to hold LH-pulse frequency in check. This was accomplished by comparing the LH-pulse pattern of intact anestrous ewes with that 10 days after ovariectomy during the mid-anestrous season. As illustrated in Fig. 13, ovariectomy caused a marked increase in both frequency and amplitude of LH pulses. (Note infrequency of pulses in intact anestrous ewes - top). This result forces one to conclude that, as during the breeding season, an ovarian hormone is needed to hold LH-pulse frequency in check during anestrus.

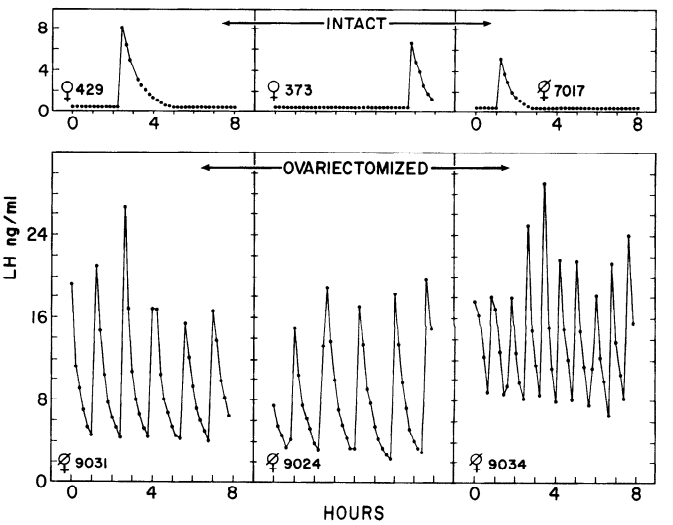


Fig. 13. Serum concentration of LH in 3 representative ewes from which blood was obtained every 12 minutes for 8 hours during the mid-anestrous season (May). Top is for ewes with intact ovaries; bottom is for ewes 10 days after ovariectomy.

The question now becomes, which hormone; specifically is it estradiol? We have used a number of experimental designs to answer this question. Most of them, unfortunately, have proven to be unsatisfactory because the anestrous ewe is so exquisitely sensitive to estradiol negative feedback that treatment with the steroid suppressed LH to an undetectable level, thus precluding a meaningful analysis of the LH-pulse pattern. In the few instances in which interpretable data have been obtained, however, it is evident that the effect of estradiol changes dramatically with season. One case in point is illustrated in Fig. 14 which describes the LH-pulse pattern of individual long-term ovariectomized ewes immediately before, and 3 days after, treatment with estradiol in either the breeding or anestrous season. In the breeding season, the effect of estradiol was limited to a reduction in pulse amplitude (top). During anestrus, in contrast, an identical estradiol treatment markedly reduced LH-pulse frequency and, surprisingly, had little or no effect on amplitude (Fig. 14 bottom, compare day 0 with day 3).

It is also evident from this study that there is some seasonal change in the LH-pulse pattern of ovariectomized ewes in the

absence of exogenous estradiol. In particular, pulse frequency prior to estradiol treatment was greater in the breeding season than that during anestrus (Fig. 14, day 0). It would appear, therefore, that two factors contribute to the infrequent occurrence of LH pulses in anestrus, the negative feedback action of estradiol and a direct inhibitory effect of long-day photoperiods on the pulse generator.

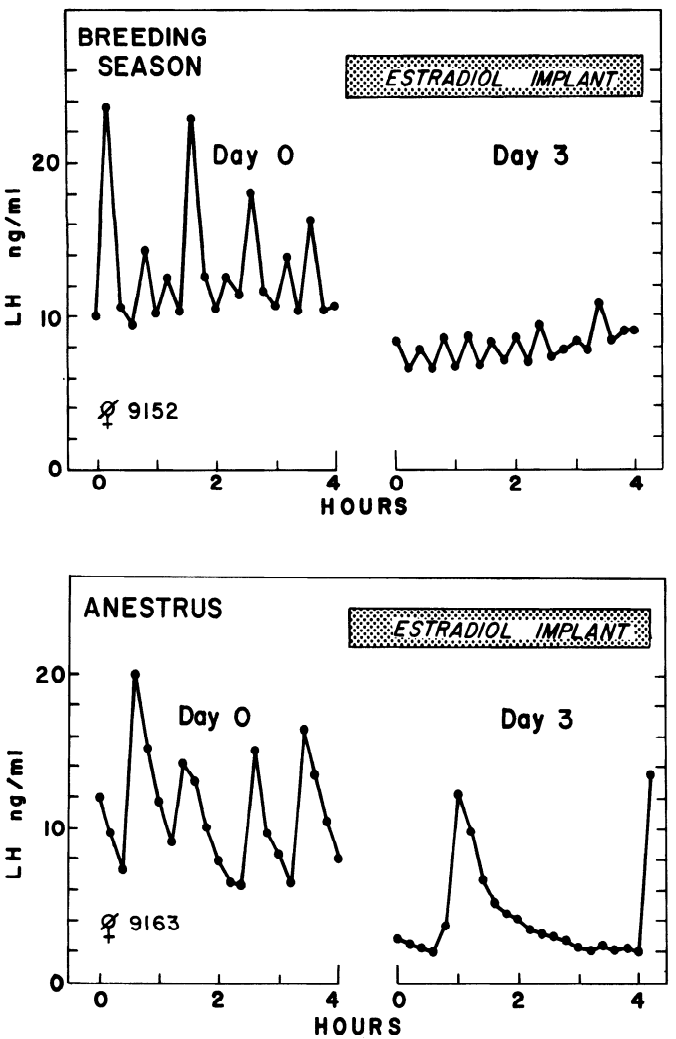


Fig. 14. Effect of estradiol on the LH-pulse pattern in representative long term ovariectomized ewes during the breeding season (top) and anestrus (bottom). Samples were obtained every 12 minutes for 4 hours immediately before (Day 0), or 3 days after (Day 3), insertion of a Silastic estradiol implant (horizontal bar) which maintained a physiological serum concentration of estradiol. From Goodman and Karsch (20).

We may now return to the primary question of this section. How does photoperiod dictate the response to estradiol negative feedback? Our current working hypothesis is that photoperiod governs the functional integrity of specific neuronal networks which determine whether or not estradiol has access to the LH-pulse generator. Under the stimulatory photoperiod of the breeding season, it seems likely that estradiol cannot hold LH-pulse frequency in check. Rather, progesterone serves this function during the luteal phase of the estrous cycle, whereas in the follicular phase, pulse frequency is not inhibited. Under the inhibitory photoperiod of anestrus, however, estradiol gains access to the pulse generator, thus holding LH-pulse frequency in check in the absence of progesterone. In this fashion, response to estradiol changes throughout the year, thereby governing the seasonal reproductive state.

CONCLUSION

This brings an end to our saga of reversible fertility in one seasonal breeder, the domestic female sheep. The past decade has proven to be productive in identifying some of the key hormonal regulatory mechanisms - the preovulatory endocrine sequence, the changing capacity of estradiol to inhibit gonadotropin secretion, the hormonal and environmental control of the pulse generator. All of these factors play a role in ensuring that the domestic ewe bears her young under environmental conditions which are favorable to their survival.

Many questions remain to be answered, questions concerning not only the control system which operates in the ewe but also the extent to which this system operates in other seasonal breeders. It would be a mistake to assume that all seasonal breeders use the same mechanisms which the domestic ewe calls into play each year to turn her reproductive system on and off. It is tempting to speculate, nonetheless, that certain commonalities do exist.

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Louise Hanson Marshall to Hy Mayerson:

I moved from housewife status in early World War II when I became a member of a team at the National Institutes of Health which was conducting simulated altitude research for the Navy. Belatedly, we were characterizing U.S. pilots' requirements for oxygen at high altitudes under combat conditions. When our service work was terminated, I continued by own research on artificial plasma expanders and capillary circulation, using dogs and rats. At the same time our family was growing up and my husband, the first neurophysiologist at NIH, was taking on increasing administrative responsibilities in the area of the neurosciences.

After 23 years of research, I undertook administrative work in Washington, D.C. for the National Research Council--National Academy of Sciences. There I had staff responsibility for the NRC Committee on Brain Sciences, which accomplished several important projects in the neurobehavioral sciences at the national and international levels. Perhaps the most significant and certainly the most permanent accomplishment was the orgagnization of the Society for Neuroscience, of which I was founding secretary-treasurer. In that capacity I initiated the *Neuroscience Newsletter,* a fun undertaking that contributed a great deal to the cohesion and success of the Society.

In 1975 mandatory retirement caught up with me, and as a widow I moved to the University of California at Los Angeles to become managing editor of *Experimental Neurology*. I am also involved in UCLA's biennial inventory of U.S. neuroscientists and collaborative research for a history of the neurosciences in the United States.

Brain Research Institute
UCLA
Los Angeles, 90024

Maurice Tainter to Bruce Dill:

I have had so many birthdays by now that you are entitled to ignore them from boredom after this. We live in the little town of Chappaqua P.O. Mt. Kisco) which is in the center of Westchester County about 35 miles north of New York City on a one acre lot imperfectly reminiscent of a Japanese garden. We get into New York regularly for ballet and other special events but otherwise lead a very quiet rustic existence. I have maintained my interest in financial management through the Board of Trustees of R.P.I. where I was Det Bronk's predecessor as Chairman of the Board of Trustees and also in reference library facilities through the N.Y. State "3-R's" program. This program is an attempt to rationalize supplying reference and research library needs by cooperative programs overlapping library systems and facilities. We have over 100 individual libraries participating in the N.Y. City area and receive important financial support from State and Federal funds. Our project, now partially completed, is to get the card catalogues of the major libraries computerized and tied in to already existing data banks. The "3-R's" program was initiated by the late James Allen before he became Commissioner of Education about 20 years ago, and has been gaining momentum steadily since.

Kitchell Rd.
Mt. Kisco, NY 10549

Jerzy Kaulbersz to Bruce:

Last October 1979, I participated actively in the 27th International Congress of Aviation and Space Medicine in Manila, Phillipines where I presented a paper entitled, "Potential Difference Across the Stomach Wall During Hypoxia." The Chairman of the organization Committee, Dr. Barcelon, wrote me, "We express our sincerest gratitude to you and your colleagues for the presentation of your paper which contributed greatly to the success of the scientific program."

I traveled to Manila with a stop of 10 days in Peking, and returned via Indonesia, Bali, Ceylon, Madras, Calcutta, Kashmir, Lahore, New Delhi, Kabul, and finally Tehran where I spent nearly a week the middle of November after the occupation of the American Embassy by the fanatical students. During the whole trip of two months, I traveled completely *alone.*

Jagellonian Univ. Acad. Med.
Grzegorzecka, 16, Cracow, Poland

Ernst Fischer to Edward Adolph:

Despite my 84 years I still feel fine. I am in fair health and the same is true of Ann. As proof I can offer the fact that we are flying to Rio de Janeiro and go to a coffee plantation of former Frankfurter friends to celebrate the 80th birthday of one of the friends. We will return just before the elections.

3110 Manor Drive
Richmond, VA 23230

Sydney A. Asdell to Edward:

It seems a very long time ago since I was at Rochester School of Medicine, actually the year of its opening. Last time I was in the city was about 10 years ago.

Things go along quite quietly here. The high point of this past summer was a visit by my sister. It was sleeting as she left Aberdeen, Scotland in the morning, and 103° at Dulles Airport in the afternoon. The heat wave curtailed our sightseeing very much.

5719 Jefferson Blvd.
Frederick, MD 21701

Ruth E. Conklin to Edward:

Thank you for the greeting on my 85th birthday. It is a pleasure to keep in touch with some of the physiologists I know. My health is good and I am still keeping house and taking care of my garden.

155 College Ave.
Poughkeepsie, NY 18603

Frederic Bremer to Edward:

I have been moved by the congratulations and wishes which you conveyed to me from the Committee on Senior Physiologists. Please transmit my thanks to the Committee and accept my cordial regards and best wishes.

Universite de Bruxelles
Blvd. de Waterloo 115
1000 Bruxelles, Belgium

Francis N. Craig to Bruce:

This should perhaps be in the form of a response to Hy Mayerson but because of your concern with the history of mouth-to-mouth resuscitation, I am writing to you.

I recently ran across a case that may be of general interest in "The Choates in America, 1643-1896. John Choate and His Descendants, Chebacco, Ipswich, Mass." by Ephriam Orcutt Jameson, Boston, 1896 (Library of Congress CS71.C545), page 63, copy enclosed:

"The Choate House on 'The Island' was struck by lightning Aug. 12, 1780, at about eight o'clock in the morning. There were six persons in the kitchen, one in the chamber, and four in the attic. The shock was seriously felt by them all, and Lydia, the youngest child, was thought to be dead, but her mother breathed into her mouth and after some time brought her to life. This stroke of lightning was the means of Margaret's conversion."

