

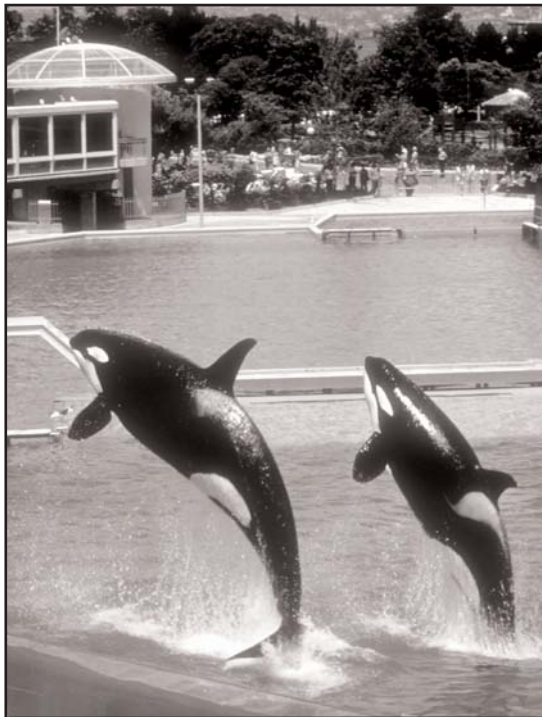
The Physiologist



A Publication of The American Physiological Society
Integrating the Life Sciences from Molecule to Organism

Volume 45, Number 4
August 2002

The Power of Comparative Physiology: Evolution, Integration, and Application



San Diego, California
August 24-28, 2002





THE Physiologist

Volume 45, Number 4

August 2002

The Status of Physiologists and Physiology at US Medical Schools

Martin Frank and Marsha Lakes Matyas

The status of physiology in academic medical schools has been a concern of the American Physiological Society for over 50 years, starting in 1945 with a study chaired by E. F. Adolph (1) and followed in 1958 by a study chaired by R. W. Gerard (11). The APS has undertaken similar studies in the last two decades as part of its efforts to define the future of the Society and the discipline. The most compelling was the study developed by the Long Range Planning Committee chaired by Ernst Knobil and published by the Society in 1990 (10). It explored the status of the science of physiology, departments of physiology, and the American Physiological Society. The recommendations made in the "White Paper" ultimately contributed to the development of the Society's 1992 Strategic Plan (16) that helped shape the current APS.

In 1996, the Society published another Long Range Planning Committee Report that was chaired by Shu Chien (8). As in the 1990 report, the Chien report made a series of recommendations related to physiology as a discipline, physiology education, physiological research, departments of physiology, and the role of the APS. The observations and issues raised in the Chien report served as the basis for the Society's development of a new Strategic Plan in 2000 (5). In subsequent years, the incoming APS Presidents revisited these reports to comment on the status of the Society and the discipline (9, 12, 13). Through these reports and subsequent discussions, a number of questions have been raised about the status of physiology in academic medicine in four key areas.

Role of physiology in the medical curriculum. Concerns have been raised that physiology is being de-emphasized in the medical curriculum, with potentially critical consequences for both medical students and the larger physiology teaching and research communities. Is the perceived de-emphasis real? If so, what is its impact on the preparation of medical students in terms of coverage of key concepts and of skills development? What is its impact on the structure of the medical school faculty and on the depth of knowledge available to guide future course development and implementation?

Education and training of PhD physiologists. Life sciences has enjoyed exceptional growth in the awarding of doctoral degrees, particularly in the late 1980s and 1990s, paralleled only by engineering, and far above mathematics, computer science, physical sciences, and geosciences (17). Similarly, the availability of funding for biomedical research has increased in the 1990s. One might expect, therefore, that like other life sciences

areas, increases in the numbers of graduate students enrolled in physiology degree programs and PhDs awarded in physiology would be evident. Is this the case? If not, what would lead to a disparity between physiology and many other life sciences fields? Furthermore, numerous discussions and reports have focused on the status of postdoctoral fellows in the US. What are the trends for postdoctoral fellows in physiology? Are they comparable to other fields? What implications does the status of postdoctoral fellows in physiology have for the field as a whole?

Faculty at US medical schools. What is the status of physiology PhDs at US medical schools? During the last decade, the finances of academic medical centers have been challenged by the diminishing recovery of patient care dollars. To balance this decrease in income, there has been an increased emphasis on the acquisition of research grant dollars, taking advantage of the expanding NIH budget. Concerns have been raised that, in order to attract research dollars in more highly funded fields, changes have occurred in the hiring patterns of basic science departments, especially physiology departments. That is, it has been suggested that physiology departments are increasingly hiring faculty trained in research areas outside of physiology with the expectation that they are more likely to generate support from NIH. Is there evidence that this is the case? If so, is the strategy successful, that is, are those faculty members raising a disproportionately high amount of funding for their departments? Have the changes in faculty composition and expertise had

(continued on page 184)

Inside this issue...

**Impact Factors:
Arbiter of Excellence?**
p. 181

155th Business Meeting
p. 193

**Experimental Biology 2003
Preview**
p. 213

**Find Full-Text Articles,
Free and Fast**
p. 217

**2002 Undergraduate Research
Fellows**
p. 221

THE Physiologist

Volume 45 Number 4

August 2002

Contents

| | | | |
|--|--------------------------|---|------------|
| The Status of Physiologists and Physiology at US Medical Schools Martin Frank and Marsha Matyas | 179 | Public Affairs "IACUC 101" at EB '02 | 223 |
| Impact Factors: Arbiter of Excellence? <i>A Matter of Opinion</i> | 181 | President Proposes Homeland Security Department | 225 |
| 155th APS Business Meeting | 193 | Bioterror Protection Bill Signed | 225 |
| Membership New Regular Members New Student Members | 204 205 | Germany Writes Protection for Animals Into its Constitution | 226 |
| APS Section Awards | 208 | Congressional Appropriations Heats Up | 226 |
| Experimental Biology 2003 Preview | 213 | NSF Doubling Effort Gets Boost | 227 |
| Distinguished Lectureships | 213 | Senate Avoids Cloning Vote | 227 |
| Societal Lectures | 214 | People & Places | 228 |
| Section-Sponsored Symposia | 214 | Ganong Named Distinguished Educator Awardee | 228 |
| Section-Sponsored Featured Topics | 215 | News From Senior Physiologists | 230 |
| Publications Find Full-Text Articles, Free and Fast | 217 | Positions Available | 234 |
| Marder New Editor of <i>JN</i> | 218 | Book Review | 238 |
| Brown New Editor of <i>AJP-Cell</i> | 219 | Books Received | 241 |
| Education APS Presents Awards at ISEF | 220 | Announcements APS Establishes Mahesh Award Fund | 241 |
| 2001 Summer Research Fellows Experience EB | 221 | 2003 John P. Hubbard Award | 242 |
| Physiology Insights: Fellowships for Undergraduate Faculty | 222 | APS Membership Application | 245 |
| APS Archive of Teaching Resources | 222 | Scientific Meetings and Congresses | 247 |
| | | APS Conference Program The Power of Comparative Physiology: Evolution, Integration, and Application | 249 |

Published bimonthly and distributed by
The American Physiological Society

9650 Rockville Pike
Bethesda, Maryland 20814-3991
ISSN 0031-9376

Barbara A. Horwitz

President

John E. Hall

Past President

John A. Williams

President-Elect

Martin Frank

Editor and Executive Director

Councillors

Kim E. Barrett,

Douglas C. Eaton, Joseph R. Haywood,

Steven C. Hebert, Virginia M. Miller,

Charles M. Tipton

Ex Officio

Dale J. Benos,

Mordecai P. Blaustein,

Robert G. Carroll,

Curt Sigmund, Celia D. Sladek

Publications Committee: *Chairman:* Dale J. Benos; *Members:* Penelope A. Hansen, Mark A. Knepper, Richard A. Murphy, Hershel Raff. *Director of Publications:* Margaret Reich. *Design and Copy Editor:* Joelle R. Grossnickle.

Subscriptions: Distributed to members as part of their membership. Nonmembers in the USA: individuals \$50.00; institutions \$75.00. Nonmembers in Canada and Mexico: individuals \$55.00; institutions \$80.00. Nonmembers elsewhere: individuals \$60.00; institutions \$85.00. Single copies and back issues when available, \$15.00 each; single copies and back issues of Abstracts issues when available, \$25.00. Subscribers to *The Physiologist* also receive abstracts of the Conferences of the American Physiological Society.

The American Physiological Society assumes no responsibility for the statements and opinions advanced by contributors to *The Physiologist*.

Deadline for submission of material for publication: Jan. 10, February issue; March 10, April issue; May 10, June issue; July 10, August issue; Sept. 10, October issue; Nov. 10, December issue.

Please notify the central office as soon as possible if you change your address or telephone number.

Headquarters phone: 301-634-7164

Fax: 301-634-7242

Email: info@the-aps.org

<http://www.the-aps.org>

Printed in the USA

Impact Factors: Arbiter of Excellence?

Several years ago, a young faculty member at a major university informed me that her department chair had mandated that any faculty member seeking tenure should make sure that they only publish manuscripts in journals with an impact factor of 5.0 or greater. As the publisher of a large number of scientific journals, I was offended by the effort of the chair to attempt to correlate the impact factor of the journal with the impact, or excellence, of the faculty member's research. It was apparent that the chair did not realize that impact factors, a bibliometric indicator developed by ISI, was not a measure of scientific quality. Instead, it would have been more relevant to use the actual citation frequency of the scientific paper in evaluating the work of individual scientists.

The question facing the scientific community in the digital age is whether impact factors have any relevance in today's environment. While libraries use impact factors as one of several determining factors for their subscription decisions, they also use shelving data, that is the number of times that a given journal is removed from the shelf by a user and reshelved by a library employee. As we all know, this is an inexact measure complicat-

ed by the fact that some individuals actually reshelf the journal themselves. In a similar vein, manuscripts are read many more times than cited. For that reason, APS has been tracking the number of hits received by the Society's online journals and correlating the information to the actual impact factor measured by ISI. As noted in Table 1, the number of hits per article online does not necessarily correlate well with the actual impact factor of the journal. As expected, a review journal like *Physiological Reviews*, with an impact factor of 27.677 also had the greatest number of hits/article online of 2,720. However, the correlation is weaker for the various sections of the *American Journal of Physiology*, with the section receiving the highest number of hits/article online, *AJP-Endocrinology and Metabolism*, having the fifth highest impact factor for AJP journals. Similarly, *Advances in Physiology Education*, the APS journal with the lowest impact factor at 0.037, had a hits/article online rate of 797, ranking second amongst the APS journals. The question facing publishers, libraries, and end users is whether impact factors or hit rates are a better measure of the journal.

In making impact factors the de facto measure of quality, the scientific community has taken a bibliometric measure developed in 1963 by ISI (1) and made it into a measure of quality. In essence, the scientific community has taken a measure familiar to each of us from our own research experiments and made it an absolute measure. An impact factor is a simple ratio of citations and papers. The numerator is the number of current year citations (e.g., citations made in the year 2001) to all

Table 2. Comparison of Experimental Protocols A and B

| Trial | Protocol A | Protocol B (2000) |
|-----------------|------------|-------------------|
| 1 | 3 | 4 |
| 2 | 4 | 1 |
| 3 | 1 | 4 |
| 4 | 1 | 4 |
| 5 | 57 | 7 |
| 6 | 3 | 6 |
| 7 | 2 | 1 |
| 8 | 44 | 1 |
| 9 | 1 | 8 |
| 10 | 1 | 2 |
| Mean± Std. Dev. | 11.7±20.7 | 3.3±2.4 |

of the papers published by a given journal in the previous two years (that is, 1999 and 2000). The denominator is the total number of papers published in the journal in 1999 and 2000. In that regard, the measure of scientific quality or impact factor is not too dissimilar from the results arising from a research experiment in which a number of experimental trials are tabulated to determine the effectiveness of an experimental protocol. As noted in Table 2, an experimental protocol incorporating 10 trials can be compared to another protocol by calculating the mean and standard deviation and performing statistical tests designed to determine if Protocol B is significantly different from Protocol A. As noted in Table 2, while the means are different, the results from the two protocols are not statistically different from each other. As a good scientist, we would each declare the results of this study to be unworthy of publication, even though it might have provided some significant insights to the experimenter. Yet, when we use a similar analysis to measure the impact of a journal, we tend to ignore all that we learned in elementary statistics. Converting protocols to journals and trials to papers (Table 3), we see that when we use impact factors, we are only using the mean, ignoring the sta-

(continued on page 182)

Table 1. A comparison of hits/article online vs. 2000 Impact Factor for the journals of the American Physiological Society

| Journal | Hits/Article (April 2002) | Impact Factor (2000) |
|--------------------|---------------------------|----------------------|
| <i>AJP - Cell</i> | 302 | 4.086 |
| <i>AJP - Endo</i> | 356 | 3.183 |
| <i>AJP - GI</i> | 271 | 3.115 |
| <i>AJP - Lung</i> | 245 | 3.303 |
| <i>AJP - Heart</i> | 246 | 3.243 |
| <i>AJP - Regu</i> | 166 | 2.765 |
| <i>AJP - Renal</i> | 272 | 4.129 |
| <i>Advances</i> | 797 | 0.037 |
| <i>JAP</i> | 289 | 2.297 |
| <i>JN</i> | 221 | 3.855 |
| <i>PRV</i> | 2720 | 27.677 |
| <i>NIPS</i> | 156 | 2.060 |
| <i>PG</i> | 729 | 1.353 |

(continued from page 181)

tistical tests that we use to analyze our own data.

It is unfortunate that the scientific community and university administrators have equated impact factors with excellence without having a complete understanding of how it is calcu-

tions gained by the publication. This suggests that most articles in a high impact journal are cited no more frequently than a paper published in a lower impact journal. Moed (5) has shown in a study of citations for journals contained within the *Science Citation Index* that about 7% of all references are cited incorrectly and this is even more prevalent in journals with dual volume-numbering systems. This latter point can help explain the citation rate for articles published in the *American Journal of Physiology*. Hamilton (4) reported that 41.3% of the biological sciences papers and 46.4% of the medicine papers published in journals covered by ISI's citation database did not receive a single citation in the five years after they were published.

Because impact factors do not equate to excellence, it is unfortunate that universities in several European countries use impact factors to help determine institutional funding. Additionally, many European investigators regularly provide journal impact factors alongside the listing of their articles on their curriculum vitae. In most cases, the impact factor provided is for the current year, not the year during which the article was published. Similarly, as evidenced by the experiences of the young faculty member noted earlier, promotion and appointment committees are increasingly using impact factors to assess the quality of the candidates.

The impact factor calculation developed by Eugene Garfield, ISI, was initially used to evaluate and select journals for listing in *Current Contents*. It covered a two-year field and did not

measure whether the journals were in a rapidly growing or stable field. As a result, the impact factor only measured the influence of an article during the first two years after publication. For journals in more stable fields, the bulk of the citations often occur after the initial two years, contributing to a longer half-life for articles published in that journal. Garfield has noted that the half-life would be longer for journals publishing articles related to physiology than for those publishing articles in molecular biology. As a result, the ranking of physiology journals improved significantly overall as the number of years increased, but the rankings within the group of physiology journals did not change significantly. Table 4 compares the 15-year and seven-year impact factor rankings for the Society's three main research journals as compared to their two-year rankings (3). For example, the *American Journal of Physiology's* two-year impact ranking in 1983 was 101 as compared to 60 for a 15-year ranking. The *AJP's* impact ranking in 1991 was 124 as compared to 64 for its seven-year ranking. The *Journal of Applied Physiology* showed an even more pronounced shift, moving from a two-year impact factor rank of 376 to 96 for a seven-year rank.

Because of the dual citation format for the *American Journal of Physiology*, it was not until 2000 that the APS was able to get ISI to disaggregate the sections of the *American Journal of Physiology* to calculate the impact factors for *AJP's* component parts. In the past, our dual referencing format had created problems of citation recognition for ISI. However, after an extended meeting with the group in 1999, an effort was made to include impact factors for the individual *AJP* journals in ISI's *Journal Citation*

Table 3. Comparison of the Impact Factors for Journals A and B

| Paper | Journal A (Cites/Paper) | Journal B (Cites/Paper) |
|---------------|----------------------------|----------------------------|
| 1 | 3 | 4 |
| 2 | 4 | 1 |
| 3 | 1 | 4 |
| 4 | 1 | 4 |
| 5 | 57 | 7 |
| 6 | 3 | 6 |
| 7 | 2 | 1 |
| 8 | 44 | 1 |
| 9 | 1 | 8 |
| 10 | 1 | 2 |
| Impact Factor | 11.7 | 3.3 |

lated or measured. As noted earlier, the denominator is a measure of the number of articles published in the journal during the previous two years. According to ISI, an article is generally defined as a research or review article based on the number of authors, references, page length, page overlap, and the inclusion of author addresses (2). It does not include *marginalia*, such as letters, news articles, book reviews, or abstracts that might also appear in a journal. According to Pendlebury (6), about 27% of the items indexed in *Science Citation Index* were such *marginalia*. Yet the numerator does include citations to these elements, contributing to an inflated impact factor for some journals. It has also been shown by Seglen (8) that about 15% of the articles in a typical journal account for half of the cita-

Table 4. Long-term vs. Short-term Journal Impact

| Journal Name | 15-Year IF (1981-1995) | 15-Year Rank | IF Rank in 1983 | 7-Year IF (1989-1995) | 7-Year Rank | IF Rank in 1991 |
|---------------------------------------|---------------------------|--------------|--------------------|--------------------------|-------------|--------------------|
| <i>Journal of Neurophysiology</i> | 52.2 | 27 | 56 | 25.1 | 38 | 86 |
| <i>American Journal of Physiology</i> | 37.1 | 60 | 101 | 19 | 64 | 124 |
| <i>Journal of Applied Physiology</i> | 30.5 | 96 | 164 | 13.3 | 96 | 376 |

Reports. In the absence of such data, the APS contracted directly with ISI to do a special citation analysis in order to compare the 10-year citation statistics for the *AJP* journals to each of their competitor journals (7). The results provided comparable information to that contained in Table 4, demonstrating that the long half-life of the physiology journals significantly improved their status and ranking when compared to competitor journals.

It is clear from an analysis of the information available from ISI that one cannot and should not consider impact factor as a measure of the quality of both the journal and the author. The impact factor provides the user with information about the average number of citations to articles published in a journal during the previous two years. An impact factor of 10 implies that articles published in 1999

and 2000 would receive 10 citations in 2001. However, since 15% of the articles receive half of the citations, it is just as likely that an article published in a journal with an impact factor of 10 has received only one or two citations. The best way to measure the quality of an author's work is to determine the number of citations received by each of his or her papers. To paraphrase a well-known saying, read the article(s) and "don't judge an author by the journal's impact factor!" ❖

Martin Frank

References

1. Garfield, E. and I. H. Sher. *New Factors in the Evaluation of Scientific Literature Through Citation Indexing. American Documentation* 14: 195-201, 1963.
2. Garfield, E. Which Medical Journals Have the Greatest Impact. *Ann.*

Intern. Med. 105: 313-320, 1986.

3. Garfield, E. Long-Term Vs. Short-Term Journal Impact: Does It Matter? *The Scientist* 12: 11-12, 1998.

4. Hamilton, D. P. Research Papers: Who's Uncited Now? *Science* 251:25, 1991.

5. Moed, H. F. and T. N. Van Leeuwen. Impact Factors Can Mislead. *Nature* 381: 186, 1996.

6. Pendlebury, D. A. Science, Citation, and Funding. *Science* 251: 1410-1411, 1991.

7. Rauner, B. Citation Statistics for the Individual Journals of the American Journal of Physiology. *The Physiologist* 41: 109-112, 1998.

8. Seglen, P. O. Why the Impact Factor of Journals Should Not Be Used for Evaluating Research. *BMJ* 314:498-502, 1997. ❖

2001 Impact Factors Are Published by Thomson/ISI

Thomson/ISI has released its 2001 Science Edition of the Journal Citation Reports, which gives journal impact factors and rankings of 5,748

science journals. The 2001 impact factors, compared with those from 2000, of the journals of the APS are given in the table below. The table also shows

the rank of APS journals in the physiology category, and each journal's rank in its related field. ❖

2001 Impact Factors

| Journal | 2001 | 2000 | 2001 Rank, Physiology (out of 74) | 2001 Rank, Related Field | Related Field |
|------------------------|--------|--------|-----------------------------------|--------------------------|-------------------|
| PRV* | 30.061 | 27.677 | 1 | | |
| AJP-Renal | 4.523 | 4.129 | 5 | 3/44 | Urol & Nephro |
| AJP-Cell | 3.896 | 4.086 | 10 | 34/147 | Cell Bio |
| AJP-GI | 3.660 | 3.115 | 11 | 7/47 | Gastro & Hep |
| AJP-Lung | 3.658 | 3.303 | 12 | 4/30 | Respiratory |
| JN | 3.517 | 3.855 | 14 | 40/197 | Neuroscience |
| Physiological Genomics | 3.352 | 1.353 | 15 | 44/147 | Cell Bio |
| | | | | 80/308 | Biochem & Mol Bio |
| AJP-Endo | 3.324 | 3.183 | 16 | 25/90 | Endo & Met |
| AJP-Heart | 3.232 | 3.243 | 17 | 7/65 | Cardio |
| JAP | 2.581 | 2.297 | 24 | 2/68 | Sport Sciences |
| AJP-Regu | 2.437 | 2.765 | 25 | | |
| NIPS | 1.817 | 2.060 | 29 | | |
| Advances | 0.186 | 0.037 | 72 | | |

*Physiological Reviews ranks 4th among all 5,748 science journals.

(continued from page 179)

impacts on course content, teaching quality, and the preparedness of medical and graduate students? Have these changes impacted the amount and type of research and teaching collaborations among faculty within the department? Finally, are the same trends evident in clinical departments in US medical schools?

Diversity issues. Throughout the 1980s and 1990s, data have been collected by numerous agencies and organizations, including the APS, American Association of Medical Colleges (AAMC), and National Science Foundation (NSF), concerning the status of underrepresented groups in science, particularly women and minorities. What do the current data suggest about the status of these groups in terms of degrees earned and their position in US academic medicine in the field of physiology?

This study attempts to explore these questions that have been raised about the status of physiology in academic medicine and to identify additional studies and possible policy issues that should be further explored. The study draws on an earlier study of 1989 and 1994 data by Matyas and Frank (15), data obtained from the AAMC for the 2001 academic year, and data from the NSF's *Science and Engineering Doctorate Awards: 2000* (19).

Role of Physiology in the Medical Curriculum

As noted in the Knobil White Paper (10), "From the first appearance of the word, physiology has been associated with medical instruction and has been preeminently institutionalized in departments of physiology housed, with but a very few exceptions, in schools of medicine. Physiology in this context has been and continues to be the basic science central to medicine."

Medical students confirm the latter statement. They consistently rate physiology as one of the premedical courses that best prepared them for medical school studies (Table 1).

Table 1 - How Important Were the Following Premedical Courses in Preparing You for Medical School? 2001

| | Ratings (%) | | | | |
|---------------------|----------------|----------------------|--------------------|--------------------|---------------|
| | Very important | Moderately important | Somewhat important | Slightly important | Not important |
| Biology | 57.3 | 25.3 | 11.6 | 4.7 | 1.1 |
| General Chemistry | 17.6 | 32.8 | 29.0 | 16.9 | 3.7 |
| Organic Chemistry | 14.0 | 27.0 | 27.2 | 22.1 | 9.7 |
| Physics | 9.2 | 23.1 | 30.9 | 26.2 | 10.7 |
| Comparative Anatomy | 36.5 | 30.0 | 17.1 | 8.5 | 7.9 |
| Biochemistry | 48.3 | 31.6 | 12.8 | 5.2 | 2.1 |
| Genetics | 36.3 | 38.5 | 17.5 | 5.9 | 1.8 |
| Physiology | 68.6 | 20.4 | 6.9 | 2.3 | 1.7 |
| Zoology | 6.4 | 14.3 | 23.8 | 25.9 | 29.6 |
| Psychology | 11.9 | 26.9 | 29.1 | 21.1 | 10.9 |

2001 Medical School Graduation Questionnaire, All Schools Report, Division of Medical Education, AAMC

Table 2 - How Well Did Instruction in the Following Sciences Basic to Medicine Prepare You for Clinical Clerkships and Electives, 2001

| | Ratings (%) | | | |
|---------------|-------------|------|------|------|
| | Excellent | Good | Fair | Poor |
| Biochemistry | 11.2 | 34.6 | 36.1 | 18.1 |
| Genetics | 9.0 | 40.9 | 37.8 | 12.3 |
| Gross Anatomy | 41.5 | 42.5 | 13.3 | 2.7 |
| Immunology | 20.7 | 48.9 | 24.1 | 6.4 |
| Histology | 15.6 | 41.9 | 32.3 | 10.2 |
| Microbiology | 29.2 | 46.7 | 18.1 | 6.0 |
| Neuroscience | 30.9 | 42.1 | 19.1 | 7.9 |
| Pathology | 48.5 | 35.6 | 12.3 | 3.5 |
| Pharmacology | 38.9 | 37.2 | 15.9 | 8.0 |
| Physiology | 44.5 | 40.5 | 11.8 | 3.1 |

2001 Medical School Graduation Questionnaire, All Schools Report, Division of Medical Education, AAMC

Table 3. Average Hours of Instruction in Preclinical Disciplines in US and Canadian Medical Schools (as reported by 100 or more schools) (2, 4)

| Discipline | Graduating Class | | |
|---------------|------------------|-----------|------|
| | 1983-1984 | 1992-1993 | 2003 |
| Anatomy | 150 | 192 | 141 |
| Pathology | 233 | 186 | 116 |
| Physiology | 167 | 134 | 103 |
| Microbiology | 155 | 126 | 103 |
| Biochemistry | 137 | 115 | 94 |
| Pharmacology | 129 | 111 | 87 |
| Neurosciences | 109 | 107 | 101 |

Table 4. PhDs Awarded in Human/Animal Physiology

| | PhDsAwarded | Awarded to Women | % Women |
|------|-------------|------------------|---------|
| 1991 | 272 | 107 | 39.3 |
| 1992 | 286 | 82 | 28.6 |
| 1993 | 271 | 100 | 36.9 |
| 1994 | 289 | 106 | 36.6 |
| 1995 | 262 | 103 | 39.3 |
| 1996 | 275 | 107 | 38.9 |
| 1997 | 227 | 82 | 36.1 |
| 1998 | 258 | 100 | 38.8 |
| 1999 | 243 | 108 | 44.4 |
| 2000 | 244 | 101 | 41.4 |

National Science Foundation Science and Engineering Doctorate Awards: 2000.

Nearly 70% of medical students rated their premedical physiology course as “very important,” higher than any other course. In addition, a high percentage indicated that their medical physiology course provided an excellent (44%) or good (40%) preparation for their clinical clerkships and electives (Table 2), second only to pathology. Therefore, medical students believe that a strong physiology education is key to their success in both

medical studies and clinical settings.

There is evidence, however, that the number of contact hours for the teaching of physiology has significantly decreased since the 1980s. As indicated in Table 3, the average number of hours of instruction of physiology decreased by 38% between the 1983-1984 and 2003 graduating medical students, dropping from 167 to 103 hours (2, 4). Similar reductions occurred in other traditional basic sci-

ences such as pathology (50% decrease) and pharmacology (32% decrease) (Table 3).

Education and Training of PhD Physiologists

In general, the number of PhDs in animal and human physiology awarded to US citizens and permanent residents has remained relatively constant at about 260 PhD degrees on average granted annually since 1991 (Table 4). In contrast, from 1991 to 2000, the total number of PhD degrees awarded in life/biological sciences increased from 4,650 to 5,855 (19). Most of the increase can be attributed to an increase in PhDs awarded in neuroscience, cell biology, and molecular biology (19). Of the total PhDs awarded in physiology, women received 100 PhDs on average annually, accounting for 41% of the total awarded in 2000. Data on minority PhDs in physiology from the same source were not available, however,

(continued on page 186)

Table 5 -Graduate Students and Faculty in the Department of Physiology at US medical schools (including Biophysics for the years 1994-1995 to 2000-2001). Institutional Profile System, LCME, AAMC

| Year | Graduate Students Candidates for Masters | Graduate Students Candidates for Doctorate | Graduate Students Fellows/ Post-Docs | Full-Time Faculty | Part-Time Faculty | Volunteer Faculty | Vacant Positions |
|------|--|--|--------------------------------------|-------------------|-------------------|-------------------|------------------|
| 1980 | 365 | 1,462 | 542 | 1,677 | 86 | 288 | 77 |
| 1981 | 399 | 1,355 | 507 | 1,759 | 92 | 338 | 75 |
| 1982 | 290 | 1,385 | 425 | 1,841 | 80 | 408 | 83 |
| 1983 | 292 | 1,199 | 482 | 1,768 | 96 | 357 | 107 |
| 1984 | 412 | 1,358 | 539 | 1,846 | 78 | 366 | 104 |
| 1985 | 340 | 1,351 | 659 | 1,807 | 77 | 361 | 104 |
| 1986 | 433 | 1,220 | 604 | 1,885 | 65 | 403 | 93 |
| 1987 | 309 | 1,360 | 741 | 2,030 | 80 | 467 | 84 |
| 1988 | 324 | 1,290 | 750 | 1,848 | 70 | 454 | 67 |
| 1989 | 212 | 1,305 | 841 | 1,870 | 71 | 454 | 73 |
| 1990 | 282 | 1,395 | 777 | 1,884 | 115 | 450 | 67 |
| 1991 | 327 | 1,368 | 805 | 1,919 | 100 | 446 | 64 |
| 1992 | 349 | 1,401 | 786 | 1,873 | 101 | 462 | 57 |
| 1993 | 212 | 1,397 | 810 | 1,881 | 81 | 413 | 58 |
| 1994 | 285 | 1,731 | 855 | 1,894 | 143 | 420 | 59 |
| 1995 | 487 | 1,399 | 809 | 1,863 | 72 | 429 | 54 |
| 1996 | 492 | 1,401 | 832 | 1,896 | 72 | 436 | 49 |
| 1997 | 459 | 1,261 | 781 | 1,852 | 63 | 361 | 53 |
| 1998 | 407 | 1,086 | 670 | 1,868 | 83 | 415 | 53 |
| 1999 | 416 | 1,077 | 713 | 1,785 | 75 | 395 | 75 |
| 2000 | 318 | 970 | 823 | 1,768 | 87 | 359 | 56 |

Table 6. Faculty Holding Physiology Degrees: Distribution by Rank and Year

| | 1989 | | 1994 | | 2001 | |
|---------------------|-------|-------|-------|-------|-------|-------|
| | No. | % | No. | % | No. | % |
| Professor | 926 | 38.4 | 948 | 42.0 | 968 | 41.3 |
| Associate Professor | 688 | 28.5 | 644 | 28.5 | 627 | 26.7 |
| Assistant Professor | 648 | 26.9 | 604 | 26.8 | 652 | 27.8 |
| Instructor | 88 | 3.6 | 60 | 2.7 | 75 | 3.2 |
| Other | 34 | 1.4 | | | 23 | 1.0 |
| Missing | 28 | 1.2 | | | 18 | 0.8 |
| Total | 2,412 | 100.0 | 2,256 | 100.0 | 2,345 | 100.0 |

(continued from page 185)

overall, minority students continue to be awarded very limited numbers of PhD degrees in biological sciences. In 1997, 2% of biological sciences PhDs were awarded to Black, non-Hispanic students, 3% to Hispanic students, and less than 1% to Native American students, a total of only 262 degrees among the more than 4,200 awarded (20).

The enrollment of physiology graduate students seeking a doctorate at US medical schools remained relatively consistent overall throughout the

1980s (mean = 1,328) and 1990s (mean = 1,352) (Table 5). There were two notable exceptions. The number of students of students peaked in 1994 at 1,731; this may reflect the impact of the 1992 Chinese Student Protection Act that allowed the approval of US permanent resident visas for a significant number of Chinese graduate students; the impact of this Act can be seen in all scientific and engineering fields of study. In the late 1990s, following this peak, there has been a significant decline in the number of graduate students in departments of physiology, with the number of students falling under 1,000 for the first time in 20 years (Table 5). This is not comparable to the overall enrollment in graduate

studies in biological sciences, which remained relatively constant throughout the 1990s and into the new millennium (6).

The number of master's students in departments of physiology increased somewhat between the 1980s (mean = 338) and 1990s (mean = 372) and has ranged from 212 to 492. During the same time period, the number of post-doctoral fellows also increased from an average of 609 annually in the 1980s to 784 in the 1990s, a 29% increase.

Faculty at US Medical Schools

The following section presents information on the status of physiologists and faculty in departments of physiology at US medical schools. The data for this section are drawn from the AAMC Faculty Roster System (FRS). The AAMC FRS is the only comprehensive information system of its kind, containing continuously updated data on the careers of current and past medical school faculty members; the database contains information on

Table 7. Faculty Holding Physiology Degrees: Distribution by Sex, Rank, and Tenure Status, 2001

| | Professor | | Associate Professor | | Assistant Professor | | Instructor | |
|---------------------|------------|------------|---------------------|-------------|---------------------|------------|------------|-----------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) | No. (%) |
| Tenured | 694 (81.5) | 85 (73.3) | 246 (49.4) | 53 (41.4) | 6 (1.3) | 3 (1.6) | 0.0 | 0.0 |
| On-track | 31 (3.6) | 6 (5.2) | 78 (15.7) | 23 (18.0) | 145 (31.0) | 45 (24.6) | 0.0 | 1 (3.7) |
| Not on-track | 75 (8.8) | 13 (11.2) | 125 (25.1) | 40 (31.3) | 196 (42.0) | 90 (49.2) | 30 (63.8) | 11 (40.7) |
| No tenure available | 23 (2.7) | 4 (3.4) | 23 (4.6) | 2 (1.6) | 18 (3.8) | 9 (4.9) | 0.0 | 0.0 |
| Missing | 29 (3.4) | 8 (6.9) | 26 (5.2) | 10 (7.8) | 102 (21.8) | 36 (19.7) | 17 (36.2) | 15 (55.6) |
| Total | 852(100.0) | 116(100.0) | 498 (100.0) | 128 (100.0) | 467(100.0) | 183(100.0) | 47(100.0) | 27(100.0) |

Table 8. Faculty Holding Physiology Degrees: Distribution by Rank and Ethnicity, 2001

| | Professor | | Associate Professor | | Assistant Professor | | Instructor | |
|--|-----------------------------------|--------|---------------------|--------|---------------------|--------|------------|--------|
| | No. | % | No. | % | No. | % | No. | % |
| | American Indian or Alaskan Native | | (0.0) | | (0.0) | 1 | (0.2) | |
| Asian or Pacific Islander | 61 | (6.3) | 62 | (9.9) | 95 | (14.6) | 20 | (27) |
| Black, Not of Hispanic Origin | 10 | (1.0) | 10 | (1.6) | 14 | (2.2) | | (0.0) |
| Mexican American or Chicano (Hispanic) | 7 | (0.7) | 4 | (0.6) | 4 | (0.6) | | (0.0) |
| Puerto Rican (Hispanic) | 4 | (0.4) | 3 | (0.5) | 3 | (0.5) | | (0.0) |
| Other Hispanic | 15 | (1.5) | 9 | (1.4) | 13 | (2.0) | 3 | (4.1) |
| White, Not of Hispanic Origin | 840 | (86.8) | 512 | (81.8) | 489 | (75.1) | 44 | (59.5) |
| Not Wish to Respond | 1 | (0.1) | 2 | (0.3) | 5 | (0.8) | 3 | (4.1) |
| Missing | 30 | (3.1) | 24 | (3.8) | 27 | (4.1) | 4 | (5.4) |
| Total | 968 | (100) | 626 | (100) | 651 | (100) | 74 | (100) |

more than 80% of US medical schools. The FRS is used for annual reports on medical school faculty, for policy studies, to provide standard and custom reports to member institutions, as a means of identifying and locating current faculty members, and as a recruitment service to assist medical schools and selected institutions seeking to appoint senior faculty.

Faculty Holding Degrees in Physiology. The numbers and rank of faculty holding physiology degrees has remained relatively stable since 1989 (Table 6). In 2001, there were 2,345 faculty members at US medical schools holding degrees in physiology. This was comparable to the number of faculty holding PhD degrees in physiology in 1989 and 1994. Of the 2,345 PhD physiologists at US medical schools, 41% of physiologists held the rank of Professor in 2001 compared with 42% in 1994 and 38% in 1989. Associate Professors accounted for 26% in 2001 and 28% in 1989 and 1994 of the physiologists on faculty. Assistant Professors accounted for 28% of faculty in 2001 and approximately 27% in 1989 and 1994. Instructors comprised approximately 3% of the faculty in the years studied.

In 2001, 47% of faculty holding a degree in physiology had tenure and an additional 14% were in tenure-track positions (Table 7). Both of these figures were less than reported in the 1994 study in which more than half of the faculty had tenure and 17% were in tenure-track positions.

Gender diversity among faculty with physiology degrees was improved in 2001 compared with the two previous studies. In 2001, 20% (n = 454) of

the faculty members were female compared with 14% (n = 330) in 1989 and 16% (n = 361) in 1994. The representation of women in each faculty rank increased relative to the earlier studies. In 2001, women made up 12% of professors, 20% of associate professors, 28% of assistant professors, and 36% of instructors. However, as in the previous studies, women are much less likely than their male cohorts to be in tenure or tenure-track positions. Of the 454 women in faculty positions, 24% are in tenure positions and 12% are in tenure-track positions. Of the 1,867 men in faculty positions, 50% are in tenure positions and 14% are in tenure-track positions. As in 1994, the 2001 data show that at every faculty rank, proportionately fewer women were tenured or on tenure-track.

Racial/ethnic diversity among medical school faculty holding degrees in physiology in 2001 (Table 8) showed limited improvement in comparison to diversity in 1989 and 1994. The overall proportion of underrepresented minority physiologists (African-American, Native American, and Hispanic) increased to 4% from 3% in 1994 and 2% in 1989. Including Asian/Pacific Islanders in the analysis increases the percentage of minority physiologists to 15% compared with 12% in 1994 and 9% in 1989.

Data were also compared on departmental appointments and areas of specialty. In 2001, the percentage of PhD physiologists employed in basic science departments decreased to 49% (Table 9) from 53% in 1994 and 55% in 1989. While the largest percentage was employed in physiology departments (30%) in 2001, this was a smaller percentage than observed in 1989

Table 9. Faculty Holding Physiology Degrees: Distribution by Department

| | No. | % |
|-------------------------|-------------|--------------|
| Basic Science | | |
| Anatomy | 108 | 4.6 |
| Biochemistry | 43 | 1.8 |
| Microbiology | 14 | 0.6 |
| Pathology (BS) | 34 | 1.4 |
| Pharmacology | 140 | 5.9 |
| Physiology | 700 | 29.6 |
| Other Basic Science | 112 | 4.7 |
| Subtotal | 1151 | 48.7 |
| Clinical Science | | |
| Anesthesiology | 116 | 4.9 |
| Internal Medicine | 384 | 16.3 |
| Neurology | 79 | 3.3 |
| OBGyn | 104 | 4.4 |
| Pathology (CL) | 35 | 1.5 |
| Pediatrics | 90 | 3.8 |
| Surgery | 159 | 6.7 |
| Other CS | 201 | 8.5 |
| Subtotal | 1168 | 49.4 |
| Admin | 14 | 0.6 |
| All others | 15 | 0.6 |
| None/Missing | 15 | 0.6 |
| Total | 2363 | 100.0 |

(38%) and in 1994 (37%).

PhD physiologists are increasingly employed in clinical science departments. In 2001, 49% were employed in clinical departments compared with 43% in 1989 and 45% in 1994. As in the earlier studies, the largest percentage of PhD physiologists was employed in departments of internal medicine (16%).

In terms of specific physiology disci-
(continued on page 188)

Table 10. Number of Faculty in Physiology Department by Sex, Rank, and Tenure Status, 2001

| | Professor | | Associate Professor | | Assistant Professor | | Instructor | |
|---------------------|------------------|------------------|---------------------|------------------|---------------------|------------------|-----------------|-----------------|
| | Male No. (%) | Female No. (%) | Male No. (%) | Female No. (%) | Male No. (%) | Female No. (%) | Male No. (%) | Female No. (%) |
| Tenured | 621(86.4) | 88(85.4) | 203 (58.2) | 45 (43.7) | 2 (0.6) | 3 (2.0) | 0.0 | 0.0 |
| On-track | 27 (3.8) | 1 (1.0) | 56 (16.0) | 21 (20.4) | 135 (38.8) | 38 (24.8) | 2 (5.0) | 2 (5.6) |
| Not on-track | 28 (3.9) | 8 (7.8) | 54 (15.5) | 22 (21.4) | 117 (33.6) | 69 (45.1) | 21 (52.5) | 17 (47.2) |
| No tenure available | 25 (3.5) | 1 (1.0) | 14 (4.0) | 5 (4.9) | 11 (3.2) | 8 (5.2) | 3 (7.5) | 1 (2.8) |
| Missing | 18 (2.5) | 5 (4.9) | 22 (6.3) | 10 (9.7) | 83 (23.9) | 35 (22.9) | 14 (35.0) | 16 (44.4) |
| Total | 719 (100) | 103 (100) | 349 (100) | 103 (100) | 348 (100) | 153 (100) | 40 (100) | 36 (100) |

Table 11. Faculty in Departments of Physiology in US Medical Schools: Distribution by Discipline, 2001

| | No. | % |
|---------------|------|------|
| Anatomy | 27 | 1.6 |
| Biochemistry | 280 | 17.0 |
| Biology | 59 | 3.6 |
| Biophysics | 86 | 5.2 |
| Chemistry | 42 | 2.5 |
| Endocrinology | 28 | 1.7 |
| Engineering | 32 | 1.9 |
| Genetics | 16 | 1.0 |
| Immunology | 10 | 0.6 |
| Microbiology | 14 | 0.8 |
| Neurobiology | 41 | 2.5 |
| Nutrition | 4 | 0.2 |
| Pathology | 8 | 0.5 |
| Pharmacology | 117 | 7.1 |
| Physics | 24 | 1.5 |
| Physiology | 700 | 42.4 |
| Psychology | 39 | 2.4 |
| Zoology | 31 | 1.9 |
| Other | 92 | 5.6 |
| Total | 1650 | 100 |

(continued from page 187)

plines, in 2001 more than 68% of the respondents stated that their area was “physiology, general.” Neurophysiology (8%), cardiovascular physiology (5%), reproductive physiology (4%), and exercise physiology (2%) accounted for an additional 19% of medical school physiologists.