Lydia, the last of ten children was born 24 Sept. 1774 and on 19 Feb. 1801 married a John Perkins, no doubt of the family that gave us the noted respiratory physiologist, the late John F. Perkins, Jr. Margaret was her sister born 8 March 1764. The mother born 27 March 1732, was Mary Giddings, daughter of Job and Margaret (Low) Giddings, and wife of William Choate. Their third son William born 10 Aug. 1759, I can claim as an ancestor. I must have seen this page before leaving Boston in 1943, but in those years the gas exchange of surviving tissue recorded by the Warburg microrespirometer was so fascinating that I wasn't paying attention to pulmonary ventilation. How many lives could have been saved if I had immediately alerted William T. Salter or Henry K. Beecher, my chiefs then, to the possibilities of what the pious John Clements refers to as the Biblical method of resuscitation.

5819 Carrington Dr.
White Marsh, MD 21162

Hallowell Davis to Edward:

The APS birthday greeting means more to me this year because my dear wife Florence died rather suddenly last month (August). We were almost the same age (84 now) but biologically I am much more fortunate. I still have office space and some secretarial service at Central Institute for the Deaf, where I go three days (short days) a week. We are still perfecting our method for electric response audiometry, using brainstem potentials, that allows us to test objectively the young and the emotionally disturbed or multiple handicapped children who are untestable by conventional methods. I have two manuscripts in preparation and another in prospect and I hope to hold on to my part time job for a least another year, perhaps more. Greetings to all my old friends in APS.

7526 Cornell Ave.
University City, MO 63130

Ernest Speigel to Hallowell Davis:

I still enjoy writing and have prepared a monographic survey of Guided Brain Operations introduced by me and my surgical associate Wycis in 1947. It is an application of the stereotactic method to the human subcortex.

6807 Lawnton Ave.
Philadelphia, PA 19126

Jenö Kramár to Bruce:

Thank you for remembering me at my 85th anniversary.

I was born in Budapest, Hungary, specialized in pediatrics, M.D., I was at Hungarian State University in Szeged for 13 years and Creighton University school of Medicine in Omaha for 23 years and retired in 1972 at the age of 77.

My motivation for selecting Ellensburg, Washington as a place of retirement was for several reasons: Familial. Son, Zoltán is a professor of history at Central Washington University, and daughter, Piró is associate clinical professor at the University of Washington and head of the ophthalmologic service of the NIH hospital in Seattle. Personal. Abundance of lakes and skiing fields in the Cascades, and absence of volcanic activity in this area... in 1972.

202 Maple St., Ellensburg, WA 98926

Edgar J. Poth to Bruce:

I returned from a surgical tour of China in September. I continue on modified time at the University of Texas Medical Branch at Galveston as Ashbiel Smith Professor of Surgery - still operating, teaching and conducting an active research program. But I am only 81!.

Kurt von Frisch to Hal:

For your friendly birthday good wishes, I thank you many times. Please pass on my thanks to the American Physiological Society. Although I do not have direct personal contact, I nevertheless feel closely associated with it. With friendly greetings.

Uber der Kause 10
8000 Munchen 90, Germany

FOURTH ANNUAL CONFERENCE ON SHOCK

MARCO ISLAND, FLORIDA

JUNE 4-6, 1981

Sponsored by the Shock Society

Contact: Sherwood M. Reichard, Ph.D.
Medical College of Georgia
Augusta, GA 30912

COUNCIL OF ACADEMIC SOCIETIES BRIEF

ASSOCIATION OF AMERICAN MEDICAL COLLEGES • 1 DUPONT CIRCLE NW • WASHINGTON DC
(202) 828-0400 FALL, 1980 VOL. 6., NO. 1

The CAS Brief is prepared by the staff of the AAMC Council of Academic Societies and is distributed through the auspices of your member society.

LEGISLATIVE UPDATE. On October 3, Congress adjourned leaving the following unresolved legislative issues of concern to the biomedical community:

- Biomedical Research Authorizations - Both the House and Senate have now passed bills (H.R. 7036 and S. 988) which would create a statute for NIH. H.R. 7036 requires re-enactment of NIH authorizations every three years, limits spending and makes other changes not provided in S. 988. Senator Kennedy, at the urging of the biomedical research community, is holding fast to the Senate bill's provisions. Citing irreconcilable differences, Senator Kennedy refused to conference the bills with Congressman Waxman before adjournment but a conference remains a real possibility in the lame duck session.

- Tax Exemptions for Scholarships - In the last week of legislative action prior to adjournment provisions to provide tax exemptions for scholarships for medical education and for research training were removed from the 1981 omnibus tax package. It is still possible, however, that Congress will pass legislation this year to provide an exemption for the tuition portion of military medical and National Health Service Corps scholarships and a one-year extension of the moratorium on taxation of National Research Service Awards.

- Institutional Educational Support - The renewal of the Health Professions Education Assistance Act of 1976 has not yet been accomplished by the Congress. The health manpower bills passed by each house (S. 2375 and H.R. 7203) are quite different. H.R. 7203 continues capitation support, requires that 50 percent of filled first year residency positions be in primary care, and phases down federal institutional educational support over three years. The Senate bill provides an innovative new National Priority Incentive Grant Program. A grant of $250 per student enrolled is provided for meeting six national priorities (e.g. increasing the number of students entering primary care careers, developing school programs to attract students to clinical investigation careers). Institutions may opt to meet none or all of the designated priorities. This proposed Senate program continues federal support for medical education, but changes the incentive from class size expansion to other national priorities. AAMC supports the Senate bill. There are many other differences between the two bills which must be resolved by a conference committee during the lame duck session following the election. Therefore, it is unclear whether a Manpower Act will emerge from this Congress.

- The 1981 Federal Budget - The perennial argument about the use of funds for abortion and other factors prevented passage of the Labor-HHS and VA budgets. On October 1, after the fiscal year began, Congress passed a continuing resolution which permits continued federal spending at the 1980 level or at the House-passed 1981 figure, whichever is lower. Depending on the election results, it is possible that a final budget may not be passed until after the new Congress begins.

ACCREDITATION COMMITTEES REORGANIZED. Conferences among the top officials of the organizations sponsoring the Coordinating Council on Medical Education and the accreditation liaison committees during the summer of 1980 resulted in an agreement to reorganize the accreditation system. The conferees agreed that the Coordinating Council on Medical Education had failed to be a forum for resolution of medical education policy issues and had been an impediment to the liaison committees responsible for the accreditation of graduate medical education and continuing medical education. It has been abolished. There will be a Council for Medical Affairs (CFMA) comprised of the two top elected officers and the chief executive officers of the American Board of Medical Specialties, the American Medical Association, the American Hospital Association, the Association of American Medical Colleges, and the Council of Medical Specialty Societies This council will provide a forum to consider issues related to medical education and other matters of mutual concern. The CFMA will not be directly involved with the accreditation committees and accreditation policies.

The Liaison Committee on Medical Education which accredits undergraduate medical education programs will not be changed in membership or operation. It will continue to be co-sponsored by the AAMC and AMA. However, the two liaison committees which were organized during the 1970's will be replaced by two new accrediting councils.

The Accrediting Council for Graduate Medical Education (ACGME) will have four representatives each from the five sponsoring organizations of the CFMA plus a resident, public and non-voting federal representative. The Council will have the authority to accredit graduate medical education programs but may delegate that authority to a residency review committee (RRC) on request for a specified period. The RRC will have to conform to ACGME policies and procedures in its accreditation activities. The ACGME will monitor and periodically review RRCs which are granted accreditation authority. The ACGME will be responsible for developing and operating the system for appealing accreditation decisions.

Staff services for the ACGME and RRCs will be provided by the AMA under conditions specified by a letter of agreement. The cost of accreditation activities will be paid for by revenues generated from charges to programs. The sponsoring organizations will equally bear the cost of ACGME activities related to policy development.

Unanimous approval by all sponsors will be required only for the general essentials and bylaws. Fiscal policies and new programs may be subjected to unanimous approval on the request of one sponsoring organization.

The LCCME will be replaced by an Accrediting Council for Continuing Medical Education (ACCME). Each of CFMA's sponsors will have three representatives. The Association of Hospital Medical Educators and the Federation of State Medical Boards will each have one representative. There will be a public and non-voting federal representative. Authority for accreditation of intra-state programs will be granted to state medical associations or consortia. Inter-state continuing medical education programs and those sponsored by medical schools will be accredited by the ACCME. The CMSS will provide staff services to the ACCME. Approval of policy issues will be the same as for the ACGME.

This reorganization and the agreements on policies and procedures should alleviate many of the conflicts that have beset the accreditation system. All sponsoring organizations are dedicated to their effective implementation.

CAS FALL MEETINGS. The CAS Fall Meetings will be held in Washington on October 26-27, 1980. A Forum on Faculty, plenary session, and discussion groups will be held on October 26. The CAS Business Meeting will take place on October 27, featuring a presentation by Dr. Jules Hirsch, Professor and Senior Physician, Department of Human Behavior and Metabolism, Rockefeller University.

INSTRUCTIONS FOR APPLYING FOR APS MEMBERSHIP

CURRENT APPLICATION FORMS

Most issues of The Physiologist routinely carry one copy of the current application form (following). This form will serve for all categories of membership. Any member desiring to sponsor more than one applicant may use a Xerox copy of this form. Any application submitted on an out-dated form will be redone on the acceptable form.

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 attend to those instructions specific to their desired category.

GENERAL INSTRUCTIONS

FOR ALL CATEGORIES:

Use only the current application form. Check the box indicating the category of membership for which you are applying. Use the SPECIAL INSTRUCTIONS for that category when filling out the form. Type the Application. Fill out all applicable spaces. Only completed applications will be reviewed.

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

Send no reprints.

Deadline Dates: Completed applications received between February 1 and July 1 are considered for nomination by the Council at the Fall Meeting. Applications received between July 1 and February 1 are considered for nomination by the Council at the Spring Meeting. Applications are not complete until all materials, including sponsor's letters, are received.

QUALIFICATIONS (Except Students):

The Membership Advisory Committee uses the following 5 categories in 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 are responsible for physiology in another department. Relatively high ratings are given to people with positions in clinical departments and to people functioning as independent investigators in commercial or government laboratories.
3. Contributions to the Physiological Literature. This category is of major importance. The applicant's bibliography is evaluated on the basis of publications in major, refereed journals which are concerned with problems judged to be primarily physiological in nature. Emphasis is given to papers published as the result of independent research. Special note is taken of publications on which the applicant is sole author or first author.
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. Special Considerations. This category permits the Membership Advisory Committee to acknowledge unique accomplishments of an applicant. These might be excellence in a specific area, or unusual contributions to Physiology resulting from talents, interest or a background substantially different from the average.

SPONSORS:

Primary responsibility for membership rests with the two sponsors who must be regular members of the Society. Sponsors should discuss the appropriateness of the selected category of membership in this Society with prospective applicants.

Each sponsor should write an independent confidential letter about the candidate using the five categories listed above to evaluate the candidate.

CHECK LIST:

1. Original copy of application signed by both sponsors.
2. Application on a current form, including the bibliography (1 original and 7 copies).
3. Mail the original, which has been signed by the two sponsors, plus 7 copies to:

Executive Secretary
American Physiological Society
9650 Rockville Pike
Bethesda, Maryland 20014

SPECIAL INFORMATION AND INSTRUCTIONS

FOR REGULAR MEMBERSHIP

Bylaws of the Society:

Article III, Section 2 - Regular Members. Any person who had conducted and published meritorious original research in physiology, who is presently engaged in physiological work, and who is a resident of North America shall be eligible for proposal for regular membership in the Society.

IF ALIEN: Please attach a letter and 7 copies stating visa status and type of passport and giving evidence of intent to stay in North America.

Duties and Privileges:

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. Sponsor New Members.
6. Orally present or co-author a contributed paper and sponsor a non-member authored paper at the Fall scientific meeting.
7. Orally present or co-author one contributed scientific paper at the annual Federation meeting or sponsor one paper.
8. Receive The Physiologist.
9. Receive Federation Proceedings, Public Affairs Newsletters and annual Membership Directory.
10. Subscribe to handbooks and periodicals published by the Society at membership rates.
11. Register to attend scientific meetings of the Federation and the APS Fall meeting at membership rates.
12. Participate in FASEB Member's Life Insurance Program, Disability Program and in Hospital Protection Plan. (For Residents of the United States, its territories or possessions).
13. Eligible to receive the Daggs Award.
14. Eligible to be selected as Bowditch Lecturer (members under 40 years of age).

FOR CORRESPONDING MEMBERSHIP

Bylaws of the Society:

Article III, Section 3 - Corresponding Members. Any person who has conducted and published meritorious research in physiology, who is presently engaged in physiological work and who resides outside of North America shall be eligible for proposal for corresponding membership in the Society.

Duties and Privileges:

1. Serve on Society Committees, Boards and Task Forces.
2. Serve as one sponsor of new Corresponding Members (One regular member must be sponsor of a new Corresponding Member).
3. Orally present or co-author a contributed paper and sponsor a non-member authored paper at the Fall scientific meeting.
4. Orally present or co-author one contributed scientific paper at the annual Federation meeting or sponsor one paper.
5. Receive The Physiologist.
6. Receive Federation Proceedings, Public Affairs Newsletters and annual Membership Directory.
7. Subscribe to handbooks and periodicals published by the Society at membership rates.
8. Register to attend scientific meetings of the Federation and the APS Fall meeting at member rates.

FOR ASSOCIATE MEMBERSHIP

Bylaws of the Society:

Article III, Section 5 - Associate Members. Persons who are engaged in research in physiology or related fields and/or teaching physiology shall be eligible for proposal for associate membership in the Society provided they are residents of North America. Associate members may later be proposed for regular membership.

Duties and Privileges:

Same as for Regular Members except for the privilege of:

1. Holding Executive Office, or membership on certain committees.
2. Voting at Society Meetings.
3. Sponsoring New Members.
4. Receiving the Daggs Award.
5. Selection as Bowditch Lecturer.
6. Sponsoring papers of which he/she is not an author.

FOR STUDENT MEMBERSHIP

Not all questions on the application form may be appropriate – Please place NA next to any such question.

Bylaws of the Society:

Article III, Section 7 - Student Members. Any student who is actively engaged in physiological work as attested to by two regular members of the Society and who is a resident of North America. No individual may remain in this category for more than five years, without reapplying.

Duties and Privileges:

1. Present one contributed paper at the Fall Scientific meeting with the endorsement of the student's advisor.
2. Receive The Physiologist.
3. Subscribe to Handbooks and Periodicals at member rates.
4. Register to attend scientific meetings of the Federation and the APS Fall meeting at student rates.

Submit original and 7 copies of application and supporting documents.

APPLICANT'S LAST NAME _____

Date _____

THE AMERICAN PHYSIOLOGICAL SOCIETY
9650 Rockville Pike, Bethesda, MD 20014

MEMBERSHIP APPLICATION FOR:

- REGULAR ☐
- CORRESPONDING ☐
- ASSOCIATE ☐
- STUDENT ☐

CURRENT MEMBERSHIP CATEGORY; YEAR ELECTED _____

See Instructions

Name of Applicant: _____
First Middle Last

Mailing Address _____ Birth Date: _____

Citizenship: _____

Country of Permanent Residence:* _____

Telephone No.: _____

*Alien residents of North America attach 8 copies of Alien Registration Card or other evidence of intent to remain in North America.

1. EDUCATIONAL HISTORY

Dates	Degree	Institution	Major Field	Advisor

Doctoral Dissertation Title: (if any)

Postdoctoral Research Topic:

2. OCCUPATIONAL HISTORY

Present Position:

Prior Positions:

Dates	Title	Institution	Department	Supervisor

SPONSORS

#1. Name: _____

Mailing Address: _____

_____

_____

_____

Telephone No. Zip Code

#2. Name: _____

Mailing Address: _____

_____

_____

_____

Telephone No. Zip Code

I have read the guidelines for applicants and sponsors 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, under separate cover.

(over)

APPLICANT'S LAST NAME _____

3. **DESCRIBE YOUR PHYSIOLOGICAL TEACHING** – What percent of your time/effort is spent in teaching Physiology?_____

Describe in the space provided your teaching of physiology including course descriptions (content, format); supervision of pre-doctoral and post-doctoral students; special contributions (films, textbooks, etc.).

4. **INTEREST IN THE SOCIETY** – List any APS Meetings attended by date and check the appropriate box for any papers.

SPRING (FASEB)			FALL (APS)		
Date	Presented	Coauthor	Date	Presented	Coauthor
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐
_____	☐	☐	_____	☐	☐

List other scientific societies of which candidate is a member:

In the space provided state your interest in wanting to join the Society:

5. **SPECIAL CONSIDERATION** – Include any other contributions (Administrative, university, national service, awards and honors) that may be important to physiology.

6. **DESCRIBE YOUR RESEARCH** – What percent of your time/effort is spent in research?_____

Describe the fundamental physiologic questions in your research and how you have answered these questions. Limit the paragraph to the space provided.

7. **BIBLIOGRAPHY** – Attach a list of your publications under the following categories:
   1. Complete physiological papers, published or accepted for publication.
   2. Physiological abstracts (limit to ½ page).
   3. Other papers not primarily physiological (limit to ½ page).

The entire bibliography should not exceed 2 pages. Give complete titles and journal references with inclusive pagination. Use the bibliographic form found in the Society's journals. List authors in the order in which they appear in the publication.

THE PHYSIOLOGY TEACHER

A COMPUTER MODEL OF THE CARDIOVASCULAR SYSTEM FOR EFFECTIVE LEARNING

Carl F. Rothe

Department of Physiology
Indiana University School of Medicine
Indianapolis, Indiana 46223

The following model and its description is presented as a useful teaching tool and also as an example of the ease of developing the differential equations of a physiological system and then solving them through simple numerical integration on a digital computer. The physiological model itself is well-established (1-5, 8). Unlike models using a series of algebraic equations, this implementation, like more complex system simulations solves a set of interacting, possibly non-linear, differential equations. Using the same approach, all sorts of relationships (respiration, neural action potentials, drug dynamics, compartmental mixing) can be handled without developing an analytic solution for the set of equations. Implementation is not restricted to a dedicated computer, a large time-sharing system or the availability of a specialized simulation language. Futhermore, the implementation presented here is interactive; responses from the computer come before the student loses interest.

(The model used is similar to that used by M. N. Levy in a recent review of cardiovascular fundamentals: "The cardiac and vascular factors that determine systemic blood flow." *Circ. Res.* 44:739-747, June 1979).

The interaction between the heart and the peripheral parts of the cardiovascular system must be understood to be able to distinguish between normal and abnormal function. A key variable is the central venous pressure, because this is a major (but not the only) determinant of: (a) the rate of blood flow from the periphery, and (b) the filling of the heart and so rate of flow from the heart. Under steady state conditions, when the venous return equals the cardiac output, the resulting central venous pressure is the "operating point" for the system. The concept of such operating points — in contrast to set-points — is crucial for our understanding of homeostasis. The ultrasimple cardiovascular model described here was designed to aid the development of such understanding and to simulate the effect of various distubances on the cardiovascular system. The cardiovascular response to exercise (reduced arterial resistance) and the compensations needed to provide adequate homeostasis may be simulated, as well as the effect of cardiac weakening (reduced contractitlity) on central venous pressure and cardiac output. The effect on "cardiac output" and "blood pressure" of changing other parameters, such as "blood volume," "venous compliance" and "cardiac compliance," may also be studied. To think only in terms of final steady state responses, rather than considering also the transient pattern of change and its quantitative characteristics, limits functional understanding. The model was designed to give this potentially valuable information for study and contemplation. Finally, the model demonstrates the ease and power of digital simulation of complex physiological systems using easily learned BASIC and a microcomputer. A different kind of information is available from such mathematical models than from mechanical models (6), for although the computer model is less direct and seemingly less real, it is much more precise and flexible.

The model is simple in that only one "heart" is used, and the cardiac output is a linear function of filling volume. Only one vascular pathway is present, and the vasculature is lumped into only one arterial bed and one venous bed. There are no reflexes. However, the basic phenomena are graphically and validly demonstrated. A much more complex model (two non-linear hearts, a pulmonary bed, two parallel vasculatures, and provision for fluid shifts across the capillaries) is valuable for exploring research ideas and concepts in my laboratory, but such a model is cumbersome to use and requires either a very high speed computer or long computing time. On a small microcomputer (Processor Technology SOL with a North Star disk system) this model operates at about real time, is quickly set up, and can be easily "revived" if "killed."

The model is presented in schematic form in Figure 1. The 9 interacting equations used to describe this dynamic system are described in the Appendix, as is the computer approach to provide an iterative solution to the set of equations.

Editor's Note: This article originally published in *The Physiology Teacher,* (22: 29-33, Dec. 1979) had a large number of printing errors. The corrected article is therefore reprinted here in full.

In Figure 2, control conditions and the initial printout are presented. If a printer is available, hard copy of the results can be printed for later study. In the table of "Current Values of Variables and Parameters," note that the total distending blood volume is much less than the total blood volume. The veins, especially at zero transmural pressure, contain a large volume of blood. At the bottom of Figure 2, a plot of the Guytonian relationship between venous return and cardiac output is presented.

Fig. 1 Schematic diagram of the model.

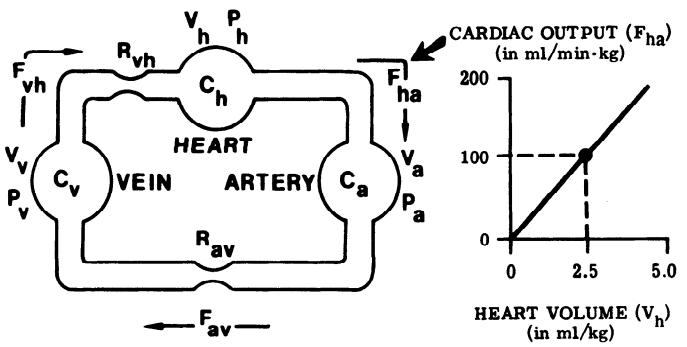

Fig. 2 Start-up and Normal Conditions.

```
RUN

For hard copy output type 1, for video 0 ? 0
Simple Cardiovascular Model  -  CVMDL  -  1978
  C.F.Rothe - Physiology - Indiana Univ., Indianapolis
Integration step size (in minutes) is  .005
Printout is set for 0.1 min intervals.
After changing parameters, continue runs until
  the flows in all 3 segments are equal.
Venous Pressure = ca. Mean Circulatory(capacity vessel) Pres.
Heart  Pressure = Central venous pressure
Distended vasc vol(ml/kg) + unstressed(55) = Total bld volume.
The MODEL has NO REFLEXES or transcapillary fluid compensation
Explore effect of the following - Try various compensations.
 1) EXERCISE - Arterial resistance (Res #1) 40% of normal.
 2) HEART FAILURE - Cardiac Contractility 30% of normal.
 3) HEMORRHAGE - Blood volume decreased 10 ml/kg
                          Press RETURN to continue
You will be given choices:
  1 - To CONTINUE computing
  2 - To CHANGE parameter values
  3 - To list as PERCENT of control values
  4 - To start over with original control values
  5 - To PLOT cardiac output & venous return vs. R. Atrial Pres
  6 - To QUIT
Use RETURN to ENTER each of your responses.
                          Press RETURN to continue
T=  0   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)    (ml/min-kg) (ml/kg)
-------      -------     -------    ------  ----- -------
01 ARTERIAL   100.00    100.00      4.00      .04      .92
02 VENOUS       8.00    100.00     14.00     1.75      .05
03 HEART        3.00    100.00      2.50      .83      .00
Heart contractile ability = 100.00 % normal
Total blood volume (ml/kg)=  75.50
Vasc distending blood vol.=  20.50 or 100.00% normal
Mean Circ Filling Pressure=   7.8 mmHg

Cont:1,Chng param:2,% of control:3,Plot:5,Quit:6? 5
Flow    Venous Return,R           Cardiac output,O
 240 I                                          *
 220 I                                       O
 200 I                                    O
 180 I                                 O
 160 IR                             O
 140 I      R                    O
 120 I            R           O
 100 I                 N - normal operating point
  80 I               O     R
  60 I            O              R
  40 I       O                        R
  20 I    O                              R
   0 I*-----I-----I-----I-----I-----I-----I-----I-----*-----I
R Atrial Pressure 2     3     4     5     6     7     8     9
Cont:1,Chng param:2,% of control:3,Plot:5,Quit:6?  2
```

An example of changing parameters to mimic exercise is presented in Figure 3. Arterial resistance (Segment 1) is reduced to about 40% of normal; venous compliance (Segment 2) is reduced to about 2/3 of normal to provide Venoconstriction, and cardiac contractility is increased to 250% of normal. A steady state is reached by the next printout (0.1 min) with arterial pressure somewhat less than normal. By choosing option 3, the variables and parameters are presented as percent of control. Even though venous compliance is 2/3 of control, the doubling of blood flow increased the transmural pressure enough to increase the venous (capacity vessel) pressure and volume to a value greater than normal. The central venous pressure operating point is at a value less than control, even with an increase in mean circulatory pressure, because cardiac contractility was greatly increased.