Faculty in departments of physiology. In 2001, the AAMC FRS included information on 1,851 faculty members with appointments in physiology departments in US medical schools. The number of full-time faculty positions remained stable between the 1980s (mean = 1,833) and 1990s

(mean = 1,868) (Table 5). In 2000, however, only 1,768 full-time faculty positions were filled, a decline from most years in the previous two decades. The number of vacant positions decreased, as well, falling from an average of 87 in the 1980s to 64 in the 1990s. Volunteer positions increased by 18% during this period, from a mean of 390 during the 1980s to 459 during the 1990s; these typically are clinical department faculty in teaching roles.

Among faculty members with a degree in physiology, approximately 41% held the rank of professor (Table 6). Similarly, of the faculty employed in departments of physiology, approximately 44% held the rank of professor (Table 10). The majority of faculty members in departments of physiology in 2001 held the PhD (87%) or MD-PhD (5%) degree (3). Only about 6% held an MD degree only. This distribution is similar to that observed in both 1989 and 1994. More than half (52%) of the faculty members in physiology departments had tenure in 2001, and an additional 15% were in tenure-track positions (Table 10).

As stated earlier, respondents to the FRS survey are asked to indicate their specific field of study or discipline (Table 11). Just over half of faculty members in departments of physiology in 1989 (56%) and 1994 (53%) identified themselves as “physiologists.” In 2001, however, only 42% identified themselves as “physiologists.” Other disciplines commonly cited in 2001 were biochemistry (17%), pharmacology (7%), and biophysics (5%). In contrast, in 1994 biochemistry was identified as the field of study for only 12% of the individuals in departments of physiology.

The proportion of physiology depart-

ment faculty positions held by women increased between 1989 and 2001. In 2001, women held 22% of faculty positions (Table 12), up from 14% in 1989 and 17% in 1994 (15). In addition, a comparison of the data published in 1995 (15) to the data in Table 12 confirms that the representation of women at all faculty ranks has increased over the decade. However, women in physiology departments—similar to women physiologists in all departments—are much less likely than their male cohorts to be in tenure-track positions (Table 10). In 2001, proportionately fewer women were tenured and more women were not in a tenure-track position at every faculty rank when compared with male faculty members. At the assistant professor level, 45% of women were in non-tenure-track positions compared with 34% of men; therefore, nearly half of women assistant professors in physiology departments are in non-tenure-track positions.

Racial/ethnic diversity among faculty in physiology departments remained unchanged in comparison to 1994. The overall proportion of under-represented minority faculty (African-American, Native American/Alaskan Natives, and Hispanic) remained unchanged at 5% of the faculty in departments of physiology (Table 13). Furthermore, Asians, Hispanics, and African-Americans are over-represented in Instructor positions compared with their total representation on the faculty in departments of physiology (Table 13). For example, whereas Hispanics comprise 4% of the total faculty in departments of physiology, they account for 6% of the instructors. These groups are also concentrated more in assistant professor and instructor positions than at higher faculty level positions.

Table 12. Number of Faculty in Physiology Department, by Sex and Rank, 2001

| | Male | | Female | |
|---------------------|------|------|--------|------|
| | No. | % | No. | % |
| Professor | 719 | 49.1 | 103 | 25.2 |
| Associate Professor | 349 | 23.8 | 103 | 25.2 |
| Assistant Professor | 348 | 23.8 | 153 | 37.4 |
| Instructor | 40 | 2.7 | 36 | 8.8 |
| Other | 9 | 0.6 | 14 | 3.4 |
| Missing | 0 | 0.0 | 0 | 0.0 |
| Total | 1465 | 100 | 409 | 100 |

Discussion

Role of physiology in the medical curriculum. It is apparent that physiology training plays a critical role in the education of future medical doctors based on the Medical School Graduation Survey conducted by the AAMC. Medical students felt that their physiology courses were critical

in preparing for both their medical studies and clinical clerkships. Despite this feedback, many academic medical centers have restructured the medical school curriculum, effectively reducing the number of instructional contact hours available for providing medical students with training in physiology. While physiology and a number of other basic science courses have seen a reduction in hours, the instructional hours devoted to anatomy and neurosciences has remained stable. Ernst Knobil (10) stated that physiology was “the basic science central to medicine” and data on two decades of medical school classes agree, yet the allocation of instructional hours suggests that medical school curriculum committees do not. Anatomical sciences appear to be weighted more heavily, as evidenced by the retention of hours for anatomy and the addition of anatomically based courses such as cell biology and microanatomy in the medical school curriculum. This restructuring has been encouraged by the Liaison Committee for Medical Education (LCME) and by efforts to also include non-basic science courses in the curriculum.

The long-term impact of this significant change in the medical curriculum is unknown. It constitutes an educational experiment with tremendous potential impacts, changing the basic core knowledge of the new generation of clinicians. Therefore, it is essential that schools monitor the progress and achievement of students on Board

exams, particularly in the areas of the basic sciences, to assure that their training is adequate. Furthermore, it will be incumbent upon schools to assure that, as contact hours are reduced, students effectively learn critical content knowledge and process skills in physiology. Toward this end, the APS and the Association of Chairs of Departments of Physiology have developed Medical Physiology Learning Objectives, a consensus on the physiological principles and concepts that are considered minimal and essential for understanding mechanisms of disease and body defenses (7).

It will also require, however, that departments have faculty with a clear understanding of not only these basic concepts and principles, but also an ongoing knowledge of progress in the fields of physiology so that important new findings can be incorporated into the curriculum. Evidence from the AAMC survey suggests that physiology departments are, indeed, diversifying their faculty to include fewer “physiologists.” If those involved in teaching medical physiology also reflect that diversity, then the long-term effects of utilizing instructors who are teaching “out-of-field” must be monitored and assessed. Again, it will be incumbent upon each school to address this issue.

Education and training of PhD physiologists. Unlike many other areas of life sciences, physiology has not enjoyed a growth of graduate students

throughout the past two decades. Rather, growth of the number of PhD graduate students has been relatively flat, with a significant decrease in the latter 1990s and into the new millennium. At the same time, there has been a significant increase in the number of postdoctoral fellows in physiology.

The specific reasons for a lack of growth in the number of graduate students in physiology are unknown. However, there are several possibilities. First, undergraduate students interested in a research career may be increasingly unaware of the broad research opportunities in physiology. There has been considerable focus in the media on biotechnology, biochemistry, and genetics, leading students to the perception that these are the “best” fields in which to work. This makes the current APS programs to increase undergraduate participation in physiology research and to increase public understanding of the benefits of physiology research even more important (13).

Second, there may simply be decreased recruitment of graduate students in departments of physiology and increased hiring of postdoctoral fellows. Extended postdoctoral positions provide an individual with additional training and opportunities for research during a time of limited opportunities for permanent positions, while providing the employer with a highly trained and motivated collaborator. Third, it may be that fewer grad-

(continued on page 190)

Table 13. Number of Faculty in Physiology Department by Rank and Ethnicity, 2001

| | Professor | | Associate Professor | | Assistant Professor | | Instructor | |
|--|-----------|-------|---------------------|------|---------------------|------|------------|------|
| | No. | % | No. | % | No. | % | No. | % |
| American Indian or Alaskan Native | | 0.0 | 2 | 0.4 | 1 | 0.2 | | 0.0 |
| Asian or Pacific Islander | 45 | 5.5 | 51 | 11.3 | 83 | 16.6 | 18 | 23.7 |
| Black, Not of Hispanic Origin | 7 | 0.9 | 9 | 2.0 | 9 | 1.8 | 3 | 3.9 |
| Mexican American or Chicano (Hispanic) | 4 | 0.5 | 2 | 0.4 | 5 | 1.0 | | 0.0 |
| Puerto Rican (Hispanic) | 2 | 0.2 | 3 | 0.7 | 4 | 0.8 | 2 | 2.6 |
| Other Hispanic | 20 | 2.4 | 12 | 2.7 | 11 | 2.2 | 3 | 3.9 |
| White, Not of Hispanic Origin | 714 | 86.8 | 350 | 77.4 | 354 | 70.7 | 38 | 50.0 |
| Not Wish to Respond | 24 | 2.9 | 14 | 3.1 | 18 | 3.6 | 5 | 6.6 |
| Missing | 7 | 0.9 | 9 | 2.0 | 16 | 3.2 | 7 | 9.2 |
| Total | 823 | 100.0 | 452 | 100 | 501 | 100 | 76 | 100 |

(continued from page 189)

uate students in departments of physiology self-identify themselves as “physiologists.” As physiology departments diversify their faculty, students in physiology departments may be working in the lab of a biochemist, pharmacologist, or biophysicist...and may self-identify themselves as such. Finally, it is possible, albeit less likely, that prospective graduate students may perceive that academic positions are less available in physiology than in other fields.

The status of postdoctoral fellows is also a concern. The number of postdoctoral fellows at US medical school physiology departments has increased significantly over the past two decades. Factors contributing to this are, certainly, an increase in foreign students and the decreasing number of vacancies in medical school physiology departments (Table 5). However, in contrast, the NSF reports no growth in the number of physiology postdoctoral fellows overall, although the overall number of postdoctoral fellows in biological sciences has increased by 17% (18). Has the diversification of faculty in departments of physiology with the goal of increasing research dollars led to an increase in the number of postdoctoral students at those institutions and a decrease in the number of graduate students in physiology? The data needed to address this issue are not currently available, but the question is an important one for both the future of physiology research and of physiology departments.

Faculty at US medical schools. The data presented here provide some support for the assertion that physiology departments in medical schools are diversifying their faculty in terms of specific discipline. Approximately half of PhD physiologists working in US medical schools are affiliated with basic science departments (Table 9). However, only 30% of the PhD physiologists employed in medical schools were in physiology departments in 2001, down from approximately 38% in 1989 and 1994. Data suggest that candidates from more highly funded

areas such as biochemistry and molecular biology are filling more positions in departments of physiology. As noted in Table 11, 17% of the faculty in departments of physiology in 2001 had degrees in biochemistry, compared with 9% in 1989 and 12% in 1994.

As discussed earlier, one of the implications of this shift is that the faculty responsible for the teaching of physiology to medical students is not as well versed in physiological principles. In addition, it makes it increasingly difficult for the faculty to offer laboratory exercises designed to emphasize physiological principles in the absence of faculty familiar with the experimental procedures. Finally, this shift in the composition of departments of physiology may further contribute to the reduction of instructional hours available to teach physiology to medical students.

Like the change in curriculum, the shift in faculty composition should be viewed as an organizational experiment in progress. If the shift was made with specific objectives in mind—to increase the level of research funding—then an evaluation of the impact of the experiment should be done. Are those faculty members raising a disproportionately high amount of funding for their departments? Has the change in faculty composition and expertise had impacts on course content, teaching quality, and the preparedness of medical and graduate students? Has it impacted the number of and type of students being trained by the department (e.g., graduate versus postdoctoral)? Has it impacted the amount and type of research and teaching collaborations among faculty within the department? These questions cannot be addressed by national surveys, but they are important ones for each department to consider.

The other half of PhD physiologists at US medical schools are employed in clinical science departments. This represents an increase compared with the percentage employed in clinical departments in 1989 (43%) and in 1994 (45%). Of those in clinical science departments in 2001, the largest percentage was in internal medicine

(16%), somewhat greater than the 14% in 1989 and 1994. Surgery departments accounted for 7% of the PhD physiologists in 2001, a slight increase from 5% in 1989 and 6% in 1994. The shift in employment of physiologists into clinical departments may reflect physiologists' substantial understanding of clinical problems and their ability to participate in the translational research studies more common in clinical departments. This should also be viewed as an experiment in organizational management with departments monitoring the benefits that PhD physiologists bring to the departments as well as their impacts on the research profile and graduate and medical student training in which the department is involved.

Diversity Issues. The number and proportion of women awarded physiology PhD degrees has remained fairly constant since 1991, despite the fact that the number of students pursuing graduate degrees in physiology (Table 5) has decreased over the same time period. Additionally, the percentage of women with PhD degrees in physiology employed in US medical schools has increased over this time period. In 2001, 20% of the faculty was female compared with 14% in 1989 and 16% in 1994. Similar increases were found in departments of physiology where the percentage in 2001 was 22% compared with 14% in 1989 and 17% in 1994. Unfortunately, whether the female PhD physiologist was in a physiology department or in another medical school department, they were more likely to be in a non-tenure-track position than their male colleagues. However, proportionally more women on faculty are in professor positions in 2001 than in 1994.

The increased participation of female physiologists on faculties may be reflective of commitment by administrators and chairs to improve gender diversity in US medical schools and of increased availability of women with physiology degrees. Recently, the National Research Council of the National Academy of Sciences conducted an extensive study, comparing matched samples of men and women

in a number of science fields, including biological sciences (14). They found that, even adjusting for differences in the age structure of men and women in the sciences, "...men are still more likely to be tenured than women at any professional age. Although these differences have declined over time, they persist, especially in research universities....Some of the difference in women's status in academia can be explained by lower productivity, as measured by publications. It seems clear, however, that difference in the positions held by women are likely the cause of lesser productivity, rather than the other way around" (p. 6). Therefore, if US medical schools are to see the continued increase in women on faculties, it will be necessary, at minimum, to assure that they have access to tenure-track positions, comparable to that of their male colleagues.

Minorities in Physiology. As is apparent from a comparison of the data in Tables 8 and 13 with the results published in 1995 (15), there has been little progress made to increase the number and proportion of minority PhD physiologists in US medical schools. This is most apparent in departments of physiology where the percentage of underrepresented minority faculty (African American, Native American, and Hispanic) remained stagnant at 5%. Those underrepresented minorities trained in physiology and recruited to US medical school were more likely to find employment outside of departments of physiology, resulting in a small increase in the percentage employed to 4% in 2001 from 3% in 1994 and 2% in 1989. When Asians/Pacific Islanders are included in the analysis, the percentage representation in both the department of physiology and within the medical school is increased. Within departments of physiology, the percentage of underrepresented minorities including Asians increased to 16% in 2001 from 12% in 1994 and 10% in 1989. Within the medical school, the percentage of underrepresented minority PhD physiologists, including Asians, increased to 15% in 2001.

While minorities experienced a slightly increased representation in US medical schools, they were unlikely to be found in higher level academic positions. There was disproportionate representation of minorities in assistant professor and instructor positions.

The results of the 2001 analysis suggest that US medical schools and departments of physiology still have a long way to go before the percentage of minority scientists is increased to levels comparable to their levels in the general population. The fact that levels of minorities have not increased appreciably since the last analysis is disappointing because efforts to encourage minority students to pursue research careers has been a significant interest of NIH and scientific societies like the American Physiological Society. While such federally funded programs as the NIH Minority Access to Research Careers (MARC) and Minorities in Biomedical Research Studies (MBRS) have provided extensive support for the participation of minorities in biomedical research, the effort has not translated to a significant increase in the participation of minorities in physiology research in academia. From the data presented here, it appears that the Federal programs did not significantly increase the number of physiologists employed in US medical schools. It is possible that PhD physiologists trained through these programs have obtained employment in industry, research institutes, or other non-medical school environments.

The APS is currently conducting a study to provide some insights into this issue. The APS' efforts for increasing the participation of minorities in physiology have focused on supporting student training at the graduate and postdoctoral levels through the Porter Physiology Development Fellowships and on encouraging the early development of a professional network through the Minority Travel Fellows Program, with support from NIDDK and NIGMS. The APS survey of all past participants in these programs is designed to gain insights into their long-term impacts and to gather information on the career paths of the

many minority undergraduate, graduate, and postdoctoral students who have participated in our programs. It is hoped that these data will suggest ways to improve these programs for greater impact.

Conclusion

This study suggests that physiology and physiologists remain strong within US medical schools, even though their representation has shifted over the decade. While the instructional hours for physiology have declined, medical students remain supportive of the role physiology plays for their medical training. Important changes with specific objectives have been made in both the medical school curriculum and in the composition of departments of physiology, but it is not apparent that important evaluative data are being gathered to assess the impact of these changes. Without assessment, whether or not these changes accomplish their goals will remain unknown.

Does the current success of the medical physiology teaching programs result from the retention of classically trained physiologists in departments of physiology to teach the physiology course? What is the impact of departmental recruitment of faculty trained in more reductionist approaches in order to maintain the research funding levels of the departments? What will be the long-term impacts of decreases in the number of PhD physiologists employed in physiology departments and increases in the number finding positions in clinical departments where they can contribute their knowledge to translational research programs associated with clinical departments? Again, the data needed to answer these important questions must be gathered and analyzed.

Women and, to a lesser extent, minority PhD physiologists are better represented in US medical schools in 2001 than in 1994 or 1989. However, their contributions to the field are limited by their overrepresentation in non-tenure-track positions. According

(continued on page 192)

(continued from page 191)

to the National Research Council, it is critical that the numbers of women and minorities on faculties and in tenure-track positions increase so that the overall scientific community can benefit from the critical diversity and perspectives they bring (14). It is imperative that the APS and the Federal government continue their efforts to actively recruit and retain undergraduate and graduate students into physiology research programs and to encourage the hiring of women and minorities into tenure-track positions.

As stated by Knobil (10), "Physiology ... has been and continues to be the basic science central to medicine." The physiology concepts and principles identified in *Medical Physiology Learning Objectives* (7) form a solid foundation on which future physicians build their knowledge of not only healthy and disease states, but the understanding of diagnostic measures and diverse treatments and of the elegance and wonder of the living organism. To weaken that solid foundation by offering only a sampling of these key concepts taught by faculty with only a cursory knowledge of the principles and how to teach them would hardly result in a robust and sound medical education. While the questions raised here are not easily answered, they are important. They assure that the future of medical education includes the strong foundation that only physiology can provide for it.



References

1. Adolph, E. F. Physiology in North America, 1945: Survey by a Committee of the American Physiological Society. *Fed. Proc.* 3: 407-436, 1946.
2. American Association of Medical Colleges. Personal communication, Al Salas, Director, CurrMIT Project, 2001.
3. American Association of Medical Colleges. Personal communication, Hisashi Yamagata, Senior Research Associate, 2002.
4. Anderson, M. B. Medical Education in the United States and Canada Revisited. *Acad. Med.* 68: S55-S63, 1993.
5. Boron, W. F. The APS Strategic Plan - A Vision for the New Millennium. *The Physiologist* 43: 71-74, 2000.
6. Burrelli, J.S. Growth Continued in 2000 in Graduate Enrollment in Science and Engineering Fields. *National Science Foundation Data Brief*, NSF 02-306, December 21, 2001.
7. Carroll, R. G., Navar. L. G., & Blaustein, M. P. *Medical Physiology Learning Objectives*. Bethesda, MD: American Physiological Society, 2001, <http://www.the-aps.org/education/MedPhysObj/medcor.htm>.
8. Chien, S., Cherrington, A., Cook, J. S., Metting, P., Raff, H., Valtin, H., Young, D. B., and Yool, A. The Sun Breaks Through the Clouds: A Bright Future for Physiology. A Report From the Long-Range Planning Committee. *The Physiologist* 39: 375-388, 1996.
9. DiBona, G. F. 73rd President of APS. *The Physiologist* 43: 57, 66-70. 2000.
10. Geibisch, G. H., Granger, J. P., Greenleaf, J. E., Lydic, R. B., Mitchell, R. H., Nadel, E. R., Schultz, S. G., Wood, J. D., and Knobil, E. What's Past is Prologue. A "White Paper" on the Future of Physiology and the Role of the American Physiological Society in It. *The Physiologist* 33: 161-180, 1990.
11. Gerard, R. W. Mirror to Physiology. A Self-Survey of Physiological Sciences. Washington, DC. Am. Physiol. Soc., 1958.
12. Hall, J. E. 74th President of APS. *The Physiologist* 44: 65, 74-79, 2001.
13. Horwitz, B. A. 75th President of APS. *The Physiologist* 45: 87, 96-99, 2002.
14. Long J. S. *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*. Washington, DC: National Academy Press, 2001, <http://www.nap.edu/catalog/5363.html>.
15. Matyas, M. L., and Frank, M. Physiologists at US Medical Schools: Education, Current Status and Trends in Diversity. *The Physiologist* 38: 1, 5-12, 1995.
16. Staub, N. C., Schultz, S. G., and Frank, M. American Physiological Society's Strategic Plan. *The Physiologist* 35: 37-43, 1992.
17. National Science Board. *Science and Engineering Indicators - 2002*. Arlington, VA: National Science Foundation, 2002 (NSB-02-1).
18. National Science Foundation, Division of Science Resources Statistics. *Graduate Students and Postdoctorates in Science and Engineering: Fall 2000*. Arlington, VA: National Science Foundation, 2002 (NSF 02-314, Project Officer, Joan S. Burrelli).
19. National Science Foundation, Division of Science Resources Statistics. *Science and Engineering Doctorate Awards: 2000*. Arlington, VA: National Science Foundation, 2001 (NSF 02-305, Author, Susan T. Hill).
20. National Science Foundation, Division of Science Resources Studies, *Science and Engineering Degrees, by Race/Ethnicity of Recipients: 1989-97*, NSF 00-311, Author, Susan T. Hill (Arlington, VA 2000).

Time: 5:30 PM, Tuesday, April 23, 2002
Place: Ernest N. Morial Convention Center, New Orleans, LA

I. Call to Order

The meeting was called to order at 5:37 PM by **President John E. Hall**, who welcomed the members to the 155th Business Meeting of the American Physiological Society. A booklet containing the agenda and a listing of all the APS award recipients was distributed to those members present.

II. Election of Officers

Executive Director **Martin Frank** announced the results of the election of officers that was conducted by mail ballot. Frank stated that a total of 1,416 ballots were cast. The membership elected **John A. Williams**, University of Michigan, as President-Elect (April 24, 2002-April 15, 2003). The two newly elected Councillors are **Virginia Miller**, Mayo Clinic and Foundation, MN, and **Charles Tipton**, University of Arizona. They will serve a three-year term (April 24, 2002-April 5, 2005) which will begin at the close of the Annual Meeting. They are replacing **Hannah Carey** and **Jo Rae Wright**.

III. State of the Society

Hall addressed the meeting and spoke on the state of the Society. He said that he was pleased with the continued growth of the Society's membership, and that the Society overall was doing well. He then spoke about his year as president of APS and of the goals he had hoped to achieve during his presidency. The first goal was to further enhance the vitality and excellence of the APS meetings and publications. In the area of publications there have been some innovative ideas put into action, such as the APS online collection, the legacy data project, the High Wire Library of the Sciences and Medicine project, and the *Physiology in Medicine* (PIM) Series. Through the Legacy Data Project, APS journal content dating back to 1898 and continuing forward will be scanned and posted online. The High Wire Library of the Sciences and Medicine project is a new web portal providing enhanced

searchability, including content of 300 plus journals. The *PIM series*, which will appear in the *Annals of Internal Medicine*, will help link physiology and medicine together. Hall praised **Dale Benos** for his leadership as Chair of the APS Publications Committee. Hall said that the APS meetings have been enhanced in several ways. The first is by further developing the "meeting within a meeting" concept at the Experimental Biology (EB) meetings. He also said the meetings have gotten stronger by empowering the sections by allowing them to create a "meeting within a meeting" for their section members. He also said that the APS conferences have been expanded to meet the needs of the entire APS membership and they highlight Physiological Genomics and Translational Research.

The second goal of Hall's term as President was to strengthen the APS sections, which he believes are the backbone of the Society. He said that the sections now have expanded resources for the EB meetings. These resources include distinguished lectureships, featured topics, allocation of symposia slots, and funding for young investigator awards. The APS sections are also strengthened through committee representation on such committees as the Section Advisory Committee (SAC), the Nominating Committee, Committee on Committees, and the Liaison with Industry Committee.

Hall's third goal was to increase the visibility of APS and the discipline of physiology. To assist APS to increase their visibility and that of physiology, a media specialist and a media company were hired, and APS formed a new Communications Committee. Together, they will be responsible for informing the media and public about new developments in physiology and contributions of APS and its members, meetings, journals, awards programs, and outreach efforts.

His fourth goal was to develop a "translational research" initiative. He began his discussion by first defining the term "translational research."

Translational research is the transfer of knowledge gained from basic research into new and

improved methods of preventing, diagnosing, or treating disease. It is also the transfer of clinical insights into hypotheses that can be tested and validated in the basic research laboratory. Translational research is bi-directional.

Hall went on to say that the gap between the basic sciences and clinical medical is growing, according to the NIH, HHMI, AHA, ACS, and others. He said that this growing gap may be due, in large part, to the declining activity in clinical physiology and integrative physiology. This declining activity in integrative physiology is likely due to: 1) technological advances in molecular biology/genomics and funding pressures have attracted physiologists to be more reductionist; 2) physiologists have often become indistinguishable from other basic scientists and, as a result, basic science departments are merging; 3) PhD training programs usually don't include pathophysiology, and sometimes very little physiology; and 4) physiology departments may not be effectively serving as a bridge between the basic sciences and clinical research.

The declining activity in clinical physiology is due, in part, to: 1) a loss of role models and mentors for translational research; 2) inadequate time for research in residency training programs; 3) financial pressures (managed care); and 4) physical and intellectual separation from the basic sciences. Hall went on to say that basic and clinical research programs are no longer conducted side by side in most academic medical centers. This separation is leading to less interaction among physiologists and clinicians. Because of declining activity in clinical and integrative physiology, APS has established a Translational Research Task Force. The goals of this task force are to: 1) ensure that physiology re-establishes itself as a discipline that links basic sciences and clinical medicine, and 2) promote interdisciplinary research that translates advances in basic science to clinical research.

(continued on page 194)

(continued from page 193)

There are several objectives APS hopes to achieve through the translational research initiative. The first is to highlight translational research in APS meetings and publications. There has been a call for translational research papers in the APS journals, and the *PIM* series, which will appear in the *Annals of Medicine*, will also include translational research articles. APS meetings will also be used to promote the initiative. For example, at the EB meetings, translational research can be more greatly highlighted by developing stronger programming ties with the American Foundation for Medical Research (AFMR); encouraging cross-cutting, bench to bedside programming; sponsoring workshops aimed at overcoming barriers to interdisciplinary research; and sponsoring workshops on career opportunities in translational research. Hall would like APS to sponsor at least one translational research conference a year and sponsor/endorse symposia at other clinical meetings (e.g., ASN, AHA, AGA).

The second objective of the initiative is to encourage physiologists to develop interdisciplinary teams that bridge molecular and cellular physiology, organ systems physiology, and clinical research. Other objectives of the translational research initiative are to: 1) promote translational research as a viable career for physiologists; 2) increase the impact of physiology on the medical school curriculum, as well as on postgraduate medical education; 3) promote training in integrative physiology; and 4) increase the visibility of physiology as a discipline.

As stated earlier, Hall said that he would also like to increase the impact of physiology on the medical school curriculum, and on postgraduate medical education. He said that physiologists often have little contact with medical students after the first year, although both medical students and clinicians believe that the teaching of physiology is important. In the 2001 AAMC Medical School Graduation questionnaire, 88.7% of the respondents said that physiology courses were important or very important in

preparing them for medical school. On another question, 84.6% rated physiology courses as good or excellent in preparing them for medical clerkships; on both of these questions, physiology was ranked higher than other basic science courses in order of importance. However, the number of course and contact hours for physiology within the medical schools is declining. Thus, the translational research initiative will also be used to: 1) promote and facilitate the instruction of basic medical physiology by Physiology Departments; 2) promote the instruction of physiology in the clinical years and in postgraduate medical education; 3) promote inclusion of pathophysiology in the medical curriculum; and 4) promote inclusion of pathophysiology and clinical research in Physiology PhD training programs.

Hall said that there are several strategies that will be employed by the translational research initiative to achieve these objectives. Some of these strategies are to: 1) obtain more information on the importance of physiology to students and clinicians; 2) be more proactive in dealing with the USMLE and making sure that physiology is well-represented; 3) obtain more information on careers in physiology, especially the need for integrative physiologists; 4) work to get the ACDP/APS medical curriculum objectives accepted; 5) build a template for a pathophysiology course ("Physiology in Medicine Grand Rounds"); and 6) use the APS Archives for promoting physiology/pathophysiology education. The Archives contains material suitable for all educational levels (K-12, undergraduate, graduate/professional) and will develop a repository of case histories, animations, figures, lectures, simulations, and links to additional resources on the web. A scientific review board has been established to review material for scientific accuracy and to verify the appropriate use of animals. Material in the Archives is searchable by title, author, subject matter, keywords, type of file, pedagogy, medical learning objectives, as well as other criteria. Also, the Archives is part of a larger BiosciEd

Net (BEN) portal that includes APS, ASM, ESA, ASBMB, Science's STKE and others.

Hall then updated the membership on the financial situation of the Society. He said that APS is in good shape, and the various programs, such as meetings and publications, are doing well.

Hall then thanked the APS staff, in particular APS Executive Director Martin Frank, Education Officer Marsha Matyas, Director of Publications Margaret Reich, Public Affairs Officer Alice Ra'anan, Membership Services Manager Linda Allen, Director of Finance Robert Price, Higher Education Programs Coordinator Melinda Lowy, and Executive Assistant Linda Comley. Hall also thanked Past-President **Gerald DiBona** and President-Elect **Barbara Horwitz** for all their help and support during his tenure.

In closing, Hall thanked the membership for the opportunity to serve the Society as its President and said that this is a "great time to be a physiologist."

V. Report on Membership

A. Summary of the Membership Status

President-Elect **Barbara A. Horwitz** reported on the status of the Society membership. As of March 22, 2002, the current membership of the Society is 10,915, of which 7,536 are regular members, 39 are honorary members, 1,056 are emeritus members, 91 are affiliate members, and 2,193 are student members. The Society also has 22 Sustaining Associate members.

B. Deaths Reported Since the Last Meeting

Horwitz read the names of those members whose deaths had been reported since the last meeting. The membership stood and observed a moment of silence in tribute to their deceased colleagues.

VI. Awards and Presentations

A. Ray G. Daggs Award

Ray G. Daggs was the APS Executive Secretary-Treasurer from 1956 until his retirement in 1972. In tribute to his devotion to the Society, the Ray G. Daggs Award was established and is given annually to a physiologist for distinguished service to the Society and to the science of physiology. The recipient receives \$500 and expenses to attend the Experimental Biology meeting. Hall was pleased to announce that the recipient of the 2002 Ray G. Daggs Award is **Elsworth Buskirk**, Pennsylvania State University.

In selecting Buskirk as this year's recipient, the Daggs Award Committee noted that Buskirk has provided distinguished service to our field and to the American Physiological Society over many years. He served as chairman of the Environmental and Exercise Physiology (the EEP) Section of the APS from 1988-1991. He was a member of the Association of Chairmen of Departments of Physiology from 1974-1991, and as well, directed the Noll Laboratory of Human Performance over these years. Buskirk has held a number of leadership positions for the American College of Sports Medicine and has been the recipient of a number of the College's awards, including the highest honorary award. The College's membership derives signifi-

cantly from the APS. He also received the Honor Award from the EEP Section of the APS in 1993. Buskirk was Section Editor for the Environmental and Exercise Physiology papers to the *American Journal of Physiology* and the *Journal of Applied Physiology* before editors and associate editors were identified. He was section editor, editor, and editor-in-chief for *Medicine and Science in Sports and Exercise* from 1973-1988, where he remains Consulting Editor. Buskirk also served on a large number of advisor panels and study sections for NSF, AHA, NRC, USAF, NASA, and ONR, including four terms on NIH study sections with two terms as chair. Buskirk has published over 245 scientific papers, books and book chapters. He has contributed significant scholarly work since 1957 in the areas of environmental and exercise, mentoring more than 40 PhD students. Since becoming Professor Emeritus in 1992, he has published a number of papers and chapters, including a chapter in the APS's *Handbook of Physiology* entitled "Nutrition and exercise in adverse environments" in 1996. He continues to be active in APS.

Congratulations to Elsworth Buskirk for a lifetime of achievement and leadership in the science of physiology and his service to The American Physiological Society and its membership.

B. Orr E. Reynolds Award

The Orr Reynolds Award, established in 1985 in honor of the second Executive Secretary-Treasurer, is presented for the best historical article submitted by a member of the Society. Members may receive the award only once, and those members who have advanced degrees in the history of science or medicine are not eligible. The recipient receives \$500 and expenses to attend the Experimental Biology meeting.

Hall was pleased to announce that the 2002 Reynolds Awardee is **Gerard P. Smith**, Weill Medical College of Cornell University, for his article entitled "Pavlov and Integrative Physiology."

C. Arthur C. Guyton Teacher of the Year Award

The Arthur C. Guyton Teacher of the Year Award was established in 1993 by the Teaching of Physiology Section and supported by the W. B. Saunders Company, publisher of *Guyton's Textbook on Medical Physiology*, used to educate generations of medical and physiology students. The award is given to an APS member who is a full-time faculty member of an accredited college or university and involved in classroom teaching and not exclusively the teaching of graduate students in a research laboratory. The recipient receives \$1,000 and expenses to attend the EB meeting.

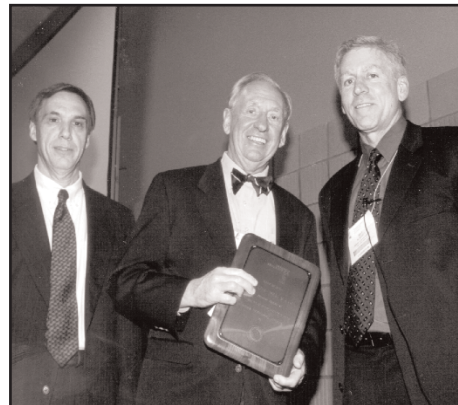
(continued on page 196)



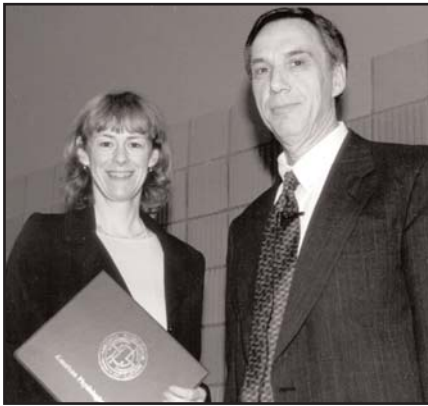
APS President John Hall presenting the Ray G. Daggs Award to Elsworth Buskirk.



President John Hall presenting the Orr E. Reynolds award to Gerard P. Smith.



President John Hall and William Schmitt presenting the Arthur C. Guyton Teacher of the Year Award to John West.



President John Hall presenting the Giles F. Filley Memorial Award to Claudette Marie St. Croix.



President John Hall presenting the Giles F. Filley Memorial Award to Mai-Lan Huynh.



President John Hall presenting the Shih-Chun Wang Young Investigator Award to Jeffrey Potts.

(continued from page 195)

Hall introduced William Schmitt from the W.B. Saunders Company who presented the 2001 Guyton Teacher of the Year Award to **John West**. West studied the functioning of the lungs and respiration and pulmonary physiology in his early years. He currently teaches at the University of California, San Diego. In his courses, he is able to integrate physiology and medicine. He has been the recipient of the Kaiser Award, and was president of the American Physiological Society 1984-1985.

D. Giles F. Filley Memorial Awards

As a result of a bequest from the family of Giles F. Filley, a memorial fund was established in 1993 to recog-

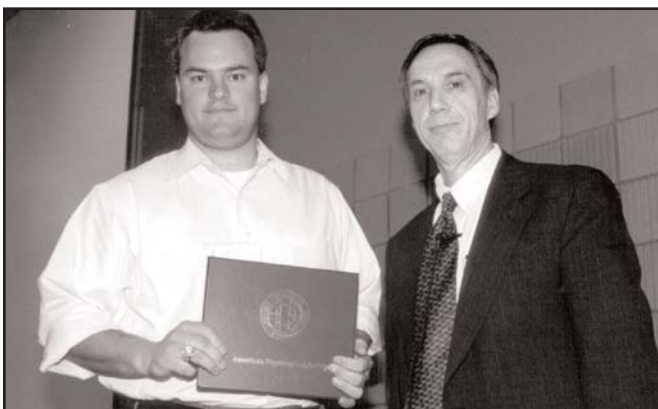
nize excellence in respiratory physiology and medicine. Two annual awards are made to investigators who hold an academic rank no higher than assistant professor and are pursuing research in respiratory physiology and medicine. Awards are made to APS members working in the United States, who have demonstrated outstanding promise based on their research program.

Hall presented the 2002 awards to **Mai-Lan N. Huynh**, University of Colorado, and **Claudette Marie St. Croix**, University of Pittsburgh.

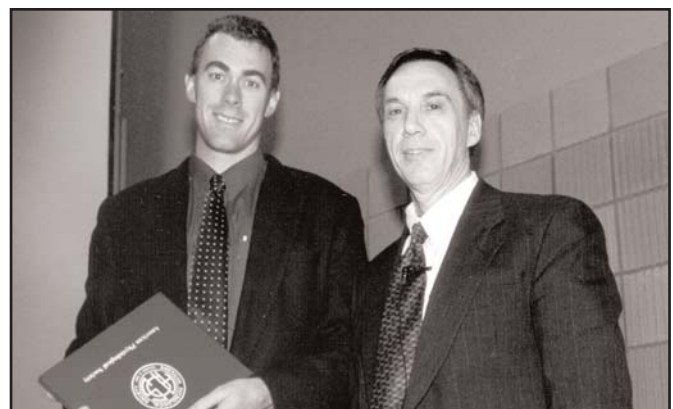
Each recipient received a \$25,000 check for use in his/her respective research program, a plaque, and reimbursement of expenses to attend the Experimental Biology meeting.

E. Shih-Chun Wang Young Investigator Award

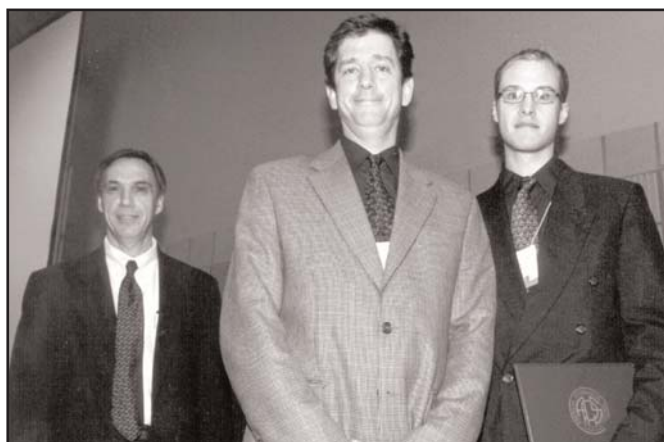
As a result of a bequest from the wife of Shih-Chun Wang, a memorial fund was established in 1998 to recognize excellence in physiology. Shih-Chun Wang was the Pfeiffer Professor of Pharmacology at Columbia University and a long-standing member of the APS. He was internationally recognized for his research contributions in the areas of neurophysiology and neuropharmacology with an emphasis on brainstem control mechanisms. An award is made to an APS member working in the US who has demonstrated outstanding promise based on his/her research program. Hall presented the 2002 Wang Award to **Jeffrey T. Potts**, Wayne State University School of Medicine, Michigan.



President John Hall presenting the Lazaro J. Mandel Young Investigator Award to James D. Stockand.



President John Hall presenting the Arthur C. Guyton Award for Excellence in Integrative Physiology to Simon C. Malpas.



President John Hall and Glenn Reinhart presenting the Liaison With Industry Award to Darren Hoffman.



President John Hall and Glenn Reinhart presenting the Liaison With Industry Award to Edward Lee.

Potts received a \$12,000 check for use in his research program, a plaque, and reimbursement of expenses to attend the Experimental Biology meeting.

F. Lazaro J. Mandel Young Investigator Award

As a result of a bequest from the wife of Lazaro J. Mandel, a memorial fund was established in 1999 to recognize excellence in epithelial or renal physiology. An annual award is made to an investigator who holds an academic rank no higher than assistant professor and is pursuing research in epithelial or renal physiology. An award is made to an APS member working in the United States who has

demonstrated outstanding promise based on his or her research program. Each award is for \$12,000 and is designated for the use of the awardee in his/her research program. Hall presented the 2002 Mandel Award to **James D. Stockand**, University of Texas Health Science Center at San Antonio.

Stockand received a \$12,000 check for use in his research program, a plaque, and reimbursement of expenses to attend the Experimental Biology meeting.

G. Arthur C. Guyton Award for Excellence in Integrative Physiology

A donation to the Society in honor of

Arthur C. Guyton led to the establishment in 1997 of an award to recognize excellence in integrative physiology. One award is made annually to a regular APS member who demonstrates outstanding promise based on his/her research program in feedback, mathematical modeling, and integrative physiology.

Hall presented the 2002 Arthur C. Guyton Award in Integrative Physiology to **Simon C. Malpas**, The University of Auckland, New Zealand.