Fig. 3. Simulation of exercise with cardiovascular compensation.

```
T=  0   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)    (ml/min-kg) (ml/kg)
-------      -------     -------    ------  ----- -------
01 ARTERIAL   100.00    100.00      4.00      .04      .92
02 VENOUS       8.00    100.00     14.00     1.75      .05
03 HEART        3.00    100.00      2.50      .83      .00
Heart contractile ability = 100.00 % normal
Total blood volume (ml/kg)=  75.50
Vasc distending blood vol.=  20.50 or 100.00% normal
Mean Circ Filling Pressure=   7.8 mmHg

To make no change type: 0 then RETURN
Change resistance? Type SEGMENT number: 1
New value of RESISTANCE is? .40
Change compliance? Type #: 2
New value of COMPLIANCE is? 1.2
Change CARDIAC CONTRACILITY? (Yes=1,No=0) 1
New value of contractility in % of normal: 250
Change BLOOD VOLUME? (Yes=1,No=0) 0
Shorten print interval to <0.1 min? Yes=1: 0
                Patience please, computing.
CONTinue computing until outflows about equal.

Time is  .1 minutes                    I # =  20
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL      92.06    199.26     3.68
02 VENOUS        12.35    199.26    14.83
03 HEART          2.39    199.26     1.99
        Total distending volume =  20.50

Cont:1,Chng param:2,% of control:3,Plot:5,Quit:6? 3
T=  .1   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)    (ml/min-kg) (ml/kg)
-------      -------     -------    ------  ----- -------
 :* * * Values as percent of control * * *
01 ARTERIAL     92.06    199.26     92.06   100.00    43.48
02 VENOUS      154.43    199.26    105.89    68.57   100.00
03 HEART        79.71    199.26     79.70   100.00   100.00
Heart contractile ability = 250.00 % normal
Total blood volume (ml/kg)=  75.50
Vasc distending blood vol.=  20.50 or 100.00% normal
Mean Circ Filling Pressure=   9.9 mmHg

Cont:1,Chng param:2,% of control:3,Plot:5,Quit:6?  5

Flow    Venous Return,R           Cardiac output,O
 240 I                                          *
 220 I         R       O
 200 I              X - CURRENT VALUE
 180 I            O     R
 160 I          O             R
 140 I        O                    R
 120 I       O                          R
 100 I                N - normal operating point
  80 I     O                                    R
  60 I   O                                          R
  40 I  O
  20 I O
   0 I*-----I-----I-----I-----I-----I-----I-----I-----*-----I
R Atrial Pressure 2     3     4     5     6     7     8     9
Cont:1,Chng param:2,% of control:3,Plot:5,Quit:6? 4
```

The effect of hemorrhage is shown in Figure 4. The model, just as a living animal, cannot be hemorrhaged instantly. We chose a hemorrhage or transfusion rate to complete the volume change in 0.2 min. Even when the hemorrhage is completed, flows out of the various segments are not equal; about 10 sec is required for the transients to die out. Please remember that the model incor-

porates no reflexes nor any provision for fluid shifts from the interstitial space into the vasculature. We defined "hypotension" as a blood pressure less than 50 mmHg and "shock" as a cardiac output less than 60 ml/min•Kg. A separate plot of hemorrhaged volume, cardiac output, central venous pressure, and venous return as a function of time will provide clues as to the transient pattern of response of the cardiovascular system. Compensatory mechanisms should be tried and enough information copied to provide a report.

Fig. 4. The effect of hemorrhage.

```
To make no change type: 0 then RETURN
Change resistance? Type SEGMENT number: 0
Change compliance? Type #: 0
Change CARDIAC CONTRACILITY? (Yes=1,No=0) 0
Change BLOOD VOLUME? (Yes=1,No=0) 1
Current TOTAL blood vol=  75.50 DISTENDING vol=  20.50
                    Normal  DISTENDING vol=  20.50
Desired (+ or -) change in volume (ml/kg) is? -10
Shorten print interval to <0.1 min? Yes=1: 1
What interval (in multiples of .005 min)? .020
                Patience please, computing.
CONTinue computing until outflows about equal.

Time is  .02 minutes                        I # =  4
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     96.82     96.59     3.78
02 VENOUS        7.95    111.92    13.84
03 HEART         2.36     78.51     1.88
        Total distending volume =  19.50

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 1

Time is  .04 minutes                        I # =  8
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     87.54     86.75     3.41
02 VENOUS        7.72    112.83    13.38
03 HEART         2.08     69.37     1.70
        Total distending volume =  18.50

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 2
      [Changed print interval & skipped some prints]

Time is  .24 minutes                        I # =  48
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     45.40     44.77     1.85
02 VENOUS        4.21     52.84     7.33
03 HEART         1.57     52.39     1.31
        Total distending volume =  10.50
**** DANGER ***** PATIENT HYPOTENSIVE
**** HURRY *****  PATIENT IN SHOCK !!!!

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 1

Time is  .34 minutes                        I # =  68
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     51.14     51.13     2.05
02 VENOUS        4.10     51.22     7.17
03 HEART         1.54     51.26     1.28
        Total distending volume =  10.50
**** HURRY *****  PATIENT IN SHOCK !!!!

              [ Skipped a printout & chose option 3 ]

T=  .44   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)   (ml/min-kg) (ml/kg)
-------     -------     -------   ------  ----- -------
 :* * * Values as percent of control * * *
01 ARTERIAL    51.22     51.22     51.22   100.00   100.00
02 VENOUS      51.22     51.22     51.22   100.00   100.00
03 HEART       51.22     51.22     51.22   100.00   100.00
Heart contractile ability = 100.00 % normal
Total blood volume (ml/kg)=  65.50
Vasc distending blood vol.=  10.50 or  51.22% normal
Mean Circ Filling Pressure=   4.0 mmHg

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 5
Flow    Venous Return,R          Cardiac output,O
 240 I                                        *
 220 I                                    O
 200 I                                 O
 180 I                              O
 160 I                           O
 140 I                        O
 120 I                     O
 100 I                  N - normal operating point
  80 I R             O
  60 I       R   O
  40 I       O     R
  20 I    O              R
   0 I*-----I-----I-----I-----I-----I-----I-----I-----*-----I
R Atrial Pressure 2     3     4     5     6     7     8     9
Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6?  4
```

In contrast to hemorrhage, which causes a marked reduction in the venous return curve, cardiac failure causes the cardiac output curve to decrease to low values, even if the central venous (heart filling) pressure is high. Cardiac contractility reduction to 30% of normal with compensatory vasoconstriction, venoconstriction, and transfusion to mimic fluid shifts into the vasculature gave the results shown in Figure 5.

The sensitivity of the cardiovascular system model to changes in various parameters can be explored by plotting cardiac output (as percent of control) against the parameters (as percent of control). An adequate plot will be obtained if 25, 50, 100, 150 and 200% of control parameter values are used. How close are these values to reality, i.e., experimental values? What would be the effect of reflexes and fluid shifts? In many cases, reliable data are not available to test critically even this ultra-simple model.

Fig. 5. Reduced contractility; with compensation by increased arterial resistance and increased blood volume.

```
Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 2
T=  0   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)   (ml/min-kg) (ml/kg)
-------     -------     -------   ------  ----- -------
01 ARTERIAL   100.00    100.00      4.00     .04      .92
02 VENOUS       8.00    100.00     14.00    1.75      .05
03 HEART        3.00    100.00      2.50     .83      .00
Heart contractile ability = 100.00 % normal
Total blood volume (ml/kg)=  75.50
Vasc distending blood vol.=  20.50 or 100.00% normal
Mean Circ Filling Pressure=   7.8 mmHg

To make no change type: 0 then RETURN
Change resistance? Type SEGMENT number: 1
New value of RESISTANCE is? 1.38
Change compliance? Type #: 0
Change CARDIAC CONTRACILITY? (Yes=1,No=0) 1
New value of contractility in % of normal: 30
Change BLOOD VOLUME? (Yes=1,No=0) 1
Current TOTAL blood vol=  75.50 DISTENDING vol=  20.50
                    Normal  DISTENDING vol=  20.50
Desired (+ or -) change in volume (ml/kg) is? 5
Shorten print interval to <0.1 min? Yes=1: 0
                Patience please, computing.
CONTinue computing until outflows about equal.

Time is  .1 minutes                         I # =  20
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     87.07     57.17     3.50
02 VENOUS        8.18     41.85    14.39
03 HEART         6.09     60.89     5.10
        Total distending volume =  23.00
**** HURRY *****  PATIENT IN SHOCK !!!!

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 1

Time is  .2 minutes                         I # =  40
Time is  .3 minutes                         I # =  60
 SITE          PRESSURE  OUTFLOW  VOLUME
01 ARTERIAL     96.49     63.12     3.86
02 VENOUS        9.39     62.62    16.43
03 HEART         6.26     62.56     5.21
        Total distending volume =  25.50

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 3
T=  .3   CURRENT VALUES OF VARIABLES  &     PARAMETERS
SEGMENT      PRESSURE    OUTFLOW   VOLUME  COMPL RESISTANCE
            (mm Hg)   (ml/min-kg) (ml/kg)
-------     -------     -------   ------  ----- -------
 :* * * Values as percent of control * * *
01 ARTERIAL    96.49     63.12     96.42   100.00   150.00
02 VENOUS     117.34     62.62    117.36   100.00   100.00
03 HEART      208.53     62.56    208.54   100.00   100.00
Heart contractile ability =  30.00 % normal
Total blood volume (ml/kg)=  80.50
Vasc distending blood vol.=  25.50 or 124.39% normal
Mean Circ Filling Pressure=   9.7 mmHg

Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 5
Flow    Venous Return,R          Cardiac output,O
 240 I                                        *
 220
 200
 180 I  R
 160 I        R
 140 I              R
 120 I                    R
 100 I                  N - normal operating point
  80 I                                  R              O
  60 I                                     O R
  40 I                           O                  R
  20 I          O                                        R
   0 I*-----I-----I-----I-----I-----I-----I-----I-----*-----I
R Atrial Pressure 2     3     4     5     6     7     8     9
Cont:1,Chnq param:2,% of control:3,Plot:5,Quit:6? 6
CONTROL IS AT VIDEO TERMINAL
```

APPENDIX

The model in schematic form is presented in Figure 1. At the right, the assumed Starling or ventricular performance relationship of cardiac output (Fha = Flow from heart to arteries) at various end diastolic volumes (Vh = Volume of heart at end of filling) is presented.

1) Fha = Kh * Vhfilled

The slope of this linear curve with the intercept at zero filling volumes is the "contractility," Kh. Just as the left heart normally buffers the right heart from changes in systemic arterial pressure, the model cardiac output is not directly influenced by arterial pressure. If the "contractility," Kh, is doubled, then twice the outflow occurs at the same filling volume. Note that heart rate is not included. In this areflexic model we assume that the product of heart rate and stroke volume is constant. In real life, compensatory mechanisms tend to maintain the stroke volume with an increased heart rate.

FLOWS through the arterial (Fav) and venous (Fvh) beds are assumed to follow "Ohm's Law," and so are directly proportional to the pressure gradients and inversely proportional to the arterial-to-venous resistance (Rav) and venous-to-heart resistance (Rvh), respectively.

2) Fav = (Pa-Pv)/Rav

3) Fvh = (Pv-Ph)/Rvh

The mean pressure in the heart during diastole (filling) is Ph. In real life there are, of course, many more segments and a pulsatile flow.

PRESSURES at each segment are computed from the definition of compliance ($C = \Delta V/\Delta P$). A linear compliance is assumed. The volume is the volume causing the vasculature to be distended and does *not* include the volume present if the transmural pressure is zero.

4) Pa = Va/Ca (Arterial)

5) Pv = Vv/Cv (Venous)

6) Ph = Vh/Ch (Heart)

The venous pressure (Pv) is the peripheral microvenous pressure and is about the same as the mean circulatory filling pressure. The heart pressure (Ph)is the central venous pressure. A simplifying assumption is that the intrathoracic pressure is zero and so Ph is also the transmural filling pressure of the heart. The "heart" diastolic distensibility (Ch) is assumed to be linear with no limit. "The heart is overdistended" is printed if the diastolic heart volume (both ventricles) exceeds 10 ml/kg.

VOLUMES of each segment, at a given instant, are then computed as the volume at a previous instant plus the integral of inflow minus outflow. Numerically, this integral is merely the difference between inflow and outflow (Fin-fout), at a given iteration, times the time interval (Δt) represented by the iteration.