Malpas received a \$12,000 check for use in his research program, a plaque, and reimbursement of expenses to attend the Experimental Biology meeting.

(continued on page 198)



President John Hall presenting a plaque to Helen Raybould, outgoing chair of the Gastrointestinal Section.



President John Hall presenting a plaque to Jeff Sands, outgoing chair of the Renal Section.



President John Hall presenting a plaque to Dee Silverthorn, outgoing chair of the Teaching of Physiology Section.



President John Hall presenting a plaque to Hannah Carey, outgoing Councillor.

(continued from page 197)

H. Liaison With Industry Awards

The Liaison With Industry Awards are given to the graduate student and the postdoctoral fellow submitting the best abstract describing a novel disease model. This award is sponsored by the Liaison with Industry Committee. This is the third year these awards have been given. Hall and **Glenn A. Reinhart**, a representative of the Liaison With Industry Committee, presented the 2002 Liaison With Industry Awards to Graduate Student **Darren S. Hoffman**, University of Iowa, and Graduate Student **Edward Wolfgang Lee**, Georgetown University Medical Center.



President John Hall presented a plaque and sailor's cap to Gerald DiBona, outgoing Past President.

I. Caroline tum Suden/ Frances Hellebrandt Professional Opportunity Awards

Thirty-six awards were made possible by the bequests of Caroline tum Suden and Frances Hellebrandt, who were long-time members of the Society. Awards are open to graduate students or postdoctoral fellows who present papers at the spring meeting. Recipients receive a \$500 check for travel to the Experimental Biology meeting, paid registration, and have access to the FASEB Placement Service. **Carole Liedtke**, Chair of the Women in Physiology Committee, presented the awards.



President-elect Barbara Horwitz receives the gavel from President John Hall.

J. Procter & Gamble Professional Opportunity Awards

The Procter and Gamble Company, a multinational, technically-based consumer products corporation, provides support for the APS Professional Opportunities Awards. The APS sections selected 12 predoctoral students who are within 12-18 months of receiving a PhD degree and are presenting a paper as first author at the spring meeting. Paid registration and \$500 checks were given to the awardees. APS Executive Director **Martin Frank** presented the awards.

K. Minority Travel Fellowships

These Travel Fellowships for minority physiologists, established in 1987, are open to advanced undergraduate, predoctoral, and postdoctoral stu-



President John Hall presenting the Walter B. Cannon Lecture Award to Allen Cowley.



Past President Gerald DiBona presenting the Henry Pickering Bowditch Award to Pontus Persson.

dents, who have obtained their undergraduate education in Minority Biomedical Research Programs (MBRP) and MARC-eligible institutions, as well as students in the APS Porter Physiology Development Program. Minority faculty members at the above institutions may also apply. Funds are provided for travel and per diem to attend the annual spring meeting. This program is supported by the NIDDK and the NIGMS. The intent of this award is to increase participation of pre- and postdoctoral minority students in physiological sciences. This year APS is pleased to present 44 Minority Travel Fellowship Awards.

Hall then asked that all the young investigator award recipients stand and be recognized by the attending membership.

K. Recognition of Outgoing Section Chairs

Helen Raybould, Chair of the Gastrointestinal Section; **Jeff M.**

Sands, Chair of the Renal Section; **Dee U. Silverthorn**, Chair of the Teaching of Physiology Section; and **Michael A. Matthay**, Chair of the Respiration Section, complete their terms at the close of this meeting. Hall thanked them for their guidance and leadership with the sections, and their help and dedication to the Society.

L. Recognition of Outgoing Councillors

Councillors **Hannah V. Carey** and **Jo Rae Wright** will complete their terms on Council at the close of the Experimental Biology 2002 meeting. Hall thanked them for their service on Council and their assistance to him, and recognized their dedication and guidance to the Society.

Hall then offered a special "Thank You" to Past-president **Gerald DiBona**. He thanked DiBona for his help, leadership, and dedicated service to the Society, presenting him with a plaque honoring his presidency.

VII. Passing of the Gavel

Hall then turned the gavel over to **Barbara A. Horwitz**, University of California, Davis, incoming President of the American Physiological Society. Horwitz thanked Hall on behalf of the Society saying that the Society had been very fortunate having **John Hall** as President.

VIII. New Business

After President Hall completed his presentation, APS member **Gabriel Nahas** took the floor and commented on Hall's remarks. Nahas raised several issues, including the idea that physiology needs to be redefined. He also said that medicine is a science composed of many arts, and that physiology is one of these arts. Hall thanked him for his comments.

There being no new business, the meeting was adjourned at 6:47 PM, April 23, 2002. ❖

Barbara A. Horwitz, President-Elect



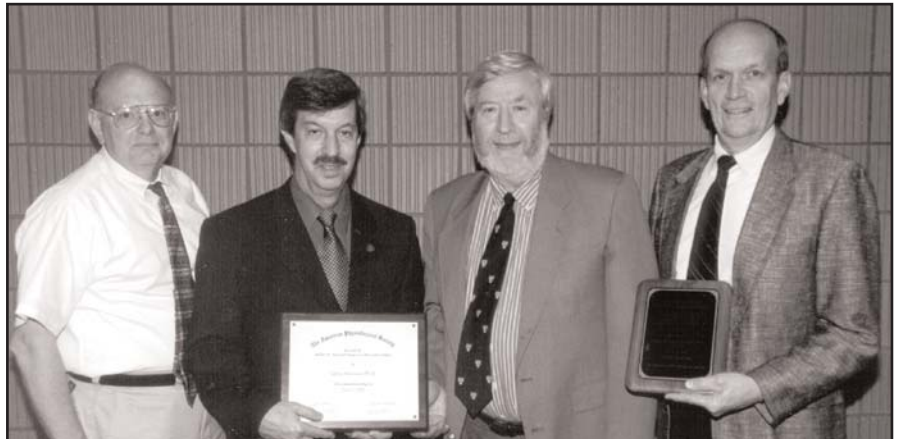
APS Presidents Gather at EB '02

Front Row: William Dantzler, Stanley Schultz, John Hall, Bodil Schmidt-Nielsen, Barbara Horwitz, Vernon Bishop.

Back Row: Walter Boron, John Williams, Gerald DiBona, John West, Jim Schafer, Shu Chien, Aubrey Taylor, Franklyn Knox, Gabriel Navar, David Bohr, Norman Staub.



Marlene Cohen of Eli Lilly Company presenting Phyllis Wise the FASEB Excellence in Science Award.



David Randall, Martin Frank, and Tim Burkholder presenting the Walter C. Randall Lecture Award to Adrian Morrison.



Gary Kline, Sue Sabur, and Gil Ebner staffing the APS exhibit booth at EB '02.



Dale Benos recognized outgoing publications committee members and editors at the Publications Banquet held at EB '02 in New Orleans. Pictured left to right are outgoing committee members Jim Schafer and Davis Manning, outgoing journal editors Penny Hansen and John Hall, Margaret Reich, APS Director of Publications, and Dale Benos, APS Publications Chair.

Graduate Students and Postdoctoral Fellows Receive Caroline tum Suden/Frances A. Hellebrandt Professional Opportunity Awards

Graduate students and postdoctoral fellows who were first authors on an abstract submitted to Experimental Biology 2002 in New Orleans, LA were eligible to apply for the Caroline tum Suden/Frances A. Hellebrandt Professional Opportunity Award. The APS Women in Physiology Committee, chaired by **Carole M. Liedtke**, Case Western Reserve University, selected 36 awardees from a pool of 105 applicants. Applicants were chosen based on the quality and novelty of their abstracts, and letters written by the candidates describing their career goals, research, and why they were particularly deserving of the award. Each awardee received \$500, a certificate of recognition, and complimentary registration for the EB 2002 meeting. Awards were presented during the APS Business Meeting at EB 2002. Awardees were:

Diego Alvarez, Univ. of South Alabama College of Medicine

Wendy Baltzer, Texas A&M Univ.

Srisaila Basavappa, Yale Univ. School of Medicine

Pamela Boyd, York Univ.

Robert Brock, Univ. of Western Ontario

Alison Dungey, Univ. of Western Ontario

Scott Earley, Univ. of New Mexico Health Science Center

Paul Fadel, Univ. of Texas Southwestern Medical Center

C. Michael Foley, Univ. of Missouri

Darren Hoffman, Univ. of Iowa

Venkateswarlu Karicheti, Albert Einstein College of Medicine

Prasad V. G. Katakam, Mayo Clinic

Ollie Kelly, Emory Univ.

Eric Lazartigues, Univ. of Iowa

Nathan LeBrasseur, Boston Univ.

Timothy Lindley, Univ. of Iowa

Maria Llinas Pias, Univ. of Mississippi Medical Center

Samantha Louey, Monash Univ.

Sarah McCarter, Univ. of Western Ontario

Donogh McKeogh, Oregon Health and Sciences Univ.

Shyamal Mehta, Medical College of Georgia

Kevin Monahan, Penn State Univ./Milton S. Hershey Medical Center

Mohammad Newaz, Texas Southern Univ.

David Rodenbaugh, Wayne State Univ.

Traci Taylor, Medical College of Georgia

Yingxiao Wang, Univ. of California, San Diego

Yu Wang, Univ. of Nebraska

Zheng Wu, Georgetown Univ.

Christian Wunder, Univ. of Western Ontario

Li Yang, Univ. of Southern California

Dan Ye, Mayo Clinic

Yong-Chun Zeng, Univ. of Nebraska

Shao-Ling Zhang, Univ. of Montreal

Xueying Zhao, Medical College of Georgia

Matt Zimmerman, Univ. of Iowa

Adrienne Stevens Zion, Columbia Univ.



Caroline tum Suden/Frances Hellebrandt Professional Opportunity Awardees.

Predocctoral Students Receive Procter & Gamble Professional Opportunity Awards at EB 2002

Once again, the APS has been able to recognize the valuable contributions of 12 predoctoral students to the science of physiology as a result of a generous contribution provided by the Procter & Gamble Company. Students who were first authors on an abstract submitted to EB 2002 in New Orleans, LA were eligible to apply for the Procter & Gamble Professional Opportunity Award through one of the 12 sections of the Society. Award recipient selection was made by the sections. Each awardee received \$500, a certificate of recognition, and complimentary registration for the Experimental Biology meeting. They were presented their awards at the APS Business Meeting at EB 2002. Awardees were:

Cardiovascular Section

Carol A. Witzak, University of Missouri-Columbia

Cell & Molecular Section

Kathryn Ault Ziel, University of South Alabama
College of Medicine

Central Nervous System Section

Christopher D. Sharp, Louisiana State University
Health Science Center

Comparative Section

Sierra R. Guynn, Creighton University
School of Medicine

Endocrinology & Metabolism Section

Patrick T. Fueger, Vanderbilt University

Environmental & Exercise Section

Erwin A. Bautista, University of California, Davis

Gastrointestinal Section

Joseph G. Duman, University of California, Berkeley

Neural Control & Autonomic Regulation Section

Lila P. LaGrange, University of Texas Health Science
Center at San Antonio

Renal Section

Ahmed A. Elmarakby, Medical College of Georgia

Respiration Section

Kenneth J. Cavanaugh Jr., University of Pennsylvania

Teaching of Physiology Section

Patti M. Thorn, University of Texas at Austin

Water & Electrolyte Homeostasis Section

Keith DiPetrillo, Dartmouth Medical School



Procter & Gamble Professional Opportunity Awardees.

APS Members Serve as Mentors to EB 2002 NIDDK/NIGMS Travel Fellows

The APS has awarded Travel Fellowships to minorities to attend the Experimental Biology meeting each spring since 1987. These travel awards are supported by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) and the National Institute of General Medical Sciences (NIGMS). Awardees are provided with funds for transportation, meals, lodging, and complimentary meeting registration. The APS Porter Physiology Development Committee reviews and selects applicants for this award. This year, 44 minority students and postdoctoral fellows were selected from 54 applications to receive fellowships, enabling them to attend EB 2002 in New Orleans, LA.

Travel Fellows in this APS program frequently cite the pairing of each Fellow with an APS member to serve as his/her mentor for the duration of the EB meeting as one of the most valuable components of the fellowship. Mentors offer guidance on appropriate sessions to attend, introduce Fellows to other scientists, and provide career advice. This component helps Fellows to maximize their time and more fully experience the many aspects of EB. Fellows often expressed their appreciation that the program provides not

just financial assistance, but professional guidance, as well. The mentors who volunteered this year are much appreciated for offering their time and expertise, especially the numerous APS members who have made this contribution for many years in a row.

Fellows and their mentors attended a closing luncheon at EB to hear from guest speakers and to receive certificates honoring their successful participation in the program from **Martin Frank**, APS Executive Director, and APS President, **John Hall**. Fellows saw the luncheon as a welcome opportunity to compare notes on their scientific activities of the week. Former APS President **L. Gabriel Navar**, of Tulane University Medical School, spoke to the audience about what to expect and how to deal with being a minority student and later a faculty member when following their chosen career in physiology.

The travel awards are open to graduate students, postdoctoral students, and advanced undergraduate students from minority groups underrepresented in science (i.e., African Americans, Hispanics, Native Americans, and Pacific Islanders). Students must be US citizens or perma-

ment residents. The specific intent of this award is to increase participation of pre- and postdoctoral minority students in the physiological sciences. For more information, contact the APS Education Office at 301-634-7132 or education@the-aps.org or visit http://www.the-aps.org/education/minority_prog/index.htm on the APS website.

EB 2002 awardees were (*denotes NIGMS Fellow):

James Patrick Abulencia, Johns Hopkins Univ.
Guy Alvarez, Colorado State Univ.
Erwin A. Bautista, Univ. of California Davis
Robert Carter III, Univ. of North Texas Health Science Center
Whitney Daniels, Ursinus College
Martin Farias III, Univ. of North Texas Health Science Center
Marcelo Febo, Univ. of Puerto Rico Medical Sciences
Karen Feng, Univ. of Arizona
Patrizia Alizia Flores, New Mexico Highlands Univ.
***Billie J. Foote**, Ft. Belknap College
Gerald D. Frank, Vanderbilt Univ. School of Medicine
Oliver I. Fregoso, Univ. of California, Santa Cruz
Jacob Garza, Texas A&M Univ., Kingsville
Daniel N. Gonzalez, Texas A&M Univ., Kingsville
Lorie Ann Gonzalez, Texas A&M Univ., Kingsville
Jorge L. Gonzalez-Perez, Univ. of Puerto Rico
Earl G. Haley, Wright State Univ.
Milton Hamblin, Meharry Medical College
***Justin Hawley**, Ft. Belknap College
Mark J. Hernandez, Univ. of Missouri, Columbia
Danielle L. Hughes, Wake Forest Univ.
Allison A. Ivy, Meharry Medical College
Nikki L. Jernigan, Univ. of New Mexico
Jennifer L.T. Keeling, Univ. of California, Santa Cruz
Ollie Kelly, Emory Univ.
Johnalyn D. Lyles, Univ. of Maryland, Baltimore
Hector Macias, Univ. of California
Jennifer Marquez, Univ. of Arizona
Chastity N. McRae, Univ. of Alabama at Birmingham
***Bethany NotAfraid**, Ft. Belknap College
Rudy M. Ortiz, Univ. of California Santa Cruz
Maria Teresa Z. Paraz, Univ. of California
Michael F. Perrine, Univ. of New Mexico Health Science Center
Steve J. Plane, Sr., New Mexico State Univ.
Kassandra Inez Rossiter, Univ. of California, Santa Cruz
Raudel Sandoval, Univ. of Illinois
Edward G. Smith, North Carolina Central Univ.
***Joseph Strike**, Ft. Belknap College

Ita T. Udosen, Texas Southern Univ.
Johana Vallejo, Univ. of Missouri, Columbia
Elizabeth K. Weihe, Mayo Foundation
Ianthalates Williams, Univ. of Alabama
Jan Michael Williams, Medical College of Georgia

EB 2002 Mentors were:

Magdalena Alonso-Galicia, Merck Research Laboratories
Francisco Andrade, Case Western Reserve Univ.
Mouhamed Awayda, Tulane Univ. Medical Center
Susan Barman, Michigan State Univ.
Kathleen Berecek, Univ. of Alabama at Birmingham
Cesar Blanco, Univ. of Southern California
Eldon Braun, Univ. of Arizona Health Science Center
Steve Britton, Medical College of Ohio
Hannah V. Carey, Univ. of Wisconsin School of Veterinary Medicine
William M. Chilian, Medical College of Wisconsin
Parimal Chowdhury, Univ. of Arkansas Medical Science
John Cuppoletti, Univ. of Cincinnati College of Medicine
Dipak Das, Univ. of Connecticut School of Medicine
Barbara E. Goodman, Univ. of South Dakota School of Medicine
Alan Hargens, Univ. of California-San Diego
Thomas C. Herzig, Uniformed Services Univ. of Health Sciences
Cynthia Jackson, Univ. of Western Georgia
Lauren Koch, Medical College of Ohio
James C. Leiter, Dartmouth Medical School
Michael Massett, Univ. of Rochester School of Medicine and Dentistry
James B. Martins, Univ. of Iowa
Evangeline Motley, Meharry Medical College
C. Leo Ortiz, Univ. of California-Santa Cruz
C. Subah Packer, Indiana Univ. School of Medicine
Nancy Pelaez, California State Univ., Fullerton
Aleksander S. Popel, Johns Hopkins Univ. School of Medicine
Chi-Sang Poon, Harvard-MIT Division of Health Sciences & Technology
Usha Raj, Harbor-UCLA Medical Center
Deborah A. Scheuer, Univ. of Missouri, Kansas City
Suresh C. Tyagi, Univ. of Mississippi Medical Center
Catherine Uyehara, Tripler Army Medical Center
Alice R. Villalobos, Univ. of Rochester
Peter Wagner, Univ. of California-San Diego

New Regular Members

*Transferred from Student Membership

- Worku Abebe**
Medical College of Georgia
- Damian Miles Bailey**
Univ. of Glamorgan, UK
- Erwin A. Bautista***
Univ. of California, Davis
- Yves Boirie**
Human Nutrition Laboratory,
France
- Claudia J. Brahler**
Univ. of Dayton, OH
- Susan V. Brooks**
Univ. of Michigan
- Hua Cai**
Emory Univ. School of Med., GA
- Chi-Hing C. Cheng**
Univ. of Illinois
- Kothapa N. Chetty**
Grambling State Univ., LA
- James B. Claiborne**
Georgia Southern Univ.
- Laura A. Dada**
Northwestern Univ.
- Arthur L. Devries**
Univ. of Illinois
- Gregory Mark Dick**
Univ. of Nevada
- Christopher G. Ellis**
Univ. of Western Ontario, Canada
- Pauline L. Entin***
Northern Arizona Univ.
- William B. Farquhar***
HRC Res & Training Inst., Boston,
MA
- Janet Lyn Fitzakerley**
Univ. of Minnesota, Duluth
- C. Michael Foley***
Univ. of Missouri
- Lourdes A. Fortepiani**
Univ. of Mississippi
- Craig Gatto***
Illinois State Univ.
- Sandra R. Grabowski**
Purdue Univ.
- Solomon M. Hamilton**
Oakwood College
- Xinbing Han**
Children's Memorial Hosp., Chicago
- Pernille Bjorg Hansen**
NIH, NIDDK
- John Daniel Hatle**
Illinois State Univ.
- Jean-Francois Hocquette**
Nat'l Inst of Agronomic Res, France
- Chuan Hu***
Memorial Sloan-Kettering
Cancer Ctr, NY
- Charles H. Hubscher**
Univ. of Louisville, KY
- Judith Nicoll Hudson**
Peninsula Med Sch, UK
- Simon M. Hughes**
King's College, London, UK
- Ronald J. Johnson***
Pharmacia Animal Health, MI
- Sheree M. Johnson***
Howard Univ., DC
- Stephen M. Kajiura**
Univ. of California, Irvine
- Venkateswarlv Karicheti**
Millennium Pharmaceuticals Inc., MA
- Franz Kehl**
Julius-Maximilians Univ., Germany
- Scot R. Kimball**
Penn State Univ.
- Landon S. King**
Johns Hopkins Univ.
- David E. Kling**
Massachusetts General Hosp.
- Deborah M. Kristan**
Univ. of Idaho
- Craig M Lilly**
Brigham and Women's Hosp., MA
- Wen Liu**
Mount Sinai Med. Ctr., NY
- James A. Logue**
Univ. of Illinois
- Anna Lysakowski**
Univ. of Illinois
- Bela Malik**
Emory Univ., GA
- Vladimir Marshansky**
Massachusetts General Hosp.
- Beatriz B. Matsubara**
Fac De Med. De Botucatu, Brazil
- Luiz S. Matsubara**
Fac De Med. De Botucatu, Brazil
- John Patrick McCarthy**
Univ. of Alabama. Birmingham
- Lynnette P. McCluskey**
Medical College of Georgia
- Stephen J. McGregor**
Eastern Michigan Univ.
- James D. McLister**
Univ. of Utah
- Meetha Medhora**
Medical College of Wisconsin
- Timothy D. Mickleborough**
Univ. of Wales Inst., Cardiff, UK
- Claire H. Mitchell**
Univ. of Pennsylvania
- Alexander A. Mongin**
Albany Medical College, NY
- Holger Nilsson**
Univ. of Aarhus, Denmark
- Marie C. Nlend**
Univ. of Miami, FL
- Zui Pan**
Univ. of Medicine and Dentistry, NJ
- Julian F.R. Paton**
Univ. of Bristol, UK
- Kevin Thomas Patton**
St. Charles Community College, MO
- Kathryn Phillips**
Jour. of Experimental Biol, UK
- Sekhara P.M. Reddy**
Johns Hopkins Univ., MD
- John Robertson**
Westminster College, UT
- Lewis P Rubin**
Women and Infants Hosp., RI
- Oscar Sacchi**
Univ. of Ferrara, Italy
- Christoph E. Schreiner**
Univ. of California, San Francisco
- Ananda P. Sen**
Calyx Therapeutics Inc., CA
- Qi Shi***
Case Western Reserve Univ., OH
- Manabu Shibasaki***
Nara Women's Univ., Japan
- Jianliang Song**
Geisinger Med. Ctr., PA
- Peter H.S. Sporn**
Northwestern Univ., IL
- Chengwen Sun**
Univ. of Florida
- Michael E. Symonds**
Univ. of Nottingham, UK
- Thomas J. Thekkumkara**
Texas Tech Univ., HSC
- Francois Tiaho**
Univ. De Rennes I, France
- W. Martin Usrey**
Univ. of California, Davis
- Jose G. Venegas**
Massachusetts General Hospital
- Jeffrey Lawrence Ward**
US Food and Drug Admin., MD
- Wei Wei**
Albert Starr Academic Ctr, OR

Thomas Weimbs
Cleveland State Univ.
Mary Elaine Wlodek
Univ. of Melbourne, Australia
Christian Wunder
Univ. of Wurzburg, Germany
Jin Xue
Yale Univ., CT

Zhi-Zhang Yang
Medical College of Wisconsin
Fu-Xian Yi
Medical College of Wisconsin
Lindon Howard Young
Philadelphia College
of Osteopathic Med.
Ming Yu
Medical College of Wisconsin

Jian X. Zhang
Univ. of North Carolina
Weiyang Zhao
Univ. of Texas Southwestern Med.
Ctr.
Xueying Zhao
Medical College of Georgia

New Student Members

Ken Abe
Georgetown Univ., DC
Alaeldein Abudabos
Clemson Univ., SC
James P. Abulencia
Johns Hopkins Univ., MD
David W. Adhoch
Louisiana State Univ.
Padmanabhan Anand
Brown Univ./Rhode Island Hosp.
Udayan M. Apte
Univ. of Louisiana, Monroe
Kiran K. Arise
Tulane Univ., LA
Lori Ann Armstrong
Univ. of Florida
Patricia Susan Armstrong
Brock Univ., Canada
Caroline V. Aylott
Univ. of Sheffield, United Kingdom
Cari Azevedo
Framingham State College, MA
Oliver A. Badali
California State Univ., Northridge
Ahmed A. Badr
California State Univ.
Jeremy Bamford
Univ. of Alberta, Canada
Supriya A. Bavadekar
Univ. of Mississippi
School of Pharm.
Carley Robin Benton
Univ. of Waterloo, Canada
Aparna Bhaskar
Univ. of North Carolina, Chapel Hill
Yan Bi
Univ. of Michigan
Jana Bibova
Charles Univ., Czech Republic
Jonathan K. Bigrigg
Brock Univ., Canada
Christopher M. Bopp
Univ. of South Carolina
Philippe Bourque
Univ. of New Brunswick, Canada

Robert J. Brosnan
Univ. of California, Davis
David Avery Brown
Univ. of Colorado
Justin W. Brown
East Carolina Univ., NC
Loan Thuy Bui
Queensland Univ. Tech, Australia
Richard J. Burke
Kennesaw State Univ., GA
Thomas E. Burkey
Kansas State Univ.
Veronica A. Campanucci
McMaster Univ., Canada
Bruno De Arruda Carillo
Univ. Federal De Sao Paulo, Brazil
Michael M. Carper
Univ. of Kansas
Christina Marie Carruthers
Bowling Green State Univ., OH
Edward L. Carruthers
Bowling Green State Univ., OH
Jason Robert Carter
Michigan Technological Univ.
Chi-Sun Chang
National Taiwan Univ., Taiwan
Chiu Yueh Chen
National Cheng Kung Univ., Taiwan
Liang Chen
Univ. of Toronto, Canada
Evonne Chin
Royal Veterinary College, UK
Kyung Hyun Choi
Univ. of Nebraska Medical Center
Eric Churchill
Case Western Reserve Univ., OH
James Richard Churilla
Florida International Univ.
Mariana Cifuentes
Rutgers Univ., NJ
Syrlene Annette Clarke
Long Island Univ., NY
Denis George Colomb
Univ. of Oklahoma Health Sci. Ctr.
Nicole L. Conaway
Univ. of Texas, Arlington

Jamie Ann Cooper
Michigan State Univ.
Cheryl A. Creelman
Univ. of Alaska, Anchorage
Paul John Cribb
Victoria Univ., Australia
Charles A. Darveau
Univ. of British Columbia, Canada
Julia Devonish
St. Cloud State Univ.
Somer Lynn Doody
Univ. of Utah
David Edwards
Univ. of Florida
Mohamed El Sawy
Tulane Univ., LA
Rolando R. Enoch
North Carolina Central Univ.
Carie S. Facemire
Univ. of North Carolina, Chapel Hill
Adrian Stuart Fairey
Univ. of Alberta, Canada
Qin Fang
Univ. of Nebraska Medical Center
Pierre Jean Ferre
Ecole Nat'l Vet, France
Terence Gan
California State Univ.
Fullerton/Loma
Jacob Garza
Texas A&M Univ., Kingsville
Carla Geurts
Univ. of New Brunswick, Canada
Edward James Girard
Lackawanna College, PA
Daniel N. Gonzalez
Texas A&M Univ., Kingsville
Lorie Ann Gonzalez
Texas A&M Univ., Kingsville
Melanie Dawn Goodman
Univ. of Oklahoma Health Sci. Ctr.
Ashraf Sherif Gorgey
Univ. of Georgia
Jennifer M. Green
Univ. of Nebraska Medical Center

- Joshua A. Gregory**
Univ. of San Diego
- Jodie Leanne Guy**
Univ. of Leeds, United Kingdom
- Earl Gregory Haley**
Wright State Univ., OH
- Richard Hamer**
North Carolina State Univ.
- Kent Chantz Hansen**
Univ. of Wisconsin, Madison
- Belinda Arlene Hart**
Tuskegee Univ., AL
- Joey W. Hayward**
Grambling State Univ., LA
- Tyson L. Hedrick**
Harvard Univ., MA
- Emily Ann Hellbach**
Xavier Univ., LA
- Neali D. Hendrix**
Univ. of Michigan
- Chris W. Herman**
Michigan State Univ.
- Thomas L. Hilder**
Univ. of North Carolina
- Marcono R. Hines, Jr.**
North Carolina Central Univ.
- Caroline Hodt**
Norwegian Univ. Sports, Norway
- Scott A. Holowachuk**
Mississippi State Univ.
- Ting-Ting Hong**
Univ. of Michigan
- Ying Huang**
Marshall Univ. School of Med
- Wim Huygens**
Katholieke Univ. Leuven, Belgium
- Juan P. Ianowski**
McMaster Univ., Canada
- Keshia L. Jackson**
Wright State Univ., OH
- Wen-Yih Jeng**
National Cheng Kung Univ., Taiwan
- Moltu Joseph**
Medical College of Wisconsin
- Mahesh Suresh Karandikar**
B J Medical College, India
- Michael R. Kearney**
Univ. of Sydney, Australia
- Abolfazl Khajavi Rad**
Univ. of Manchester, UK
- Susan Elizabeth Kirkup**
Royal Veterinary College, UK
- Andor Joseph Kiss**
Univ. of Illinois, Urbana-Champaign
- Frederick Steven Korte**
Univ. of Missouri
- Patricia L. Kultgen**
Univ. of North Carolina
- Gargi Kundu**
Louisiana State Univ.
- Alice Y. Kuo**
Virginia Polytech Inst-State Univ.
- Maros Kustar**
Framingham State College, MA
- Shani T. Lampley**
Tuskegee Univ., AL
- Shena Lynn Latcham**
Univ. of Missouri
- Jennifer Ann Lepire**
Framingham State College, MA
- Li-Fu Li**
Massachusetts General Hospital
- Jia-Jun Liao**
National Taiwan Univ., Taiwan
- Pallavi B. Limaye**
Univ. of Louisiana, Monroe
- Chuanchi Lin**
Framingham State College, MA
- Mu-Eu Liu**
National Taiwan Univ., Taiwan
- Todd R. Luka**
Tulane Univ., LA
- Kathleen C. Lundberg**
Case Western Reserve Univ., OH
- Julie M. Malachinski**
De Paul Univ., IL
- Victor J. Mamani**
Univ. of Nac Mayor San Marcos, Peru
- Airton L. Manoel**
Escola Paulista De Med., Brazil
- Jznzhe Mao**
Georgia State Univ.
- Chad David Markert**
Ohio State Univ.
- Constantine S. A. Markides**
Univ. of Texas Medical Branch
- Rodolfo Randy Martinez**
Univ. of North Texas Hlth Sci Ctr
- Benjamin Jason Mathis**
Univ. of Texas, Austin
- Suzanne Duchai McAlear**
Univ. of Alabama, Birmingham
- Joseph Matthew McClung**
Univ. of South Carolina
- Kellie McCormick**
Univ. of California, Davis
- Marshall Douglas McCue**
Univ. of California, Irvine
- Diana Medina**
New Mexico State Univ.
- Marie C. Miller**
St. Louis Univ., MO
- Meredith Louise Miller**
Univ. of Texas, Austin
- Benjamin F. Miller**
Univ. of California, Berkeley
- Stephanie Misono**
Harvard Medical School/Children's Hosp., MA
- Shawnda Morrison**
Univ. of New Brunswick, Canada
- Tyler Moulton**
Framingham State College, MA
- Moustafa Bayoumi Moustafa**
Ohio State Univ.
- Monica H. Moya**
New Mexico State Univ.
- Subrata Nath**
Florida International Univ.
- Ravi Nistala**
Univ. of Iowa
- Robert C. Noland**
East Carolina Univ., NC
- Lourdes P. Norman**
Pennsylvania State Univ.
- April Elizabeth Ochoa**
California State Univ., Northridge
- Robert E. Oliver**
Grambling State Univ., LA
- Serina Dawn Ortiz**
Univ. of California, Los Angeles
- Mark Paciga**
Univ. of Western Ontario, Canada
- Vinay K. Parameswara**
Univ. of Texas Health Sci Ctr
- Ghazaleh Parizi**
Framingham State College, MA
- Chad Michael Paton**
Univ. of Maryland
- Alexander H. Penn**
Univ. of California, San Diego
- Jessica Elise Peppler**
Univ. of Hawaii
- Jessica Perez**
Univ. of Alabama, Birmingham
- Sharon Lynn Phaneuf**
Univ. of Florida
- Deepali A. Pitre**
Ohio State Univ.
- Susan Patricia Phelps**
California State Univ., Fullerton
- Steven Joe Plane**
New Mexico State Univ.
- Blakely Ann Plaster**
Framingham State College, MA
- Jennifer Lyn Pluznick**
Univ. of Nebraska Med. Ctr.
- Satyanarayana R. Pondugula**
Kansas State Univ.
- Olga Potella**
Univ. of Missouri
- Edward S. Potkanowicz**
Kent State Univ., OH

- Rohit Ramchandra**
Univ. of Auckland, New Zealand
- Habib Moshref Razavi**
Univ. of Western Ontario, Canada
- Mark R. Rheault**
McMaster Univ., Canada
- Scott Robert Richmond**
Univ. of Kansas
- Ernest Ricks**
Grambling State Univ., LA
- Karen Lynn Riska**
St. Cloud State Univ., MN
- Dianne Louise Robinson**
California State Univ., Fullerton
- Melvin Louis Robinson II**
Alcorn State Univ.
- Regina Mary Rochefort**
Framingham State College, MA
- Jacqueline B. Rojas**
Curtin Univ. of Technology, Australia
- Andrew G.J. Rosenberger**
Univ. of Guelph, Canada
- Kevin P. Russeth**
Univ. of Minnesota, Duluth
- Venkata S. Sabbiseti**
Univ. of Louisiana, Monroe
- Jennifer Ellen Salem**
Case Western Reserve Univ.
- Arpana Arvind Sali**
Univ. of Kentucky
- Glaucio Scremin**
Pennsylvania State Univ.
- Michael T. Sellix**
Florida State Univ.
- Joshua Taylor Selsby**
Univ. of Florida
- Aubie Kay Shaw**
Univ. of Minnesota, Duluth
- Satoshi Shiojima**
Nat'l Ctr Child Hlth & Devel., Japan
- Trevor Jay Silvernail**
Univ. of North Carolina, Chapel Hill
- Aerial L. Singleton**
New Mexico State Univ.
- Lisa Ann Skinner**
Univ. of British Columbia, Canada
- Kristine Skjoaas**
Kansas State Univ.
- Kylie Sheree Smith**
Linus Pauling Inst, OR
- Wook Song**
Texas A&M Univ.
- Sandy L. Spann**
Grambling State Univ., LA
- Sorachai Srisuma**
Johns Hopkins Univ., MD
- Jonathan A.W. Stecyk**
Simon Fraser Univ., Canada
- Lukasz Struzik**
Univ. of Toronto, Canada
- Nicole Stupka**
Univ. of Melbourne, Australia
- Liga Svanks**
Framingham State College, MA
- Marta Szaszak**
Semmelweis Univ., Hungary
- Nathaniel J. Szewczyk**
Univ. of Pittsburgh, PA
- Stanley A. Tan**
Oakcrest Health Res Inst, CA
- Chris Kyle Taylor**
Creighton Univ. Med. Sch., NE
- Jian Teng**
Univ. of Wisconsin, Madison
- Linda J Teplitz**
Univ. of Illinois, Chicago
- Errol L.M. Thomson**
Health Canada, Canada
- Vanessa I. Toney**
Brown Univ., RI
- Christopher Torrens**
Univ. of Southampton, UK
- Meghna Trivedi**
Univ. of Houston, TX
- Ming-Ho Tsai**
Nat'l Cheng-kung Univ., Taiwan
- Kedar S. Vaidya**
Univ. of Louisiana, Monroe
- Leamon Viveros**
Texas A&M Univ.
- Justin C. Voog**
Minnesota State Univ.
- Saroja V. Voruganti**
Univ. of Texas, Austin
- Pavle Josip Vrljicak**
McGill Univ. Health Ctr, Canada
- Michael J. Wacker**
Univ. of Kansas
- Christine Gail Wagner**
Auburn Univ. College of Vet. Med., AL
- Qianben Wang**
Univ. of Maryland, Baltimore
- Elizabeth K. Weihe**
Mayo Clinic, MN
- Jin-Fu Wen**
Jeonbug National Univ., Korea
- Jay M. Weitzner**
Southern Connecticut State Univ.
- Corey C. Wiggins**
Alcorn State Univ., MS
- Sarah B. Wilkinson**
McMaster Univ., Canada
- Heather L. Wilson**
Univ. of Saskatchewan, Canada
- Jason J. Winnick**
Ohio State Univ.
- Brian Lee Wolfe**
Bloomsburg Univ., PA
- Patti Lynn Wright**
Univ. of South Alabama
- Guan-Hsun Wu**
National Taiwan Univ., Taiwan
- Ruwei Xu**
Prince Henry's Inst., Australia
- Shu-Chuan Yang**
Inst. of Neuroscience, Taiwan
- Maxim V. Zakhartsev**
Univ. of Antwerp, RUCA, Belgium
- Nicholas A. Zane**
Washington and Jefferson College, PA
- Yu Joy Zhao**
Loma Linda Univ., CA
- Xiangjian Zheng**
Medical College of Georgia
- Beiyan Zhou**
Northwestern Univ., IL.
- Mary E. Zimmer**
Univ. of British Columbia, Canada
- Yi Zuo**
Northwestern Univ., IL

Cardiovascular

The **Young Investigator Award** is intended for members, but not necessarily fellows, of the Cardiovascular Section of the APS who have received a PhD, MD, DSc, DVM, or DDS degree with an academic rank or equivalent not higher than that of Assistant Professor who have already made a substantive independent contribution and hold future promise but are not, as yet, well established. The nomination package, to be sent to the Chair of the Awards Committee of the APS CV Section, should consist of a letter of nomination, a seconding letter (preferably from someone outside of the nominee's institution), and a CV of the candidate.

The **Berne Distinguished Lectureship** award is presented to a scientist who is a Fellow of the Cardiovascular Section of the APS, who has made outstanding prior contributions to cardiovascular research, and whose current research is particularly interesting, such that the presentation of this work would be expected to contribute to further interest in the CV Section meeting. This award is in honor of one of the most distinguished members of the Cardiovascular Section, Robert M. Berne. The nomination package, to be sent to the Chair of the Awards Committee of the APS CV Section, should consist of a letter of nomination, one or more seconding letters (preferably from someone outside of the nominee's institution), and a CV of the candidate.

The **Carl J. Wiggers Award** is presented to a scientist who is a Fellow of the Cardiovascular Section of the APS, who has made outstanding and lasting contributions throughout his/her career to cardiovascular research, and who will bring broader and more international representation to the CV Section meetings. This award is in honor of the Cardiovascular Section's founder, Carl J. Wiggers. The nomination package, to be sent to the Chair of the Awards Committee of the APS CV Section, should consist of a letter of nomination, one or more seconding letters (preferably from someone outside of the nominee's institution), and a CV of the candidate.

The **Cardiovascular Section Young Investigator Award** (\$500) is designed to entice submission of abstracts to the Experimental Biology meetings from junior investigators and to aid them in their travel expenses. To be eligible, the investigator must be within 10 years of receiving his/her PhD or MD degree and have submitted a first-authored abstract to a Cardiovascular Section topic category (see Physiology topic category list under the heading "Cardiovascular Section"). Abstracts from eligible individuals will be judged by the Cardiovascular Section Awards Committee and a total of up to nine each year which are judged to be the most meritorious will be awarded. Eligible individuals are requested to Email a copy of their submitted abstract to the Chair of the Cardiovascular Section Awards Committee; Irving G. Joshua at igjosh01@gwise.Louisville.edu, to arrive by **November 22, 2002**.

Cell and Molecular Physiology

The **Cell and Molecular Physiology Student Awards** (\$300) are available for up to two pre-doctoral candidates, depending on applicant pool. One award will be given for work done while enrolled as a medical or graduate (doctoral or masters) student. A second award is reserved for undergraduate researchers. Applicants must be first author on an abstract submitted to the Experimental Biology meeting. The student or their mentor must be a member in good standing of the APS, with a primary affiliation in the Cell and Molecular Physiology section. Members of the CAMP Steering Committee will review all applications. Winners will be announced, and awards presented, at the Cell and Molecular Section Banquet at the EB meeting. Applicants must complete the Student Award Certificate form and have the mentor submit a brief (e.g. half-page) letter describing why the trainee is deserving of the award. Email or Fax a copy of the submitted abstract, the Student Award Certification form, and letter to Peter K. Lauf, MD, Email: [peter.lauf@wright](mailto:peter.lauf@wright.edu)

.edu, Fax: 937-775-3769. Deadline is **November 22, 2002**.

The **Cell and Molecular Physiology Young Investigator Awards** (\$500) will be given to two successful candidates for work performed while in the first through third postdoctoral year or medical residency. Applicants must be first author on an abstract submitted to the Experimental Biology meeting. The trainee or their mentor must be a member in good standing of the APS, with a primary affiliation in the Cell and Molecular Physiology section. Members of the CAMP Steering Committee will review all applications. Winners will be announced, and awards presented, at the Cell and Molecular Section Banquet at the EB meeting. Applicants must complete the Student Award Certificate form and have the mentor submit a brief (e.g. half-page) letter describing why the trainee is deserving of the award. Email or Fax a copy of the submitted abstract, the Student Award Certification form, and letter to Peter K. Lauf, MD, Email: peter.lauf@wright.edu, Fax: 937-775-3769. Deadline is **November 22, 2002**.

Central Nervous System

The **Central Nervous System (CNS) Section Van Harreveld Memorial Award** (\$300) will be presented by the CNS Section to recognize outstanding research in neuroscience by a graduate student or postdoctoral fellow. The recipient must be first author on an abstract presented at the meeting. Mail copy of the submitted abstract and the completed APS Award Certification Form to Dr. Susan M. Barman, Department of Pharmacology & Toxicology, Michigan State University, East Lansing, MI 48824-1317. Deadline for receipt of application is **December 6, 2002**.