7) $Va_{(t+\Delta t)} = Va_{(t)} + (Fha-Fav) \cdot \Delta t$

8) $Vv_{(t+\Delta t)} = Vv_{(t)} + (Fav-Fvh) \cdot \Delta t$

9) $Vh_{(t+\Delta t)} = Vh_{(t)} + (Fvh-Fha) \cdot \Delta t$

The logic of these equations is based on the differential equation for conservation of material:

a) $\frac{dV}{dt} = f_{in} - f_{out}$

By definition, dV/dt can be approximated at very small time intervals as:

b) $\frac{dV}{dt} = \frac{\Delta V}{\Delta t} = \frac{V_{n+1} - V_n}{t_{n+1} - t_n}$

Thus, letting $\Delta t = t_{n+1} - t_n$ and converting iteration number to time:

c) $\frac{V_{t+\Delta t} - V_t}{\Delta t} = f_{in} - f_{out}$

And so, at the next iteration (after rearranging Eq. c):

d) $V_{t+\Delta t} = V_t + (f_{in} - f_{out}) \cdot \Delta t$

By making the time interval (Δt) short (e.g., 0.005min), variables do not change appreciably during each iteration. A much longer integration step size (Δt) leads to instability, a much shorter one extends computation time. The following is the heart of the algorithm in BASIC. Values of the variables and the volumes of "blood" in the segments are repeatedly computed by looping back from line 1140 to 970 until the end of the next print interval (T4) is reached.

```
 970  P(1) = V(1)/C(1)
 980  P(2) = V(2)/C(2)
 990  P(3) = V(3)/C(3)
1000  F(1) = (P(1)-P(2))/R(1)
1010  F(2) = (P(2)-P(3))/R(2)
1020  F(3) = K9 * V(3)
1050  V(1) = V(1) + (F(3)-F(1)) * T1
1060  V(2) = V(2) + (F(1)-F(2)) * T1
1070  V(3) = V(3) + (F(2)+F4-F(3)) * T1
1080   V4 = V4 + F4 * T1
1140 IF T9<T4 THEN 970
```

Symbols are:

(1) is the arterial segment, (2) the venous, (3) the heart, P = pressure, V = volume, C = compliance, F = flow, R = resistance, K9 is the cardiac contractility (flow as a function of fiber length), T1 is the integration interval (0.005 min), T9 = the current time, V4 = hemorrhaged blood volume, F4 = hemorrhage rate, and * means multiply.

The computer we use computes with 8 digits of precision, and so truncation errors are minor. This bootstrap method works. Although more elaborate integration routines are available, the simple Euler or rectangular integration is simple yet satisfactory (7) for these models. From a set of differential equations describing the system (such as above), the difference differential equations can be easily developed and solved on a digital computer. Difficult analytical solutions or gross simplifications are not required. The approach works with complex or non-linear differential equations describing physiological functions.

The parameters for "normal" are given in Figure 2. The compliance and distending volumes for each segment are less well established than the values for flow and resistance.

Although the basic equations require only 9 lines of coding, the program is 214 lines long to provide for user information, plotting of the cardiac output and venous return relationships, output of variables and input of changes in parameter values. The model was designed for video (CRO) display with 16 lines of 65 characters each. It is written in BASIC and is available, with suggestions for use, on request from the author. Serious users will document the magnitude and importance of the oversimplification employed and may find ways to improve the model without losing its heurisitic value.

ACKNOWLEDGEMENTS

Modeling approaches and concepts from Authur Guyton, Tom Coleman and colleagues are gratefully acknowledged.

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WANTED - ALIVE AND PROVOCATIVE - MEDICAL STUDENT LABORATORY EXERCISES

Student laboratories in American medical schools are under attack for being irrelevant, boring, expensive, and time-consuming. Yet lectures, textbooks, audio-visual aids, and demonstrations do not seem to provide the active, hands-on experience of a good laboratory experiment. We want our students to learn the attitudes of effective scientific investigators; to appreciate the power and pitfalls of the experimental method; to be skeptical of "the" authority, dogma and tradition. We want them to respect the results of a well-designed experiment and to disregard pseudoscience - and know how to tell them apart. Unfortunately, too often our labs are indeed dreary, cookbook bores taught by those who have "better" things to do. The student laboratory is not always well.

To provide physiology teachers examples of effective student laboratory experiments, we are asking that you submit for publication in *The Physiology Teacher* a lab exercise(s) that:

1. Holds the interest of most students.
2. Teaches important physiological concepts.
3. Involves hypotheses to be tested.
4. Yields results that may be unexpected, and
5. Provokes discussion.

Although new experiments are welcome, examples of the organization and presentation of effective classical experiments will be especially helpful. Old dogs -- and long-established departments -- can learn new tricks.

The experiments will be peer-reviewed and when 30-40 have been published in *The Physiology Teacher* (including many from previous issues), they will be published as a book by the American Physiological Society for use by physiology teachers in the revision of their laboratory course.

Please use the Information For Authors: The Laboratory Experiment, published in the Vol. 5, No. 2, p. 7, April 1976 issue of *The Phsyiology Teacher* (or write for a copy). With the statement of objectives, please include hypotheses to be tested. Submit three copies to the Executive Editor, The Physiology Teacher, 9650 Rockville Pike, Bethesda, MD 20014.

LETTERS TO THE EDITOR

To provide a forum for discussion about the pros and cons of student laboratories and what can be done to improve them, "Letters to the Editor" will also be considered for publication. What criteria should be used in developing and conducting student laboratories? What excites, bores, distracts or interests students in the lab? Should laboratories be compulsory when time is scheduled for them in the curriculum? Should grades be given? On what basis? Should this endangered species, in a time of financial exigencies, be allowed to become extinct? For those who feel that the teaching of physiology is important, *The Physiology Teacher* provides a unique communication medium. Let's use it.

Carl F. Rothe, Guest Editor
Dept. of Physiology
Indiana Univ. Med. Ctr.
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THOUGHTS ON MEDICAL WRITING AND TEACHING*

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When Bill Dantzler and Fred Wright invited me to give this talk, I was hesitant to accept because I dislike any exercise that smacks of bragging. But then I realized that someone would address you, and I quickly decided that I might as well do it. So much for modesty! So, having written two books that have been gratifyingly successful -- and that, much to my satisfaction, have been accepted equally by beginning students and discriminating faculty and investigators -- I shall describe some of the elements that I deliberately incorporated into them. These elements fall into two categories: some general guiding principles, and more minor technical features. I follow similar tenets in my teaching, and that is why the title of this talk pertains not only to writing but also to teaching. After all, writing textbooks is merely a written form of teaching.

I am cognizant of the fact that this gathering is full of successful writers and teachers. Let me therefore apologize in advance for any implication that I know how to write and teach and that others should therefore do likewise; I am merely describing some methods that seem to have worked for me.

GENERAL PRINCIPLES

Write for a Specific Readership

Both of my books have been directed to medical students: RENAL FUNCTION to first-year students and RENAL DYSFUNCTION to second-year students. (Actually, our son had a better idea for a title, at least so far as the promotion of sales is concerned. He suggested that I call the first book "The Sensuous Kidney, by V."; a colleague, Paul Stern, thought that the second might be called "The Son of Renal Function".) Anyhow, a former mentor of mine, Scott Swisher, sensed this feature when he wrote of my second book: "It is with some pride that I am going to put this on a relatively small list of books that I believe have honestly been written for student consumption. It has always saddened me that many people who purport to write student textbooks are actually writing them to impress their peers."

Somewhat ironically, I credit that giant among renal physiologists, Robert Pitts, for this trait in my books. (I say 'ironically' because Robert Pitt's famous book and mine inevitably became competitors.) Toward the end of his life, Dr. Pitts allowed himself the indulgence of expounding his philosophy on certain matters, such as research and writing -- although the indulgence was always exercised in response to an invitation. I treasure two of these treatises that were published, and I profit from their wisdom by re-reading them periodically: One, delivered as an after-dinner speech to the Salt and Water Club, is entitled "Some Aphorisms on Research and Writing" and was published in the Yale Journal of Biology and Medicine in 1971 (4); the other, entitled "Why a Physiologist?," appeared as a prefatory essay in the Annual Review of Physiology in 1976 (5). In the first of these, Dr. Pitts gives advice to those who are contemplating authoring a book or monograph. He says: "I have written two monographs, the first ["The Physiological Basis of Diuretic Therapy"] a resounding flop, the second ["Physiology of the Kidney and Body Fluids"] a modest success [perhaps the understatement of the year!]. To my somewhat biased view, they were equally well written. Why should one have been a failure, the other a success? [One] aphorism is, write for a specific reading audience to fill a specific need. My first monograph was not needed; the second apparently was."

RENAL FUNCTION was an outgrowth of rather extensive hand outs that I had used at Dartmouth for a number of years. As I began to revise these notes for a national audience, and as I tried to keep the narrative simple, I became very aware of my colleagues who might think: "That dumb cluck, Valtin, doesn't he know any better?" At that point, I walked out of the library for lunch, and I happened to run into one of our medical students who said, "I'm sure glad you are writing that book, Dr. Valtin." With that encouragement, and recalling Robert Pitts' aphorism, I resolved to ignore possible censure from my colleagues and to write strictly for beginning students. Fortunately, this incident happened during the very first week of the writing of RENAL FUNCTION.

Stick to the "Core"

Part of the success of any short, introductory textbook must be that it limits itself to describing the fundamentals of its field. I have a story that illustrates this point. While I was writing RENAL FUNCTION, John Stewart and I were working on a computer model of the renal countercurrent system (8). Juha Kokko and Floyd Rector (2) had just devised their passive theory of countercurrent multiplication in the inner medulla,[1] and being aware of Stewart's model, they asked him to try out their proposal. John quickly found out that the passive theory could work, and he became very excited about this new concept. With youthful enthusiasm, he asked me how I would handle this new idea in my book. After just a moment's reflection, I replied that I would not include it, for however exciting and ingenious, it did not introduce a wholly new principle into renal physiology. The principle was still that of a countercurrent multiplier; only the mode of its operation was new. I shall describe the passive model in the second edition of RENAL FUNCTION, but the reason for its inclusion will be more for what it says about the role of urea in the conservation of water by mammals than that it embodies a new axiom.

For some years now I have worried that a second edition of RENAL FUNCTION is overdue. I am more than half-way done with the task, and in the meantime I take solace again from something that Robert Pitts said. In the preface to the second edition of his textbook (3) he wrote: "What a student needs to know in 1968 is not especially different from what he needed to know in 1963."

There are, in fact, only a handful of new concepts that will be

*Presented at the Renal Dinner, annual meeting of FASEB, Anaheim, California, April 15, 1980.

[1]John Stephenson proposed a similar model simultaneously (7).

added to the next edition of RENAL FUNCTION. The exclusion of much current work does not, of course, say that I consider that work to be of little consequence; I trust that I would not be so presumptuous. The exclusion reflects, rather, what I consider to be the importance of distinguishing our role as investigators and teachers of advanced students on the one hand, from our role as instructors of introductory courses on the other.

Discuss Concepts in Context

The organization of my books reflects an effort to tell a coherent story by placing the various aspects of renal function in the context of their contribution to the main purpose of the kidneys, namely, the preservation of balance for water and solutes. As investigators, we have a tendency to become so fascinated with the phenomena that we are studying that we tend to describe them in isolation. While such tunnel vision may be acceptable in the research setting, it is not helpful for the beginning student. We cannot, for example, expect the beginner to be as fascinated by the tremendous rate of renal blood flow and glomerular filtration rate, or by the autoregulation of these two variables, as we are as serious students of the kidney. But when we show how these phenomena evolved to subserve the important function of salt and water balance, they become at once more understandable and more interesting to the beginning student. Or, to take another example, the heterogeneity of nephrons, their crazy countercurrent configuration, the fact that a distal tubule is always apposed to its own glomerulus at the juxtaglomerular apparatus, the relatively low rate of blood flow to the inner medulla -- all these are likely to be meaningless facts to the beginning student, whereas they become enthralling the moment that we describe them as part of an overall design for the maintenance of salt and water balance.

There is, of course, another way in which we can enliven our subject, and that is to put the kidney in the context of world history. Homer Smith managed to do this in numerous lectures, and I would like to quote from one of these, "De Urina," which he delivered to the Kaiser Foundation Hospitals in California in 1957 (6). Smith tells of the efforts of the Confederates during the Civil War to extract nitrate from urine and convert it to gunpowder. An agent in Selma, Alabama, John Harrolson, advertised in the newspaper:

> The ladies of Selma are respectfully requested to preserve the chamber lye collected about the premises for the purpose of making nitre. A barrel will be sent around daily to collect it.
>
> John Harrolson
> Agent Nitre Mining Bureau

To which a Confederate soldier replied:

> John Harrolson! John Harrolson! You are a wretched creature. You've added to this bloody war a new and awful feature. You'd have us think while every man is bound to be a fighter. The ladies, bless the dears, should save their P for nitre.
>
> John Harrolson! John Harrolson! Where did you get the notion To send your barrel 'round the town to gather up the lotion? We thought the girls had work enough making shirts and kissing, But you have put the pretty dears to patriotic pissing.
>
> John Harrolson! John Harrolson! Do pray invent a neater And somewhat more modest mode of making your saltpetre; For 'tis an awful idea, John, gun-powdery and cranky, That when a lady lifts her shift she's killing off a Yankee.