The **Young Investigator Award of the Central Nervous System Section** provides at least two awards of \$500 each and complimentary advance registration fees for recognition of meritorious research by young investigators who participate in the annual Experimental Biology meeting. To qualify for this award, the

applicant must have received a PhD or other professional degree within the past 10 years and must present a poster or talk at the Experimental Biology Meeting. The subject matter of this presentation can be any topic related to the central or peripheral nervous system. Applications are reviewed and rated by the CNS Section Awards Committee. To apply for this award, the applicant should submit four copies of the abstract (or a paragraph describing his/her research if it is to be presented in a Symposium), and a letter indicating the novelty of the research project described in the abstract, the year he/she received a degree, his/her current position, and whether he/she is a member of the APS. Membership in the APS is not required but is highly recommended. Mail these items to the: Dr. Susan M. Barman, Department of Pharmacology & Toxicology, Michigan State University, East Lansing, MI 48824-1317. Deadline for receipt of application is **January 25, 2003**.

Comparative Physiology

The **Comparative Section Young Investigator Award** (\$500) will provide three travel awards for recognition of meritorious research by young investigators who participate in the Experimental Biology meeting. Candidates must have completed their PhD within the past 10 years, be a member of APS, and must present a talk or poster at the Experimental Biology meeting. The subject matter can be any topic that deals with comparative physiology. Applicants should submit their abstract, abstract submission confirmation page, a one-page CV, and a one-page summary of research accomplishments and goals via email to: Stan Lindstedt, PhD, Chair of the Comparative Section (stan.lindstedt@nau.edu) by **November 20, 2002** for review by the Section Steering Committee. The winners will be notified by email before March 1, and the award will be presented at the Comparative Section Business Meeting during the EB meeting.

The **Comparative Physiology Section Scholander Award** (\$200) will be presented to an outstanding

young investigator presenting a paper in the "Scholander Award" Session. To be eligible, applicants must submit their abstract to the Scholander Award Session topic category (see Physiology topic category list under the heading Comparative Section, topic category #1063-APS), be first author on the abstract, and be not more than five years past the highest degree. Mail a copy of your abstract submission and completed APS Award Certification Form to Linda Allen, Meetings Department, APS, 9650 Rockville Pike, Bethesda, MD 20814-3991; Fax: 301-634-7241.

Endocrinology and Metabolism

Research Award of the Endocrinology and Metabolism Section (certificate plus cash prize, depending on funds available) is intended to recognize graduate student, resident or postdoctoral fellow who presents the best abstract for research in the area of endocrinology and metabolism at the Experimental Biology Meeting. Applicants must be first author on a submitted abstract and should mail a copy of the abstract, the completed Award Certification Form, and a letter from the sponsor of the abstract indicating the training status of the individual to Charles Lang, Department of Cellular & Molecular Physiology, Pennsylvania State Univ. College of Medicine, Hershey, PA 17033-0850. Abstracts will be judged for scientific content by a committee comprised of the E&M Section members. The successful candidate will be notified approximately 30 days prior to the Experimental Biology Meeting and will be presented the award during the Endocrinology & Metabolism Section Business Meeting. Deadline for application is **November 13, 2002**.

The **Endocrinology & Metabolism Section Young Investigator Award** (\$500) is presented to one or more pre-doctoral graduate students whose investigations in endocrinology and metabolism physiology has been designated by the Steering Committee as being an example of meritorious research. The recipient must be first author on a submitted abstract to the

Endocrinology & Metabolism Section (see Physiology topic category list under the heading "Endocrinology & Metabolism Section"), and be certified by his/her advisor as being eligible for such an award. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Charles Lang, Department of Cellular & Molecular Physiology, Pennsylvania State Univ. College of Medicine, Hershey, PA 17033-0850. Deadline for application is **November 13, 2002**.

Environmental and Exercise Physiology

The **Environmental and Exercise Physiology Section Honor Award** recognizes a previous or current primary member who has made significant research contributions to the scientific advancement of environmental, exercise, or thermal physiology while enhancing the educational objectives of the section. The recipient receives a plaque, a check for \$1,250, reimbursement of the registration fee, and the opportunity to discuss his/her research as the featured speaker at the annual EEP Section Banquet.

The **Environmental & Exercise Physiology (EEP) Section Gatorade Young Investigator Award** (\$600 plus registration and EEP Banquet ticket) is presented to a pre-doctoral graduate student whose investigation in either environmental, exercise, or thermal physiology has been designated by the Steering Committee as an outstanding example of experimental research. The recipient must be first author on a submitted abstract to the EEP Section topic category (topic category numbers 1088-APS through 1098-APS), certified by his/her advisor as being eligible for such an award, answer a questionnaire from the Steering Committee, one who has not received an advanced degree at the date of the abstract deadline, and be present at the EEP Section Awards Banquet. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Kenneth Baldwin, Department of Physiology &

(continued on page 210)

(continued from page 209)

Biophysics, University of California, Irvine, CA 92697. Deadline for application is **November 13, 2002**.

The **EEP Section Gatorade Beginning Investigator Award** (\$750 plus registration and EEP Banquet ticket) is presented to a post-doctoral fellow or its equivalent whose investigation in either environmental, exercise, or thermal physiology has been designated by the Steering Committee as an outstanding example of experimental research. The recipient must be first author on a submitted abstract to the EEP Section topic category (topic category numbers 1088-APS through 1098-APS), answer a questionnaire from the Steering Committee, have received their advanced degree within four years of the date of the abstract deadline, and be present at the EEP Section Awards Banquet. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Kenneth Baldwin, Department of Physiology & Biophysics, University of California, Irvine, CA 92697. Deadline for application is **November 13, 2002**.

The **EEP Section Recognition Award** (\$500) is presented to one or more pre-doctoral graduate students whose investigations in either environmental, exercise, or thermal physiology has been designated by the Steering Committee as being an example of meritorious research. The recipient must be first author on a submitted abstract to the EEP Section topic category (topic category numbers 1088-APS through 1098-APS), and be certified by his/her advisor as being eligible for such an award. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Kenneth Baldwin, Department of Physiology & Biophysics, University of California, Irvine, CA 92697. Deadline for application is **November 13, 2002**.

The **EEP Section Military Physiology Award for Beginning Investigators** (\$750) recognizes outstanding research in either environmental, exercise, or thermal physiology by a postdoctoral fellow or equiva-

lent that is relevant to the physiological missions of the US Armed Forces. Applicants must have received their advanced degree within four years of the abstract submission date and must be first author on an abstract submitted to an APS EEP Section topic category (topic category numbers 1088-APS through 1098-APS). The award recipient must attend the EEP Section Awards Banquet to receive the cash prize and certificate. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Kenneth Baldwin, Department of Physiology & Biophysics, University of California, Irvine, CA 92697. Deadline for application is **November 13, 2002**.

The **EEP Section Graduate Student Military Physiology Award** (\$600) recognizes outstanding research in either environmental, exercise, or thermal physiology by a graduate student that is relevant to the physiological missions of the US Armed Forces. Applicants must be first author on an abstract submitted to an APS EEP Section topic category (topic category numbers 1088-APS through 1098-APS). The award recipient must attend the EEP Section Awards Banquet to receive the cash prize and certificate. A copy of your abstract submission and a completed APS Award Certification Form should be mailed to Kenneth Baldwin, Department of Physiology & Biophysics, University of California, Irvine, CA 92697. Deadline for application is **November 13, 2002**.

Gastrointestinal

The **Abbott Distinguished Research Award for Excellence in Gastrointestinal Physiology** recognizes a scientist who has carried out highly meritorious research in gastrointestinal or liver physiology. The recipient receives a commemorative plaque, a \$750 award, and presents an award lecture at the section's annual business meeting/reception. The recipient is chosen by the Gastrointestinal Section Steering Committee. The section membership is encouraged to submit nominations, which should be sent to the Steering Committee Chair.

Nominations consist of a cover letter outlining the candidate's qualifications for the award and his/her curriculum vitae.

The **Gastrointestinal Physiology Section Student Prize** (\$500) is designed to challenge and reward trainees who are engaged in gastrointestinal research. Two awards will be made at the Experimental Biology Meeting. One will be given for work done while enrolled as a doctoral or medical student. A second award will be given for work performed during the first through third postdoctoral years or during a medical residency. In order to be considered, the applicant must be first author on an abstract submitted for the meeting and either the applicant or sponsor must be a member of APS. A copy of the submitted abstract, accompanied by the signed and completed APS Award Certification Form should be sent to Hugh Nellans, GI Pharmacology & Oral Drug Delivery, Abbott Laboratories, Dept 46V, Bldg AP9, 100 Abbott Park Road, Abbott Park, IL 60064-6122 to arrive on or before **January 3, 2003**.

The **Gastrointestinal Section Young Investigator Awards** will provide travel support (\$500) for junior investigators to participate in the annual Experimental Biology meeting. To be eligible for the award, the investigator must be within 10 years of receiving a higher degree (PhD, MD or DVM), and must submit an abstract to a Gastrointestinal Section topic category. To apply for the award, applicants should submit their abstract and a brief statement of research accomplishments by **January 10, 2003** by Email to Matthew Grisham, Chair of the GI Section Steering Committee at mgrish@lsuhsc.edu.

Liaison With Industry Award

The **Liaison with Industry Committee Novel Disease Model Award** (\$500/graduate student; \$800/postdoctoral fellow) will be granted to the graduate student and postdoctoral fellow submitting the best abstracts describing a novel disease model. The model can be cellular

or in vivo but should clearly emphasize the potential utility of the system for future research related to a disease process. This award is sponsored by the Liaison with Industry Committee. A copy of the submitted abstract, accompanied by the signed and completed Award Certification Form should be sent to Linda Allen, Membership Services, APS, 9650 Rockville Pike, Bethesda, MD 20814-3991 to arrive on or before **November 18, 2002**.

Neural Control and Autonomic Regulation

The **Michael J. Brody Young Investigator Award** of the APS Neural Control and Autonomic Regulation Section (\$500), sponsored by Merck & Co., recognizes a promising young investigator who has made a significant research contribution to the understanding of neural control and autonomic regulation. The award is open to graduate students (post-candidacy exams), postdoctoral fellows, and clinical fellows who present and are first author on an abstract at Experimental Biology. Either the applicant or the abstract sponsor must be a member of APS. Applicants must mail a copy of the submitted abstract, the completed APS Award Certification Form, a list of publications, a one-page summary and evaluation of research contributions, written by the applicant, and a cover letter signed by both the applicant and sponsor indicating the date, or expected date, of highest degree. The deadline for receipt of applications is **November 20, 2002**. Send applications to Jeanne L. Seagard, Research Service 151, VA Medical Center, 5000 West National Avenue, Milwaukee, WI 53295.

The **Neural Control and Autonomic Regulation (NCAR) Young Investigator Awards** will provide travel support (\$500) to junior investigators to present meritorious research at the annual Experimental Biology Meeting. To be eligible, the investigator must have a PhD, MD, or other professional degree with an academic rank or equivalent not higher than that of Assistant Professor and conduct either basic or clinical

research in a field of neural control and autonomic regulation. Junior faculty members are particularly encouraged to apply for this award. To apply, the investigator must submit a first-authored abstract to any appropriate neural control topic of the Experimental Biology meeting. Award criteria will be based on current work reflected in the abstract and overall contributions to the field. A copy of the abstract and a CV from the investigator must be received by **December 1, 2002** by the Member-at-Large of the NCAR Steering Committee, Robin Davisson, Assistant Professor, Department of Anatomy and Cell Biology, University of Iowa, 1-570 BSB, Iowa City, IA, 52242. The abstracts will be judged by the NCAR Steering Committee and the most meritorious applications will be awarded.

Renal

The **Robert W. Berliner Award for Excellence in Renal Physiology**, sponsored by Abbott Laboratories, is given to an outstanding senior researcher and educator in renal physiology. The recipient receives \$1,000 plus reimbursement for travel expenses incurred during the Experimental Biology meeting. The award winner is also acknowledged at the Renal Dinner.

The **Young Investigator Award for Excellence in Research**, sponsored by AstraZeneca, recognizes an outstanding young investigator, less than 41 years old, or less than 15 years beyond receipt of his/her first doctoral degree. Research topics qualifying consideration include any area of renal physiology, pathophysiology, or hypertension. A nominee for renal physiology is required to have published original work in the *American Journal of Physiology-Renal Physiology* or similar journal during the preceding four years. The recipient receives \$1,000 plus reimbursement for travel expenses incurred during the Experimental Biology meeting. The award winner is also acknowledged at the Renal Dinner. A candidate should refer to the current Section Chair's updated contact infor-

mation at (http://www.the-aps.org/sect_groups.htm).

The **Aventis Pharmaceutical Excellence in Renal Research Awards** are sponsored by Aventis Pharmaceutical and designed to promote and develop excellence in research pertaining to molecular, cellular, or organ mechanisms involving the kidney. Awards are presented to two categories of students: predoctoral students (including graduate students and medical students) and postdoctoral fellows. Award recipients must be first authors on an abstract submitted to a Renal Physiology topic category (see Physiology topic category list under the heading "Renal Section") for programming at the Experimental Biology Meeting. Prior to the meeting a first level of evaluation is conducted based on the submitted abstract; a subset of abstracts are further judged during oral presentation at the meeting. Award winners are announced at the annual Renal Dinner held in conjunction with the meeting. Students and fellows are strongly urged to participate in the award process. Mail completed Award Certification Form and a copy of the submitted abstract to Ed Inscho, Chair, Renal Section Awards, Medical College of Georgia, Department of Physiology, 1120 15th St., Augusta, GA 30913-3000. Email: EINSCHO@mail.mcg.edu Applications are due on the abstract deadline.

The Renal Section of the APS will provide at least two awards (\$500 each) for recognition of meritorious research by young investigators (junior faculty) who participate in the annual Experimental Biology Meeting. To qualify for this award, the applicant must have finished postdoctoral work, may not be a senior faculty member, i.e. may not have a faculty rank of Associate or Full Professor, and may not have won this award in previous years. Candidates should either be an author on an abstract submitted to the EB meeting, or agree to submit a late-breaking abstract if they did not submit one originally and they are selected for this award. Applications will be reviewed and

(continued on page 212)

(continued from page 211)

rated by the Renal Section Awards Committee. To apply for this award, please submit a copy of the submitted abstract or a note agreeing to do so if selected, and a note indicating your current position. If you plan to submit an abstract only if selected for this award, please include a note explaining this decision. Alternatively, Renal Section members may nominate candidates for this award by submitting the above items. Membership in the APS is not required, but awardees will be encouraged to join if they are not members. The awards will be presented at the annual Renal Dinner during the EB meeting. Send these items by **December 15, 2002** to the Chair of the Renal Section Award Committee, Ed Inscho, Chair, Renal Section Awards, Medical College of Georgia, Department of Physiology, 1120 15th St., Augusta, GA 30913-3000. Email: EINSCHO@mail.mcg.edu

Respiration

The **Julius Comroe, Jr. Travel Award of the Respiration Section** (\$500) was established to increase support for new investigators and enhance their involvement in the Respiration Section of APS with original presentations of their scientific work at the annual meeting. To be eligible for the award, applicants must submit a copy of the submitted abstract, accompanied by the signed and completed Award Certification Form to Linda Allen, Membership Services, APS, 9650 Rockville Pike, Bethesda, MD 20814-3991 to arrive on or before **November 18, 2002**.

The Section Steering Committee also acts as the review body for the Giles F. Filley Memorial Awards for Excellence in Respiratory Physiology and Medicine.

Teaching of Physiology

The **Arthur C. Guyton Physiology Teacher of the Year Award** is sponsored by the W. B. Saunders Company. A nominee must be a full-time faculty member of an accredited college or university and be a member of the APS. The Selection Committee will look for independent evidence of

excellence in classroom teaching over a number of years at the undergraduate, graduate, or professional levels, commitment to the improvement of physiology teaching within the candidate's own institution, and contributions to physiology education at the local community, national or international levels. Each nominee must be nominated by a member of APS. The nominator is responsible for completing application materials and forwarding six copies to the chairperson of the Award Selection Committee. The award winner is announced at the APS Business Meeting at the Experimental Biology meeting. The Teacher of the Year receives a plaque, an honorarium of \$1,000, and expense reimbursement of up to \$750 to attend the meeting. The awardee is requested to write an essay on his/her philosophy of education for publication in *The Physiologist*.

The Teaching of Physiology Section (\$500) will provide two travel awards for outstanding posters presented in the Teaching Poster Sessions at Experimental Biology 2003. To qualify for this award, the applicant must be first author on the poster, and age 40 or under OR within 10 years of receiving the PhD or MD. Applicants must also be APS regular, affiliate, or student members. Abstracts will be reviewed and rated by the Teaching Section Steering Committee. All poster abstracts must be formally submitted to EB by the abstract deadline. To apply for this award, please send a copy of your abstract submission and a completed APS Award Certification Form to Penelope A. Hansen, PhD, Memorial University Faculty of Medicine, St. John's, NF, Canada A1B 3V6, Fax 1-709-777-6576. Deadline for receipt of the application is **November 8, 2002**.

Water and Electrolyte Homeostasis

The **Young Investigator Award in Regulatory and Integrative Physiology** was established to encourage young investigators to continue research careers in cardiovascular, renal, and neuroendocrine integration. The award is presented annually

at the business luncheon of the Water and Electrolyte Homeostasis Section to a young investigator (less than 40 years old) who has made important contributions to our understanding of the integrative aspects of cardiovascular, renal, and neuroendocrine physiology in health and/or disease. The recipient of the award will present a short lecture on his/her research during one of the scientific sessions of the Experimental Biology meeting and will be invited to publish a manuscript on this presentation in the *American Journal of Physiology-Regulatory, Integrative & Comparative Physiology*. Any member of the APS in good standing may apply or be nominated for the award. Applications are reviewed by the Awards Committee of the Water and Electrolyte Homeostasis Section and should include a curriculum vitae of the nominee, a brief one-page summary and analysis of the research contributions of the nominee, a complete list of publications, and two letters of nomination from members of the APS.

The **Water & Electrolyte Homeostasis Section Young Investigator Travel Award** (\$500) will provide support for travel expenses for junior investigators to attend the annual Experimental Biology Meeting. To be eligible, the investigator must be either a pre-doctoral student or within ten years of receiving his/her PhD or MD degree. Applicants must be first author on an abstract submitted to an APS Water & Electrolyte Homeostasis Section topic category (see physiology topic list under the heading "Water and Electrolyte Section"). The WEH Steering Committee will judge the abstracts. Applicants are requested to send a copy of their submitted abstract to Tom Lohmeier, Department of Physiology & Biophysics, Univ. of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216-4505, Fax: 601-984-1817; Email: tlohmeier@physiology.umsmed.edu by **December 2, 2002**. ❖

Experimental Biology 2003
April 11-15, San Diego, California
Physiology InFocus
Physiological Implications of Oxidative and Nitrosative Stress
Organizer: Barbara Horwitz, University of California, Davis

General Overview and Physiological Relevance

Oxidative Stress: Cardiovascular Consequences

Emerging Concepts in Oxidative and Nitrosative Signaling

Oxidative Stress: Pulmonary Consequence

Section Distinguished Lectureships

August Krogh Distinguished Lectureship of the APS Comparative Physiology Section

Lecturer: **Peter Scheid**, Ruhr University, Bochum, Germany
Title: *The Goose of the Himalaya and Central Chemosensitivity; New Ideas From an Old Problem*

Horace W. Davenport Distinguished Lectureship of the APS Gastrointestinal Section

Lecturer: **Jeffrey I. Gordon**, Washington University
Title: *TBD*

Carl Ludwig Distinguished Lectureship of the APS Neural Control & Autonomic Regulation Section

Lecturer: **John H. Coote**, University of Birmingham, UK
Title: *The Significance for Circulatory Control of the Paraventricular Nucleus*

Hugh Davson Distinguished Lectureship of the APS Cell & Molecular Physiology Section

Lecturer: **Roger Tsien**, University of California, San Diego
Title: *TBD*

Carl W. Gottschalk Distinguished Lectureship of the APS Renal Section

Lecturer: **William J. Arendshorst**, University of N. Carolina
Title: *TBD*

Joseph Erlanger Distinguished Lectureship of the APS Central Nervous System Section

Lecturer: **Fred H. (Rusty) Gage**, The Salk Institute
Title: *Regulation and Function of Adult Neurogenesis*

Claude Bernard Distinguished Lectureship of the APS Teaching of Physiology Section

Lecturer: **John D. Bransford**, Vanderbilt University
Title: *TBD*

Julius H. Comroe, Jr. Distinguished Lectureship of the APS Respiration Section

Lecturer: **John B. West**, University of California, San Diego
Title: *Thoughts on the Blood-Gas Barrier*

Edward F. Adolph Distinguished Lectureship of the APS Environmental & Exercise Physiology Section

Lecturer: **Jere Mitchell**, University of Texas Southwestern Medical School
Title: *TBD*

Robert M. Berne Distinguished Lectureship of the APS Cardiovascular Section

Lecturer: **Eric O. Feigl**, University of Washington
Title: *Berne's Adenosine Hypothesis of Coronary Blood Flow Control*

Ernest H. Starling Distinguished Lectureship of the APS Water & Electrolyte Homeostasis Section

Lecturer: **Friedrich C. Luft**, Humboldt University, Berlin
Title: *The Role of Genetic Models in Elucidating Cardiovascular Reflex Regulation*

Solomon A. Berson Distinguished Lectureship of the APS Endocrinology & Metabolism Section

Lecturer: **Christopher B. Newgard**, Duke University
Title: *Mechanisms of Fuel-Stimulated Insulin Secretion and How They Fail in Diabetes*

Societal Lectures

The Walter B. Cannon Memorial Award
Shu Chien, University of California, San Diego
Henry Pickering Bowditch Award Lecture
Paul Kubes, University of Calgary

Walter C. Randall Lecture on Biomedical Ethics
TBD

Section-Sponsored Symposia

Modulation of Respiratory Motoneurons From Molecules to Behavior

Albert J. Berger

Epithelial-Neuronal Interactions Underlying Bladder Gene-Regulation and Sensory Function

Lori A. Birder

Life to Death Decisions and the Fate of Apoptotic Cells

John A. Cidlowski

Redox Signaling of Angiogenic Response in the Heart

Dipak K. Das and Nilanjana Maulik

Recent Advances in the Study of Hexose Transport Proteins

Ronaldo Ferraris

Molecular Regulation of Nitric Oxide Synthase Activity

Jeffrey Garvin and Jennifer Pollock

Physiology in Medicine: Renal and Cardiovascular Physiology

John E. Hall and Dale J. Benos

Role of the Transcription Factor, TonEBP/NFAT5

Maurice Burg and Joseph Handler

Genomics of Angiogenesis and the Microcirculation

Jay B. Hoying

Caveolar Domains in Cell Signaling

Paul A. Insel

Thin Filament Regulation of Muscle Contraction

J-P. Jin

The Function and Regulation of Mitochondrially Produced Nitric Oxide in Cardiomyocytes

Anthony J. Kanai and James Peterson

Novel Ca²⁺ Signaling Mechanisms in Vascular Myocytes:

Cyclic ADP-Ribose, Ryanodine Receptors and

Ca²⁺-induced Ca²⁺ Release

Pin-Lan Li and Cornelis Van Breeman

Subcellular Organization of Second Messenger Signaling in Cells of the Cardiovascular System

Ron Lynch

Redox Regulation of Renal Function and Arterial Pressure

R. Davis Manning, Jr. and Ai-Ping Zou

Regulation of Ion Channel Structure and Function by Reactive Oxygen Nitrogen Intermediates

Sadis Matalon and Douglas C. Eaton

The Pons: A Critical Component in Respiratory Control

Donald R. McCrimmon

The Teacher as an Educational Researcher

Joel Michael and Dee Silverthorn

Caveolin Regulation of Endothelial Function

Richard D. Minshall and Asrar B. Malik

Functional Proteomics: Applications to the Cardiovascular System

Peipei Ping

Transgenic Models of Heart Failure Therapeutics

J. David Port

Functional Genomics and Proteomics of Hypoxia

Nanduri Prabhakar and Jon Klein

The Chronobiology Environment of Mammals

Roberto Refinetti

Gap Junctional Hemichannels: Physiology and Pathophysiology

Luis Reuss and Lisa Ebihara

Magnetic Resonance: Unique Non-Invasive Insights Into the Physiology of Exercise

Russ Richardson and Mark Olfert

The Renin-Angiotensin System and Development

James C. Rose and Charles Rosenfeld

Flow / Stretch-Regulated Membrane and Ion Transport in Epithelia

Lisa Satlin and Gerard Apodaca

The History and Physiology of High Altitude

Decompression Sickness

Suzanne Schneider and Michael R. Powell

Neurogenic Hypertension

Alan Sved

Remodeling of the Brain Underlies the Success of Behavioral Therapies for Motor Dysfunction

Edward Taub

Mechanisms for Contractile Depression in Heart Failure

Richard A. Walsh and Kenneth R. Chien

Non-Arterial Circulations: The Dark Side of Cardiovascular Biology

Steve Warburton and Tobias Wang

The Identities of Estrogen Receptors Mediating Nongenomic Effects

Cheryl S. Watson

New Roles for Ammonia in Renal Ion Transport

I. David Weiner and L. Lee Hamm

Section-Sponsored Featured Topics

Muscle Fatigue

William T. Ameredes

Tissue Response to Ischemic Injury: Adaptive and Regenerative Strategies

David P. Basile

Integrated Cell Systems

James Bassingthwaite

Developmental Plasticity of Respiratory Control

Ryan W. Bavis

Evolution of Vascular Regulation From the Neonate to the Aging Adult: Mechanisms and Functional Consequences

Matthew Alan Boegehold

Central Neurons and Efferent Pathways Controlling Thermoregulation

Jack A. Boulant and Kazuyuki Kanosue

Cardiovascular Physiology: From Bench to Classroom

Richard Bukoski and Charles Seidel

Development of Excitation-Contraction Coupling in the Embryonic Heart: From Simplicity to Complexity

Tony L. Creazzo

Oxidant Mechanisms in Neural Regulation of Cardiovascular Function

Robin L. Davisson

Berne Lecture Featured Topic: Berne's Adenosine Hypothesis of Coronary Blood Flow Control

Eric O. Feigl

Therapeutic Potential of Hypothermia: Bridging the Gap Between Clinical and Basic Thermoregulatory Research

Christopher Gordon and Michael Dae

Functional Brainstem Anatomy: Can We Tell Cardiovascular and Respiratory Neurons Apart?

Paul Gray

The Lung—A Very Special Place for Dendritic Cells

Gabriele Grunig

Interaction Between Histone Acetylation and DNA Methylation

Alessandro Guidotti

Intermittent Hypoxia: Physiological and Genomic Consequences

Gabriel Haddad

Glial/Neuronal Bi-directional Signaling

Glenn Hatton

Preconditioning of Myocardium Against Infarction

Franz Kehl

Epithelial Anion Channels: Structure, Form, Function

Kevin Kirk and Catherine Fuller

Structure and Regulation of Epithelial Na and K Channels

Thomas R. Kleyman and Douglas C. Eaton

Reflex Regulation of Airway Function and Breathing

Lu-Yuan Lee and Brendan Canning

Wiggers Award Featured Topic: Nitric Oxide and the Cardiovascular System

Alan Lefer

Neurohumoral Control of Body Fluid Volume and Arterial Pressure

T. Lohmeier

Causes and Consequences of pH Variability in Vertebrates

Lynn Hartzler

AstraZeneca Young Investigator Featured Topic

Jeffrey Miner

Is it the Physiology, the Students, or is it Me? Reflections on the Classroom

Harold Modell

Trafficking of Membrane Transporters in the GI Tract and Beyond

Curtis Okamoto

Comparative Aspects of the Hormonal Responses to Metabolic Demands

Rudy M. Ortiz

Identifying Genes and Targets in Cardiovascular Autonomic Pathophysiological States

Julian Paton

Regulation of Vascular Smooth Muscle Cell Phenotype: Contractile versus Proliferative

Usha Raj

Hypertension (Starling Distinguished Lectureship Featured Topic)

Richard Roman

Insights on Renal Function and Blood Pressure Control From Genetically Manipulated Animals

Richard Roman

The Molecular Physiology of HCO₃ Transport

Michael Romero and Mark O. Bevenssee

The History and Physiology of High Altitude Decompression Sickness

Suzanne Schneider and Michael R. Powell

New Insights on Neuro-Immune Interactions in Autonomic Regulation

Yvette Tache

Hypoxic Metabolic Response: Autoregulation, Acclimation and Adaptation

Glenn Tattersall

Arteriogenesis and Collateralization

Joseph L. Unthank

Regulation of Ion Transporter Trafficking

Wenhui Wang

The Regulation of Sympathetic Nerve Activity in Chronic Heart Failure

Irving Zucker

Cross Sectional Symposia

AT-1 and AT-2 Receptors: Antagonists in Cellular Action?

Colin Sumners and Meredith Hay

Lineage Specific Programming of Stem Cells into Tissues

Qais Al-Aqwati

Mitochondria Regulation of Cell Function

Jahar Bhattacharya

Neuron-Glial Interactions in Nervous System Function

Joseph S. Erlichman

Peroxisome Proliferator-Activated Receptors (PPARs)

Youfei Guan and Curt Sigmund

Guest Society Symposia and Lectures

American Federation for Medical Research (AFMR)

Oxidative Stress, Antioxidant Supplementation and Diabetes

Emmanuel C. Opara

Everything Old is New Again: Thyroid Hormone and the Failing Heart

Carlin S. Long

The Biology of Differentiated Thyroid Cancer: A Bench to Bedside Review

Bryan R. Haugen

Building Better Bone: Sex Genes and Drugs

Thomas L. Clemens

Biomedical Engineering Society (BMES)

Understanding Protein Unfolded States: Implications for Folding, Function, Evolution and Disease

Rohit V. Pappu

The Microcirculatory Society (MCS)

The Landis Award Lecture

TBA

MCS President's Symposium: Mechanisms of Microvascular Dysfunction in Diabetes

Paul F. McDonagh

MCS Young Investigator's Symposium

Jefferson C. Frisbee and David W. Stepp

Society for Experimental Biology and Medicine (SEBM)

Career Planning for Experimental Biology, Biomedical and Physician Scientists

Kenneth L. Barker

Workshops and Special Symposia

Refresher Course on Muscle Physiology

George Ordway and Robert Hester

Frontiers of Intravital Microscopy:

Crossroads of Physiology and Pathology

Michael S. Goligorsky

Science and the Media

Andrea Gwosdow

Methods to Detect Oxidative and Nitrosative Stress

Matthew B. Grisham and Joe Granger

NHLBI Program for Genomic Applications:

Background for Physiologists

Anne Kwitek-Black

Understanding and Applying Critical Translational Assays

Glenn Reinhart and Chahrazad Montrose-Rafizadeh

Peer Review and Publication in APS Journals

Dale Benos

Careers in Physiology Symposium: The Drug Discovery

Process: Opportunities for Physiologists

John H. "Wick" Johnson and James M. Norton

Presentation Skills

Carole M. Liedtke, Siribhinya Benyajati, and Joan Lakoski

Experimental Biology 2003

Experimental Biology 2003 will be held from **April 11-15, 2003** in San Diego, CA. (Note the change from the original dates!) The Abstract Submission Deadline is **November 13, 2002**.

The online submission form will be available in early fall at <http://www.faseb.org/meetings/eb2003>. Check this site often for updates and deadline information.

Find Full-Text Articles, Free and Fast

In the February 2002 issue of *The Physiologist* (1), we introduced the new portal site of the HighWire Library of the Sciences and Medicine (HWLSM), which allows you to search all of Medline plus 300 journals' full-text at once—including all the APS journals, of course! In this issue, we begin a series of short articles highlighting important tools or features of this new site. The new site is at <http://highwire.stanford.edu>.

The search results page in the new HWLSM contains much more information and many more functions than other sites' search result pages. In this article we'll look at how the page helps you spot the full-text articles to which you can get immediate, online access.

Take a look at the search result for "high altitude respiration" and notice the text under the journal cover next to each citation. You'll see that HWLSM now tells you which articles are:

free to you because your institution has purchased a subscription and provides access for you

free because the publisher has made the article free to anyone on the internet

available for purchase: you can pay with a credit card and get the full text immediately online.

If there is no indication under the cover image, then you will need your own personal subscription to gain access . . . or maybe a trip to the library!

As always, readers of HWLSM-based full-text articles also get free access to most of the full-text of articles that are cited in over 300 other HWLSM-based journals, whether or not you or your institution have a subscription. So from any APS journal article, you can link immediately to cited articles if they say [Full Text] in the online reference section.

HWLSM hopes these accessibility indicators will help busy researchers select articles for which they can be assured of getting full-text access online. If you are interested in knowing which HWLSM-based journals

(continued on page 218)

The screenshot shows the HighWire search interface. At the top, there's a navigation bar with links like Home, Search, My Email Alerts, For Institutions, For Publishers, About, Contact, and Help. Below that is a search box with 'Author:' and 'Keyword(s):' fields. The search results are displayed in a list format, with each entry showing a journal cover, the journal title, and the article title. The first result is from 'The Journal of Immunology' with the article 'INFLAMMATION: Peter Schmid-Grendelmeier, Frank Altnauer, Barbra Fischer, Christian Bizer, Alex Straumann, Günter Menz, Kurt Blaser, Brunello Wüthrich, and Hans-Uwe Simon Eosinophils Express Functional IL-13 in Eosinophilic Inflammatory Diseases'. The second result is from 'The New England Journal of Medicine' with the article 'REVIEW ARTICLES: John G. Laffey and Brian P. Kavanagh Hypocapnia'. The third result is from 'Thorax' with the article 'OCCASIONAL REVIEWS: R Polosa, S Rorke, and S T Holgate Evolving concepts on the value of adenosine hyperresponsiveness in asthma and chronic obstructive pulmonary disease'. The fourth result is from 'Am. J. Physiol: Regulatory, Integrative and Comparative Physiology' with the article 'APPETITE, OBESITY AND METABOLISM: Yann Voituron, Bruno Verdier, and Claude Grenot The respiratory metabolism of a lizard (Lacerta vivipara) in supercooled and frozen states'. The fifth result is from 'Am. J. Physiol: Heart and Circulatory Physiology' with the article 'Effects of oxygen tension on energetics of cultured vascular smooth muscle'. The sixth result is from 'Am. J. Physiol: Lung Cellular and Molecular Physiology' with the article 'Estradiol attenuates hypoxia-induced pulmonary endothelin-1 gene expression'. Each result includes a 'this article is FREE to you why?' indicator and links for 'Abstract', 'Full text', and 'PDF'.

(continued from page 217)

your institution has subscribed to, click on [Institutional Subscriptions] on the new HWLSM home page; if you are interested in which journals make back articles free to the world, click on [Free Back Issues] on the home page; and if you are interested in which journals' articles are available via online purchase, click on [Pay Per View] on the home page.

And even when the full-text article is not online, the [Abstract] link that is available will give you access to more than just the abstract. For example, you can see a list of full-text articles that have cited that article, and link to those articles easily. So there's a good reason to visit the abstract page on the HWLSM site even if you think you might have already seen the abstract in PubMed.

In the next issue we'll look at some of the other features of the search result page that will help you speed your literature review.

Reference

1. Frank, M. Creating a Better Mousetrap. *The Physiologist*, 45(1), 3, February 2002.

Marder New Editor of *Journal of Neurophysiology*

Eve Marder is the Victor and Gwendolyn Beinfeld Professor of Neuroscience in the Biology Department and Volen Center for Complex Systems at Brandeis University. Marder received her PhD in 1974 from UCSD, and subsequently conducted a one-year postdoc at the University of Oregon and then a three-year postdoc at the Ecole Normale Supérieure in Paris, France. She became an assistant professor in the Biology Department at Brandeis University in 1978, and was promoted to professor in 1990. During her time at Brandeis University, Marder has been instrumental in the establishment of both undergraduate and graduate programs in neuroscience.

Marder has served on the editorial board of the *Journal of Neurophysiology* since 1989. For almost six years she was a reviewing editor for the *Journal of Neuroscience*. Additionally, she now sits on the editorial boards of *Physiological Reviews*, *Journal of Neurobiology*, *Journal of Comparative Neurology*, *Current Biology*, *Current Opinion in Neurobiology*, *Journal of*



(Photo credit: D. Marder)

Eve Marder

Experimental Biology, and *Journal of Comparative Physiology*. Marder has served on numerous study sections and review panels for the NIH, NSF, and other funding agencies. She also has served on the Council for the Society for Neuroscience, Council of the Biophysical Society, and several APS committees.

Marder is a Fellow of the American Association for the Advancement of Science, a Fellow of the American

Academy of Arts and Sciences, and a trustee of the Grass Foundation. She was the Forbes Lecturer at the MBL in 2000 and the Einer Hille Lecturer at the University of Washington in 2002.

Marder has studied the dynamics of small neuronal networks using the crustacean stomatogastric nervous system. Her work was instrumental in demonstrating that neuronal circuits are not "hard-wired" but can be reconfigured by neuromodulatory neurons and substances to produce a variety of outputs. Together with Larry Abbott, her laboratory pioneered the "dynamic clamp." Marder was one of the first experimentalists to forge long-standing collaborations with theorists and has for almost 15 years combined experimental work with insights from modeling and theoretical studies. Her work today focuses on understanding how stability in networks arises despite ongoing channel and receptor turnover and modulation, both in developing and adult animals. ❖

Moving?

If you have moved or changed your phone, fax, or email address, please notify the APS Membership Office at 301-530-7171 or fax to 301-571-8313. Your membership information

can also be changed by visiting the Members Only portion of the APS website at <http://www.the-aps.org>.

Brown New Editor of *American Journal of Physiology-Cell Physiology*

Dennis Brown, Professor of Medicine at Harvard Medical School and Director of the Program in Membrane Biology at Massachusetts General Hospital, Boston, will succeed Kim Barrett as the Editor-in-Chief of the *American Journal of Physiology, Cell Physiology*, on July 1, 2002. Born in Grimsby, a small fishing port on the East coast of England, he obtained his PhD from the School of Biological Sciences at the University of East Anglia in Norwich in 1975, in the area of the hormonal control of glycogen metabolism. He moved to Geneva, Switzerland later in the same year to work in the Department of Morphology under the guidance of the renowned cell biologist Lelio Orci. After working for a few weeks on pancreatic islets, a fortuitous collaboration drew his attention to the role of microtubules in vesicle trafficking, secretion, and Golgi organization. Based on this work, he developed his continuing interest in epithelial cell structure, membrane function, and vesicle/protein trafficking, and he learned many of the imaging and immunolabeling techniques that are applied in his research. Living and working in Geneva also provided him with the opportunity to become fluent in French, a skill which he has used to give native language research seminars in Montreal and Paris, albeit with a Swiss accent. While in Geneva, he was promoted to the permanent position of Chargé de Recherche, and could indeed have spent the rest of his research life in Switzerland. However, a meeting with Dennis Ausiello (then Chief of the Renal Unit and now Chief of Medicine at the MGH) at an epithelial transport meeting in the mountain resort of Arolla in Switzerland, persuaded him that exciting opportunities for academic and personal growth existed in the USA. After patiently waiting for a green card, his wife and two children moved across "The Pond" to Boston in December 1986.

Since then, his work on the regulation of membrane protein recycling



Dennis Brown

has placed him at the forefront of research aimed at integrating cell biology with physiology, particularly with respect to renal epithelial cells. The roles in protein trafficking of phosphorylation events, the cytoskeleton and accessory coat proteins on transport vesicles are central themes of his research. He is most well-known for his studies on the intracellular trafficking and recycling of aquaporins in collecting duct principal cells, and proton pumps in renal intercalated cells, but his studies have also addressed similar questions related to a variety of membrane proteins and cell types. Indeed, current studies in the Program in Membrane Biology use an integrated in vitro and in vivo approach to address the regulation of epithelial cell transport processes throughout the urogenital tract. He has been an Editorial Board member and Associate Editor for both *AJP-Renal* and *AJP-Cell Physiology* over the past several years, and was the Carl Gottschalk Distinguished Lecturer at the Experimental Biology meeting in Washington in 2000. He is currently also on the Editorial Boards of the *Journal of the American Society of Nephrology* and the *Journal of Histochemistry and Cell Biology*.

In addition to his work in the scientific arena, Brown is a soccer fanatic and coached his son's select travel team to five Massachusetts State Championships and three USA Region I Championships in the mid-1990's.

He currently coaches his younger daughter's team and is hoping for the same level of success. By the time this biographical sketch appears, the World Cup will be over and the fate of his beloved England team will have been sealed.