Everything Checked by Experts

Nowadays, it is unusual for one person to write an entire textbook in a scientific field. Recognizing my own compulsive nature -- knowing, in other words, that I would be thoroughly editing and practically rewriting the contributions of others -- I made the decision early on to write the books myself. That posed the problem that it is virtually impossible for a single person to be fully up-to-date even in a relatively restricted field like the kidney. I solved this problem by selfishly calling on my friends and colleagues. Every chapter was checked by one or two persons who are expert in the topic of that chapter, and their suggestions and corrections were incorporated into the final version. I remain grateful for this help, which was invariably asked of very busy people.

Interestingly, very few authors follow this practice. I find that difficult to understand, for it is this final step that assures accuracy. I suspect that there are several reasons for their failure to do so: reticence to impose on others (of which I apparently have not been guilty); the reluctance to rewrite after so much effort and time has gone into preparing the original draft of a chapter; the eagerness to get the book out, since all of us are invariably behind schedule; and finally, the fact that most of us write only single chapters, which presumably deal with the area of our particular expert knowledge.

Willingness to Take Time

Writing a good book or giving a good lecture takes an enormous amount of time -- and usually, the more concise the style, the greater the effort to achieve it. It is well known that for many good writers whose prose flows smoothly, the process is an arduous struggle. Articulate expression, made off the cuff, is a rarity; more often than not, seeming spontaneity is the result of meticulous planning. In my own case, the precision of style results in large part from constant consulting of dictionaries and books of synonyms.

No single chore of producing my books was as onerous for me as having to prepare the indexes. Although a professional indexer prepared the initial draft, I checked every entry and usually added to it, especially with cross-references. Completing the index is necessarily the final step in the production of a book, for it can be undertaken only after the page-proofs have been prepared. At that point, having gone through the stages of copy-editing, galley proofs, and page-proofs, the author can hardly face a further delay and the boring task of checking every entry. Yet, a useful index is an essential part of a good texbook. In the fall of 1978, as I marshaled all the willpower at my command to complete the index for RENAL DYSFUNCTION, I was encouraged to learn that I had had a kindred spirit in no less a figure than Sir William Osler. Harvey Cushing, in his two-volume work on the life of Osler, quotes Osler's description of how his famous textbook was written. Of part of the process, Osler says (1): "In January [1892] I made out the index, and in the entire work nothing so wearied me as the verifying of every reference."

I dwell on the willingness to take the time to do a job properly because I think it is the opposite trait -- the unwillingness to do so -- that lies at the basis of so much poor teaching in our medical schools. The quality of many of our teaching exercises is appalling, especially when one considers the high tuition that students must pay: the disorganization and lack of timing, the lack of continuity among lectures in the same course, the amount of duplication. And most of these shortcomings, I am convinced, result not from want of ability but *from a disinclination* to do the requisite amount of homework, to take the time to prepare, to coordinate, to rehearse.

TECHNICAL FEATURES

Thus far, I have discussed major principles that guided the writing of my books. I would now like to list a few technical details that, in my opinion, add to the efficacy of a textbook for beginners.

Simple picture first. It helps to present complicated concepts first in a simplified form. The renal countercurrent system is an example. One can explain the essence of the mechanism by referring only to the transport of NaCl and water in a single type of nephron, showing how the corticopapillary interstitial gradient is built up and how fluid in the collecting duct is rendered hypertonic to plasma through passive diffusion of water in response to that gradient. Having established this basic operation, one can then build on the simplified model by adding the role of urea, the passive model for countercurrent multiplication in the inner medulla, countercurrent exchange in the vasa recta, and the possible functional role of heterogeneity of nephrons.

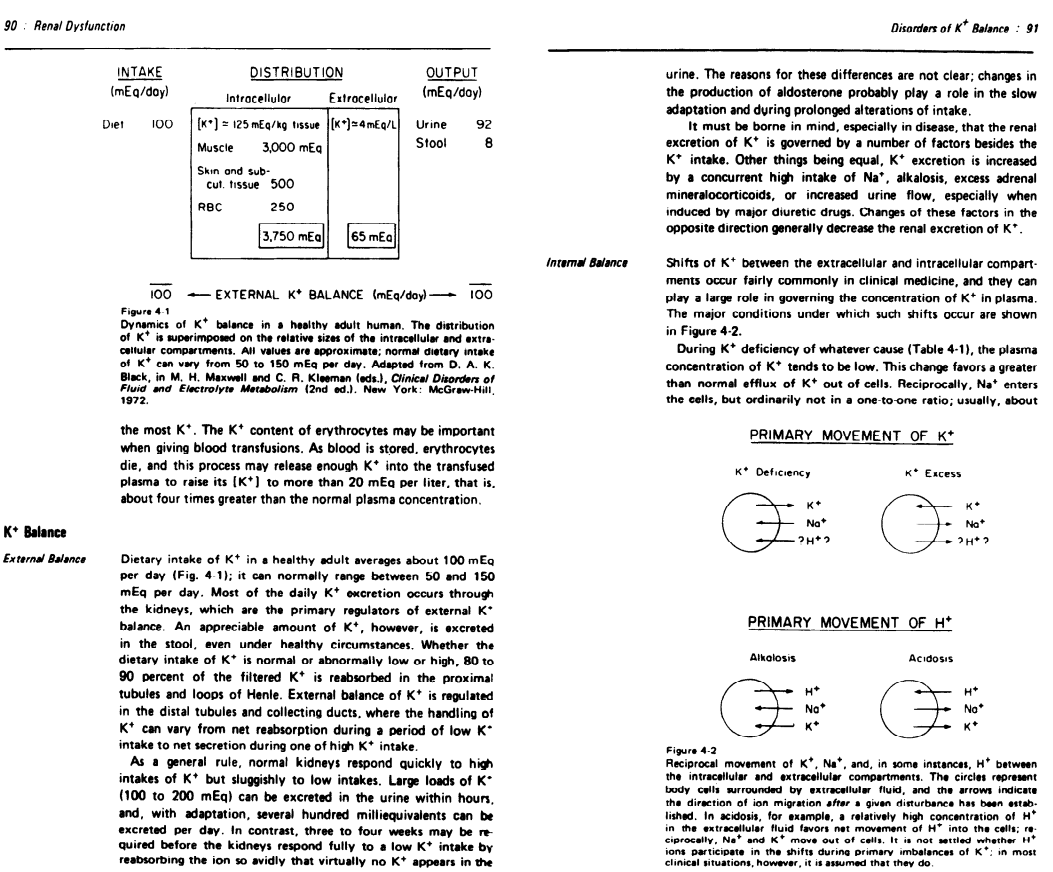
Specify the seeming obvious. Some points that are obvious to us are not self-evident to the beginner, and it can save the student much time and grief if we spell them out. Two examples will suffice. Many students will struggle to explain the rate of glomerular filtration through the equation, $\dot{Q} = \frac{\Delta P}{R}$, not realizing that that relationship describes axial flow, not transmural flow. Much confusion can be saved by pointing out in so many words that transmural flow is determined by the filtration coefficient, K_f, and the balance of Starling forces: $\dot{q} = K_f [(P_c - P_t) - \pi_p - \pi_t)]$. It is also often not self-evident to the beginner that the proton of carbonic acid cannot be buffered by bicarbonate. Again, hours of fruitless struggle can be saved by illustrating this fact through the equation:

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$
$$\Big\| \; Buf^-$$
$$HBuf$$

Once the relationships are seen in this form, and explained, it becomes obvious that the reaction in the first line cannot proceed simultaneously from right to left as well as from left to right.

No reference citations. Documentation of every assertion is not only not important for the beginning student but it tends to be distracting. Therefore, I choose not to cite references in the text. One must reconcile this decision with our desire to encourage the student whose curiosity is aroused and who wishes to read further. That is the reason for selected references at the end of each chapter; since specific works are not cited in the text, a student can choose the correct references with the help of an instructor.

No footnotes. I have resisted the temptation to use footnotes or to assign greater or lesser importance to certain parts of the text through use of different type. The reason for this decision is that if a given fact is deemed important enough for inclusion in a basic textbook, then presumably it deserves full billing. I don't mean to say that each fact is equally important. But I prefer to emphasize points through clear headings and subheadings (Fig. 1) rather than to imply through footnotes or small type that some sections need not be read.



90 : Renal Dysfunction

Figure 4-1
Dynamics of K^+ balance in a healthy adult human. The distribution of K^+ is superimposed on the relative sizes of the intracellular and extracellular compartments. All values are approximate; normal dietary intake of K^+ can vary from 50 to 150 mEq per day. Adapted from D. A. K. Black, in M. H. Maxwell and C. R. Kleeman (eds.), *Clinical Disorders of Fluid and Electrolyte Metabolism* (2nd ed.). New York: McGraw-Hill, 1972.

the most K^+. The K^+ content of erythrocytes may be important when giving blood transfusions. As blood is stored, erythrocytes die, and this process may release enough K^+ into the transfused plasma to raise its $[K^+]$ to more than 20 mEq per liter, that is, about four times greater than the normal plasma concentration.

K^+ Balance

External Balance

Dietary intake of K^+ in a healthy adult averages about 100 mEq per day (Fig. 4-1); it can normally range between 50 and 150 mEq per day. Most of the daily K^+ excretion occurs through the kidneys, which are the primary regulators of external K^+ balance. An appreciable amount of K^+, however, is excreted in the stool, even under healthy circumstances. Whether the dietary intake of K^+ is normal or abnormally low or high, 80 to 90 percent of the filtered K^+ is reabsorbed in the proximal tubules and loops of Henle. External balance of K^+ is regulated in the distal tubules and collecting ducts, where the handling of K^+ can vary from net reabsorption during a period of low K^+ intake to net secretion during one of high K^+ intake.

As a general rule, normal kidneys respond quickly to high intakes of K^+ but sluggishly to low intakes. Large loads of K^+ (100 to 200 mEq) can be excreted in the urine within hours, and, with adaptation, several hundred milliequivalents can be excreted per day. In contrast, three to four weeks may be required before the kidneys respond fully to a low K^+ intake by reabsorbing the ion so avidly that virtually no K^+ appears in the

Disorders of K^+ Balance : 91

urine. The reasons for these differences are not clear; changes in the production of aldosterone probably play a role in the slow adaptation and during prolonged alterations of intake.

It must be borne in mind, especially in disease, that the renal excretion of K^+ is governed by a number of factors besides the K^+ intake. Other things being equal, K^+ excretion is increased by a concurrent high intake of Na^+, alkalosis, excess adrenal mineralocorticoids, or increased urine flow, especially when induced by major diuretic drugs. Changes of these factors in the opposite direction generally decrease the renal excretion of K^+.

Internal Balance

Shifts of K^+ between the extracellular and intracellular compartments occur fairly commonly in clinical medicine, and they can play a large role in governing the concentration of K^+ in plasma. The major conditions under which such shifts occur are shown in Figure 4-2.

During K^+ deficiency of whatever cause (Table 4-1), the plasma concentration of K^+ tends to be low. This change favors a greater than normal efflux of K^+ out of cells. Reciprocally, Na^+ enters the cells, but ordinarily not in a one-to-one ratio; usually, about

Figure 4-2
Reciprocal movement of K^+, Na^+, and, in some instances, H^+ between the intracellular and extracellular compartments. The circles represent body cells surrounded by extracellular fluid, and the arrows indicate the direction of ion migration *after* a given disturbance has been established. In acidosis, for example, a relatively high concentration of H^+ in the extracellular fluid favors net movement of H^+ into the cells; reciprocally, Na^+ and K^+ move out of cells. It is not settled whether H^+ ions participate in the shifts during primary imbalances of K^+; in most clinical situations, however, it is assumed that they do.

Fig. 1. Two consectuve pages from: H. Valtin. *Renal Dysfunction. Mechanisms Involved in Fluid and Solute Imbalance.* Boston: Little, Brown, 1979.

Many illustrations, designed specifically for the book. It is important for a student to gain a sense of progress as he or she is reading the book. Relatively short pages, studded liberally with illustrations (Fig. 1) can provide a psychological boost merely by allowing frequent turning of pages. Furthermore, I deem it important to redraw graphs especially for the book, not only to give the work a pleasing appearance of uniformity, but more so to make illustrations readily comprehensible to the beginner (Fig. 2). While the meaning of a clearance ratio is reflexly comprehensible to a renal physiologist, it is not so to the beginning student. We can clarify the message of a graph through simple translation: from "fractional clearance" to "relative filterability"; from "DEAE" to "polycationic dextran"; from "dextran sulfate" to "polyanionic dextran." At the same time, by reproducing the formula and the original points, we can preserve the scientific authenticity of the data. It is by supplying the translation that we prevent the student, tired and reading late at night, from becoming frustrated with our cherished jargon.

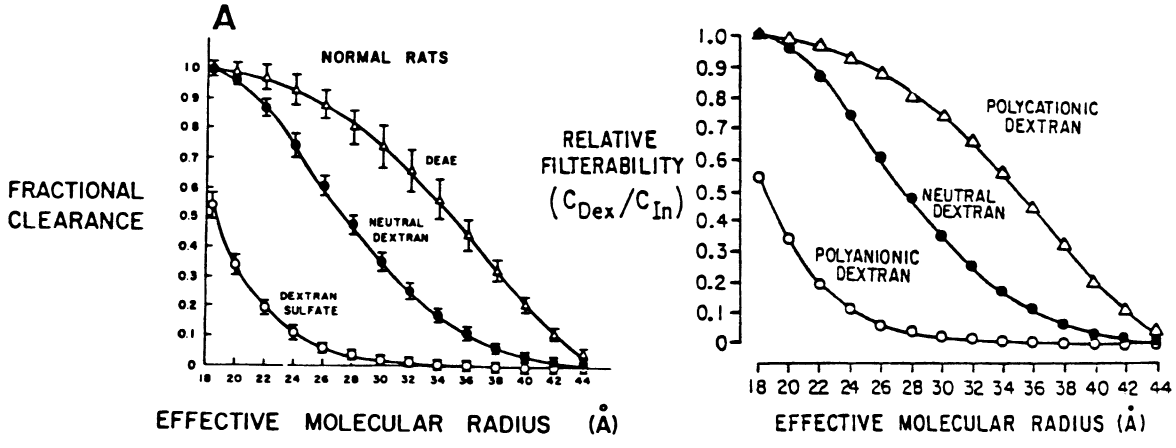


Fig. 2. Adaptation of a published research communication (on the left; from Bohrer, M.P. et al. *J. Clin. Invest.* 61:72, 1978) for an illustration designed specifically for a textbook (Valtin H. *Renal Function. Mechanisms Preserving Fluid and Solute Balance in Health,* 2nd ed. Boston: Little, Brown, in preparation).

Problems and answers. One way of clarifying the material is to have the student work through problems. The reasoning that leads to the solution of a problem can often explain important principles. That is why I consider it important to provide not only the answer to the problem but also a detailed exposition of how the answer was derived.

In our department at Dartmouth, we are always experimenting with new forms of teaching -- only in part, I fear, for the benefit of students; in good part, to keep ourselves from getting stale. One form of teaching that we use frequently is problems that emphasize the integrative nature of physiological responses. One year the final examination took the form of 'stem' situations, each of which gave rise to questions that pertain to the major subdivisions of physiology that we cover. A typical stem would be: "A passenger in an airplane at 29,000 feet is suddenly subjected, owing to failure of the cabin pressurizing equipment, to a degree of hypoxia that provokes a generalized sympathetic discharge"; and that stem would then be followed by several questions about the cardiovascular, respiratory, endocrine, neural, and renal consequences of the environmental perturbation. Those of us who teach renal physiology spent hours trying to devise appropriate and meaningful questions for various stems. At the end of an exhausting afternoon, we still needed a renal question to the stem, "A subject who has been lying supine on a tilt table for several hours is suddenly tipped to the standing position." Finally, in desperation, we gave up and posed the following question: "At that very moment [when the tilt table was upended] the subject's sister began to eat two pounds of pretzels. One hour later..."

Summaries. It helps the reader -- any reader, not just the beginner -- to be provided with a summary of what has been said. If that summary is to serve its purpose, it must be written in words that are largely different from those used in the body of the text. Mere repetition is unlikely to clarify, but a restatement might.

And thus, to follow my own admonition, let me summarize what I have said. If there is a common thread in the ingredients of good teaching and the writing of good textbooks, it is to care enough and to have the imagination to put ourselves in the place of the student. Once we can perceive the student's difficulties and frustration, it becomes easy to devise means that aid the process of learning.

REWARDS

The tremendous effort that goes into producing a good book has its compensations, both tangible and intangible. With luck, the royalties can put one's children through college. One pleasure is to dedicate the book. I am reminded of the inscription in one volume on vertebrate physiology: "To all the cold-blooded fishes in the sea and my wife." Not the least of the benefits is what one learns. All of us who have taught know that "teaching is the best teacher." It is a truism that one must thoroughly understand a complicated idea in order to describe it clearly; I confess to only now fully understanding a number of concepts that I had taught authoritatively -- and correctly -- for years. Finally, there is the gratification of receiving the approbation of students, especially when it is tendered with a sense of humor. A few months ago, our second-year students included a mock 'stem-exam' with a critique of our course. One stem read: "A woman gives birth under water and later admits that the child was conceived at high altitude." Another question went as follows: "What is the major effect of transplanting the loop of Henle from a desert rodent into a water buffalo?" The multiple-choice answers: (a) the water buffalo will urinate rat piss; (b) the desert rat will die; (c) the water buffalo will migrate to the desert; (d) all, none, or some of

the above. The questionnaire ended with a request, unbeknown to me, for a new slogan to be put on the back cover of my book. Among several clever suggestions, my favorite was one that will have familiar ring to those among you who like to watch sports on T.V:"Urine Good Hands With Valtin."

I thank you for listening.

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HARWOOD S. BELDING AWARD IN ENVIRONMENTAL PHYSIOLOGY

The Environmental, Thermal and Exercise Physiology Section of the American Physiological Society will again present the annual Belding Award for outstanding research in environmental physiology by a graduate student at the Temperature Regulation Dinner during FASEB week. The Award includes a prize of $200.00. To be eligible for the Award, the graduate student must have presented or will present the paper at the 1980 Fall or 1981 Spring meeting and must be the first author on the published abstract. Either a typewritten copy of the presentation or a manuscript related to the research should be submitted by March 15 to:

Dr. E. R. Nadel
John B. Pierce Foundation Laboratory
290 Congress Avenue
New Haven, Connecticut 06519

The Award committee will notify all applicants of its decision by April 5.

BOOK REVIEWS

Applied Physiological Mechanics. Dhanjoo N. Ghista, Ed. Harwood Academic Publ., New York, 1980. 901 pp. illus., index, $117.50.

The aim of Applied Physiological Mechanisms is "to elucidate selected physiological phenomena and mechanisms, by invoking appropriate rigor in the pertinent discipline of applied mechanics (such as elasticity, fluid mechanics, vibration theory)." Translated freely, this means that selected physiological systems have been subjected to modeling and mathematical analysis. The book is the first of a series and consists of five physiologically based divisions: bioenergetics and biomaterials, skeletal mechanics, cardiopulmonary mechanics, urological mechanics and mechanics of the ocular and vestibular systems. Each section is written by different contributors and contains an abstract, multiple chapters, references, glossary, and an appendix. Some sections are single-author presentations; others represent the contributions of multiple authors; in all, there are 28 contributors. The material is directed toward senior undergraduates to first-year graduates with a knowledge of mechanics. If the book is used as a text in physiology, the editor states that, "the instructor would (in some cases) need to provide a brief coverage of the mechanics foundations of the concerned analysis employed in that chapter." Therefore to benefit from the material an entering knowledge of mechanical and hydraulic systems is advantageous.

Section 1, Biomechanics and Bioenergetics deals with a variety of chemical and physical aspects of living tissue. There is detailed coverage of energy transformation, starting with the sun, progressing through photosynthesis and metabolism, and ending with the energy requirements for cellular and system communication. Very extensive coverage is devoted to the mechanical properties of brain, muscle, tendon, ligament, and blood vessels. Stress-strain tensor analysis is presented and viscoelastic models with linear and nonlinear components are described. A considerable amount of experimentally derived data are listed along with the theoretical models. The section concludes with a thorough discussion of heat and mass transfer through the skin.

Section 2. Skeletal Mechanics opens with the presentation of a two-component, porous-solid model with perfusion (representing blood flow) which simulates bone remodeling (healing). It is known that stress and/or strain alter bone remodeling and the history of this concept is presented. Many equations are derived for the model which is still under development. The section continues with presentations of the history and origin of the piezo (pressure) electric phenomenon in response to bone loading. The various theories are discussed and a model is presented. The importance of load-induced piezoelectricity in bone remodeling is discussed. The lubrication of normal and arthritic joints is then considered. Joints are classified into synovial, cartilaginous and fibrous types and their properties are presented. Joint loading, range of motion and aging effects are covered.

Section 3. Cardiopulmonary Mechanics deals with the mechanical properties of the mitral valve and their relation to the frequency spectrum of the first heart sound, vascular elasticity and models of the aorta, and mechanical properties of the lung, including gas exchange. The concepts of stress and strain, strain-relaxation, compliance, Poisson's ratio and Young's modulus are covered. Pulse-wave velocity and its significance are discussed, along with the effect of age and drugs on aortic elasticity. The mechanical properties of the lung are described, along with pressure-volume relationships and the quantities that effect it are

well covered. Stress-strain relationships in the lung are discussed, along with lung testing through simple pulmonary function measurements. Air flow is modeled and the mechanics of carbon dioxide and oxygen transport are described.

Section 4. Uterine and Urological Mechanisms has as its objective the presentation of discussions of the anatomy and physiology of the systems covered. In general, the two organs, uterus and kidney (including ureter) are covered well. Uterine activity (mechanical and electrical) is treated in a detailed manner with the active and passive properties well outlined. Uterine physiological and mechanical changes during pregnancy are clearly described, along with pressures developed during labor. The anatomy of the kidney and its functional unit, the nephron, are presented and illustrated. The function of each part is discussed. The regulation of renal blood flow, body fluid balance and the three mechanisms of kidney function are explained well. A short discussion of urine transport along the ureter concludes this action. Three theories for peristaltic transport (cystoid, suction-pump, and active relaxation) are presented. A mechanical model for the ureter is developed and transport equations are given.

Section 5. Ocular and Vestibular Mechanics deals with various aspects of intraocular pressure, eye blood supply and vestibular integration of eye motion. The fluid dynamics of intraocular pressure regulation are modeled and the underlying hypothesis presented. The functional anatomy of the eye is covered in detail. The importance of elasticity in tonometry is analyzed well and a thorough engineering treatment is presented. The ophthalmodynamometric techniques to measure blood pressure in the retinal vessels are presented clearly. The vestibulo-ocular reflex is covered extensively. A model is created to predict its behavior and experimental data obtained from rotary-nystagmus tests fit the model very well. As yet the model has experienced only limited application clinically. Computer processing of the electronystagmogram is described.

Applied Physiological Mechanics contains a considerable amount of material that physiologists do not ordinarily encounter. These days, faculty in biomedical engineering programs are always eager to identify challenging areas for the application of engineering theory; the life sciences provide a fertile field for such endeavors. The results of these efforts turn up in theses, dissertations and journals not ordinarily seen by life scientists. This book provides the physiologist with a view of such engineering analysis applied selected areas of the life sciences. However, to profit from the contents of this book, a familiarity with differential equations is beneficial, for the laws of nature are written in differential equations.

To review such a large book adequately invites writing another book; but this is not appropriate. Suffice it to state that in the areas presented, there is a wealth of information, including references and appendices, that will be of lasting value. The anatomy and physiology of each topic are quite well covered. The individual chapters have abstracts that will assist the reader in identifying what is to come. The organization of the chapters is similar and the editor is to be complimented for achieving this feat, in view of the large number of contributors. The weakest part of the book is its index.

Taken as a whole, Applied Physiological Mechanics will be a useful reference book. In the areas it covers, it is up to date and will be of value to physiologists as well as biomedical engineers.

L.A. Geddes, Ph.D.
Purdue University

Current Topics in Eye Research. Vol. 3 J.A. Zadunaisky and H. Davson, Eds. Academic Press, New York, 1980. 336 pp., illus., index, $35.00.

This book provides an excellent multi-disciplinary review of up-to-date information on electrophysiological, biochemical, vascular, immunologica, and cell biology research on the retina, pigment epithelium, and optic nerve.

In the first chapter, Paul Witkovski provides an easily readable, up to date summary on the mechanisms of photoreceptors, including retinal excitation, electrophysiologic events, biochemical events, and the interrelationship between the various retinal cells during central transfer of the visual impulse. The references at the end of this section are particularly valuable for the research interested in the basic physiology of the visual impulse.

In the second chapter, Richard Lolley discusses cyclic nucleotides, a recently discovered group of chemicals normally present in the sensory retina. The literature of the past six years is reviewed, in addition to a detailed discussion about chemical pathways for this group of chemicals. He also emphasized the important point that at least some inherited disorders that cause visual degeneration and blindness in animals, and perhaps in humans, may relate to abnormailites in this system. This, therefore, represents an area where understanding the chemistry of the tissue may eventually provide better treatment of the disease.