Finally, his plans for the *Cell Physiology* section of the journal are simple—to make it the number one place to publish physiologically-relevant cell biology. The focus of the journal will be on cell signaling (hormone-receptor interactions, cell-matrix interactions, pH and Ca⁺⁺ signaling etc.), intracellular events that result from these signals (including vesicle trafficking, cytoskeletal modulation, signal transduction cascades, gene regulation etc.), and the ultimate cellular response at the physiological level (membrane transport/ion channel function, secretion, cell division, apoptosis, migration, contraction etc.). The composition of the new team of Associate Editors reflects this push towards cell signaling (Paul Insel, University of California, San Diego) and its consequences in muscle cells (Bill Gerthoffer, U. Nevada), vascular tissue (Kathy Griendling, Emory Univ.), and epithelial cells (Jennifer Stow, U. Brisbane). Continued emphasis will be placed on transport processes and molecular interactions in a variety of mammalian and alternative experimental systems (Kathy Sweadner, MGH; Seth Alper, Beth Israel/Deaconess; Kevin Strange, Vanderbilt). The inclusion of Jenny Stow from Brisbane, Australia also reflects a need and a desire to attract more submissions and interest from her part of the World, and to give the journal more International impact. The composition of the modified editorial board will also emphasize the aims outlined above. Dr. Brown is excited by the possibility of building on the excellent work of his predecessors Dale Benos and Kim Barrett, and working with his team of talented Associate Editors to push the journal to still greater heights. ❖

APS Presents Awards at 53rd Annual International Science and Engineering Fair

The 53rd Annual International Science and Engineering Fair (ISEF) was held in Louisville, KY, on May 12-18, 2002. Sponsored by Intel, this year's ISEF featured over 1,200 outstanding high school science students from the US and 37 other countries. Students competed individually or as teams in 14 different categories, including behavioral and social sciences, biochemistry, computer science, engineering, gerontology, and medicine and health. In addition to the Grand Awards presented by the Intel Foundation and five other organizations, Special Awards were given by 93 scientific, professional, industrial, educational, and governmental organizations in the form of scholarships, tuition grants, summer internships, scientific field trips, and equipment grants. As is our tradition, the APS presented Special Awards in the form of cash prizes and student memberships to select finalists with the best projects in the physiological sciences, including cellular physiology, animal physiology, and neurophysiology.

The judging team was led by **George Ordway** from the Department of Physiology at The University of Texas Southwestern Medical Center at Dallas, and included APS members from Louisville and Lexington, KY. **David Randall** and **Daniel Richardson** from the Department of Physiology at the University of Kentucky College of Medicine joined **Andrew Roberts**, **Dale Schuske**, **Frederick Miller**, **Richard Stremel**, **Ayotunde Adeagbo**, and **Jeff Falcone** from the

Department of Physiology and Biophysics at the University of Louisville School of Medicine.

The APS First Place Award of \$1,000 went to **Jennifer Oakley Tshorn**, a senior at John Jay High School in Katonah, NY. Jennifer's project, "Action of Indole-3 carbinol in Breast Cancer," also was the overall winner in the Medicine and Health category. **Philippe Andre Bouchard** won the APS Second Place Award of \$500 with his project entitled, "The Role of Osteopontin Gene Expression on the Vasoprotective Effects of Estrogen on Vascular Injury." Philippe is a sophomore at The Altamont School in Birmingham, AL. There was a tie for the APS Third Place Award between two students from Pennsylvania. **Elizabeth Katherine Tronsor**, a junior at Ephrata Senior High School in Ephrata, PA, was chosen from the Biochemistry category for her project, "Quercetin, A Nitric Oxide Inhibitor in Raw 264.7 Cells." **Megan Clarke Roberts** is a junior at Carlisle High School in Carlisle, PA and was selected for her project, "Effect of FGFR and EFGR Antibodies on the Growth Rate of HL-60 Cells." Elizabeth and Megan each received \$500.

In addition to the four award winners, the APS also recognized six other students in the form of a one-year student membership in the APS and subscriptions to *The Physiologist* and *News in Physiological Sciences*. These outstanding science students were: **Xiaolong Zhou**, a senior at Miami Palmetto Senior High in Miami, FL

("Zinc Induces Apoptosis in Tumor Cells by Activating Caspases in a Unique Manner: Implications for Tumor Therapy"); **Sam Adler Golden**, a senior at John Jay High School in Katonah, NY ("Ciliary Neurotrophic Factor: A Possible Regulator of Reg Gene Expression in the Pancreas"); **Irena Ilieva Yambolieva**, a senior at East Wooster High School in Reno, NV ("Endothelium-derived Relaxing Factors in Canine Pulmonary and Mesenteric Arteries"); **Sue Si Chen**, a junior at Cordova High School in Cordova, TN ("Nuclear Factor-kB and Pro-inflammatory Mediators in the Infarcted Heart"); **Crystal Mary-Lou Pinto**, a senior at Francis Libermann Catholic High School in Toronto, Ontario, Canada ("Antioxidants: Effects on Microglial Neurotoxicity"); and **Ankita C. Baxi**, a junior at Houston High School in Germantown, TN ("Expression of Constitutively Active Oncogene, c-Src, Disrupts Cell-cell Adhesion").

Next year's Intel ISEF will be held in Cleveland, OH on May 11-17, 2003. The one-day judging for APS Special Awards is always an interesting, rewarding, and enlightening experience for APS members who participate. For those in the Cleveland area, please consider joining the APS Special Awards judging team for the 2003 Intel ISEF. If interested, please contact Marsha Matyas in the APS Education Office (mmatyas@the-aps.org). ❖



George Ordway presents APS awards to Jennifer Tshorn, Philippe Bouchard, Elizabeth Tronsor, and Megan Roberts.



APS Judges (from left): Frederick Miller, Andrew Roberts, Ayotunde Adeagbo, Daniel Richardson, George Ordway, Dale Schuske, Jeff Falcone, and David Randall.

2001 Undergraduate Summer Research Fellows Experience at EB

The APS Undergraduate Summer Research Fellowship (UGSRF) program was developed in 1999 by the APS Career Opportunities in Physiology Committee to attract quality students into physiology graduate programs. The fellowships are given to 12 students each year to work in the laboratory of an APS member for three months during the summer. Many of these students have not had the experience of conducting physiological research. At the end of the fellowship, students are given the opportunity to attend the Experimental Biology (EB) meeting the following year to experience a large scientific meeting. Many present posters based on their research.

This year at EB 2002 in New Orleans, LA, 10 of the 12 2001 UGSRF students attended the meeting. Eight

of those 10 presented a total of nine poster presentations, which were programmed into the regular scientific portion of the EB program. The 10 students attended an orientation session that is designed to acquaint them with each other and to orient them to the EB meeting.

The 2001 APS Undergraduate Summer Research Fellows were **Jennifer L. Barone** (Williams College), Research Host: **Steven Swoap** (Williams College); **Kush R. Desai** (Univ. of Illinois, Urbana-Champaign), Research Host: **Dorothy A. Hanck** (Univ. of Illinois, Chicago); **Helen M. Eddy** (Acadia Univ.), Research Host: **Rene J. L. Murphy** (Acadia Univ.); **Jewel A. Jessup** (Salem College), Research Host: **Debra I. Diz** (Wake Forest Univ.); **Roger Kapoor** (George Washington

Univ.) Research Host: **Celia D. Sladek** (Chicago Medical School); **Sanjana T. Karim** (Davidson College), Research Host: **Abu B. Al-Mehdi** (Univ. of Pennsylvania); **Michael A. Llewellyn** (Oregon State Univ.), Research Host: **Thomas J. Roberts** (Oregon State Univ.); **Manus M. Patten** (Syracuse Univ.), Research Host: **John M. Russell** (Syracuse Univ.); **Sunita Puri** (Yale Univ.), Research Host: **Darrell P. Neuffer** (Yale Univ.); **Vikram J. Vaz** (Harvard College), Research Host: **Charles A. Czeisler** (Harvard Univ. Medical School); **Francisco C. Villafuerte** (Universidad Peruana Cayetano Heredia), Research Host: **Carlos Monge** (Universidad Peruana Cayetano Heredia); and **Daniel S. Wu** (Cornell Univ.), Research Host: **Klaus W. Beyenbach** (Cornell Univ.).

2002 Undergraduate Summer Research Fellows Announced

The APS Council has approved the following student applications for 2002 Undergraduate Summer Research Fellowship program.

Student

Taslina Bhuiyan, Columbia University
Susan Canny, Stanford University
LaToya D. Carson, Pennsylvania State University
Matthew H. Collins, Furman University
Dawn M. Grimes, University of Missouri, Kansas City
Jennifer L. Hageman, University of Colorado, Boulder
Lisa Kang, Loyola University at Chicago
Kaly Kao, University of California, Berkeley
Benedict J. Kolber, University of Dayton
Lucila A. Martinez, Columbia University
Michelle Llander Ofreneo, St. Louis University
Michael David Thompson, Washington University

Research Host

Rae Silver, Columbia University
Michael J. Caplan, Yale University
Donna H. Korzick, Pennsylvania State University
Jennifer S. Pollock, Medical College of Georgia
Tina Hines, University of Missouri, Kansas City
Rodger Kram, University of Colorado, Boulder
Eugene B. Chang, University of Chicago
John G. Forte, University of California, Berkeley
Carissa M. Krane, University of Dayton
Rae Silver, Columbia University
Barrie P. Bode, St. Louis University
Jeffrey Gidday, Washington University Medical School

APS Sustaining Associate Members

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



Abbott Laboratories
 ADInstruments
 Astra Arcus USA, Inc.
 Axon Instruments, Inc.
 Berlex Biosciences
 Gould, Inc.
 The Gatorade Company
 The Grass Foundation

Harvard Apparatus
 Janssen Research Foundation
 Eli Lilly and Company
 The Mack Printing Group
 Merck and Company, Inc.
 Nycomed, Inc.
 Pfizer, Inc.
 Pharmacia and Upjohn, Inc.

Procter & Gamble Co.
 Rhone-Poulenc Rorer
 W. B. Saunders Company
 Schering-Plough Res. Inst.
 G. D. Searle and Company
 SmithKline Beecham Pharm.

Physiology Insights: Fellowships for Undergraduate Faculty

The Physiology Insights Fellowship Program for undergraduate faculty at two- and four-year colleges was instituted by APS in 1996. For the past several years, APS has supported this program, which allows undergraduate faculty to attend the Experimental Biology (EB) meeting by providing complimentary registration. The program is designed to attract undergraduate educators who live in a three- or four-state region surrounding the meeting site.

This year at the EB 2002 meeting in New Orleans, LA, five undergraduate faculty members received the fellowship to attend the meeting. These included Susan L. Edwards, Georgia Southern University in Statesboro, GA; Martha Sette, Technical College of the Lowcountry in Beaufort, SC;

Rebecca Sheller, Southwestern University in Georgetown, TX; Casey A. Shonis, Bloomsburg University in Bloomsburg, PA; and Susan O. van Loon, Our Lady of Holy Cross College in New Orleans, LA.

The Physiology Insights program includes a luncheon and workshop for fellows that address special issues of importance to two- and four-year undergraduate educators. This year's workshop was entitled "Online Models and Tools for Transforming Physiology Teaching and Learning." Topics covered included the APS Archive of Teaching Resources, BioSciEd Net portal, and other valuable online resources. Speakers for the workshop were **Robert G. Carroll**, Chair of the APS Education Office, and **Barbara E. Goodman**, **William R. Galey**, and

Penelope Hansen, all members of the APS Undergraduate Collections Development Group.

Fellows also have the opportunity to discuss among each other matters of common interest and to offer suggestions to APS staff for program improvement. Fellows participate in the regular scientific session, special sessions, and exhibits as well.

Up to 15 fellowships will be made available to regional undergraduate educators for Experimental Biology 2003 in San Diego, CA. The deadline for applications for 2003 will be Friday, March 28. Details about the program can be found at <http://www.the-aps.org/education/PhysInsts/insi-info.html>. ❖

APS Archive of Teaching Resources



The APS Archive of Teaching Resources (<http://www.apsarchive.org>) continues to grow with the recruitment of a variety of new learning objects from educators all over the country. To date, about 40 items have been received for the Archive from various sources.

However, more material is still needed. Please consider submitting material that you have developed to use to make your teaching more effective. These can be

lecture or course outline or PowerPoint lecture slides that is particularly effective with your students problems or cases you've written for your classes

diagram(s) that you've created to illustrate a specific pathway or process that seems to clarify it for your students simulations or videos you have developed

web sites you have discovered that have valuable information for your teaching

teaching tools/materials that you are developing that would benefit from feedback from your colleagues

anything educational related to physiology, pathophysiology, or clinical physiology

APS along with the other BiosciEd Net (BEN) partners are pleased to announce the launch of the BEN portal site (<http://www.bioscienet.org>) July 1. Through the BEN portal, educators will be able to access the teaching archives of not only APS but also American Association for the Advancement of Science, American Society for Microbiology, Ecological Society of America, Science's Signal Transduction Knowledge Environment, American Society for Biochemistry and Molecular Biology, and Society of Toxicology, as well as others.

Presentations about the Archive, including submitting objects and searching for objects, have been made at the Human Anatomy and

Physiology Society (HAPS) meeting (a new BEN partner); the Council on Undergraduate Research meeting in New London, CT; and the International Congress of Pathophysiology in Budapest. Look for us at upcoming presentations at the APS Conference on "The Power of Comparative Physiology: Evolution, Integration and Application" in San Diego, CA; the Society for Advancement of Chicanos and Native Americans in Science in Anaheim, CA; the regional HAPS Conference in Arnold, MD; the National Association of Biology Teachers in Cincinnati, OH; and the Sixth Annual Meeting of the International Association of Medical Science Educators in Guadalajara, Mexico.

By submitting learning objects that you have developed, you can help your colleagues in their efforts to find the best tools for introducing their students to the exciting discipline of physiology. ❖

“IACUC 101” at EB 02; EB 03 Follow-on Planned

Some 60 scientists participated in a four-hour symposium on the workings of the Institutional Animal Care and Use Committee (IACUC) that was offered as part of Experimental Biology 2002. “Everything You Ever Wanted to Know About the IACUC But Were Afraid to Ask” was organized by the APS Animal Care and Experimentation Committee (ACE) with support from the NIH Office of Laboratory Animal Welfare (OLAW). The session was co-sponsored by the American Society for Pharmacology and Experimental Therapeutics, American Society for Nutritional Sciences, American Association of Immunologists, American Association of Anatomists, and the Federation of American Societies for Experimental Biology.

A similar program entitled “IACUC 101 for Scientists” is planned for EB 2003 in San Diego. That symposium will take place on Friday, April 18, 2003, from 1-5 pm. Further information and a registration form will be included in the EB 2003 Call for Papers.

“Everything You Ever Wanted to Know About the IACUC” was moderated by ACE Committee Chairman John Stallone. It was adapted from the popular “IACUC 101” series and offered working scientists an overview of the IACUC process. The program also included several opportunities to pose questions to representatives from OLAW, USDA’s Animal and Plant Health Inspection Service (APHIS)-Animal Care, and the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) International. An electronic version of this article with links to these organizations and other materials related to this symposium are available on the APS website at http://www.the-aps.org/pub_affairs/IACUC.

Monte Matthews, who is the Director of the Office of Veterinary Services and Animal Care at the University of Oregon, described the

evolution of the US laboratory animal welfare system and the role played by the IACUC. The post-World War II origins of animal welfare oversight go back to 1950. The US had begun increasing its investment in biomedical research after World War II, and in 1950, five Chicago-area veterinarians at research facilities began discussing ways to enhance science by improving the care provided to laboratory animals. By 1953 this group was publishing proceedings of its discussions and incorporated itself as the Animal Care Panel (ACP).

In 1952, the National Academy of Sciences established the Institute of Laboratory Animal Resources (ILAR). Both ILAR and the ACP were addressing animal welfare issues 15 years before there were any federal oversight laws. The ACP appointed an Animal Facilities Certification Committee that developed into the independent accrediting body now known as AAALAC. In 1963, the ACP sought NIH funding to develop a *Guide for Laboratory Animal Facilities and Care*, which evolved into the *Guide for the Care and Use of Laboratory Animals (Guide)*, a document periodically updated by ILAR and published by the National Research Council. The Animal Care Panel itself continued to grow and in 1967 was reconstituted as the American Association for Laboratory Animal Care (AALAS).

Matthews explained that the 1966 Laboratory Animal Welfare Act (later known as the Animal Welfare Act) established the first federal animal care standards. It set a handful of minimum standards that applied to the areas where dogs and cats intended for research were housed. It also required facilities to maintain records on the dogs and cats they purchased. The legislation came about after a 1966 *Life* magazine article, “Concentration Camps for Dogs,” that described how dealers treated animals that were to be sold to research.

The Animal Welfare Act was amended in 1970, 1976, 1985, and 1990, gradually expanding the number of animal species covered and the breadth of welfare requirements. The 1970

amendments changed the name of the law and extended USDA regulation beyond cats and dogs to include non-human primates, rabbits, guinea pigs, and hamsters. The 1970 amendments also granted the USDA discretion to regulate other species of warm-blooded vertebrates used in research. (One area of continuing controversy has been whether this provision permitted or required the USDA to regulate laboratory rats and mice, as well as birds. That controversy has been resolved for now with the approval of the 2002 farm aid bill, which amends the AWA to exclude these species.)

The 1985 AWA amendments made sweeping changes to the regulations, requiring facilities that use covered species to designate an institutional official and to establish an IACUC to conduct program oversight and review all proposed research, educational, or testing activities.

Matthews recounted the history of a parallel system of oversight for the care and use of laboratory animals that developed within the Public Health Service (PHS). The PHS is part of the Department of Health and Human Services and serves as the parent organization to such agencies as the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC). In 1971, the NIH formalized a policy requiring humane treatment of animals based upon the requirements of the *Guide*. This policy was formally adopted by the PHS as a whole in 1973 and was subsequently revised in 1979. In 1985, Congress adopted legislation reauthorizing NIH programs known as the Health Research Extension Act. This legislation included a provision making the PHS Policy on Humane Care and Use of Laboratory Animals part of the framework of laws governing the NIH and required henceforth that all PHS-funded research involving vertebrate animal species be conducted according to the PHS Policy. The elements of the PHS Policy largely paralleled the AWA in requiring the appointment of an institutional official and the establishment of an IACUC, although the com-

(continued on page 224)

(continued from page 223)

position and mandates of the IACUC differed somewhat from that specified by the AWA.

In many ways, 1985 was a watershed because it was also the year that the US Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training were adopted. These nine principles apply to all federally funded activities involving animals.

Molly Greene of the University of Texas Health Science Center at San Antonio (UTHSCSA) discussed the function and responsibilities of the IACUC. Greene has been with UTHSCSA since 1986 and currently serves as the Director of the Department of Academic Support. Her talk described key components of effective animal care and use programs. She emphasized that an effective program complies with federal, state and local laws and regulations, can assure the public of quality animal care, minimizes the burden on research teams, and facilitates scientific research.

Greene detailed the responsibilities of the various "team members," including the Institutional Official, IACUC members, IACUC staff, attending veterinarian, and researchers, staff, and students. Greene said that the membership of an IACUC should represent the research and teaching strengths of the institution.

The ultimate purpose of IACUC review is to protect the continued use of animals in research. Sometimes, however, issues arise between investigators and the IACUC, and it is important to handle them in ways to minimize conflict. For example, Greene recommended that when the IACUC asks an investigator to modify a protocol prior to its approval, it should cite the pertinent section of regulation or policy in its response to the investigator. Greene provided a handout on Protocol Review Process Requirements listing the responsibilities of the IACUC under the AWA and the PHS Policy and identifying the sections of regulation or policy containing the various requirements. This document is available electronically on the APS web site at [http://www.the-](http://www.the-aps.org/pub_affairs/IACUC)

[aps.org/pub_affairs/IACUC](http://www.the-aps.org/pub_affairs/IACUC).

Greene recommended that the IACUC take responsibility for compliance issues so that the veterinarian and animal care staff can focus on animal care and facilitating research. She referred participants to the statement on Adequate Veterinary Care on the website of the American College of Laboratory Animal Medicine (<http://www.aclam.org>).

Stallone reviewed the basics of protocol review requirements as required under the AWA, PHS Policy, and US Government Principles. He provided a series of issues to be addressed, IACUC approval criteria and questions that should be answered to the IACUC's satisfaction before a protocol is approved. He provided two handouts developed by Greene to assist IACUCs. The first was a side-by-side comparison of the respective Protocol Review Content Requirements of the AWA regulations, PHS Policy, the Guide, and the US Government Principles. The second was a model Protocol Review Checklist Greene designed to help IACUCs make certain that the protocol has addressed all relevant issues satisfactorily. (These documents are also available on the APS website at the URL indicated above.)

The question-and-answer sessions between talks covered a wide range of topics. One questioner wanted to know how to determine when significant and unexpected animal loss has occurred that should be reported to OLAW or USDA. OLAW Director Nelson Garnett, DVM, explained that although it is difficult to give detailed guidance, it is generally expected that institutions with PHS Assurances will report cases where an approved activity has to be suspended or when there has been an instance of serious non-compliance with the PHS Policy or a deviation from the NRC Guide that result in the preventable deaths of animals.

Training requirements were also discussed. Garnett noted that training should be oriented toward the activities an individual engages in. The requirement for training specifies that training must be available but does

not prescribe its frequency or intensity. Richard Van Sluyters, OD, PhD, a Professor of Optometry and IACUC Chair from the University of California, Berkeley, who was representing AAALAC, noted that investigators at his institution are asked to take a training refresher course at least every five years. This requirement is typically fulfilled through periodic seminars given to each department by the attending veterinarian. Jodie Kulpa, DVM, of the APHIS Animal Care staff at USDA recommended that training should be offered in a variety of lectures, workshops, hands-on clinics and online courses tailored to areas where researchers want and need further information. The website <http://www.iacuc.org> was recommended as a resource because it provides a list of training programs and model policies.

The panel was asked whether there are ethical standards in place for research involving animal exercise. At the moment, the only standard regarding exercise is the AWA requirement that dogs be provided with opportunities to exercise. AAALAC's Van Sluyters indicated that it is important for scientists involved in specific types of research to provide written guidelines that IACUCs can use when reviewing protocols. Garnett said that OLAW is interested in supporting the development of such guidelines, as is the National Academy of Sciences, possibly in the form of an ILAR committee report similar to the *Guide*.

Another question that provoked a lively interchange involved protocols for animal models that cause pain and distress. The questioner was concerned about instances in which the attending veterinarian has decided to euthanize an animal without notifying the investigator so the data were lost and the animal's life was wasted. Andrea Barnes, DVM, of the APHIS Animal Care staff commented that the issue may be one of specifying a humane end point for the experiment, and pilot studies may be needed to refine or define that end point. Barnes pointed out that the animal study proposal serves as a contract between the

principal investigator and the animal care staff so it is important to indicate what are the end points for each group of animals and to spell out whether the investigator is to be notified before animals are euthanized. Van Sluyters noted that veterinarians have an obligation to euthanize animals that are suffering so provisions should also be made about how to proceed if the lab personnel are unavailable. Greene underscored the need for the IACUC to ensure that these procedures have been established before animal use begins. ❖

President Proposes Homeland Security Department

President Bush has proposed the creation of a cabinet level Department of Homeland Security to improve the nation's ability to defend itself against terrorist threats. The new agency would bring together nearly 170,000 federal employees and \$37.5 billion in domestic security programs from various government agencies. The four primary missions of the new department would be chemical, biological, radiological, and nuclear countermeasures; information analysis and infrastructure protection; border and transportation security; and emergency preparedness and response. Some of the changes proposed under this massive reorganization would affect agencies that fund and oversee biomedical research.

"The President's most important job is to protect and defend the American people," the White House said in a statement explaining the proposal. "America needs a single, unified homeland security structure that will improve protection against today's threats and be flexible enough to help meet the unknown threats of the future." The details of the sweeping proposal were closely guarded until President Bush announced it in a June 6 televised address. The plan had been developed by a handful of trusted

advisors who worked in secrecy. Implementing legislation to create the Department of Homeland Security was submitted to Congress on June 18, and President Bush asked Congress to expedite its passage so that the new agency would be in place by the anniversary of the September 11 attacks.

In the areas of civilian biodefense research and public health response, the plan calls for transferring some 300 government workers and \$4 billion to the new department. Some concerns have arisen about how the new department will affect on-going infectious disease research. Analysts believe that \$1.7 billion of the biodefense research and civilian response budget will be drawn from funds the administration originally proposed for bioterrorism research activities at the National Institute for Allergy and Infectious Diseases. In addition, the section of the proposed legislation that deals with chemical, biological, radiological and nuclear countermeasures includes the following language:

"With respect to any responsibilities carried out through the Department of Health and Human Services under this subsection, the Secretary [of Homeland Security], in consultation with the Secretary of Health and Human Services, shall have the authority to establish the research and development program, including the setting of priorities."

FASEB President Bob Rich pointed to two troubling aspects of this plan in a June 24 letter to House Energy and Commerce Committee Chairman W.J. "Billy" Tauzin. While "supporting the efforts of the Congress and the Administration to provide adequately for homeland defense against future acts of terrorism," Rich expressed concern about the efficacy of taking a "top down" approach to research on potential infectious agents of bioterrorism. "The risk is that a 'top down' approach to research might preclude the discovery and development of new understandings of infectious agents," Rich wrote.

Rich also questioned the proposal to transfer major elements of the HHS research and public health portfolio to

the new department, which would then provide funds for the NIH and CDC to carry out the designated tasks. "Funding transfers are likely to be accompanied by a re-allocation of and redistribution according to different research priorities," Rich wrote. "If there is no reallocation, such interagency transfers are pointless and will only add transaction costs and delay to performing the research." Rich concluded by noting that FASEB members "share [the] belief that enhanced federal coordination and oversight is essential to protect all Americans from bioterrorism, but we are concerned that the proposed structural research changes, however well-meaning, might well be counter-productive."

The Department of Homeland Security could also affect biomedical research through the proposed transfer of the USDA's Animal and Plant Health Inspection Service (APHIS) to the proposed Security Division of Border and Transportation Security. The transfer is intended to improve the effectiveness of APHIS efforts to safeguard US agriculture from exotic invasive pests and diseases. However, it is unclear what impact the transfer would have on other aspects of APHIS operations, including its responsibility to enforce the Animal Welfare Act regulations. ❖

Bioterror Protection Bill Signed

On June 12 President Bush signed into law a \$4.6 billion bioterrorism bill (Public Law 107-188). The law authorizes funds to purchase stockpiles of vaccines and antibiotics, mandates increased protection of the food supply, and authorizes grants to the states for emergency preparedness against bioterror attacks. The legislation had virtually unanimous support in Congress. The conference report passed the House by a vote of 425-1 and passed the Senate by a vote of 98-0.

(continued on page 226)

(continued from page 225)

The measure requires the Department of Health and Human Services (DHHS) to develop a list of biological agents or toxins that pose a threat to public health and safety, and to update the list every two years. Individuals who handle these materials must register with the Secretary of HHS. DHHS must submit these names to the Attorney General for background checks and keep a database of registered persons and materials.

Funds were also authorized for the Centers for Disease Control and Prevention to upgrade its scientific equipment and laboratories and for DHHS to award grants to health professions schools and programs to relieve shortages of health professionals needed to prepare for bioterrorism or other public health emergencies.

The new law also provides new penalties for causing the disruption of or physical damage to animal research and agricultural facilities. It also makes conspiring to commit "animal enterprise terrorism" a criminal offense. The law establishes penalties for actions that result in economic damages, serious bodily injury, and death. Crimes that cause economic damages of up to \$10,000 are subject to fines and/or a prison term of up to 6 months. Actions that cause economic damages of \$10,000 or more are subject to fines and/or a prison term of up to three years. In both instances, those convicted of the crimes may be required to pay restitution for the damage caused. Crimes against animal enterprises that result in serious bodily injury may be punished with fines and/or a prison term of 20 years, and crimes that result in a death may be punished by fines and/or imprisonment for life. ❖

Germany Writes Protection for Animals Into its Constitution

Germany has included protection of

animals as an element in its Basic Law or constitution. The lower house of parliament approved the measure on May 17, with 543 lawmakers supporting it, 19 lawmakers voting against it, and 15 abstaining. The upper house of parliament followed suit on June 21.

Switzerland passed a similar amendment in 1992, allowing animals to be recognized before the law as beings rather than things.

The German constitutional amendment followed a decade of debate and will require federal courts in that nation to weigh animal protection against other considerations, such as scientific and religious freedom. Until this year, conservative legislators opposed the amendment on the grounds that it might damage German research. However, opinion shifted sharply after Germany's highest court dismissed a court challenge to Muslim slaughter practices. Muslim law requires butchers to slaughter animals without first stunning them. By contrast, German animal welfare laws are based on the belief that it is more humane to stun animals prior to slaughter. The court refused to intervene in this case because freedom of religion was enshrined in the Basic Law, while protection for animals was not.

The amendment added the words "and animals" to a clause in the Basic Law that obliges the state to respect and protect the dignity of "life." This passage was previously interpreted as referring only to human life. The amended language now reads, "The state takes responsibility for protecting the natural foundations of life and animals in the interest of future generations."

Some scientists are concerned about the implications of this language for their work. The BBC reported that one German organization called the Society for Health and Research said that the amendment would create legal insecurity in research and education because it opens the door to court challenges of animal research as well as moves by the government to restrict certain research.

Consumer Affairs Minister Renate

Kunast, a member of the pro-environmentalist Green party that backed the language, insisted that it would not place animals above humans. "People remain the most important," she said after the lower house voted to approve the amendment. However, questions remain concerning how the courts will interpret the language and how perceived conflicts between the interests of humans and animals will be resolved. Kunast was also quoted commenting, "Work is not stopping. It is just beginning." ❖

Congressional Appropriations Season Heats Up

Congress is lagging behind schedule to finish the 13 spending bills that fund the federal government. Further delays are expected as the issue of Homeland Security takes center stage as the top priority for Congress.

To date, the House has passed two FY 2003 spending bills and four other House bills are scheduled for full committee action by the middle of July. However, the bills that fund most biomedical research, such as the Labor HHS and VA-HUD appropriations bills, likely will not come up before the August recess. These bills, particularly the Labor HHS, are large, involve numerous controversial issues and take time to pass.

In the Senate, Senate Appropriations Chairman Robert Byrd (D-WV) indicated that he intends to move all 13 annual appropriations bills through his committee before the August recess. Currently only two bills, FY 2003 Interior and Military Construction, have made it out.

However, Senate Republicans are threatening to hold up appropriations bills. Senate Majority Leader Trent Lott (R-MS) said he would protest bills that far exceed President Bush's budget request by loading them down with amendments. ❖

NSF Doubling Effort Gets Boost

The effort to put the National Science Foundation's (NSF) budget on a five-year doubling path is gaining momentum in the 107th Congress.

On May 3, 2002, leadership from the House Science Committee, including Chairman Sherwood Boehlert (R-NY), Ranking Member Ralph Hall (D-TX) and physicist Vernon Ehlers (R-MI) circulated a "Dear Colleague" letter asking House members to show support for a \$5.5 billion appropriation for the NSF in FY 2003. This would be a \$720 million increase over the agency's FY 2002 level and \$479 million more than the Bush administration's request. This effort fueled the movement to pass authorization legislation.

On June 6, 2002, advocates for doubling the NSF's budget achieved a victory when the House of Representatives overwhelmingly (397-25) voted to pass H.R. 4664 the "Investing in America's Future Act." The bill now moves to the Senate for consideration.

This legislation, which will reauthorize NSF programs, calls for doubling the NSF's budget over five years with a series of 15% increases. The first step would be a funding level of \$5.5 billion for fiscal year (FY) 2003. While authorizing legislation does not actually fund federal agencies, it does provide strong justification for particular funding levels for a program.

During the House floor debate on the bill, Representative Ehlers noted that "National Science Foundation funding has fallen behind that of other major federal research agencies, and we are not third among nations in our spending of basic research." Representative Connie Morella (R-MD) echoed Representative Ehlers' remarks: "If we expect the technological advances we have achieved in recent years to continue, we must fund the underpinning science and engineering more robustly. In addition, we must provide adequate resources to produce the next generation of scientists and engineers. As the premier supporter of the overall scientific

enterprise, the NSF has the ability to balance the research and education dollars needed to achieve both of these goals." ❖

Senate Avoids Cloning Vote

In early June, a major Senate floor debate on all forms of cloning legislation was averted. Cloning opponent Senator Sam Brownback (R-KS) declined an offer by Senate Majority Leader Thomas Daschle (D-SD) to have his legislation brought to the Senate floor for a vote.

Late last year, Senator Daschle offered Senator Brownback a chance to bring his bill to the floor for a vote later in the year in exchange for not trying to attach it to the FY 2002 Labor Health and Human Services, Education and Related Agencies appropriations bill. Under Senator Daschle's offer there would be three full days of debate on various pieces of cloning legislation, including Senator Brownback's legislation.

In early June, Senator Brownback rejected this offer. He felt that under the agreement his legislation would be put in a position to fail while cloning proponents Senators Arlen Specter (R-PA) and Diane Feinstein's (D-CA) legislation would pass. Senators Specter and Feinstein's legislation bans reproductive cloning but not the use of cloning techniques for research and to develop therapies.

Senator Daschle indicated that the

agreement he arranged was his final attempt to debate the issue on the Senate floor: "It is up to others to decide how to pursue [cloning legislation]. I don't have time to keep coming back to this issue."

Brownback has not given up on trying to ban all forms of cloning. Late in the evening of June 13, he attempted to offer an amendment to an unrelated bioterrorism insurance bill. His amendment would have blocked the issuance of patents for cloned human beings or the technology to produce them. This effort failed after the Senate voted to remove all amendments that had nothing to do with bioterrorism insurance from the bill.

Subsequently Senator Brownback indicated he would no longer try to persuade the US Senate to pass a bill outlawing all human cloning. Instead, he says he will work to win congressional approval for a two-year moratorium on such work. ❖

William F. Ganong Named Endocrine Society's 2002 Distinguished Educator Awardee

APS Member **William F. Ganong**, DSC, MD, former Chair of the Department of Physiology at the University of California, San Francisco, has been named the winner of the Endocrine Society's 2002 Distinguished Educator Award.

This award, which is presented in recognition of exceptional achievement as an educator in the discipline of endocrinology and metabolism, was

presented at ENDO 2002, the 84th Annual Meeting of The Endocrine Society, June 19-22, in San Francisco.

Ganong, the Lange Professor of Physiology Emeritus at UCSF, was chairman of the department from 1970 to 1987. His research focused primarily on the neuroendocrinology of aldosterone regulation, a field to which he made major contributions.

In 1963, Dr. Ganong published the

first edition of a textbook, *Review of Medical Physiology*. The book has been frequently revised and updated and the 20th edition appeared in 2001. It has been translated into 17 languages and has sold over two million copies and has had a major influence on biology and medicine students internationally. ❖

Keren M. Abberton recently accepted a position with the Department of Microsurgery, Bernard O'Brien Institute, Fitzroy, Australia. Previously, Abberton was associated with the Department of Pharmacology and Physiology, University of Rochester Medical Center, Rochester, NY.

Jordi Altimiras has moved to Sweden to accept a position with the Biology Department, Linkopings Universitet, Linkoping, Sweden. Formerly, Altimiras was with the Department of Sciences, Saude University Beira Interior, Covilha, Portugal.

Nigel M. Bagnall has affiliated with the Leicester Warwick Medical School, University of Warwick, Coventry, United Kingdom. Previously, Bagnall was with the Department of Physiology, University of Birmingham, Birmingham, UK.

LeAnn Blomberg has joined the Department of Germplasm and Gamete Physiology, United States Department of Agriculture, Agricultural Research Services and the Animal and Natural Resources Institute, Beltsville, MD. Prior to her new commitment, Blomberg was associated with the Lung Biology Laboratory, Georgetown University School of Medicine, Washington, DC.

Matthew J. Campen recently affiliated with the Toxicology Division, Lovelace Respiratory Research Institute, Albuquerque, NM. Campen was with the Department of Pulmonary Medicine, Johns Hopkins University, Baltimore, MD.

Robert Carter has affiliated with the US Army Research Institute of Environmental Medicine, Thermal and Mountain Medicine Division, Natick, MA. Prior to his new position, Carter was with the Department of Physiology, University of North Texas Health Science, Forth Worth, TX.

James Liberal Costantin has affiliated with the Department of Ion Works, Molecular Devices Corporation, Sunnyvale, CA. Costantin formerly was associated with the Department of Molecular and Cellular Biology, University of California, Berkeley, CA.

Kevin P. Davy has joined the Department of Physiology and Biophysics, University of Mississippi Medical Center, Jackson, MS. Davy previously was with the Department of Health and Exercise Science, Colorado State University, Fort Collins, CO.

Christophe Depre accepted a position with Cell Biology, Cardiovascular Research Institute, University of Medicine and Dentistry, Newark, NJ. Previously, Depre was with the Cardiovascular Research Institute, Hackensack University Medical Center, Hackensack, NJ.

Robert Jason Durand has moved to the Division of Health and Performance Enhancement, Pennington Biomedical Research Center, Louisiana State University, Baton Rouge, LA. Prior to his new appointment, Durand was affiliated with the Department of Physiology, Tulane University Health Science Center, New Orleans, LA.

Anthony G. Durmowicz recently associated with the Department of Pediatrics, Washington University School of Medicine, St. Louis, MO. Prior to his new position, Durmowicz was with the Department of Pediatrics Pulmonology, University of Utah School of Medicine, Salt Lake City, UT.

Alan Gelperin recently joined Biology Computation Research, Monell Chemical Senses Center, Philadelphia, PA. Previously, Gelperin was with Biology Computation Research, Bell Labs Lucent, Murray Hill, NJ.

Michael Paul Godard has joined the Department of Health, Sport & Exercise Science, University of Kansas, Lawrence, KS. Formerly, Godard was associated with the Department of Sports Medicine, University of Southern Maine, Gorham, ME.

Roy D. Goldfarb has a new position of Professor of Physiology and Medicine with the Department of Medicine, Section of Cardiology, University of Medicine and Dentistry, Camden, NJ. Goldfarb had been with the Department of Medicine, Section of Cardiology, Rush Presbyterian, St. Luke's Medical Center, Chicago, IL.

Vallie Michelle Holloway accepted a position with the Burn Shock & Trauma Institute, Loyola University Medical Center, Maywood, IL. Prior to her new post, Holloway was with the Department of Pharmacology, Florida A&M University College of Pharmacy and Pharmaceutical Science, Tallahassee, FL.

Charles J. Homcy is currently the President of Research and Development, Millennium Pharmaceuticals, Inc., Cambridge, MA. Homcy formerly was Executive Vice President, Research and Development, COR Therapeutics, South San Francisco, CA.

Mika B. Jekabsons is a Postdoctoral Fellow currently affiliated with Buck Institute, Novato, CA. Previous to his new affiliation, Jekabsons was associated with the Dunn Human Nutrition Unit, Medical Research Council, Wellcome Trust, Cambridge, England.

Raouf A. Khalil has joined VA Boston Healthcare-Research, Harvard Medical School, W. Roxbury, MA. Khalil was previously associated with the Department of Physiology and Biophysics, University of Mississippi Medical Center, Jackson, MS.

W. Michael King moved from the Department of Neurology, University of Mississippi Medical Center, Jackson, MS. King joined the Department of Otolaryngology, University of Michigan, Ann Arbor, MI.

Anne Apperly Knowlton recently affiliated with the Department of Cardiovascular Medicine, University of California, Davis, CA. Prior to her new position, Knowlton was with the Department of Cardiology, Baylor College of Medicine, VA Medical Center, Houston, TX.

Stephen J. Kopp has accepted the position as Provost, Ohio University, Athens, OH. Kopp was previously Dean, College of Health Professions, Central Michigan University, Mt. Pleasant, MI.

Gerald D. Larson has joined the Health and Exercise Science Department, MidAmerica Nazarene University, Overland Park, KS. Larson was formerly with the Department of Nursing, University of Missouri, Kansas City, MO.

Ronald D. Reed has recently joined the Department of Biology, European Office Aerospace Research and Development, USAF Academy, CO.

Formerly, Reed was with the US Air Force European Office of Aerospace Research & Development, London, England.

Jose D. Rojas has moved to the Department of Cell and Molecular Physiology, Yale University School of Medicine, New Haven, CT. Prior to his new position, Rojas was with the Department of Physiology, Texas Tech University Health Science Center, Lubbock, TX.

Carl Saab accepted a position with the Department of Neurology, Yale University VA Medical Center, West Haven, CT. Formerly, Saab was with the Department of Neuroscience, University of Texas Medical Branch, Galveston, TX.

Richard C. Schaeffer is currently associated with the Department of Research Services, VA Medical Center, Tucson, AZ. Schaeffer previously had been with the Department of Vascular Biology, Sidney Kimmel Cancer Center, San Diego, CA.

Louis Simchowicz has become Director, Fellowship Office, National Institute of Diabetes, Digestive and Kidney Diseases, NIH, Bethesda, MD. Simchowicz was formerly with the Office of Grant & Education Program, Howard Hughes Medical Institute, Chevy Chase, MD.

Mark Slivkoff has accepted the position of Professor of Physiology, Medical University of the Americas, San Pedro, Belize, Central America. Slivkoff had previously been associated with the Department of Biomedical Engineering, Arizona Health Sciences Center, University of Arizona, Tucson, AZ.

Louis C. Smith recently accepted the position as Project Leader of ADViSYS Inc, The Woodlands, TX. Smith was formerly Director, Preclinical Product Development, Valentis, Inc., The Woodlands, TX.

Philip L. Smith was formerly the Senior Investigator, Drug Delivery Systems, Glaxo SmithKline, Collegeville, PA. Smith is currently

affiliated with Venture Investments, S.R. One, Limited, Glaxo SmithKline, West Conshohocken, PA.

Edward E. Soltis has affiliated with the Department of Physiology and Neuroscience, Medical University of South Carolina, Charleston, SC. Soltis was formerly with College Pharmacy, Western University Health Science, Pomona, CA.

Arlene A. Stecenko recently moved from the Center for Lung Research, Vanderbilt University School of Medicine, Nashville, TN, and affiliated with the Department of Medicine, Emory University, Atlanta, GA.

Anthony Cecil Steyermark has transferred from the Department of Physiology, University of California, Los Angeles and affiliated with the Department of Biology, University of St. Thomas, St Paul, MN.

Jiping Tang has accepted a position with the Department of Molecular and Cellular Physiology, Louisiana State University Health Sciences Center, Shreveport, LA. Prior to her new affiliation, Tang was associated with the Department of Physiology and Biophysics, Jackson, MS.