Lynette Feeney-Burns provides a comprehensive review of the anatomy and ultrastructure of the retinal pigment epithelium, particularly in relation to origin and embryology of the melanin pigment. The pathways of melanin systhesis are reviewed, the sequence of organelle assembly is discussed, and the functions of melanin, in both normal and abnormal states are reviewed. The second portion of this chapter is a comprehensive discussion of lipofuscin, a substance which accumulates in high concentration in the retinal pigment epithelium due to the highly phagolysomal functions of the cells. She emphasizes that these two pigment epithelial pigments have different origins, chemical compositions, and metabolic pathways.

J. Terry Ernest summarizes the physiology of the vasculature of the distal segment of the optic nerve and choroid. The complex interrelationship of the retinal circulation and the posterior ciliary circulation is reviewed from the anatomic and physiologic viewpoint. The contraversies regarding the exact nature of the complex blood supply to this region is reviewed. Of particular interest is his update on the clinical and experimental information relating the blood-retinal-barrier.

Jean-Pierre Faure provides a very complex update on autoimmunity in the retina. Much of the first half of the chapter summarizes presently known experimental evidence regarding immune mechanisms and antibody localization. The second portion of the chapter correlates the role of uveal-retinal auto-immunity in several human ocular diesases, including sympathetic ophthamia and other forms of uveitis. Several specific clinically useful immunologic tests are described and reviewed. Little is mentioned regarding the role of immunology in ocular tumors; there is a brief discussion of retinoblastoma, but the reader is referred elsewhere for the details regarding tumor immunology.

In summary, this book provides an excellent, easily readable, multidisciplinary overview, with emphasis on five different fields of retinal research. It provides the most concise yet comprehensive overview in its field and is highly recommended to those interested in basic vision research.

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Membrane Physiology. T.E. Andreoli, J.F. Hoffman, and D.D. Fanestil, Eds. Plenum Press, New York, 1978, 1980. 468 pp., illus., index, $19.95.

This soft-cover book contains selected chapters from an earlier (1978) hard-cover edition called Physiology of Membrane Disorders. The short version is subdivided into three major topics: the anatomy and molecular nature of membranes; methods used in elucidating the nature and function of membranes; and problems pursued by researchers studying membrane phenomena. An introductory section provides a thorough review of the anatomy of membranes and their lipoprotein structure is explored from an anatomical vantage with regard to specialized membranes such as the nerve myelin sheath and retinal rods. Motion of lipid molecules within membranes is expertly described as intramolecular rotation, segmental motions, polar headgroup motions, and whole molecule motions of the rotational and translational types; however, a familiarity with NMR techniques, electron spin resonance probes and Raman spectroscopy would greatly enhance the reader's appreciation of this subject. A chapter on the structure and arrangement of membrane proteins illustrates clearly the different categories of these molecules, and especially describes the biophysics of proteins involved in membrane transport phenomena. Of course, excursions into the biology of membranes requires sophisticated techniques, and this text includes a lengthy chapter devoted to the methodologies of the electron microscopist. Another extensive technical chapter schools the reader in the current state-of-the-art of optical methods (UV absorption, circular dichroism and optical rotatory dispersion) used to study biomembranes. And, for those readers who are perplexed at times by the mathematics governing membrane activity, there is a chapter leading the reader from Fick's Laws through the biomathematics of osmosis, electrogenic pumps, and facilitated diffusion. Cell biologists are familiar with the importance of tracers in the study of membrane processes and a chapter devoted to this topic defines isotope effects, the importance of reaction rates, compartmentalization, and the measurement of initial and net fluxes. The movements of ions and their relationship to the electrical properties of membranes are described, as are lipid bilayers as membrane models. Juxtaposed to charged-ion movement is a section on the transport of electrically neutral ions or ion pairs, which is followed by a chapter on sodium and potassium transport in red blood cells which defines once again the rudiments of the ion pump. A chapter on ion-coupled transport condenses the biology of sodium and hydrogen-coupled transport processes, and the ion gradient hypothesis into an easily read and useful reference explaining the stoichiometry and transmembrane electrical potential differences influencing these processes. The coupling of ion transport to metabolism is thoroughly treated in a separate chapter. Later chapters discuss the role of sodium ions in determining cell volume, and the importance of calcium in regulating channel permeability during intercellular communication. Several important chapters are devoted to membrane specific functions including their reactivity with immune system, their interaction with hormones, and their modification by drugs. Thus, the editors have brought together a wealth of knowledge concerning the techniques and background information governing cell research today.

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Biomembranes: Fundamentals in Relation to Human Biology. James S. Beck. Hemisphere Publ. Corp., Washington, D.C., 1980. 172 pp., illus., index, $19.95.

Biomembranes is a concise overview of membrane morphology and function. The author has undertaken the difficult task of introducing a broad subject area to the reader who will, hopefully, gain an appreciation for the state-of-the-art of cell research. The first chapter presents the general properties of membranes from their basic structural components to their complex biophysical interactions as studied in monolayer systems. For the student, the detailed artificial physical models used to illustrate the unique characteristics of membrane lipids may be difficult to appreciate without a modicum of biological sophistication. On the other hand, the description of membrane morphology is well within the conceptualization of most readers. Evidence elucidating the protein structure of membranes is well presented, and the author succeeds at introducing the reader to numerous methodologies and their contribution to the development of current theories of membrane architecture. Building upon the basic structure of membranes, the reader is introduced to transport phenomena -diffusion, osmosis, component-reactive transport, flow-coupled transport. In this chapter, as well as in certain other sections of the book, the reader is at times subject to a steeplechase presentation of simplistic imaging coupled to sophisticated biophysical discussions. A later chapter deals with cell compartmentation and presents several hypothetical models of the topological characteristics of membrane-bound enzymes; however, the chapter is built upon a major description of proton transport in mitochondrial membranes. The chapter on membrane biogenesis is well written and is a good summary of our current knowledge in the areas of membrane turnover and synthesis. A timely and informative discussion of mitosis and lectin-induced agglutination highlights the chapters surveying membrane fission and fusion and intercellular relations. One of the main strengths of this text lies in the author's consistent interest in the surface components of membranes and their roles in cell maintenance, growth, and receptivity to stimuli. It is an important thread guiding the reader through diverse discussions of biophysical and biochemical phenomena.

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Physiology. I.I. Shahied. Vantage Press, New York, 1980. 440 pp., illus., refs., $12.50.

This text was designed to fill a void between the traditional physiology tome and the all-too-superficial physiology reviews. The customary subject areas are covered in a simple, almost stark, but readable style. The book progresses from a general chapter describing membrane potentials and conduction in nerves through the physiology of muscles, gastrointestinal function, liver function, respiration, the renal system and acid-base balance, cardiovascular elements, the nervous system, a large section on endocrines, metabolism, and temperature regulation. It must be noted that there is no index for this rather lengthy text. Numerous diagrams presented throughout the text are helpful in summarizing basic concepts. While most sections contain accurate and current material, the section describing action potentials in the heart should have included the role of calcium conduc-

tance in cardiac electrical activity. Generally speaking, the author has succeeded at his attempt to provide a comprehensive review of the subject matter of physiology. However, the text would not be appropriate as a primary source for introducing students to this important and complex discipline. Occassionally, the superficiality of the discussions require that the reader have had prior exposure to the subject in order to appreciate certain sections of the text.

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Renal Prostaglandins, Vol. 1. James B. Lee, Ed. Eden Press Inc., Montreal, 1977. 238 pp., illus., index, $24.00.

Renal Prostaglandins is a review of the role of prostaglandins in renal physiology. The text is multi-authored, however, the chapter subjects have been well selected and in the review retain congruence. An historic overview adequately summarizes the identification of prostaglandins, and identifies the major problem to be explored in other chapters - research and identification of vasodepressor elements contributing to renal antihypertensive endocrine function. A chapter describing the various specialized methodologies used in prostaglandin research has been included, and it offers some interesting expertise for the researcher. For those readers unfamiliar with the kidney components central to its antihypertensive activity, an excellent review of the morphology and physiology of the renomedullary interstitial cell system is offered. Morphological correlations of lipid droplets in these cells with prostaglandin levels is interesting and well presented. The clearly documented involvement of prostaglandins in Barrter's Syndrome can be appreciated by researcher and clinician alike, as it is presented in several different sections of the text. An expert and up-to-date review of prostaglandin biosynthesis and metabolism in the kidney has been included, and the chapter melds biochemistry to the further elucidation of the role of prostaglandins as antihypertensive agents. A brief chapter describing the effects of prostaglandins on renal blood flow is somewhat overshadowed by the chapter which develops the evidence garnered by classical research protocol into a thesis of the involvement of prostaglandins in renal sodium exchange. A later chapter relates prostaglandin actions to changes in urine volume. An excellent review is presented of the involvement of prostaglandins in blood pressure regulation. The circulatory effects of exogenous prostaglandin administration, inhibition of prostaglandin synthesis, and stimulation of endogenous prostaglandin synthesis, are described in detail for both normotensive and hypertensive animals. The relationship between prostaglandins and the cardiovascular-renal-adrenal effects of volume depletion is important and thoroughly described in two chapters of the text. Thus, this review provides the reader with a thorough portrayal of the role of prostaglandins in the dynamic cardiovascular-renal system.

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Foundations of Physiological Instrumentation. N.N. Goldstein and M.J. Free. Charles C. Thomas, Springfield, IL, 1979. 384 pp., illus., index, $39.50.

Foundations of Physiological Instrumentation, by Goldstein and Free was written for students, teachers, clinicians and researchers and decribes the way physiological instruments frunction. The presentation emphasizes functions and minimizes mathematics.

The book is divided into two parts: Fundamentals of instrumentation and Experiments. An extensive bibliography describes the literature on instrumentation laboratory manuals, anesthesia for small animals and includes a wealth of practical data and discusses home-made instruments.

Part 1: Fundamentals discusses transduction, calibration, errors, noise, and harmonic frequency spectra for physiological signals. Recording systems are analyzed and one chapter discusses electrical safety.

Part 2: Laboratory Experiments, outlines ion-exchange experiments, the frog sciatic nerve preparation and nitella studies. A few experiments have been composed using human subjects; these cover ECG, phonocardiography, and plethysmography. The white rat is used in several experiments on blood pressure, flow, volume, respiration and neuromuscular activity. In this section there is a good treatment of blood pressure recording equipment.

The Appendix describes the contents of many books and presents a short critique on each. Anesthesia, intubation and catheterization are well covered.

This interesting and useful book was written by two biologists who desire to make physiological instrumentation easily understood. The treatment of the measuring process is well done. It is obvious that the authors are experienced in the measurement of physiological events. The book contains a storehouse of practical and useful information. There is perhaps a little too much jargon, but this perhaps is the necessary language in the field.

All in all, the book will be very useful to those who, for the first time, are faced with the measurement of physiologic events.

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Physiotherapy Assessment. Anne Parry.
Springer Publ. Co., New York 1980, 96 pp., illus., index, $6.95.

Physiotherapists, both studients and qualified, will find this short manual of interest, since it provides concise guidelines to the examination of patients as a basis to determine the aims and appropriate methods of physical treatment. After an introduction dealing with history-taking, the the patient's psychological background and social environment, a short chapter is devoted to the respiratory system. Assessment of the nervous and the musculo-skeletal systems are described in greater detail, with particular emphasis on critical joint ranges for functional activity. A final chapter provides check-lists for the examination of various categories of patients.

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Handling the Handicapped. A Guide to the Lifting and Movement of Disabled People. 2nd Ed.

The Chartered Society of Physiotherapy. Springer Publ. Co., New York 1980, 138 pp., illus., index, $6.25.

This booklet, which provides a practical description of methods recommended for lifting or moving handicapped persons and of techniques used by the disabled to move himself with or without aid might prove of interest to all those who have to work or live with invalids such as nurses, physiotherapists, relatives, as well as to the invalids themselves. Special chapters deal with handling in the swimming pool area and with mounting and dismounting for the disabled rider. Most techniques are illustrated by photographs (in certain instances, sketches might have been clearer). Since the book has been written in England and is primarily intended for British readers, all technical devices (hoists, beds, wheelchairs) described are British-made; similarly, a list of useful addresses is provided, but refers only to organisations in England.

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ALBERTUS MAGNUS

Albert von Bollstadt, called Albertus Magnus (1193-1280) a famous naturalist of the 13th centry.

A Dominican monk, he taught at Paris and Cologne and published a number of books, being known as the Aristotle of the period. His philosophical works, running to twenty one volumes, were arranged in the Aristotelian manner. His knowledge of physical science was exceedingly good considering the period in which he lived. His writings did not include any medical works, probably because of his religious connections, although his writings included observations on anatomy and physiology (De animalibus, De anima, De sensu et sensato, De sonno et vigilia).