Michael Keith Wilkerson has affiliated with the Department of Pharmacology, University of Vermont, Burlington, VT. Prior to his new affiliation, Wilkerson was with the Department of Health and Kinesiology, Texas A&M University, College Station, TX.

Wenliang Zhou has joined the Renal Unit, Massachusetts General Hospital, Harvard Medical School, Charlestown, MA. Zhou was formerly with the Department of Surgery, Harvard Medical School, Boston, MA.

Adrienne Steven Zion has moved to the Biobehavioral Sciences, Columbia University Teachers College, New York, NY. Prior to her new position, Zion was with the Bronx VA Medical Center, Spinal Cord Damage Research, Bronx, NY. ❖

Letter to Novera Herbert Spector

Virendra B. Mahesh writes: "Thank you for the letter of January 11, 2002 congratulating me on my 70th birthday in April this year. In response to your request, I am giving you, hereby, details of my retirement, how the decision was reached and what I am doing now.

"The elimination of a designated retirement age in academic life creates both exciting opportunities as well as challenges. The opportunity is the chance to continue to be productive and creative and not be compelled to retire prematurely. The challenge is to identify the appropriate time of retirement. The possibility of staying too long on the job or forced to retire because of decreased productivity or due to becoming non-competitive in the field should be avoided. This is important because the academic environment flourishes only with the constant infusion of new ideas and new approaches. Most importantly, the transition should be made with grace and dignity.

"The decision for me was a particularly difficult one as I really enjoyed what I was doing with the exception of administrative responsibilities. I was at the Medical College of Georgia for 40 years and for the last 27 years served as the chairman of my department (Department of Endocrinology 1972-1986 and Department of Physiology and Endocrinology 1986-1999). I had been funded continuously as principle investigator for the last 39 years by NIH (my first NIH R01 started nine months after my initial appointment) and held a NIH research-training grant for 35 years. I had served on three regular and several ad hoc NIH study sections including being chair for several since 1975. I had mentored 11 MS students, 25 PhD students and 59 postdoctoral fellows and had over 400 peer-reviewed research publications. I was still active professionally in all aspects of academic life and my institution was anxious for me to continue my appointment.

"After giving considerable thought

to the situation, I came to the conclusion that it was about time when I should spend more time doing things I really enjoy and give up those that are burdensome. I was in an excellent position to initiate change, which is inevitable in the long run, at my pace and under conditions of my choosing. And finally, I was in an excellent position to negotiate resources that would make my future goals feasible.

"I therefore, decided to retire as Regents Professor and Chairman, Department of Physiology and Endocrinology at the Medical College of Georgia in 1999. I still follow my life long interests to the fullest. As Regents Professor and Chairman Emeritus, I still teach, mentor and collaborate in research. I, thus, continue to participate in the most attractive part of research, that is identifying key questions, generating hypotheses, designing experiments and evaluating results. I leave grant writing, fund raising, and laboratory management to my collaborators. I still participate as ad hoc member of NIH study sections, although not as frequently as I am asked to do. I am serving as editor-in-chief, of the premier journal in the field of reproduction, *Biology of Reproduction* from July 1, 1999 to June 30, 2004. In addition, I served as councillor and member of the Steering Committee of the Section of Endocrinology and Metabolism of the American Physiological Society from 1999 to 2001. I am currently a member of the Joint Program Committee of the American Physiological Society representing the Section of Endocrinology and Metabolism for a three-year term (2001 to 2004). I go to all major scientific meetings in my area of interest and retain an office at the Medical College of Georgia."

Letters to Michael Barany

Otakar V. Sirek writes: "I am no longer involved in teaching and research, but have developed my longstanding interest in classical music, particularly in opera. Nevertheless, on my mind are some reflections on the past that I would like to share with my younger colleagues. My thoughts con-

cern two subjects: one is undergraduate teaching, the other is family life of two professionals. It is a highly personal view, based on my 56 years of marriage combined with professional partnership.

"As to undergraduate teaching, there can be no argument that it must be first-rate, if in subsequent studies a student should do well in graduate courses and conduct good research. To that effect there are excellent text books and other teaching aids that should give the undergraduate the necessary ammunition to learn the subject well. However, most undergraduates are young individuals not well-equipped to distinguish essential information from details. An experienced lecturer can help the student to integrate concepts regarding the function of individual organs in relation to the body as whole. In my opinion, it is in this area where formal lectures are important. The additional advantage of formal lectures in a professional faculty is the latitude to allow the teacher to tailor the course to the specific needs of a given discipline in the health sciences.

"As to the family life of two professionals, I feel very strongly that if the union is to succeed, rights and duties need to be responsibly assessed by both partners before marriage. Adherence to commitments is particularly important if the partners intend to have children. Even if everything is planned ahead of time, there will be unforeseen situations where flexibility will be of essence and willingness to substitute for one another sheer necessity. To run careers as scientists and parents is demanding, but nothing is ever achieved without sacrifice. Boys and girls have a right to have their mommy and daddy around; parents have the duty to respect those rights by dividing their quality time and by sharing not only household responsibilities, but also the upbringing of their children. I realize that each family has to make suitable adjustments, depending on the type of employment, age of their offspring and other circumstances, but to me, the basic principle is undeniable: children need both parents if they are to grow

up as balanced individuals. In this respect, I can present some credentials, in that both my wife and I were teaching and doing research all our adult lives and succeeded to bring up four children, now adults, who have good family lives and careers to be proud of. At the end of the day, I can say, 'Yes, challenging it was, but also extremely rewarding.'"

Setsuro Ebashi writes: "Thank you for your congratulatory notes for my 80th birthday.

"After graduation from the University of Tokyo, School of Medicine in 1944, I served the Navy as a surgeon for two years and then started scientific research in the Department of Pharmacology in the University of Tokyo under the guidance of Professor Hiroshi Kumagai, in whose laboratory I had spent much time as an undergraduate and enjoyed its stimulating and comfortable atmosphere. Professor Kumagai, gave me the theme 'electrophysiology of smooth muscle,' but I eventually converted to biochemical approach after I read and was deeply impressed by the book '*Chemistry of Muscular Contraction*' by Albert Szent-Gyorgyi. I was especially attracted by the demonstration of ATP-induced contraction of glycerol-treated psoas muscle fibers in this book, but soon noticed that fibers shortened never be elongated even after removal of ATP. This is quite different, for example, from acetylcholine-induced contraction of living muscle, where the removal of acetylcholine quickly results in relaxation. Inquiring into this puzzling fact, I found in 1952 that the relaxation could be induced by adding muscle extract to the contracted fiber together with ATP. However, soon it was realized that the same experiment had already been done more than a year ago, and, therefore, I had no scientific priority. This was not my disappointment but an encouragement and I pursued the active principle in the extract, relaxing factor, and in 1955 identified it as the microsomal fraction of muscle, first isolated by Kielly and Meyerhof as granular-MgATPase in

1948.

"As for mechanism of relaxation, I guessed that it might be the removal of Ca^{2+} ion from the actomyosin system, but the results of my experiments showed no parallelism between Ca^{2+} -depriving activities of various chelating agents and their relaxing activities. Disappointed by these results, I joined Professor Fritz Lipmann's laboratory at the Rockefeller Institute in 1958. I was inclined to convert to enzymology under Professor Lipmann, but he advised me to continue my own muscle research. I followed this valuable advice, and one day, having reexamined my previous results obtained in Japan, I found a serious mistake in my previous calculations: after correction there was a precise parallelism between the two activities! At this point I was convinced about the Ca^{2+} -depriving nature of the relaxing factor, and indeed, I could demonstrate that the factor strongly takes up Ca^{2+} from the medium in the presence of ATP. In the meantime, the factor was shown electronmicroscopically to consist of fragmented sarcoplasmic reticulum. I could also demonstrate that a minute amount of Ca^{2+} is necessary for the contractile reaction induced by ATP of well-washed Ca^{2+} -free natural actomyosin system. In order to prove this, I had to exert all possible efforts to avoid the contamination of Ca^{2+} from reagents or exuded from glassware of the day. From these results, a clear picture of the excitation-contraction coupling could be drawn for the first time: the shuttle movement of Ca^{2+} from the sarcoplasmic reticulum to the contractile system and vice versa cause contraction and relaxation, respectively.

"Coming back to Japan from New York, I then inquired into the basis of Ca^{2+} sensitivity of the actomyosin system. A clue was in the fact that actomyosin composed of myosin and a certain preparation of actin was insensitive to Ca^{2+} . At first I thought that denaturation of actin might be responsible to the Ca^{2+} insensitivity and started to examine various actin preparations. However, I finally reached the conclusion that a protein

factor associated with actin, which resembled tropomyosin, was responsible for the Ca^{2+} sensitivity. The protein factor was then found to consist of two components; one was classical tropomyosin and the other a new protein having a strong Ca^{2+} binding capacity, named troponin (1965). Thus it was established that the contractile system underlying physiological contraction is composed of four proteins, i.e., two contractile proteins, myosin and actin, and two regulatory proteins, tropomyosin and troponin, and the present view of the molecular mechanism of contraction-relaxation cycle was reached.

"Looking back, I was fortunate to have great teachers, Professor Kumagai, who enthusiastically guided me toward the scientific research and always encouraged me warmly, and professor Lipmann, who gave me invaluable advice and suggestions."

Richard V. Andrews: "Please accept my thanks to you and the Committee on Senior Physiologists for remembering my 70th birthday with congratulations. Also, please accept my apology for being so remiss about answering; I was away from my home and office during January until now.

"I retired from full-time teaching and research in 1997. I could not forecast continuing laboratory research on wild-caught small mammals because of the hanta virus scare, which made animal care committee's and facilities less than enthusiastic. While I continued field surveys of wild mouse and vole abundance for two years, prospects for gaining financial support are dim, so that I have no further plans for formal research. I continued some part-time teaching of medical and nursing students as emeritus Professor until this past year, but gave those duties to younger faculty as a part of their career development. I now enjoy the freedom that retirement provides for leisure travel.

"I would like to remind younger physiologists that the tradition of our discipline transcends important grounding in technical skills and seeks to explain integrative function

(continued on page 232)

(continued from page 231)

of the whole. Participation in the advancement of our science not only requires designing and executing well-controlled experiments, but also encourages transmission of the excitement of discovery to each new generation of students. Both personal involvements in advancement of our science, and in the nurture of students, bring lasting personal satisfaction.

“Once again, thank you for your letter of congratulations.”

W. Ross Adey writes: “I am indeed honored by the invitation of the Members of the Senior Physiologists Committee to mark the occasion of my 80th birthday with a brief description of my current activities and my philosophical approach to research and thinking.

“The actual day of my 80th birthday passed like all previous working days, with its usual tangled web of challenging basic science, clinical evaluations, and the inevitable bureaucracies that have become the uninvited handmaidens of all our science.

“The long term focus of my research interests continues to seek answers to the intrinsic organization of tissues, and how communication between cells may set tissue thresholds for extrinsic and intrinsic stimuli determined by their ensemble behavior, as they “whisper together” in a range of faint and private languages.

“Increasingly, experimental evidence points in this direction from actions of physical agents, including gravitational fields, ionizing radiation, and extrinsic and intrinsic nonionizing electromagnetic fields; and by interactions of imposed nonionizing electromagnetic fields with hormonal regulatory mechanisms. There is the salutary observation, challenging to us all, that the human auditory threshold involves a hair cell vibration of 10^{-11} meters, or about the diameter of a single hydrogen atom. But by an as yet unknown mechanism, the ear suppresses the vastly larger noise of its thermal atomic and molecular collisions, functioning as an almost ‘perfect’ amplifier close to 0 degree K.

“I officially retired six years ago, but this blessed condition seems to have wrought little or no change in the sense of importance, and even urgency, that one feels towards the growing edifice of science. We dare not fail to engender in younger minds a passionate curiosity and an imagination sufficient to kindle their commitment to all that is great and good in the scientific method. Reflecting on major changes wrought in the national medical research scene over the past 40 years, there is a cause for deep and growing concern that research training, and the culture of research accomplishment, have stifled the burning thorn of personal discontent that should be the creative option of all young minds entering on a research career.

“Graduate students are assigned a project that is typically a segment of their advisor’s grand vista. They may not deviate to ask creative ‘what if’ questions. They emerge from the chrysalis of their training, bearing a parchment to the professional market place, affirming proficiency in certain techniques, but in no way proclaiming the arrival of that precious citadel of a creative mind. Carl Djerassi’s novel, *Cantor’s Dilemma*, might well be required reading for us all.

“May I conclude with an emergent thought from my own research experience. Formal instruction in physics, theoretical and applied, has become the weakest link for the majority of those entering on a career in medical research. It begins at the high school level. We now discern biological organization based in physical processes at the atomic level, beyond the realm of chemical reactions in the exquisite fabric of biomolecules. Without a versatility in biophysics that matches their typical knowledge in molecular biology and biochemistry, none may cross this threshold to the cutting edge of key areas in future medical research.

“Thank you for the great privilege of submitting these personal reflections.”

David V. Bates writes: “Many thanks for reminding me so gracefully that my 80th birthday was fast approaching. My recollections of that period of

my life when physiological questions dominated it, may be some of historical interest, so here they are.

“After the trauma of World War II, those of us in clinical work in most disciplines had a natural interest in physiology. Chest physicians were preoccupied with problems of managing tuberculosis (their traditional bread and butter), and were not interested in trying to design tests of lung function, nor in lung physiology. I can recall the amazement with which we learned about the fundamental work on gas exchanged (the alveolar air equation for example) and lung mechanics that has come out of the wartime research in the US Air Force and Navy. My postgraduate year in 1952 with Julius Comroe in Philadelphia sharpened my perception of the many interesting physiological questions that remained to be investigated; and established my lifelong friendship with Robert Forster and Ward Fowler. Academic medicine in Britain was stagnating, which is why I followed my mentor, Ronald Christie to McGill in 1956. I remember that I took an oscilloscope and camera with me, as we were using this for the first measurements of lung compliance. I also took an Astrup P_{CO_2} apparatus, and we were one of the first groups managing respiratory failure with knowledge of the arterial P_{CO_2} . Our work on lung function was greatly stimulated by the development of external counting and the use of Xe133; and those I recruited, particularly Joseph Milic-Emili and Peter Macklem, were destined to add many dimensions to our understanding of lung function. At this time, I established a close intellectual relationship with the Department of Physiology at Dartmouth, under the leadership of the late Marsh Tenney. I had had an exercise treadmill constructed in Bart’s in London (maybe the first in a hospital?), and brought this with me to the Royal Victoria Hospital in Montreal. Our studies of exercise diffusing capacity there brought me into close contact with those, mainly in Scandinavia, interested in exercise physiology.

“The invitation to become Chairman

of the Department of Physiology at McGill meant that I gave up my clinical responsibilities, but in exchange I acquired new research space. This I devoted to building a Perspex exposure chamber to define the effects of low concentrations of ozone of the lung if it was breathed during exercise. One highlight of my career as a physiologist was the task of organizing the Respiratory Dinner at the International Physiology Congress in Washington DC in 1968. This was held at the Mayflower Hotel, with a prior reception at the National Geographic Society headquarters. At the dinner, Wallace Fenn (whose birthday it was), Julius Comroe, Andre Cournand, and Ronald Christie were all at the same table. Music was provided by a distinguished group, including the first horn

of the Chicago Symphony Orchestra, who had been interested in the respiratory mechanics of blowing wind instruments.

“In 1972, I was invited to move to the University of British Columbia and to double the size of the medical school. At this point I left the physiological scene, though I continued to keep in touch with the many friends I had made during that period. Five years of that (more than three times the current ‘half-life’ of US Deans of Medicine in that era I think), brought me to 1977, when I returned to clinical bedside teaching and developed a research program in Environmental Epidemiology; this led to one of the first ‘time series’ studies of the association between hospital admissions for acute respiratory disease and daily

levels of air pollutants in Southern Ontario. After I retired in 1987, I continued this research interest, in which I am still involved; last year I began co-editing a newsletter on health and air pollution with a colleague (a lawyer) in Washington DC. We have been very much encouraged by the warm reception given to our first issue.

“I have never regretted the 22 years in which I participated in the development of our understanding of lung physiology; the field has, of course, moved on, but I like to think that this occurred because, during that period, we did our work so well. What word of wisdom would I like to pass on? Knowledge is indivisible.” ❖

Postdoctoral Positions

Postdoctoral Fellow-Pathology Division: Postdoctoral positions are available at Stokes Research Institute of The Children's Hospital of Philadelphia (CHOP). S/He will study the functions of chaperone proteins in the immune system. Projects include: chaperones role in antigen receptors selection, control of receptor expression and chaperone-mediated antigen presentation (see *Immunity*, 13:433; *JCB*, 152:705, *JMB*, 313:1023, *Nature*, 370:373). Successful candidates should have an MD/PhD degree and strong background in any of the relevant disciplines. Skills in some of the following is preferred: molecular biology, transgenic and knockout mice, cell biology, protein biochemistry and tumor immunology. Please submit a CV, a statement of research interests, and the names and contact information for three references to Dr. Yair Argon, The Children's Hospital of Philadelphia, 802 Abramson Research Center, 3516 Civic Center Boulevard, Philadelphia, PA 19104, Email: yargon@midway.uchicago.edu.

Postdoctoral Position: NIH-funded postdoctoral position available immediately to study the rapid neurophysiological actions of steroids in hypothalamic neurons. Project involves whole-cell patch recording using infrared-DIC videomicroscopy in hypothalamic slices and single-cell RT-PCR to identify cellular transcripts. Candidate must have a MD and/or PhD degree and a strong background in neuroendocrinology with experience in whole-cell patch recording, signal transduction and molecular biology. Salary is commensurate with experience according to NIH guidelines. Candidates should send CV and names of three references to Dr. Martin J. Kelly, Department of Physiology & Pharmacology, Oregon Health & Science Univ., Portland, OR 97201. Fax: 503-494-4352, Email: kellym@ohsu.edu. [AA/EEO]

Postdoctoral Position in Cardiovascular Neurophysiology: An-NIH funded postdoctoral fellowship is available immediately to investigate synaptic mechanisms regulating the excitability of autonomic cell groups in the hypothalamic paraventricular nucleus (PVN). Experience in the use of electrophysiologic techniques (extra/intracellular recording, whole-cell patch clamp) is required and familiarity with fluorescent imaging, immunohistochemistry and/or in situ hybridization is desirable. A competitive salary and benefits package is available. Send a CV and a list of three referees to: Glenn M. Toney, Department of Physiology - 7756, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78229-3900; Tel: 210-567-4372; Email: toney@uthscsa.edu. [EEO/AA]

Postdoctoral Position: The Department of Bioengineering at the University of Washington is looking for a postdoctoral research candidate to join the group on Computational and Integrative Bioengineering within the National Simulation Resource Facility. The candidate will be involved in the development and analysis of cardiac metabolic systems analysis, and to a lesser extent, biological signal transduction, and gene regulatory networks. Information about the programs and projects can be found at <http://nsr.bioeng.washington.edu> and <http://www.physiome.org>. The available position is funded by an annual stipend from a NIH/NHLBI Cardiovascular Training Grant. Current levels of funding range from \$31,092 to \$48,852/year depending on experience. We are looking for someone with a computational science or bioengineering background who has experience and interests in integrative biology research. An ideal candidate will have an interdisciplinary training with a strong background in computation and in mammalian biology, emphasizing metabolism. Experience in network analysis methods, control theory, and the analysis of signaling processes and networks using engi-

neering or applied mathematics approaches is highly preferred. Required skills include expertise in at least one scientific programming language. Eligible candidates for this position must be citizens or non-citizen nationals of the US. The position is available immediately and will be initially limited to a one-year term. The appointment may be continued for two more years, depending upon mutual agreement and availability of the funds. Applicants should Email their resume, list of publications, and contact details of three references to Dr. James Bassingthwaight, Department of Bioengineering, University of Washington, Box 357962, Seattle WA 98195-7962. [EEO]

Postdoctoral Fellows: The Department of Medicine, Division of Nephrology of New York Medical College invites applications from individuals with a strong background in physiology, cell and molecular biology of the kidney, and/or vascular biology to join the newly organized Renal Research Institute. Three positions are currently available for postdoctoral fellows. These positions will provide an opportunity to work on projects related to the biology of nitric oxide, renal injury, adhesion molecules and endothelial dysfunction. This newly developed institute is also seeking to recruit MDs/PhDs or both with experience in protein chemistry. Applications from individuals with a strong background in bone marrow stem cell research are invited to apply. Please send letters of application and curriculum vitae to: Peter M. Brown, Director, Human Resources, New York Medical College, Valhalla, NY 10595; Email: peter_brown@nymc.edu, Fax: 914-594-4309.

Postdoctoral Fellow/Research Associate Positions: Two positions are available for study of molecular and cellular mechanisms of plasma membrane protein recycling in epithelial cells. Studies will focus on molecular characterization of proteins associated with and regulating the Rab11

family of small GTPases. Research approaches include proteomic and structural characterization, regulated over-expression as well as knockout and transgenic mouse models. All work funded by multiple NIH grants. Salary levels commensurate with experience. Send CV to James Goldenring, MD, PhD, Department of Surgery and the Vanderbilt-Ingram Cancer Center, Vanderbilt University School of Medicine, CC-2306 MCN, 1161 21st Ave. S., Nashville, TN 37232-2733 or Email: jim.goldenring@vanderbilt.edu.

Postdoctoral Fellow or Junior Faculty: Position applications are invited for NIH-funded positions for two research projects. The first will focus on the role of the SNARE membrane fusion machinery in epithelial cell polarity and polarized membrane trafficking. The second will focus on the function of polycystin-1, a protein affected in polycystic kidney disease (PKD) that is one of the most common inherited diseases. For information about the focus of the lab and publications, see: <http://www.lerner.ccf.org/cellbio/weimbs/>. Enthusiasm about science, and experience in molecular biology and/or cell biology are required. Highly qualified candidates may be recruited at the "Research Associate" or "Project Scientist" level (equivalent to Lecturer or Research Assistant Professor) which is a semi-independent position enabling the candidate to submit his/her own grant applications. The Cleveland Clinic's Lerner Research Institute provides an outstanding interactive environment for biomedical research with state-of-the-art support facilities and competitive salaries and benefits. For further information, see <http://www.lerner.ccf.org/>. This project will provide a broad range of training in cutting-edge cell biological methodology in an exciting and expanding field of basic research. Interested applicants should send their CV with a summary of research experience, list of publications and names of references by Email or Fax to: Thomas Weimbs, PhD, Department of Cell Biology, Lerner Research

Institute/NC10, The Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195, USA. Fax: 216-444-9404, Email: weimbst@ccf.org.

Postdoctoral Position: Department of Physiology, University of Tennessee Health Science Center. NIH-funded position immediately available to study the regulation and physiological functions of local and global calcium signaling and ion channels in arterial smooth muscle cells. Required qualifications include a PhD or MD in Physiology or a related field. Experience with patch clamp electrophysiology, confocal microscopy and/or calcium imaging preferred. Send curriculum vitae and names and addresses of three references to Jonathan H. Jaggar, PhD, Department of Physiology, University of Tennessee Health Science Center, 894 Union Avenue, Memphis, TN 38163, USA. [EEO/AA]

Academic Positions

Chair, Department of Biomedical Engineering: Oregon Health & Science University (OHSU) announces a new department of Biomedical Engineering and a search for its first chair. Responsibilities: Develop a unique focus for research and training; recruit outstanding faculty and students; develop interdisciplinary educational programs; build collaborative linkages with the larger University; foster partnerships with the regional biotech community; secure external programmatic funding and encourage technology transfer and commercialization of research discoveries. Qualifications: A strong background in engineering or another quantitative science and relevant experience within a biomedical field; a record of success as an independent scholar; an entrepreneurial spirit; capacity to represent the department effectively to external constituencies; familiarity with commercializing intellectual property, a commitment to translational research and successful technology transfer; an understanding of a research university's role in the economic development of its region

and state; a record of successful fiscal management and academic credentials suitable for a senior faculty appointment. Applications: The search has begun and will continue until the position is filled, ideally in early fall 2002. Confidential inquiries and requests for a Position Specification may be directed to the consultant assisting the search committee, E. Kay Dawson, by Email (preferred) at ekdawson@qwest.net, Tel: 503-292-4889. Applicants should submit a cover letter responsive to the Position Specification, a curriculum vitae, and the names of five references to the search committee chair, Dr. Misha Pavel, OGI School of Science & Engineering, 20000 NW Walker Road, Beaverton, OR 97006-8921. [EO/AA]

Assistant Professor of Anatomy and Cell Biology: A tenure track position in the newly renovated Department of Anatomy and Cell Biology is available. Candidates must have a PhD, MD, or equivalent, post-doctoral experience, and an active research program with current or a high potential for attracting external support. Although individuals in a variety of research areas will be considered, preference will be given to scientists engaged in research concerning molecular medicine, cell and developmental biology, molecular neurobiology or cancer. The successful candidate will be expected to participate in a team-taught course for professional students such as Gross Anatomy, Histology, Cell and Molecular Biology, Developmental Biology or Neuroscience and a graduate course in their area of expertise. For more information, visit our web site at <http://www.uiowa.edu/~anatomy/>. Interested individuals should send a CV, bibliography, a brief statement of research and teaching experience, plus the names of three references to: Dr. Mary J.C. Hendrix, Head, Department of Anatomy and Cell Biology, College of Medicine, The University of Iowa, Iowa City, IA 52242. [EEO/AA] Women and minorities are encouraged to apply.

(continued on page 236)

(continued from page 235)

Research Positions

Research Technician I: Research Technician I position is available at Stokes Research Institute of The Children's Hospital of Philadelphia (CHOP). S/He will participate in a planned research project by performing research protocols with direct guidance and close supervision by the program director and/or senior technical personnel. S/He needs a specialized education in the biological or chemical sciences, is required to exercise discretion and judgement in execution, and interpretation of experiments and of data derived. Project(s) will include studying the functions of chaperone proteins in the immune system. Successful candidates should have a Bachelor's degree in biology, chemistry, biochemistry, or related field. Entry level training position. Please submit a Resume and the names and contact information for three references to Dr. Yair Argon, The Children's Hospital of Philadelphia, 802 Abramson Research Center, 3516 Civic Center Boulevard, Philadelphia, PA 19104, Email: yargon@midway.uchicago.edu or Fax: 215-590-4644. Reference ID#57 on all correspondence.

Research Technician III: Research Technician III position is available at Stokes Research Institute of The Children's Hospital of Philadelphia (CHOP). S/He will participate in a planned research project by performing research protocols with direct guidance and close supervision by the program director and/or senior technical personnel. S/He needs a specialized education in the biological or chemical sciences; is required to exercise discretion and judgement in execution, and interpretation of experiments and of data derived. Project(s) will include studying the functions of chaperone proteins in the immune system. Successful candidates should have a Bachelor's degree in biology,

chemistry, biochemistry, or related field. Two years of research laboratory experience required. Please submit a Resume and the names and contact information for three references to Dr. Yair Argon, The Children's Hospital of Philadelphia, 802 Abramson Research Center, 3516 Civic Center Boulevard, Philadelphia, PA 19104, Email: yargon@midway.uchicago.edu or Fax: 215-590-4644. Reference ID#57 on all correspondence.

Research Associate Positions: We are interested in enthusiastic candidates in the area of skeletal muscle physiology for postdoctoral fellowships in the Molecular Imaging Research Center at Michigan State University. This is a well-funded program in the area of skeletal muscle physiology, metabolism and gene expression. We seek candidates with interests in both basic and applied research that will employ molecular techniques and/or non-invasive techniques (fluorescence microscopy, magnetic resonance imaging or spectroscopy, muscle mechanics etc) to evaluate the effects of metabolic stress and changes in the pattern of activity on muscle function and the phenotypic expression of proteins. A PhD in physiology, biochemistry or a related discipline is required. This is an annual fixed term appointment renewable upon mutual agreement. Start date September 30th, 2002 and review of applications immediately and continue until the position is filled. Interested applicants should send a CV, copies of recent publications and the names and contact information for three references to: Robert Wiseman, PhD, Department of Physiology, Michigan State University, East Lansing, MI. 48824. Questions can be directed via email rwise-man@msu.edu.

Research Specialists are needed for a new research effort being conducted at The Children's Hospital of Philadelphia. **Research coordinators:** For the combined SEAD 2 and SEAD 3 protocols, the project staff will share responsibility as described

below. Though the two project coordinators will share responsibility for the two protocols, the senior project coordinator will have primary responsibility for SEAD 2, and the assistant project coordinator will have primary responsibility for SEAD 3. A major efficiency will be gained by combining the recruitment efforts for SEAD 2 and 3. **Senior Research Coordinator:** A Licensed nurse practitioner will be recruited and trained to help develop and implement the protocol. The senior research coordinator will participate in the implements of the protocol for SEAD 2 and 3, but will have primary responsibility to ensure the completion of SEAD 2. The nurse practitioner will collaborate with Drs. Bernbaum, Tershakovec, and Weinzimer in the development of the protocol and manuals, and will be trained in the accurate completion of the Ballard examinations. It is necessary to utilize a nurse practitioner in this position, due to the skills recruited to complete a physical examination. The nurse practitioner will collaborate with the assistant research coordinator to recruit participants from collaborating practices and the Hospital of the University of Pennsylvania nursery, and will schedule and complete the examinations and collection of appropriate samples. The nurse practitioner will coordinate the organization of collected data, and will participate in weekly research team meetings. Though this project will require a relatively small amount of time for actual examination of subjects and data collection, the majority of the research coordinators time will be spent on subject recruitment, interaction with participating practices, quality assurance procedures, and data management. The research coordinator will devote 100% effort to the project. **Assistant Project Coordinator:** A nurse/assistant project coordinator who will be responsible for primary data collection activities and for day-to-day operations of the program will be recruited. The assistant project coordinator will participate in organization and recruitment efforts for SEAD 2 and 3, but will have primary responsibility to coordinate the imple-

mentation of SEAD 3. The coordinator will travel among primary care sites to aid in the recruitment of subjects, complete the collection of biological samples and proper transport to The Children's Hospital of Philadelphia, and will also oversee the proper shipping of biological materials from the Children's Hospital to CODA. The assistant project coordinator will collaborate with the Project Coordinator to organize the recruitment participation of children in both SEAD 2 and 3. The individual to be recruited for this position will have a background in pediatrics, clinical care and research, and have the skills necessary to complete the sample collection. The project coordinator will devote 100% effort to the project. Interested, qualified candidates are requested to forward their credentials to schaaf@email.chop.edu. [EOE]

Exercise Physiologist: The Division of Biological Sciences, University of California, Davis, invites applications and nominations for two positions in exercise physiology. These tenure-track positions may be at the Assistant Professor, Associate Professor or Professor level, as appropriate to the candidate's qualifications. These positions will be in the Exercise Biology Program, with the possibility of a joint appointment in the UC Davis School of Medicine. A PhD (or equivalent) and postdoctoral experience is

required. Candidates must have an outstanding record of research achievement and will be expected to develop a strong research program in exercise physiology. Particular attention will be afforded candidates who have an integrative perspective and employ mechanistic approaches to address important issues in exercise physiology, especially as related to muscle physiology/adaptation to exercise, and to candidates who would strengthen current campus initiatives on genomics, mouse biology, aging or gender-related responses to exercise. The successful candidates will be expected to teach undergraduate and graduate level courses in exercise biology and participate fully in the teaching and advising programs coordinated by the Divisions of Biological Sciences and Graduate Studies. Applications should include 1) curriculum vitae (with Email address), 2) statement of current and proposed research interests, 3) three relevant reprints, 4) statement of teaching experience/interests, 5) names, telephone numbers, and addresses (postal and Email) of at least three references, and 6) candidates should also arrange to have their reference letters mailed directly to the Committee Chair. All materials should be sent to Charles A. Fuller, Chair, Exercise Biology Search Committee, Exercise Biology Program, University of California, One Shields Avenue, Davis, CA 95616-8674. Closing date: open

until filled, but all materials must be received by **September 30, 2002** to be assured of full consideration. The University of California, Davis, is an affirmative action/equal opportunity employer with a strong institutional commitment to the development of a climate that supports equality of opportunity and respect for differences.

Electrophysiologist: Key scientist in the Biology group; will help formulate and lead projects within the group. Will spend the majority of his/her time conducting experiments. Must have expertise in electrophysiology as well as cell biology and/or molecular biology. Responsibilities: Designing and conducting experiments in ion channel electrophysiology along with data analysis and presentation. Will also design and conduct experiments involving cell biology (i.e. development of stable cell lines) and/or molecular biology (i.e. gene cloning and expression) depending on expertise. Requirements: PhD in Neurobiology, Physiology or equivalent; at least four years postdoctoral experience. For confidential consideration: Howard Adamsky, Senior Recruiter, Scion Pharmaceuticals <http://www.scionpharma.com>, 200 Boston Avenue, Suite 3600, Medford, MA 02155; Tel: 781-391-1900 x6111; Email: howardadamsky@scionpharma.com. ❖

Advertise your job vacancy to over 10,000 members and subscribers!

Ads are accepted for either positions available or positions wanted under all categories. The charge is only \$75. All ads are also posted on the APS Career Opportunity Web page immediately upon receipt until the deadline has past.

If you would like to have your ad listed in The Physiologist or on the APS Career Opportunities Web page

(http://www.the-aps.org/careers/car_pos_avail.htm), the following items are needed: a copy of the ad, the name of a contact person, and either a purchase order number, credit card number (with expiration date and name of cardholder) or billing address. Send the information to Linda Comley (Email: lcomley@the-aps.org; Tel: 301-634-7165; Fax: 301-634-7242).

Gravity and the Lung: Lessons from Microgravity

Lung Biology in Health and Disease, Vol. 160.

G. Kim Prisk, Manuel Paiva, and John B. West (Editors).

NY: Marcel Dekker, 2001, 383 pp., illus., index, \$175.00.

ISBN: 0-8247-0570-X.

At this point, any book on real physiology is welcome, and here we have one on an interesting aspect of respiratory physiology. Volume 160 in the Lenfant series addresses questions about the effect of gravity on the respiratory system. The editors, Kim Prisk, Manuel Paiva, and John West were investigators in the Spacelab program, which ended in 1998. They designed many of the experiments that were done in orbit, and they analyzed and interpreted much of the data that were obtained. In addition, a number of studies of respiratory mechanics during parabolic flights have accrued over the last decade. This book draws on the information obtained from the Spacelab program and on centrifuge and parabolic flight studies. The objective of the authors is to use data obtained in hyper- and micro-G conditions to shed light on the effects of normal gravity on respiratory function.

The book begins with an enjoyable review by West of the history of thought on the effects of gravity on respiration. He begins by tracing the history of ideas about the effect of gravity on the lung and chest wall, beginning with the work of Orth at the end of the 19th century and the work of Orsos, Wirz, and Rohrer in the first part of the 20th century. Then he gives a short history of the use of centrifuges and parabolic flight trajectories, and this leads to a section on the

history of the USSR and US space programs. Readers of the *Journal of Applied Physiology* enjoyed a longer version of the section on the Soviet program that appeared in the October, 2001 issue of that Journal. In Chapter 2, Glaister reviews the work done in a centrifuge at Farnborough in the 1960's and 1970's.

In Chapter 3, Estenne provides a well-organized and clearly-written review of the effect of gravity on the chest wall. He notes that on board the Spacelab, FRC was observed to be 15% lower than the preflight standing value. This observation is consistent with observations during parabolic flights, and he concludes that the net effect of gravity in the standing position is inspiratory. It seems strange that at this date we have no solidly established value of the gravitational force on the rib cage. Two noteworthy papers on this subject have appeared since the chapter was written. One, by Loring, et al. (*J Appl Physiol* 90: 2141-2150, 2001), gives the best estimate of this force near FRC, and the other, by Bettinelli, et al. (*J Appl Physiol* 92: 709-716, 2002), indicates that the gravitational forces on the chest wall depend strongly on lung volume.

Paiva and Prisk, in Chapter 4, and Prisk, in Chapter 6, describe data on ventilation and perfusion inhomogeneities, respectively. Both chapters begin with brief reviews of classical ideas about the effects of gravity. The chapter on ventilation focuses on the slope of phase III during multi-breath washin maneuvers and ignores data on concentration vs. breath number. The interpretation of these data yield qualitative information about the mechanisms that contribute to nonuniform ventilation, but no quantitative estimate of the magnitude of ventilation inhomogeneity. Tests of perfusion inhomogeneity in hyper- and micro-G conditions are limited to

measurements of the amplitude of cardiogenic oscillations in CO₂ concentration in expired gas after breath-hold. Both ventilation and perfusion inhomogeneities are reduced under micro-G conditions, but not by much. Twenty years ago, this would have been a surprising result, but in light of the data on nongravitational inhomogeneities that have appeared over the last decade, this result is confirmational. Non-gravitational inhomogeneity of perfusion is given its due in Chapter 7 by Hlastala, Robertson, and Glenny.

In Chapter 10, Buckley describes the effect of gravity on central venous pressure (CVP). CVP had been expected to be higher in micro-G because of an expected shift of fluid to the thorax. In fact, CVP was found to be lower in micro-G. Buckley discusses possible explanations for this result, and this discussion raises a number of interesting questions about the determinants of intrathoracic and blood pressures. Another aspect of this question is discussed in a chapter on control of ventilation by Prisk. He notes that the difference between the response of ventilation to hypoxia in micro-G and standing 1-G is similar to the difference between supine 1-G and standing 1-G, and he suggests that both are due to differences in blood pressure at the carotid bodies.

The book also includes chapters on the effects of gravity on aerosol transport, gas exchange, exercise and gas exchange, fluid balance in the lung, and decompression sickness. The broad range of topics that are covered in the book illustrates the fact that gravity and hence, posture, play a role in many aspects of respiratory physiology. ❖

Theodore A. Wilson
Minneapolis, Minnesota

<http://www.the-aps.org>

Have you checked out the APS web site lately? Catch up on the latest in what's going on within the Society. Don't miss special calls for papers in the APS Journals and APS Award Application deadlines. The information is updated frequently.

Corrigenda: A Book Review of *The Autonomic Nervous System in Health and Disease* was published in the June 2002, Vol. 45 (3) issue of *The Physiologist* without the reviewer's name. The reviewer was J.A. Armour, Dalhousie University. *The Physiologist* regrets this error.
The Autonomic Nervous System in Health and Disease
David S. Goldstein
Monticello, NY: Marcel Dekker, Inc., 2001, 618 pp., illus., index, \$195.00. ISBN: 0-8247-0408-8.

To the Editor:

I am writing about the review of my book, *The Autonomic Nervous System in Health and Disease*. (1) The review appeared without by-line in Volume 45 No. 3, pp. 164-165, of *The Physiologist*. My thanks to you for publishing the review, and to the Reviewer for the time and effort spent writing it. I also thank the Reviewer for several complimentary comments, but I do wish to respond to some criticisms.

As noted correctly by the Reviewer, the book strives to convey concepts to a general audience, especially to clinical researchers and practitioners in the nascent discipline of neurocardiology. Most of the literature about central interactions regulating sympathetic and parasympathetic nervous system outflows, and about central neural interactions underlying responses to stresses, has consisted of studies in anesthetized animals. Few organizing concepts have emerged from a plethora of phenomenological data, and one may reasonably question the relevance of such studies to issues of human health and disease. For instance, the Reviewer dislikes the concept of splinting of baroreceptors in arterial walls as a cause of baroreflex inactivation. The literature in animals emphasizes much more plastic adjustments in baroreflex function, and the discussion in the book could well have presented this mass of experimental information in a more balanced way. Nevertheless, from the point of view of a clinical neurocardiologist, I would guess that chronic atherosclerotic changes do indeed have an important

impact on baroreflex regulation of blood pressure. Studies as long ago as the 1960's described circulatory effects of encased carotid sinuses and success of "baropacing" for chronic clinical hypertension (9).

Analogously, although animal studies support the assertion that angiotensin II exerts "cardioaugmenter" effects by modifying populations of intrinsic cardiac neurons, I am unaware of clinical research support for such an effect of angiotensin II-or, for that matter, for the existence of functionally important intrinsic cardiac neurons in humans. On the contrary, the bradycardic effect of systemically administered angiotensin II in conscious humans provided the basis for the original description, by Smyth, Sleight, and Pickering in 1969, of their well accepted clinical method of measuring baroreflex-cardiovagal gain, by injection of vasoactive drugs with little or no direct acute effects on heart rate (14).

The concept proposed in the book that the sympathetic nervous and adrenomedullary hormonal systems play different roles in the body economy conflicts with that of a unitary "sympathoadrenal system," promulgated by Cannon in the early 20th century and still widely accepted. The Reviewer seems to view the notion of different functions, labeled for didactic convenience as "housekeeping" and "distress," as without scientific foundation. The text goes into some detail, however, in citing and analyzing the relevant literature. For instance, psychologically distressing situations preferentially increase adrenomedullary secretion, as indicated by plasma epinephrine levels, whereas adjustments to challenges to homeostasis such as to orthostasis, meal ingestion, exposure to decreased environmental temperature, and mild exercise preferentially increase sympathetic neural outflows, as indicated by plasma norepinephrine levels. (2) Conversely, sedation preferentially attenuates adrenomedullary responses to real-life distressing situations in humans, a finding reported by our group more than 15 years ago (3) and replicated several times since then.

One may of course argue about the appropriateness of the labels used for the distinctive roles of these two limbs of the autonomic nervous system, but clearly there is scientific foundation for the concept of differential regulation of the adrenomedullary hormonal and sympathetic nervous systems in humans.

The Reviewer argues that epinephrine exerts significant effects on total vascular resistance but not by decreasing arteriolar resistance. This seemingly paradoxical statement does not fit with the clinical research literature. Studies using intra-arterial infusion of epinephrine have shown that in humans, epinephrine markedly and unequivocally decreases forearm vascular resistance, (8) and relatively small increments in circulating epinephrine levels are associated with decreased total peripheral resistance (7).

Concerning autonomic regulation of gastrointestinal function, the text reflects accurately the poor current fund of knowledge about components of the autonomic nervous system that actually regulate gastrointestinal function and how they are coordinated. The presentation does not negate in any way the potential importance of this contribution. An example of such deficiency in knowledge is the source of dopamine produced in the gastrointestinal tract. In humans, most of dopamine production and metabolism take place not in the brain, not in the sympathetic nervous system, and not in the adrenal medulla, but in mesenteric organs. (4) Surely locally produced dopamine must play a role in autonomic regulation of gastrointestinal function, but this role remains largely mysterious.

The Reviewer objects to concepts that would distinguish "goals" of low-pressure and high-pressure baroreceptor systems. Researchers have disagreed about this for many years, and the discussion notes the difficulty of the problem, especially as applied to human health and disease. The presentation does not justify the severe and inappropriate accusation of "misinformation."

(continued on page 240)

(continued from page 239)

Regarding catecholamine production in the heart, animal literature about ventricular interstitial catecholamine content does not put into doubt—and if anything confirms—the validity of clinical findings based on tracer kinetic approaches for assessing cardiac presynaptic sympathetic function, using local rates of entry of norepinephrine, dihydroxyphenylglycol, and dihydroxyphenylalanine into the venous drainage. The important modification by Kopin and co-workers in 1998 (11) bears particular mention in this regard.

As an example of “varied and sometimes fanciful conclusions,” the Reviewer cites the statement that coronary artery occlusion is less likely to lead to ventricular fibrillation if psychological distress is minimized, presumably because an extensive enough infarct would precipitate ventricular fibrillation anyway. Studies by Verrier, Lown, and others, however, provide substantial evidence in support of a role of acute emotional distress in lowering the threshold for ventricular fibrillation (13). The text does draw inferences here from studies of coronary occlusion in animals, (1, 10, 12) but an abundance of indirect clinical literature would be consistent with those inferences, as discussed in the text.

Finally, the Reviewer argues that the text overdraws contrasts between reductionism and homeostatic thinking, since understanding neurocardiologic syndromes requires both approaches. I share the hope and expectation that the future of medical science will see the merging of these perspectives. This is the essence of what I call “scientific integrative medicine” (5). Perhaps the text should have focused more on the need for “synthesis” rather than the present dialectic.

In summary, in critiquing this book the Reviewer seems to have drawn heavily from a wealth of animal literature and, in so doing, failed to consider adequately the main stated purposes of the book, which are to present principles of neurocardiology, teach integrative physiology, foster testing of mechanistic and experimental therapeutic hypotheses, help understand neurocardiologic disorders, and improve the management of patients with dysautonomias. Time will tell whether the book moves the field forward toward these goals. ❖

David S. Goldstein

References

1. DeSilva RA, Verrier RL, Lown B. The effects of psychological stress and vagal stimulation with morphine on vulnerability to ventricular fibrillation (VF) in the conscious dog. *Am Heart J* 1978;95:197-203.
2. Dimsdale JE, Moss J. Plasma catecholamines in stress and exercise. *JAMA* 1980;243:340-342.
3. Dionne RA, Goldstein DS, Wirdzek PR. Effects of diazepam premedication and epinephrine-containing local anesthetic on cardiovascular and plasma catecholamine responses to oral surgery. *Anesth Analg*. 1984;63:640-646.
4. Eisenhofer G, Aneman A, Friberg P, Hooper D, Fandriks L, Lonroth H, et al. Substantial production of dopamine in the human gastrointestinal tract. *J Clin Endocrinol Metab* 1998;42:374-377.
5. Goldstein DS. On the dialectic between molecular genetics and integrative physiology: Toward a new medical science. *Perspectives Biol Med* 1997;40:505-515.
6. Goldstein DS. *The Autonomic Nervous System in Health and Disease*. New York, NY: Marcel Dekker, Inc.; 2001.
7. Goldstein DS, Dionne R, Sweet J, Gracely R, Brewer HB, Jr., Gregg R, et al. Circulatory, plasma catecholamine, cortisol, lipid, and psychological responses to a real-life stress (third molar extractions): effects of diazepam sedation and of inclusion of epinephrine with the local anesthetic. *Psychosom Med* 1982;44:259-272.
8. Grossman E, Chang PC, Hoffman A, Tamrat M, Goldstein DS. Evidence for functional α_2 -adrenoceptors on vascular sympathetic nerve endings in the human forearm. *Circ Res* 1991;69:887-897.
9. Kezdi P, editor. *Baroreceptors and Hypertension*. Oxford, UK: Pergamon; 1967.
10. Kolman BS, Verrier RL, Lown B. Effect of vagus nerve stimulation upon excitability of the canine ventricle. *Am J Cardiol* 1976;37:1041-1045.
11. Kopin IJ, Rundqvist B, Friberg P, Lenders J, Goldstein DS, Eisenhofer G. Different relationships of spillover to release of norepinephrine in human heart, kidneys, and forearm. *Am J Physiol* 1998;275:R165-R173.
12. Lombardi F, Verrier RL, Lown B. Relationship between sympathetic neural activity, coronary dynamics and vulnerability to ventricular fibrillation during myocardial ischemia and reperfusion. *Am Heart J* 1983; 105:958-965.
13. Lown B, Verrier RL. Neural activity and ventricular fibrillation. *N Engl J Med* 1976;294:1165-1170.
14. Smyth HS, Sleight P, Pickering GW. Reflex regulation of arterial pressure during sleep in man: quantitative method of assessing baroreflex sensitivity. *Circ Res* 1969;24:109-121.

Blaustein's Pathology of the Female Genital Tract, 5th Edition.
Robert J. Kurman, (Editor).
New York: Springer-Verlag, 2002,
1391 pp., illus., index, \$189.00.
ISBN: 0-387-95203-9.

Exercise and Stress Response: The Role of Stress Proteins.
Marius Locke and Earl G. Noble
(Editors).

CRC Series in Exercise Physiology.
Boca Raton, FL: CRC, 2002, 226 pp.,
illus., index, \$99.95.
ISBN: 0-8493-0458-X.

In Vivo Optical Imaging of Brain Function.
Ron D. Frostig (Editor).
Methods & New Frontiers in
Neuroscience
Boca Raton, FL: CRC, 2002, 259 pp.,

illus., index, \$119.95.
ISBN: 0-8493-2389-4.

Perceptual Learning.
Manfred Fahle and Tomaso Poggio
(Editors).
Cambridge, MA: MIT Press, 2002, 455
pp., illus., index, \$65.00.
ISBN: 0-262-06221-6.

Announcements

APS Establishes Virendra B. Mahesh Award Fund

The American Physiological Society is pleased to announce the establishment of the Virendra B. Mahesh Award Fund to promote the career development of young investigators pursuing research in the area of Endocrinology. The award will be presented to the graduate student or postdoctoral fellow submitting the best abstract to the annual



Virendra B. Mahesh

Experimental Biology meeting in the area of Endocrinology. The Endocrinology and Metabolism Section of the American Physiological Society will initiate the Virendra B. Mahesh Program at the EB '04 meeting. The award recipient will receive a check in the amount of \$1,000 and a certificate of recognition. ❖

13th Annual Computed Body Tomography for the Technologist 2002

This meeting presents a comprehensive review and update of the current role of Computed Body Tomography for the CT Technologist with an emphasis on Spiral (Helical) CT and the multidetector CT technology. The lectures are designed to present the material from both an anatomic and pathologic approach with emphasis on CT technique and optimization of scanning protocols. Recent advances in CT application, including multidetector CT, CT angiography, and three-dimensional imaging will be addressed. The role of CT compared to other imaging modalities, both from a cost-effective standpoint and from better clinical management, will be discussed and addressed during the various lectures. After attending the meeting, the technologist will have a better understanding of the current state-of-the-art of CT and will be aware of the changes that are taking place in clinical CT scanning today.

Course objectives include improving understanding of the principles of spi-

ral and multidetector CT scanning, learning how to optimize CT scanning techniques for more accurate diagnoses in the head, chest and abdomen, learning how to optimize scanning techniques to improve patient throughput and exam efficiently, learning more about the newest CT applications, including 3D CT, CT angiography, virtual colonoscopy and cardiac imaging, and learning about multislice CT and its advantages over standard spiral CT.

Participants will expand their knowledge in: normal anatomy and pathology, CT scanning techniques and protocols, CT technology, recent advances and future trends in the field, new CT clinical applications, spiral (Helical) CT and multidetector CT, and CT 3D Workstations

The Johns Hopkins University School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians. The Johns Hopkins University School

of Medicine takes responsibility for the content, quality and scientific integrity of this CME activity.

The Johns Hopkins University School of Medicine designates this educational activity for a maximum of 23 hours in category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the activity.

The American Registry of Radiologic Technologists recognizes Category 1 for Category A credit for the radiologic technologist.

Dates: October 24-27, 2002

Location: Flamingo Hotel, Las Vegas, NV

Price: \$495.

Contact information: Office of Continuing Medical Education Johns Hopkins University School of Medicine Turner 20, 720 Rutland Avenue, Baltimore, Maryland 21205-2195. Tel: 410-955-2959; Fax: 410-955-0807 or Email: cmenet@jhmi.edu. ❖

Pediatric Allergy and Immunology for the Practitioner 2002

This course is designed as a comprehensive update on pediatric allergy and immunology for the practicing physician. All lectures will be clinically oriented and extensive audience participation will be encouraged. Special emphasis will be placed on the diagnosis and management of common allergic and immunologic prob-

lems for the caretaker.

Date: September 13-14, 2002

Johns Hopkins University School of Medicine

Contact: Office of Continuing Medical Education; Johns Hopkins University School of Medicine, Turner 20, 720 Rutland Avenue, Baltimore, MD 21205-2195.

Tel: 410-955-2959; Fax: 410-955-0807,

Email: cmenet@jhmi.edu; Web:

<http://www.med.jhu.edu/cme>

National Board of Medical Examiners Call for Nominations 2003 John P. Hubbard Award

The National Board of Medical Examiners invites nominations for the 2003 John P. Hubbard Award. This award recognizes individuals who have made a significant contribution to the assessment of professional competency and educational program development at any level along the continuum of medical education and delivery of health care.

It is expected that the successful candidate will have demonstrated outstanding achievement in one or more of the following areas:

- a substantial record of fostering the development of evaluation methods

and/or measurement techniques; or

- personal contributions to basic or applied research in the creation or improvement of assessment methodology; or

- accomplishment in improving the quality of evaluation at an organizational level; or

- contributions through the education or mentoring of students, colleagues, fellows, or graduate students, to further progress in evaluation

A letter of nomination is to be submitted from a primary sponsor specifically addressing the nominee's achievements in relation to at least

one of the criteria and is to be accompanied by the nominee's current curriculum vitae and any other relevant information that would be useful to the Award Committee. These materials must be received no later than **September 6, 2002**. The Award Committee will select finalists. Nominators of finalists may be asked to submit additional information.

Direct all materials or inquiries to: 2003 Hubbard Award Committee, National Board of Medical Examiners 3750 Market Street, Philadelphia, PA 19104. Tel.: 215-590-9648; Email: Hubbard@nbme.org. ❖

Generalist Physician Faculty Scholars Program Nominations Invited for Robert Wood Johnson Foundation Program

Nominations are invited for the Generalist Physician Faculty Scholars Program.

Funded by The Robert Wood Johnson Foundation, the program offers career development awards to outstanding junior faculty in medical school departments/divisions of general internal medicine, family practice, and general pediatrics. The Foundation will grant up to 15 four-year awards of \$300,000 in 2003.

Grants will be made to sponsoring institutions to help cover the scholars' salary and research costs. The Foundation seeks scholars pursuing research on topics of relevance to generalism, including, among other subjects, medical education, health services research, and primary care.

Scholars have a unique opportunity to receive career and research mentoring from leading academicians who serve on the program's National

Advisory Committee. Nominations are made by the deans of four-year, fully accredited United States medical schools. Application packets can be downloaded from the following web site: <http://www.gpscholar.uthscsa.edu/gpscholar/FacultyScholars/becoming.html>.

Deadline for Nominations: **September 20, 2002**.

This program will no longer accept new scholars after 2004. ❖

Burroughs Wellcome Fund 2003 Clinical Scientist Awards in Translational Research

The Burroughs Wellcome Fund conducts its Clinical Scientist Awards in Translational Research program to support established independent physician-scientists who are dedicated to translational research—the two-way transfer between work at the laboratory bench and treatment of patients. The program is intended to help reduce grantees' general clinical responsibilities, freeing more time for them to pursue the vital link between basic and clinical research. The program aims to identify and reward proven mentors and to increase their capacity to train the next generation of investigators skilled in translational research.

The program's goal is to foster the development and productivity of established independent physician-scientists who will strengthen translational research, through their own studies as well as their mentoring of physician-scientist trainees. The awards are intended to give recipients the freedom and flexibility to explore fundamental scientific questions, to apply the resulting knowledge at the bedside, and to bring insights from the clinical setting back to the laboratory for further exploration. These efforts, it is hoped, will lead to better under-

standing of the mechanisms of disease as well as to new methods of diagnosing, treating, and preventing disease.

BWF is interested particularly in supporting investigators who will bring novel ideas and new approaches to translational research. Proposed activities may draw on the many recent advances in the basic biomedical sciences—including such fields as biochemistry, cell biology, genetics, immunology, molecular biology, and pharmacology—that provide a wealth of opportunities for studying and alleviating human disease.

Candidates must have an MD or MD-PhD degree and hold an appointment or joint appointment in a subspecialty of clinical medicine. (References to "MD" and "PhD" include all types of medical and scientific doctoral degrees.) In exceptional circumstances, non-MD candidates will be considered if their work is likely to contribute significantly to the clinical enterprise; these candidates must hold an appointment or joint appointment in a clinical department.

Candidates must be academic investigators at the late assistant professor or associate professor level, holding a tenure-track or equivalent position, at the time of application. Individuals

holding the rank of professor are ineligible.

Candidates must be nominated by their dean or department chair. Applications must be approved by an official responsible for sponsored programs (generally from the grants office, office of research, or office of sponsored programs) at the degree-granting institution. Candidates should contact one of these offices for information about the nominating process at the institution.

The 2003 Clinical Scientist Awards in Translational Research brochure contains important information about the program, guidelines, selection process, terms, and application instructions. The brochure is available for viewing and printing via PDF (Portable Document Format) (http://www.bwfund.org/translational_clinical_awards.htm).

The deadline for receipt of all application materials by BWF is 4 p.m., **September 3, 2002**. BWF will interview selected finalists; candidates will be notified by mid-January 2003 about interviews and BWF will conduct the interviews in early February. The awards will be announced in March and will begin on July 1, 2003. ❖

Physiology in Perspective Walter B. Cannon Memorial Lecture Award

The Cannon Memorial Lecture honors Walter B. Cannon, President of the Society from 1913-1916 and one of the century's most distinguished physiologists. The plenary lecture is presented annually by a distinguished physiologic scientist, domestic or foreign, at the spring meeting on a subject that addresses some aspect of the concept of homeostasis as enunciated in Cannon's classic work, *The Wisdom of the Body*. The lecture, sponsored by the Grass Foundation, is selected by the APS President with the consent of Council.

The recipient receives an honorarium of \$4,000 plus

travel and per diem expenses and is invited to submit a manuscript for consideration of publication in one of the Society's journals.

Nominations for the Cannon Lecture Award should be adequately documented to demonstrate the candidate's contributions to physiology. A curriculum vitae should accompany the letter of support describing the nominee's achievements. Submit nominations by **October 1** to: The APS Cannon Lecture Award, 9650 Rockville Pike, Bethesda, MD 20814-3991.

September 4-8

56th Annual Meeting and Symposium of the Society of General Physiologists on "Trafficking of Transporters", Woods Hole, MA. *Information:* Society of General Physiologists, Tel: 508-540-6719; Fax: 508-540-0155; Email: sgp@mbl.edu; Internet: <http://www.sgpweb.org>.

September 6-9

3rd International Workshop: Mechano-Electric Feedback and Cardiac Arrhythmias, Oxford, UK. *Information:* Peter Kohl, MD, PhD, RSRF, Head, Cardiac MEF Lab, University Laboratory of Physiology, Parks Road, Oxford OX1 3PT, UK. Fax: +44-0-1865-272-554; email: peter.kohl@physiol.ox.ac.uk.

September 12-15

4th World Congress on Stress, Edinburgh, Scotland. *Information:* Northern Networking Ltd., Congress Central Office, 813 South Street, Glasgow G14 0BX, Scotland, UK. Tel: +44-0-141-954-4441; Fax: +44-0-141-954-2656; Email: stress@glasconf.demon.co.uk; Internet: <http://www.stress-conf.co.uk/>

September 14-18

European Respiratory Society (ERS) Annual Congress, Stockholm, Sweden. *Information:* ERS Headquarters, 1, boulevard de Grancy, CH - 1006 Lausanne. Tel: +41-21-613-02-02; Fax: +41-21-617-28-65; Email: info@ersnet.org; Internet: <http://www.ersnet.org>.

September 18-20

Physiome 2002-70eme Reunion De La Societe De Physiologie, L'Hotel Gouverneur de Sainte-Foy, Quebec, Canada. *Information:* Dr. E. Rousseau, Department de Physiologie et Biophysique, Faculte de Medecine, Universite de Sherbrooke, J1H 5N4 Sherbrooke, QC, Canada; Tel: +819-564-53-06; Fax: +819-564-53-99; Email: erouss01@courrier.usherb.ca; Internet: <http://physiome2002.chus.qc.ca>.

September 19-24

7th International Symposium on Dendritic Cells, Bamberg, Germany. *Information:* Internet: <http://www.dc2002.de/>

September 20-24

24th Annual Meeting of the American Society for Bone and Mineral Research, San Antonio, TX. *Information:* ASBMR, 2025 M St., NW, Ste. 800, Washington, D.C. 20036-3309; Tel: 202-367-1161; Fax: 202-367-2161; Email: asbmr@dc.sba.com; Internet: <http://www.asbmr.org>.

September 23-25

3rd World Chinese Congress of Digestology, China *Information:* Lian-Sheng Ma, President of WCCD, PO Box 2345, Beijing 100230 China. Fax: 0086-65891893; Email: wcjd@public.bta.net.cn

September 29-Oct.2

15th Annual Congress of the European Society of Intensive Care Medicine, Barcelona, Spain. *Information:* ESICM Congress Secretariat, 40 Avenue Joseph Wybran - 1070 Brussels - Belgium; Tel.: 32-2-559-03-55; Fax: 32-2-527-0062; Email: public@esicm.org; Internet: <http://www.esicm.org>.

October 1-4

STADY III - International Symposium on Signal Transduction in Health and Disease, Tel Aviv, Israel *Information:* Professor Zvi Naor, Department of Biochemistry, Tel Aviv University, Ramat Aviv 69978, Israel. Tel.: +972-3-6409032 or 6417057; Fax: +972-3-6406834; Email: Naorzvi@post.tau.ac.il or stady2002@uni-tours.co.il.

October 9-13

The 10th World Congress on Psychiatric Genetics, Brussels, Belgium. *Information:* Internet: <http://www.wcpg2002.be>.

October 16-19

Canadian Society for Exercise Physiology (CSEP) Annual Scientific Conference, St. John's, Newfoundland, Canada. *Information:* Scott MacKinnon, Tel: 709-737-8807; Email: SMACKINN@MUN.CA; Internet: <http://www.mun.ca/~dbehm/csep.htm>.

October 19-23

28th Annual Meeting of the American Society for Histocompatibility and Immunogenetics, Opryland Hotel, Nashville, TN. *Information:* ASHI, 17000 Commerce Parkway, Suite C, Mt. Laurel, NJ 08054; Tel: 856-638-0428; Fax: 856-439-0525; Email: ashi@ahint.com; Internet: <http://www.ashi-hla.org>.

October 20-23

Vinsalud 2002 - Chile Wine and Health International Congress, Crowne Plaza Hotel, Santiago, Chile *Information:* Internet: <http://www.vinsalud2002.cl>

October 27-29

12th World Congress of the International Society for Brain Electromagnetic Topography (ISBET), Naples, Italy. *Information:* ISBET 2002 Organising Committee, Dept. of Psychiatry, Univ. of Naples SUN, Largo Madonna delle Grazie, 80138 Naples, Italy, Tel: +39-081-5666512; Fax: +39-081-5666523, Email: umberto.volpe@libero.it, Internet: <http://www.isbet2002.it>.

November 18-21

Genomics on Target: From Function to Validation, Sheraton Boston Hotel, Boston, MA. *Information:* Genomics on Target, 1037 Chestnut Street, Newton Upper Falls, MA 02464; Tel: 617-630-1300; Fax: 617-630-1325; Internet: <http://www.genomicsontarget.com>



An APS Intersociety Meeting

The Power of Comparative Physiology: Evolution, Integration, *and Application*



San Diego, California
August 24-28, 2002

The Power of Comparative Physiology: Evolution, Integration and Application
 August 24-28, 2002—Town & Country Resort & Convention Center, San Diego, CA

| TIME | SUNDAY, AUGUST 25 | MONDAY, AUGUST 26 | TUESDAY, AUGUST 27 | WEDNESDAY, AUGUST 28 |
|-----------------|--|--|---|---|
| 8:00-9:00 AM | 1.0 Plenary Lecture G. Somero | 13.0 Plenary Lecture A. Cossins | 25.0 Plenary Lecture J.B. West | 40.0 Plenary Lecture R.B. Huey |
| 9:00 AM-1:00 PM | <p>2.0 The Power of Integration G. Lauder, Chair</p> <p>3.0 Polar Molecular Biology: Proteins and Enzymes at their Lower Temperature Extremes D. Petzel, Chair</p> <p>4.0 Integration of Motor Function: Mechanisms that Reduce Energy Cost and/or Enhance Performance A.A. Biewener, Chair</p> <p>5.0 Cellular and Molecular Responses to Depressed Metabolism and Low Temperature H. Carey/G. Florant, Cochairs</p> <p>6.0 Neuropeptides Integrating Physiological Processes in Invertebrates: an Evolutionary and Comparative Approach K.H. Hoffman, Chair</p> | <p>14.0 DNA Microarrays: Applications to Comparative Physiology A. Gracey, Chair</p> <p>15.0 Homeostasis of Essential yet Toxic Metals M. Grosell/N. Bury, Cochairs</p> <p>16.0 Linking Muscle Genes to Structure and Physiology, a Comparative Approach A. El Haj/ I. Johnston, Cochairs</p> <p>17.0 Mitochondrial Responses to Environmental and Physiological Challenge C. Moyes, Chair</p> <p>18.0 Diving: Where have We Been, Where are We Going? M.A. Castellini, Chair D.R. Jones/P.J. Butler, Cochairs</p> | <p>26.0 Phylogenetic Approaches to Understanding Physiological Evolution T. Garland, Jr., Chair</p> <p>27.0 The Comparative Physiology of Carbonic Anhydrase K. Gilmour/S.F. Perry, Cochairs</p> <p>28.0 The Influence of Comparative Physiology on Engineering: Neuro-muscular Biological Inspiration toward the Design of Artificial Muscle and Robots R. Full, Jr., Chair</p> <p>29.0 Relaxed Homeothermy P. Frappell/P. Butler, Cochairs</p> <p>30.0 Host-parasite Interactions: a Comparative Approach G. Filk, Chair</p> | <p>41.0 Developmental Physiology: Plasticity and Constraints D.T. Manahan/S.C. Hand, Cochairs</p> <p>42.0 Physiological and Genetic Responses to Environmental Stress G. Hofmann/M. Feder, Cochairs</p> <p>43.0 Acclimatization to Hypoxia: Supply versus Demand Strategies F.L. Powell, Chair</p> <p>44.0 Regulation of Vertebrate Renal Function: a Comparative Approach W.H. Dantzler/E.J. Braun, Cochairs</p> |
| 2:30-5:30 PM | Poster Session & Social Sponsored by the: <i>Comparative Biochemistry and Physiology Journal</i> | Poster Session & Social Sponsored by the: <i>Physiological and Biochemical Zoology Journal</i> | Poster Session & Social Sponsored by the: <i>Journal of Experimental Biology</i> | Poster Session & Social Sponsored by the: <i>American Journal of Physiology: Regulatory, Integrative and Comparative Physiology</i> |
| Evening Events | Evening Free | Birch Aquarium Social Scripps Institute of Oceanography 6:00-10:00 PM | Evening Free | 49.0 Scholander Award Banquet featuring Barbara Block 6:00-10:00 PM |

2002 APS Intersociety Meeting
The Power of Comparative Physiology:
Evolution, Integration, and Application

APS Council

President
Barbara A. Horwitz, Ph.D.

Past President
John E. Hall, Ph.D.

President Elect
John A. Williams, M.D., Ph.D.

Kim E. Barrett, Ph.D.
Douglas C. Eaton, Ph.D.

Joseph R. Haywood, Ph.D.
Steven C. Hebert, M.D.

Virginia M. Miller, Ph.D.
Charles M. Tipton, Ph.D.

ex officio Members

Dale J. Benos, Ph.D.
Mordecai P. Blaustein, M.D.

Robert G. Carroll, Ph.D.
Martin Frank, Ph.D.

Celia D. Sladek, Ph.D.
Curt D. Sigmund, Ph.D.

Conference Organizing Committee

James W. Hicks, Ph.D. (Chair)

Albert Bennett, Ph.D.
Barbara Block, Ph.D.

Steven C. Hand, Ph.D.
Donald C. Jackson, Ph.D.

Stephen C. Wood, Ph.D.

Acknowledgements:

The Intersociety Meeting Organizing Committee and The American Physiological Society gratefully acknowledge financial support provided through unrestricted educational grants from:

National Science Foundation
U.S. Army Medical Research Acquisition Activity
U.S. Department of the Navy, Office of Naval Research
Thomas Maren Foundation
American Journal of Physiology: Regulatory, Integrative and Comparative Physiology
Comparative Biochemistry and Physiology Journal
Journal of Experimental Biology
Physiological and Biochemical Zoology Journal

GENERAL INFORMATION

Location:

Town & Country Resort and Convention Center, 500 Hotel Circle North, San Diego, California 92108, telephone: 800-772-8527 or 619-291-7131, Fax: 619-291-3584.

APS Registration Desk:

Town & Country Resort and Convention Center Atlas Foyer.

On Site Registration Hours:

| | |
|----------------------|-------------------|
| Saturday, August 24 | 2:00 PM – 9:00 PM |
| Sunday, August 25 | 7:00 AM – 4:00 PM |
| Monday, August 26 | 7:30 AM – 4:00 PM |
| Tuesday, August 27 | 8:00 AM – 3:00 PM |
| Wednesday, August 28 | 8:00 AM – 3:00 PM |

On Site Registration Fees:

The registration includes entry into all scientific sessions and exhibits, the Opening Reception, Scholander Banquet, and daily Poster Session Socials.

| Type | Fee |
|--------------------|-------|
| Member | \$310 |
| Retired APS Member | \$200 |
| Nonmember | \$360 |
| Postdoctoral | \$250 |
| Student | \$200 |
| Spouse | \$75 |

Payment Information:

Registrants may pay by check, money order or credit card (VISA, Master Card, or American Express). Checks and money orders must be payable to The American Physiological Society and drawn on a United States bank. Your name and full address should be typed or printed clearly on your check.

Member Registration:

Official guest society members may register at member rates provided they supply proof of their membership. Certification of membership may be provided in the form of a copy of the membership identification card or letter from the guest society headquarters. Official Guest societies are: American Physiological Society, Australian and New Zealand Society for Comparative Physiology and Biochemistry, Canadian Society of Zoologists, European Society of Comparative Physiology and Biochemistry, German Society of Zoologists, Society for Experimental Biology, and The Society for Integrative and Comparative Biology.

Postdoctoral Registration

Any person who has received a Ph.D. degree in physiology or a related field within four years of this meeting and as attested by the department head may register at the postdoctoral rate. **A statement signed by the department head must be presented at the time of registration.**

Student Registration:

Any student member or regularly matriculated student working toward a degree in one of the biomedical sciences is eligible to register at the student rate. Nonmember postdoctoral fellows, hospital residents and interns, and laboratory technicians do not qualify as students. **A Student identification card must be presented at the time of registration.**

Guest Registration:

Nonscientist, spouse or guest registrants may register for a fee of \$75. The guest registration fee includes entry into the Exhibit Hall, Opening Reception, Poster Session Socials and the Scholander Banquet. Guest Registrants may **not** attend symposia or lectures.

Press:

Press badges will be issued at the APS Conference Registration Desk (located in the Atlas Foyer) only to members of the working press and freelance writers bearing a letter of assignment from an editor. Representatives of allied fields (public relations, public information, public affairs, etc.) may register as nonmembers in the registration area.

Audio/Video Taping of Sessions:

Audio or video taping of sessions is not permitted without prior and written approval of the The American Physiological Society and Conference Organizing Committee Chair.

Individuals Requiring Assistance:

Registrants with questions regarding special housing, transportation and auxiliary requirements should contact the APS Meeting Office, 9650 Rockville Pike, Bethesda, Maryland 20814-3998, telephone, 301-530-7010. **This meeting is accessible to all people.**

Continuing Medical Education (CME) Credit:

The Federation of American Societies for Experimental Biology (FASEB) is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians. Category I CME credits will be offered at this meeting. CME application forms will be available at the Conference Registration Desk. For the purposes of continuing medical education credits toward the American Medical Association Physician's Recognition Award, the APS Conference: The Power of Comparative Physiology: Evolution, Integration and Application is jointly sponsored by FASEB. There is a \$35 application fee, payable upon submission of the form. For more information, contact the FASEB Office of Scientific Meetings and Conferences at 301-530-7010.

GENERAL INFORMATION

Program Objective:

The goal of this meeting is to bring together comparative biologists who utilize a diversity of approaches including molecular, cellular, organ and organismal physiology/biochemistry, functional morphology, biomechanics and biophysics, ecology and evolutionary biology to understand physiological processes and traits. The meeting will highlight accomplishments that have occurred since the last large comparative meeting and, more importantly, will provide a forum to showcase new directions and approaches.

The specific aims of this conference include: 1) to convene an internationally recognized interdisciplinary group of investigators to explore the rapid changes that comparative physiology has undergone as a result of the incorporation of a variety of new tools and technologies into the discipline; 2) to promote widespread participation of young scientists through a travel award program and; 3) to interest new investigators and students in pursuing research using comparative approaches to understand physiological processes and traits.

Target Audience:

This meeting is intended for all scientists and professionals from different fields who share an interest in learning how advances in the field can aid in the study of comparative biology.

Message Center:

The message board will be located in the Atlas Foyer. Attendees should check for messages daily. Please suggest that callers who wish to reach you during the day leave a message with the APS Conference Registration Desk during registration hours: 619-291-3584 and ask for the APS Conference Registration Desk in the Atlas Foyer.

Social Events:

Opening Reception—Saturday, August 24, 7:00-9:00 PM, Tiki Hut Pavilion, poolside—Start the meeting off under the stars, munching and talking to colleagues at the famed Town & Country Resort Tiki Hut.

Afternoon Poster Session Socials—Sunday through Wednesday, 2:30-5:30 PM, Lower Level, Exhibit Hall—The poster sessions have been designed to enhance participation and interaction by featuring beer and wine with light snacks.

Reception at Birch Aquarium at Scripps—Separate-purchase event; cost \$50—Monday, 6:00-10:00 PM, 2300 Expedition Way, La Jolla—Join us for a light dinner, cash bar and networking with your colleagues on Monday, August 26, 6:00-10:00 PM. Shuttle buses will depart the Resort at 5:30 PM. Ticket price includes entrance fee.

The Birch Aquarium—the interpretive center for Scripps Institution of Oceanography—is a unique and stimulating facility with a spectacular setting overlooking the Pacific Ocean. The mission of the Birch Aquarium, in brief, is to 1) provide ocean science education through creative exhibits and programs; 2) interpret Scripps Institution of Oceanography research, emphasizing the inter-disciplinary nature of the science used to study the Earth; and 3) to promote conservation through education and research. To learn more about the Aquarium visit their web site at: <http://aquarium.ucsd.edu/index.html>.

TICKETS MUST BE PURCHASED IN ADVANCE.

Scholander Lecture and Award Banquet—Wednesday, August 28, 6:00 PM, Grand Ballroom—All registrants are invited to attend the Wednesday evening banquet featuring the Scholander Lecturer, **Barbara Block**, Hopkins Marine Station, Stanford University who will present a talk entitled "*The Fire Inside: Saving Atlantic Bluefin Tuna*". Prior to the lecture there will be a presentation of the Scholander Award winner. A cash bar reception is scheduled at 6:00 PM followed by dinner at 7:00 PM. **Each registrant must pick-up a complimentary dinner coupon by 10:00 AM on Monday, August 26th at the APS Conference Registration desk.**

San Diego Area:

Local information including locations of attractions, accommodations, shopping and dining are available on the San Diego Convention & Visitors Bureau website: <http://www.sandiego.org>.

Weather:

San Diego enjoys beautiful weather year round with an average daily temperature of 70°.

Airline Reservations:

United Airlines and US Airways are the official co-carriers for the meeting. Special discounted rates can be obtained by contacting the appropriate airline and referencing the identification code listed:

United Airlines: 800-521-4041, meeting ID code: 592SV
US Airways: 877-874-7687, Gold File Number: 20122236

Car Rental:

Alamo Rent-a-Car has been appointed the official car rental company for the meeting. Special discounted rates have been extended to all participants. Reservations may be made by calling **800-732-3232**. Be sure to identify yourself as an APS meeting attendee and refer to **Group ID #964592** and request **rate code GR**.

DAILY SCHEDULE

SATURDAY, AUGUST 24

ONSITE REGISTRATION
SAT. 2:00 PM-9:00 PM—ATLAS FOYER.

OPENING RECEPTION
SAT. 7:00-9:00 PM—TIKI HUT PAVILLION.

SUNDAY, AUGUST 25

Plenary Lecture

1.0 AN INTEGRATED VIEW OF PROTEIN ADAPTATION: FROM THE SEQUENCE TO THE "SOUP"
SUN. 8:00-9:00 AM—TOWN & COUNTRY RM.

Speaker: **George Somero**,
Stanford Univ., Hopkins Marine Station.

Symposium

2.0 THE POWER OF INTEGRATION
SUN. 9:00 AM-1:00 PM—TOWN & COUNTRY RM.

Chair: **George Lauder**

Part I: Integrating Across Levels of Analysis

9:00 **2.1** Genomics and Physiology: Integrative Studies of metabolism and Growth in Larvae. **Donal Manahan**, Univ. of Southern California.

9:25 **2.2** Endothermy in Fish: Thermogenesis, Ecology and Evolution. **Barbara Block**, Hopkins Marine Station, Stanford Univ.

9:50 **2.3** Selection Experiments: A Unique Tool for Integrating Morphology, Physiology and Behavior. **Ted Garland**, Univ. of California, Riverside.

Part II. Integrating across disciplines

10:15 **2.4** Genetics and Comparative Physiology: New Approaches to Understanding the Genetic Basis of Functional Traits. **Michelle Riehle**, Univ. of California, Irvine.

10:40 **2.5** Hydrodynamics and Comparative Physiology: Quantifying Fluid Motion to Understand How Animals Swim. **George Lauder**, Harvard Univ.

11:05 Break

11:20 **2.6** Mathematical and Mechanical Modeling: Insights into Organismal Function. **Sanjay Sane**, Univ. of California, Berkeley.

Part III. Integrating across species

11:45 **2.7** Paleontology, Physiology, and the Use of Phylogeny to Study the Evolution of Vertebrate Locomotion. **Stephen M. Gatesy**, Brown Univ.

12:10 **2.8** Biophysics of Avian Structural Coloration: Insights from a Comparative Analysis. **Richard Prum**, Univ. of Kansas.

12:35 **2.9** Comparative Analysis and Phylogeny as Tools for Testing Physiological Hypotheses about the Evolution of Endothermy in Fishes. **Kathy Dickson**, California State Univ., Fullerton.

Symposium

3.0 POLAR MOLECULAR BIOLOGY: PROTEINS AND ENZYMES AT THEIR LOWER TEMPERATURE EXTREMES
SUN. 9:00 AM-1:00 PM—SAN DIEGO RM.

Chair: **David Petzel**

9:00 **3.1** The Expression of Myoglobin in Hemoglobinless Antarctic Fish. **Bruce Sidell**, Univ. of Maine.

9:30 **3.2** Antifreeze Proteins in Arctic and Antarctic Fishes. **Arthur DeVries**, Univ. of Illinois.

10:00 **3.3** Evolution of AFGP Gene in Northern Cod Fish. **Chris Cheng**, Univ. of Illinois.

10:30 **3.4** Warm-Acclimation of Antarctic *Trematomus bernacchii* Decreases Gill Na/K-ATPase 3-Subunit Isoform Protein Expression without a Change in Isoform mRNA Expression. **Sierra Guynn**, Creighton Univ.

11:00 Break

11:15 **3.5** A Structural Basis of Protein Cold-Adaptation in Antarctic Fish? **Craig Marshall**, Univ. of Otago, Dunedin, New Zealand.

11:45 **3.6** Metabolic Rate Adjustments to Polar Cold: Whole Animal Phenomena-Molecular Explanations? **Hans Pörtner and Magnus Lucassen**, Alfred Wegener Inst. for Polar & Marine Res., Bremerhaven, Germany.

12:15 **3.7** The Nature of Antarctic Fish Biodiversity. **Joseph T. Eastman**, Ohio Univ.

DAILY SCHEDULE

Symposium

- 4.0 INTEGRATION OF MOTOR FUNCTION: MECHANISMS THAT REDUCE ENERGY COST AND/OR ENHANCE PERFORMANCE**
SUN. 9:00 AM-1:00 PM—GOLDEN WEST RM.
- Chair: **Andrew A. Biewener**
- 9:00 **4.1** Are the Functional Dynamics of Muscle Constrained by Architecture? **Andrew A. Biewener**, Harvard Univ.
- 9:30 **4.2** Diverse Mechanical Functions in a Single Muscle: How Muscles Change Function for Different Locomotor Demands. **Annette M. Gabaldón**, Oregon State Univ.
- 10:00 **4.3** Multiple Mechanical Functions of Muscles in Running Birds. **Richard L. Marsh**, Northeastern Univ.
- 10:30 **4.4** Patterns in Form, Muscle Function and Performance in Fish. **John Altringham**, Leeds Univ. U.K.
- 11:00 **4.5** Varying Dynamics of Muscle Function in Relation to Locomotor Performance. **Anna Ahn**, Concord Field Station, Harvard Univ.
- 11:30 **4.6** Scaling of Insect Flight Muscle Efficiency. **Graham Askew**, Univ. of Leeds, U.K.
- 12:00 **4.7** Linking Muscle Function to Spring-Like Behavior of the Legs During Locomotion. **Claire Farley**, Univ. of Colorado, Boulder.
- 12:30 **4.8** Coordination, Muscle Work, and Efficacy in Human Vertical Jumping. **Maarten Bobbert**, Free Univ. of Amsterdam, The Netherlands.

**Don't Forget to
Pick-up your
complimentary
Banquet Ticket
by 10:00 AM, Monday!!**

Symposium

- 5.0 CELLULAR AND MOLECULAR RESPONSES TO DEPRESSED METABOLISM AND LOW TEMPERATURE**
SUN. 9:00 AM-1:00 PM—CALIFORNIA RM.
- Supported by an unrestricted educational grant from the United States Department of the Navy, Office of Naval Research.*
- Chairs: **Hannah Carey** and **Gregory Florant**
- 9:00 **5.1** Introduction. **Hannah Carey**, Univ. of Wisconsin, Madison.
- 9:05 **5.2** The Impact of Post-Genome Science on Comparative Physiology: Model Species and 'Bespoke' Solutions. **Andrew Cossins**, Univ. of Liverpool, U.K.
- 9:30 **5.3** Gene Expression Profiling of Aging and its Retardation by Caloric Restriction. **Tomas Prolla**, Univ. of Wisconsin, Madison.
- 9:55 **5.4** Molecular Determinants of the Hibernating Phenotype. **Sandra Martin**, Univ. of Colorado Sch. of Med.
- 10:20 **5.5** Mammalian Hibernation through the Eyes of mRNA and Protein Expression Profiling. **Matthew Andrews**, Univ. of Minnesota, Duluth.
- 10:45 **5.6** Insulin Signaling Pathways in Mammalian Hibernators. **Gregory Florant**, Colorado State Univ.
- 11:10 **5.7** Cellular Metabolic Responses to Hypoxia: Role of Mitochondria as the Cellular Site of O₂ Sensing. **Paul Schumacker**, Univ. of Chicago.
- 11:45 **5.8** Stress-Induced Signaling Pathways Associated with Depressed Metabolism and Low Temperature. **Hannah Carey**, Univ. of Wisconsin, Madison.
- 12:10 Enhanced Antioxidant Activity in the Longest-Living Rodent Species (*Heterocephalus glaber*). **Timothy O'Connor**, City College of New York, CUNY (11.10).
- 12:25 Evidence for a Cryoprotective Protein in Freeze-Tolerant Larvae of the Goldenrod Gall Fly, *Eurosta solidaginis*. **Nancy Pruitt**, Colgate Univ. (11.4).
- 12:40 Discussion

DAILY SCHEDULE

Symposium

- 6.0** **NEUROPEPTIDES INTEGRATING PHYSIOLOGICAL PROCESSES IN INVERTEBRATES: AN EVOLUTIONARY AND COMPARATIVE APPROACH**
SUN. 9:00 AM-1:00 PM —RM.
- Chair: **Klaus H. Hoffmann**
- 9:00 **6.1** New Tricks From Old Animals: The Generation and Interpretation of Positional Information in *Hydra*. **Thomas Bosch**, Univ. of Kiel, Germany.
- 9:30 **6.2** Worms: Neural Simplicity and Neuropeptide Complexity. **Aaron Maule**, Queen's Univ. of Belfast, UK.
- 10:00 **6.3** Modulation of Neuropeptide Receptors by Gene-Related Peptides and Acid pH. **Paul Benjamin**, Univ. of Sussex, Brighton, UK.
- 10:30 **6.4** Post-Translational Modifications of the CHH/MIH/GIH Family of Sinus Gland Neuropeptide Hormones. Evolutionary Implications. **Alberto Huberman**, S. Zubirán Natl. Inst. of Med. Sci. and Nutrition, Mexico City, Mexico.
- 11:00 **6.5** Effects of Adipokinetic Hormones on Reproduction in Insects. **Matthias W. Lorenz**, Univ. of Bayreuth, Germany.
- 11:30 **6.6** Expression and Structure-Function Studies of Locust ITP: an Antidiuretic Neuropeptide Related to Several Major Crustacean Hormones. **John Phillips**, Univ. of British Columbia.
- 12:00 **6.7** Insect Adipokinetic Hormones: Release and Integration of Flight Energy Metabolism. **Dick Van der Horst**, Utrecht Univ., The Netherlands.
- 12:30 **6.8** Insect Allatostatin: Evolutionary Trends and Multifunctional Tasks. **Klaus H. Hoffmann and Gerd Gaede**, Univ. of Bayreuth, Germany and Univ. of Cape Town, South Africa.

Posters

- 7.0** **SCHOLANDER/SICB/SEB AWARD COMPETITION**
SUN.—EXHIBIT HALL, LOWER LEVEL
- Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM
- Board #
- 1 **7.1** Plasma membrane rafts of rainbow trout are subject to thermal acclimation. **J. K. Zehmer, A. M. Sanchez and J. R. Hazel**. Arizona State Univ., Tempe.
- 2 **7.2** The heat shock response in gastropods (Genus *Tegula*): from promoters to intertidal zonation. **L. Tomanek**. Stanford Univ., Pacific Grove.
- 3 **7.3** Effect of intermittent hypoxia on the estuarine teleost, *Gillichthys mirabilis*. **N.M. Aguilar**. Univ. of California, Irvine.
- 4 **7.4** Neurotransmitter receptors in NOS-expressing neurons of the rat glossopharyngeal nerve. **V.A. Campanucci, M. Zhang and C.A. Nurse**. McMaster Univ., Hamilton, Canada.
- 5 **7.5** Variation in oxygen sensitivity in insects of different size and age. **K.J. Greenlee and J.F. Harrison**. Arizona State Univ., Tempe.
- 6 **7.6** Regulation of the cardiovascular system of common carp (*Cyprinus carpio*) during severe hypoxia at three acclimation temperatures. **J.A.W. Stecyk and A. Farrell**. Simon Fraser Univ.
- 7 **7.7** Evaluation of Na⁺, K⁺ Cl⁻ and H⁺ transport across the apical membrane in Malpighian (renal) tubule cells of *Rhodnius prolixus*. **J.P. Ianowski and M.J. O'Donnell**. McMaster Univ.
- 8 **7.8** The effects of amino acids on ion transport and fluid secretion in the Malpighian tubules of *Rhodnius prolixus*. **M.H. Hazel and M.J. O'Donnell**. McMaster Univ.
- 9 **7.9** Reduced GFR during gold acclimation of freeze-tolerant Cope's gray treefrog helps to conserve circulating cryoprotectant glycerol. **J.C. West and D.L. Goldstein**. Wright State Univ.
- 10 **7.10** Osmoregulation in avian nectarivores: an integrative approach. **T.J. McWhorter, C. Martinez del Rio and B. Pinshow**. Univ. of Arizona, Univ. of Wyoming and Ben-Gurion Univ. of the Negev, Israel.

DAILY SCHEDULE

| Board# | | Board# | |
|--------|---|--------|--|
| 11 | 7.11 Saluretic actions of acutely elevated vasopressin in fasting northern elephant seals. R.M. Ortiz, C.E. Wade, C.L. Ortiz and F. Talamantes. Univ. of California, Santa Cruz and NASA-Ames Res. Ctr. | 23 | 7.23 Fiber type composition in the swimming muscles of harbor seals (<i>Phoca vitulina</i>). R.R. Watson and R.W. Davis. Texas A&M Univ., Galveston. |
| 12 | 7.12 Elimination of plant toxins: an explanation for dietary specialization in mammalian Herbivores? J.S. Sorensen-Forbey, C.A.S. Turnbull and M.D. Dearing. Univ. of Utah. | 24 | 7.24 Chemosensitivity during sleep in the juvenile harbour seal (<i>Phoca vitulina richardsi</i>). L.A. Skinner and W.K. Milsom. Univ. of British Columbia. |
| 13 | 7.13 Photoperiod-induced weight loss in lemmings is due to an increase in energy expenditure. M.S. Johnson, M.L. Blaylock and T.R. Nagy. Univ. of Alabama, Birmingham. | 25 | 7.25 A longitudinal study of oxygen store development in nursing harbor seal pups. C.A. Creelman, J.M. Burns and J.F. Schreer. Univ. of Alaska and Univ. of Waterloo, Canada. |
| 14 | 7.14 Shunting in alligators: does it make a difference? M.N. Gardner and D.R. Jones. Univ. of British Columbia. | 26 | 7.26 Does titin contribute to the muscle spring? T.E. Reich, P. Keim and S.L. Lindstedt. Northern Arizona Univ. |
| 15 | 7.15 Function of the hammerhead shark cephalofoil. S.M. Kajiura. Univ. of California, Irvine. | 27 | 7.27 Biochemistry of steller sea lion muscle as it relates to development of dive physiology. J.P. Richmond, J.M. Burns, L.D. Rea. Univ. of Alaska and Alaska Dept. of Fish & Game, Anchorage. |
| 16 | 7.16 Effects of feeding on strong ions and blood gases in <i>Varanus exanthematicus</i> . L. Hartzler, A F. Bennett and J.W. Hicks. Univ. of California, Irvine. | 28 | 7.28 Ontogeny of diving bradycardia in bottlenose dolphins (<i>Tursiops truncatus</i>). S.R. Noren. Univ. of California, Santa Cruz. |
| 17 | 7.17 The effects of pregnancy on ventilation and oxygen consumption in the lizard, <i>Tiliqua rugosa</i> . S. Munns and C. Daniels. Univ. of Adelaide, Australia. | 29 | 7.29 Hypothalamic thermosensitivity and body temperature set-point changes in hypoxic squirrels. G.J. Tattersall and W.K. Milsom. Univ. of British Columbia. |
| 18 | 7.18 Swimming effects on metabolic recovery from anoxia in turtles. D.E. Warren and D. C. Jackson. Brown Univ. | 30 | 7.30 Species and developmental differences in respiratory cold tolerance: hibernator versus non-hibernator. B. Zimmer and W.K. Milsom. Univ. of British Columbia. |
| 19 | 7.19 Molecular cloning of multi-drug resistant (MDR) transporter cDNAs in the cabbage looper, <i>Trichoplusia ni</i> . M.R. Rheault, M. O'Donnell and C. Donly. McMaster Univ. and Agriculture and Agri-Food Canada. | 31 | 7.31 Oxygen delivery problems may reduce jumping performance in larger locusts. S.D. Kirkton, G.S. Timmins, D. Hartung, J.A. Niska and J.F. Harrison. Arizona State Univ. and Univ. of New Mexico. |
| 20 | 7.20 Comparative effects of the anesthetics brexvatil and isoflurane on cardiovascular function in the turtle. V.I. Toney, S.J. Warburton, D.C. Jackson, S. Carney and T. Wang. Brown Univ., New Mexico State Univ., Tougaloo Col., Providence, RI and Aarhus Univ., Denmark. | 32 | 7.32 Cardiovascular changes induced by voluntary and mechanical ventilation in full term emu embryos (<i>Dromaius novaehollandiae</i>). E.M. Dzialowski, S.J. Warburton, J.L. Black and W.W. Burggren. Univ. of North Texas, Denton and New Mexico State Univ. |
| 21 | 7.21 Does chronic hypoxia during postnatal development elicit long-lasting changes in chemosensitivity in rats? R.W. Bavis, E.B. Olson, Jr., E.H. Vidruk and G.S. Mitchell. Univ. of Wisconsin, Madison. | 33 | 7.33 Proteins in plastic and population variation in egg production in grasshoppers. J.D. Hatle and S.A. Juliano. Illinois State Univ. |
| 22 | 7.22 Metabolic indicators in harbor seal muscle tissue. L.K. Polasek and R. Davis. Texas A&M Univ., Galveston. | 34 | 7.34 Molecular chaperone activity in ectothermic animals: temperature sensitivity of Hsc70 orthologues from perciform fishes. S.P. Place and G.E. Hofmann. Arizona State Univ. |

DAILY SCHEDULE

| Board# | | Board# | |
|--------|---|------------|---|
| 35 | 7.35 Acclimation-induced variability in the activation of heat shock transcriptional factor HSF1 in the goby <i>Gillichthys mirabilis</i> : implications for ecological plasticity in the heat shock response. B.A. Buckley and G.E. Hofmann. Arizona State Univ. | 46 | 7.46 Exercise studies of mudskippers. H.J. Lee, B.E. Simmons, J.M. Fenger, J.B. Graham. UCSD. |
| 36 | 7.36 Acclimation of eurythermality: a comparative analysis of cardiac and neural thermal tolerance in porcelain crabs from different thermal habitats. J.H. Stillman. Hopkins Marine Station, Stanford Univ. | 47 | 7.47 Sex vs. parthenogenesis: increased capacity for sustained locomotion at low temperature in parthenogenetic geckos. M. Kearney, R. Wahl, and K. Autumn. Univ. of Sydney, Australia and Lewis & Clark Col., Portland, OR. |
| 37 | 7.37 Metabolic adjustments to seasonal cold exposure in juvenile green turtles. A.L. Southwood, C.A. Darveau and D.R. Jones. Univ. of British Columbia. | 48 | 7.48 Allometric cascade: a multiple-causes model of body mass effects on metabolism. C.A. Darveau, R.K. Suarez, R.D. Andrews and P.W. Hochachka. Univ. of British Columbia, Univ. of California, Santa Barbara and Univ. of Alaska, Seward. |
| 38 | 7.38 Index of biological compensation of temperature (Z-approach). M.V. Zakhartsev, H.O. Portner and R. Blust. Univ. of Antwerp, Belgium and Alfred Wegener Inst. for Polar & Marine Res., Bremerhaven, Germany. | 49 | 7.49 Steady swimming muscle dynamics of the shortfin mako shark (<i>Isurus oxyrinchus</i>) and the leopard shark (<i>Triakis semifasciata</i>). J. Donley and R.E. Shadwick. Scripps Inst. of Oceanography and UCSD. |
| 39 | 7.39 Muscular adaptation to cold exposure increases energetic cost of locomotion in monodelphis domestica mammal lacking brown adipose tissue. P.J. Schaeffer and S.L. Lindstedt. Washington Univ. and Northern Arizona Univ. | 50 | 7.50 Determination of mechanical equivalent of heat and functional capacity of metabolism of body. Y. Cinar. Univ. of A. Izzet Baysal, Duzce, Turkey. |
| 40 | 7.40 Gene expression and cold adaptive phenotypes in <i>Caenorhabditis elegans</i> . P. A. Murray, A.Y. Gracey and A.R. Cossins. Univ. of Liverpool, U.K. | 51 | 7.51 Cognitive influence on the physiology of diving in harbour seals (<i>Phoca vitulina</i>). S.J. Thornton, G. Weingartner, R.D. Andrews, A. Zelichowska, P.W. Hochachka. Univ. of Otago, Dunedin, New Zealand and Univ. of British Columbia. |
| 41 | 7.41 Downregulated protein synthesis during mammalian hibernation: active and passive mechanisms. F. Van Breukelen and S.L. Martin. Univ. of Colorado, Denver. | 52 | 7.52 The oxidatively-stressed seal. D.M. Bailey, B. Davies, T.P. Johnson, G.W. Davison, I.S. Young and M.A. Fedak. Univ. of Glamorgan, UK, Queen's Univ. Belfast and The Sea Mammal Res. Unit, St. Andrews, UK. |
| 42 | 7.42 Sequence mutations in teleost cardiac troponin C that are permissive of cardiac function at low temperatures. T.E. Gillis, C.D. Moyes and G.F. Tibbits. Simon Fraser Univ. and Queens Univ. | | |
| 43 | 7.43 Snake venom: prey digestion from the inside out? M.D. McCue. Univ. of California, Irvine. | | |
| 44 | 7.44 Strategies of digestion: effects of age and diet quality on digestive efficiency and mean retention time in harbor seals. S.J. Trumble and M.A. Castellini. Univ. of Alaska, Fairbanks. | | |
| 45 | 7.45 Electrophysiological properties of the L-type Ca ²⁺ current in cardiomyocytes from Pacific mackerel and Bluefin tuna. H.A. Shiels, J. Blank, A.P. Farrell, and B.A. Block. Univ. of Leeds, UK and Hopkins Marine Station, Stanford Univ. | | |
| | | Posters | |
| | | 8.0 | THE POWER OF INTEGRATION SUN.—EXHIBIT HALL, LOWER LEVEL Posters on display 8:00 AM – 7:00 PM Authors in attendance 2:30-5:30 PM |
| | | Board # | |
| | | 53 | 8.1 Digestive enzyme activity in herbivorous and carnivorous prickleback fishes (Teleostei:Stichaeidae): ontogenetic and phylogenetic effects. D.P. German, M.H. Horn and A.Gawlicka. California State Univ., Fullerton. |

DAILY SCHEDULE

- Board#
54 **8.2** Histochemistry and enzyme histochemistry of the digestive system in herbivorous and carnivorous prickleback fishes (Teleostei: Stichaeidae). **A. Gawlicka, M.H. Horn and K.H. Kim.** California State Univ., Fullerton.
- 55 **8.3** What does it take to be a herbivore? Gut structure and function in three species of new world silverside fishes (Teleostei: Atherinopsidae) with different diets. **M.H. Horn, A. Gawlicka, E.A. Logothetis, A.M. Jones, J.W. Cavanagh, D.P. German and C.T. Freeman.** California State Univ. Fullerton, North Carolina Aquarium, Wilmington and Colorado State Univ.
- 56 **8.4** Simulation of the 6000-km migration run of European eel shows remarkably low energy costs. **V. Van Ginneken, E. Anthonissen and G. Van den Thillart.** Evol. & Ecol. Sci., Leiden, The Netherlands.
- 57 **8.5** Lactate processing in endothermic fishes: gluconeogenic enzyme activities in fast glycolytic myotomal muscle and liver of tunas and the short-fin mako shark. **J.M. Backey, S. Paul and K.A. Dickson.** California State Univ., Fullerton.
- 58 **8.6** Decrease in the degree of hyperkalemia caused by an acute lactic acid infusion. **K.S. Kamel, S. Cheema-Dhadli, C. Chong, M.A. Shafiee and M.L. Halperin.** St. Michael's Hospital, Univ. of Toronto.
- 59 **8.7** Temperature and the chemical composition of poikilotherms. **H.A. Woods, W. Makino, J. Cotner, S. Hobbie, J.F. Harrison, K. Acharya, J.J. Elser.** Univ. of Texas, Austin, Univ. of Minnesota, St. Paul and Arizona State Univ., Tempe.
- 60 **8.8** May we translate physiological data of rat mud therapy studies to human? **S. Korobov.** Lermontovskii Clin. Sanatorium, Odessa, Ukraine.
- 61 **8.9** Measuring lean, fat and total body masses of migrant birds with dual-energy X-ray absorptiometry. **C. Korine, I.G. Van Tets, S. Daniel and B.Pinshow.** Ben-Gurion Univ. of the Negev and Blaustein Inst. for Desert Res., Israel.

Posters

9.0 POLAR MOLECULAR BIOLOGY PROTEINS AND ENZYMES AT THEIR LOWER TEMPERATURE EXTREMES SUN.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board

- 62 **9.1** Changes in gill basolateral membrane composition and Na⁺K⁺ ATPase activity in Arctic char *Salvelinus alpinus* exposed to seawater. **J.S. Bystriansky and J.S. Ballantyne.** Univ. of Guelph.
- 63 **9.2** Osmoregulation and freezing avoidance in fertilized eggs of the antarctic naked dragon fish *Gymnocraco acuticeps*. **M. Marjanovic, B. Lawrence, N. Wright, J. Carlson and A.DeVries.** Eastern Illinois Univ., Charleston and Univ. of Illinois, Urbana-Champaign.
- 64 **9.3** Do high rates of protein degradation partially explain low growth rates in antarctic limpets? **K.P. Fraser, A. Clarke and L.S. Peck.** British Antarctic Survey, Cambridge, UK.
- 65 **9.4** Calcium binding of parvalbumin is conserved at normal physiological temperatures in antarctic and temperate teleost fishes. **T.S. Moerland, J.R. Erickson and B.D. Sidell.** Florida State Univ., Tallahassee and Univ. of Maine, Orono.
- 66 **9.5** Structure function studies of lens crystallins from cold adapted antarctic notothenioid fishes. **A.J. Kiss and A. DeVries.** Univ. of Illinois, Urbana-Champaign.
- 67 **9.6** Pancreatic expression of antifreeze protein is a common mechanism in all antifreeze-producing fish to prevent intestinal freezing. **J. Logue and C.C. Cheng.** Univ. of Illinois, Urbana-Champaign.
- 68 **9.7** The physiological cost of temperature adaptation in marine ectotherms. **A. Clarke and K.P.P. Fraser.** British Antarctic Survey and Cambridge, UK.
- 69 **9.8** Substrate specificity and structure of fatty Acyl CoA synthetase from notothenioid fishes. **T.J. Grove and B.D. Sidell.** Univ. of Maine, Orono.
- 70 **9.9** Mechanisms of LDH adaptation to seasonal temperature change in cod (*Gadus morhua*). **M.V. Zakhartsev and R. Blust.** Univ. of Antwerp, Belgium.

DAILY SCHEDULE

Posters

10.0 INTEGRATION OF MOTOR FUNCTION MECHANISMS THAT REDUCE ENERGY COST AND/OR ENHANCE PERFORMANCE
SUN.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

- 71 **10.1** Is the anterior, axial position of the red myotomal muscle in tunas associated with an increased locomotor performance? **C.A. Sepulveda, J.B. Graham, K.A. Dickson and H.E. Dowis.** UCSD and California State Univ., Fullerton.
- 72 **10.2** Thunniform swimming: muscle dynamics and mechanical power production by aerobic fibers of yellowfin tuna (*Thunnus albacares*). **R.E. Shadwick, D.A. Syme and S.L. Katz.** Scripps Institution of Oceanography and Univ. of Calgary.
- 73 **10.3** Manipulation of center of mass position in trotting quadrupeds. **D. Lee.** Univ. of Utah.
- 74 **10.4** Hind limb joint kinetics of the horse during jumping. **D.J. Dutto, D.F. Hoyt, S.J. Wickler, E.A. Cogger and H.M. Clayton.** California State Poly. Univ., Pomona and Michigan State Univ.
- 75 **10.5** EMG activity in forelimb and hind limb muscles during level and incline trotting in the horse. **D.F. Hoyt, S.J. Wickler, K.L. De La Paz and E.A. Cogger.** California State Poly. Univ., Pomona.
- 76 **10.6** Time of contact and muscle strain rates do not explain the energetics of the walk-trot transition in horses. **D.A.J. Johnsen, D.F. Hoyt, E.A. Cogger and S.J. Wickler.** California State Poly. Univ., Pomona.
- 77 **10.7** Mitochondria are calcium sinks in rodent extraocular muscle. **F.H. Andrade and C.A. McMullen.** Case Western Reserve Univ.
- 78 **10.8** Fascicle strain in an architecturally complex muscle in running birds. **J.A. Carr, C. Buchanan, D.J. Ellerby, H. Henry and R.L. Marsh.** Northeastern Univ.
- 89 **10.9** Mechanical function of a "hamstring" muscle in running guinea fowl. **D.J. Ellerby, R.L. Marsh, C. Buchanan, J. Carr and H. Henry.** Northeastern Univ.
- 80 **10.10** The effects of incline on the three-dimensional hindlimb kinematics of the arboreal lizard, *Chamaeleo calyptrotus*. **T.E. Higham and B.C. Jayne.** Univ. of Cincinnati.

Board #

- 81 **10.11** *In vivo* length changes of the rat rectus femoris and vastus lateralis during treadmill locomotion. **R.J. Monti and A.A. Biewener.** Harvard Univ.
- 82 **10.12** Temperature-dependent plasticity of aerodynamic design in *Drosophila*: implications for kinematics and free-flight ability. **S.P. Roberts, M.R. Frazier, S.D. Kirkton and J.F. Harrison.** Univ. of Nevada, Las Vegas, Univ. of Washington and Arizona State Univ.
- 83 **10.13** Effects of load type and air temperature on the energetics of load carriage in the honeybee, *Apis mellifera*. **J.F. Harrison, E. Okoroh, E. Feuerbacher, J.H. Fewell and S.P. Roberts.** Arizona State Univ., Univ. of California, Berkeley and Univ. of Nevada Las Vegas.
- 84 **10.14** Forms of locomotion in the moon snail, *Euspira lewisii*. (Mollusca: gastropoda). **G.B. Bourne, P.R. Spackman, M. S. Newel.** Univ. of Calgary.
- 85 **10.15** Metabolite diffusion in giant muscle fibers of the spiny lobster *Panulirus argus*. **G.S. Adams, S.T. Kinsey and T.S. Moerland.** Univ. of North Carolina, Wilmington and Florida State Univ.
- 86 **10.16** Gender difference in running speed: humans versus horses and dogs. **P.L. Entin, D.A. Prante and E.E. Entin.** Northern Arizona Univ. and Aptima, Inc., Woburn, MA.
- 87 **10.17** Withdrawn.
- 88 **10.18** The evolution of tendon: morphology and material. **A. Summers.** Univ. of California, Irvine.

Posters

11.0 CELLULAR AND MOLECULAR RESPONSES TO DEPRESSED METABOLISM AND LOW TEMPERATURE

SUN.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

- 89 **11.1** Pharmacological anoxia and true anoxia result in two different whole-cell NMDAR current responses in cortical neurons from the western painted turtle. **L. Buck and D. Shin.** Univ. of Toronto.

DAILY SCHEDULE

Board

- 90 **11.2** Stable isotope changes during fasting in pinnipeds. **K.A. Hobson, V.K. Stegall and L. Rea.** Prairie and Northern Wildlife Res. Ctr., Saskatoon and Alaska Dept. of Fish & Game, Anchorage.
- 91 **11.3** Changes in the apoptotic pathway in intestinal epithelial cells during hibernation. **C.C. Fleck and H.V. Carey.** Univ. of Wisconsin, Madison.
- 92 **11.4** Evidence for a cryoprotective protein freeze-tolerant larvae of the goldenrod gall fly, *Eurosta solidaginis*. **N.L. Pruitt.** Colgate Univ.
- 93 **11.5** Partial links between the seasonal acquisition of cold tolerance and desiccation resistance in the Goldenrod Gall Fly *Eurosta solidaginis*. **N.C. Ruehl, J.B. Williams and R.E. Lee, Jr.** Miami Univ., Oxford, OH.
- 94 **11.6** Consequences of starvation on metabolic rate and life history traits in the nematode, *Caenorhabditis elegans*. **W.A. Van Voorhies.** New Mexico State Univ.
- 95 **11.7** Proteomic analysis of brain and heart proteins in a hibernating mammal. **K.P. Russeth, C.M. Walker, M.M. Tredrea and M.T. Andrews.** Univ. of Minnesota, Duluth.
- 96 **11.8** Out cold: protein expression in liver of golden-mantled ground squirrels. **E. Epperson and S.L. Martin.** Univ. of Colorado Hlth Sci. Ctr. and Sch. of Med., Denver.
- 97 **11.9** Neuroendocrine control of hibernation in mammals: role of the HPA axis. **A.K. Shaw, C. Watschke, M.M. Tredrea and M. Andrews.** Univ. of Minnesota, Duluth.
- 98 **11.10** Enhanced antioxidant activity in the longest-lived rodent species (*Heterocephalus glaber*). **B. Andziak, R. Buffenstein and T.P. O'Connor.** City College of New York.

Poster

12.0 NEUROPEPTIDES INTEGRATING PHYSIOLOGICAL PROCESSES IN INVERTEBRATES: AN EVOLUTIONARY AND COMPARATIVE APPROACH

SUN.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM

Authors in attendance 2:30-5:30 PM

Board

- 99 **12.1** Topical application of an insect neuropeptide on crickets (*Gryllus bimaculatus*). **M.W. Lorenz.** Univ. of Bayreuth, Germany.
- 100 **12.2** Interaction of molluscan cardio-active neuropeptides. **R.B. Hill, D.D. Brooks, T.J. Fort, L.P. Collis and H. Huddart.** Univ. of Rhode Island, Kingston, Univ. of Central Lancashire, UK, Univ. of Puerto Rico and Lancaster Univ., UK.

Going to the
Birch Aquarium
Monday night?

You MUST have
a ticket to
board the bus
and to gain
entry into the
aquarium

Buses Depart
5:30 PM, Monday
front entrance

DAILY SCHEDULE

MONDAY, AUGUST 26

Plenary Lecture

- 13.0 THE IMPACT OF POST-GENOME SCIENCE ON COMPARATIVE PHYSIOLOGY: MODEL SPECIES AND BESPOKE SOLUTIONS**
MON. 8:00-9:00 AM—TOWN & COUNTRY RM.

Speaker: **Andrew Cossins**,
Univ. of Liverpool.

Symposium

- 14.0 DNA MICROARRAYS: APPLICATIONS TO COMPARATIVE PHYSIOLOGY**
MON. 9:00 AM-1:00 PM—TOWN & COUNTRY RM.

Chair: **Andrew Gracey**

- 9:00 Introduction.
- 9:05 **14.1** The Molecular Cascade Linking Cd Toxicity to Piscine Developmental Abnormalities. **Peter Kille**, Cardiff Univ.
- 9:40 **14.2** Metabolism and Microarray Analysis of Cardiac Gene Expression. **Doug Crawford**, Univ. of Missouri.
- 10:15 **14.3** Genomics Approaches for Understanding Adaptation. **Anthony Long**, Univ. of California, Irvine.
- 10:50 Break
- 11:15 **14.4** Gene Expression Associated with Diurnal Temperature Cycling in the Annual Killfish *Austrofundulus Limnaeus*. **Jason Podrabsky**, Hopkins Marine Station, Stanford Univ.
- 11:50 **14.5** Expression Profiling During Thermal and Hypoxic Acclimation in Common Carp. **Andrew Gracey**, Univ. of Liverpool, UK.
- 12:25 **14.6** A Common Gene Expression Program in the Response of Yeast Cells to Diverse Environmental Changes. **Audrey Gasch**, Lawrence Berkeley Natl. Lab.

Symposium

- 15.0 HOMEOSTASIS OF ESSENTIAL YET TOXIC METALS**
MON. 9:00 AM-1:00 PM—SAN DIEGO RM.
Supported by the Society for Experimental Biology

Chairs: **Martin Grosell** and
Nicolas Bury

- 9:00 Opening Remarks.
- 9:10 **15.1** How Copper Enters Cells: Roles of High Affinity Copper Transporters in Physiology and Development. **Dennis Thiele**, Univ. of Michigan.
- 9:40 **15.2** Heavy Metal Uptake and Sequestration in Lobster Hepatopancreatic Epithelial Cells and their Organelles. **Gregory Ahern**, Univ. of North Florida.
- 10:10 **15.3** Copper Homeostasis in Telost Fish. **Martin Grosell**, The August Krogh Inst., Denmark.
- 10:40 **15.4** Physiology, Toxicology, and Homeostasis of Silver in Fish and Aquatic Invertebrates. **Chris M. Wood**, McMaster Univ.
- 11:30 **15.5** Molecular Control of Zinc Transport in Fish. **Christer Hogstrand**, King's Col. London, UK.
- 12:00 **15.6** Uptake and Regulation of Iron in Telost Fish. **Nicolas Bury**, King's Col., London, UK.
- 12:30 **15.7** Bioavailability and Cellular Processing of Zinc in Fish Using *in vivo* and *in vitro* Approaches. **Ronny Blust**, Univ. of Antwerp, Belgium.

Symposium

- 16.0 LINKING MUSCLE GENES TO STRUCTURE AND PHYSIOLOGY, A COMPARATIVE APPROACH**
MON. 9:00 AM-1:00 PM—GOLDEN WEST RM.

Chairs: **Alicia El Haj** and **Ian Johnston**

- 9:00 **16.1** Single Molecule Analysis and the Myosin Family of Molecular Motors. **James Spudich**, Stanford Univ.
- 9:30 **16.2** Effect of Temperature Acclimation on Structure and Thermal Stability of Myosin Isoforms in Carp Fast Skeletal Muscle. **Shugo Watabe**, Univ. of Tokyo.

DAILY SCHEDULE

- 10:00 **16.3** Genes Regulating Muscle Growth in Telost Fish and their Responses to Temperature Change. **Ian A. Johnston**, Gatty Marine Lab., Univ. of St. Andrews, U.
- 10:30 **16.4** Molecular Determinants of Cardiac Na⁺-Ca²⁺ Exchanger Temperature Dependence. **Glen F. Tibbits**, Simon Fraser Univ.
- 11:00 Break
- 11:15 **16.5** Linking Temperature Related Shifts in Muscle Genotype and Phenotype to Whole Animal Physiology and Performance: A Crustacean Model. **Alicia J. El Haj**, Keele Univ., UK.
- 11:45 **16.6** Alternative Splicing, Muscle Contraction and Intraspecific Variation of Dragonfly Flight Muscle. **James Marden**, Pennsylvania State Univ.
- 12:15 **16.7** An Integrative Analysis of Myosin Function. **Sanford I. Bernstein**, San Diego State Univ.
- 12:45 Discussion

Symposium

- 17.0 MITOCHONDRIAL RESPONSES TO ENVIRONMENTAL AND PHYSIOLOGICAL CHALLENGE**
MON. 9:00 AM-1:00 PM—CALIFORNIA RM.

Chair: **Chris Moyes**

- 9:00 **17.1** Origins of Variation in Mitochondrial Content of Vertebrate Muscle. **Chris Moyes**, Queen's Univ.
- 9:25 **17.2** Mitochondrial Reactive Oxygen Species Production. **Anne Murphy**, MitoKor Inc., San Diego.
- 9:50 **17.3** Mitochondrial Mechanisms in Cell Death. **John Lemasters**, Univ. North Carolina, Chapel Hill.
- 10:15 **17.4** Role of Mitochondrial Reactive Oxygen Species in Signaling in Endothelial Cells Undergoing Mechanical Strain. **Paul Shumacker**, Univ. of Chicago.
- 10:40 **17.5** Mitochondria: a Comparative Perspective on the Proton Leak and Membrane Bilayer. **Anthony Hulbert**, Univ. of Wollongong, Australia.

- 11:05 Break
- 11:45 **17.6** Role of Nitric Oxide and Mitochondria in Control of Firefly Flash. **June Aprille**, Univ. Richmond.
- 12:10 **17.7** Energy Metabolism and Insect Flight. **Raul Suarez**, Univ. of California, Santa Barbara.
- 12:35 **17.8** Mitochondrial Structure and Function in Relation to Exercise. **Hans Hoppeler**, Univ. of Berne, Switzerland.

Symposium

- 18.0 DIVING: WHERE HAVE WE BEEN AND WHERE ARE WE GOING?**
MON. 9:00 AM-1:00 PM—PACIFIC BALLROOM

Cochairs: **Michael A. Castellini**, **David R. Jones** and **Patrick J. Butler**

- 9:00 **18.1** Introduction. **Michael A. Castellini**, Univ. of Alaska, Fairbanks.
- 9:05 **18.2** Diving Bradycardia: Reflexes, Reflexes Everywhere but No Time to Stop and Think? **David R. Jones**, Univ. of British Columbia.
- 9:30 **18.3** Behavioral Influences on Diving Energetics in Penguins. **Rory P. Wilson**, Univ. of Kiel, Germany.
- 10:00 **18.4** The Effect of Behavior on Physiological Dive Capacity in Marine Mammals: What Lies Beneath. **Terrie M. Williams**, Univ. of California, Santa Cruz.
- 10:30 **18.5** Physiology and Behavior of Free-Diving Penguins. **Paul J. Ponganis**, Scripps Inst. of Oceanography, UCSD.
- 11:00 **18.6** The Development of Diving Ability in Pinnipeds. **Jennifer M. Burns**, Univ. of Alaska.
- 11:30 **18.7** The Balance Between Hypoxia and Aerobic Metabolism in Seals During Diving. **Randall W. Davis**, Texas A&M Univ., Galveston.
- 12:00 **18.8** The Energetics of Diving and the Question of Metabolic Depression. **Russel D. Andrews**, Univ. of Alaska, Fairbanks.
- 12:30 **18.9** Diving Into the Future. **Patrick J. Butler**, Univ. of Birmingham, U.K.

DAILY SCHEDULE

Posters

19.0 SCHOLANDER/ SICB/SEB AWARD COMPETITION

MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

See session 7.0 for full listing.

Posters

20.0 DNA MICROARRAYS: APPLICATIONS TO COMPARATIVE PHYSIOLOGY

MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

53 **20.1** Down-regulation of metabolism in fish exposed to hypoxia and starvation. **C.Y. Hung, D.J. Randall and R.Kong.** City Univ. of Hong Kong.

54 **20.2** Evolution of desiccation resistance in laboratory populations of *Drosophila*. Physiological and molecular mechanisms. **C.H. Vanier and A.G. Gibbs.** Univ. of Arizona.

55 **20.3** Loading states modulate skeletal muscle gene profile. **M. Flück, S. Schmutz, M. Wittwer, M. Mayet-Sornay, D. Desplanches and H. Hoppeler.** Univ. of Berne, Switzerland and Univ. of Lyon, France.

56 **20.4** Proteome analysis of rainbow trout liver proteins: molecular responses to altered diet. **S. Martin, F. Medale, S. Kaushik and D. Houlihan.** Univ. of Aberdeen, UK and INRA, St. Pee Sur Nivelles, France.

56A **20.5** Production of a bespoke cDNA clone set for transcript screening of mammalian hibernation. **D. Williams, A. Gracey, S. Martin and A. Cossins.** Univ. of Liverpool, UK and Univ. of Colorado Sch. of Med., Denver.

Poster

21.0 HOMEOSTASIS OF ESSENTIAL YET TOXIC METALS

MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

57 **21.1** Transcriptome and proteome responses to zinc in fish. **S. Balesaria, C.N. Glover and C. Hogstrand.** King's College, London UK.

58 **21.2** Investigation of putative transporters responsible for zinc transport in the fish gill. **A. Qiu and C. Hogstrand.** King's College, London, UK.

59 **21.3** Long-term kinetic measurements of intracellular free zinc using the fluorescent probe FluoZin-3. **F.A.R. Muylle, D. Adriaensen, W. De Coen, J. Timmermans and R. Blust.** Univ. of Antwerp, Belgium.

60 **21.4** Copper accumulation and metallothionein induction in three freshwater fish during sublethal copper exposure. **G. De Boeck, T.T.H. Ngo, K. Van Campenhout and R. Blust.** Univ. of Antwerp, Belgium.

Posters

22.0 LINKING MUSCLE GENES TO STRUCTURE AND PHYSIOLOGY, A COMPARATIVE APPROACH

MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

62 **22.1** Variation in heavy chain myosin genes between stenothermal and eurythermal crustaceans: a link between phenotypic plasticity and genotype. **J. Rock, N.M. Whiteley, J.M. Holmes, J.L. Magnay, S.J. McCleary, S.Beech, G. Goldspink and A.J. El Haj.** Univ. of Wales, Keele Univ., and Univ. of London, UK.

63 **22.2** Myosin heavy chain isoform distribution and expression in lobster skeletal muscles. **S. Medler, D.L. Mykles.** Colorado State Univ., Ft. Collins.

64 **22.3** Kinetic differences between *Drosophila* muscle types: the fast wild type myosin versus a slow embryonic isoform expressed in *Drosophila* indirect flight muscle. **D.M. Swank, S.I. Bernstein, D. W. Maughan.** Univ. of Vermont and San Diego State Univ.

DAILY SCHEDULE

Board #

- 65 **22.4** Force generation and shortening velocity in canine extraocular and limb muscle fibers. **P.J. Reiser, M.P. Vitucci and J.A. Morrison.** Ohio State Univ.
- 66 **22.5** Ca²⁺ transients activate calcineurin/NFATc1 and initiate fast-to-slow transformation. **G.Gros, N. Hanke, R.J. Scheibe, J.D. Meissner and H.-P. Kubis.** Med. Hochschule Hannover, Germany.

Posters

23.0 MITOCHONDRIAL RESPONSES TO ENVIRONMENTAL AND PHYSIOLOGICAL CHALLENGE
MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

- 67 **23.1** Preliminary characterization of a monocarboxylate transporter in isolated cardiac mitochondria from *Bufo marinus*. **J.M. Duerr.** George Fox Univ., Newberg, OR.
- 68 **23.2** Mechanisms of energy conservation in the liver of the overwintering frog, *Rana temporaria*. **E. Court and R. Boutilier.** Univ. of Cambridge, UK.
- 69 **23.3** Effects of temperature, magnesium and quinine on mitochondrial proton leak in teleost fishes. **A.G. Rosenberger and J.S. Ballantyne.** Univ. of Guelph.
- 70 **23.4** Intracellular PO₂ is not an important modulator of tissue oxygen consumption above the P₅₀ of myoglobin in mouse skeletal muscle *in vivo*. **D.J. Marcinek, W.A. Ciesielski, K.E. Conley and K.A. Schenkman.** Univ. of Washington and Children's Hosp. and Regional Med. Ctr., Seattle.
- 71 **23.5** Changes in mitochondrial oxidative phosphorylation during insect metamorphosis. **M.E. Chamberlin.** Ohio Univ.
- 72 **23.6** Partial compensation of proton permeability in mitochondria and inner membrane liposomes from thermally acclimated trout. **M.F. Gerrits and J.R. Hazel.** Arizona State Univ.
- 73 **23.7** Bioenergetics of diapause in encysted embryos of the brine shrimp *Artemia franciscana*. **J.A. Reynolds, J.A. Covi and S.C. Hand.** Louisiana State Univ., Baton Rouge.

Board #

- 74 **23.8** RNA Synthesis and transcript stability in mitochondria from embryos of *Artemia franciscana* under conditions of anoxia-induced quiescence. **B.D. Eads and S.C. Hand.** Univ. of Wisconsin, Madison, Louisiana State Univ., Baton Rouge.

Posters

24.0 DIVING: WHERE HAVE WE BEEN AND WHERE ARE WE GOING?
MON.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors in attendance 2:30-5:30 PM

Board #

- 75 **24.1** Diving experience and the aerobic dive capacity of muskrats: does training produce a better diver? **R.A. MacArthur and K.L. Campbell.** Univ. of Manitoba.
- 76 **24.2** The functional significance of the cardiovascular dive response to routine diving in the harbor seal *Phoca vitulina*. **N.M. Elliott, R.D. Andrews and D.R. Jones.** Univ. of British Columbia.
- 77 **24.3** Oxygen, carbon dioxide, and behavior: what are divers doing at the surface? **L.A. Cornick and M.A. Castellini.** Univ. of Alaska, Fairbanks.
- 78 **24.4** Identifying prey ingestion based on blubber levels of 20:1ω11 and 22:1ω11 fatty acids in free-ranging Steller sea lions (*Eumetopias jubatus*). **L.D. Rea.** Alaska Dept. of Fish & Game, Anchorage.
- 79 **24.5** Can terrestrial models of “body condition” be applied to a marine mammal? **M.A. Castellini, B. Fadely, J.M. Castellini, S.J. Trumble and T. Mau.** Univ. of Alaska, Fairbanks and Natl. Marine Mammal Lab., Seattle.
- 80 **24.6** Muscle blood flow and heart rate during sleep apnea in elephant seals. **T. Knower, D.H. Levenson and P.J. Ponganis.** UCSD.
- 81 **24.7** Seasonal and short-term effect of temperature on metabolic rate of the loggerhead turtle, *Caretta caretta*. **S. Hochscheid, F. Bentivegna and J.R. Speakman.** Stat. Zool. Anton Dohrn, Naples, Italy and Univ. of Aberdeen, UK.
- 82 **24.8** Fetal lung development in the elephant reflects the adaptations required for snorkeling in adult life. **J.B. West, Z. Fu, A.P. Gaeth and R. V. Short.** UCSD and Univ. of Melbourne, Australia.

DAILY SCHEDULE

- Board #
- 83 **24.9** Aerobic capacity in the skeletal muscles of Weddell seals: key to longer dive durations? **S.B. Kanatous, R.W. Davis, R. Watson, L. Polasek, T.M. Williams and O. Mathieu-Costello.** Univ. of Texas Southwestern Med. Ctr., Dallas, Texas A&M Univ., Galveston, Univ. of California, Santa Cruz and UCSD.
- 84 **24.10** Overcoming buoyancy: surface descent in thick-billed murre (*Uria lomvia*). **J.L. Hamilton.** Brown Univ.
- 85 **24.11** The reflex control of heart rate during diving in lesser scaup ducks. **K. Borg and D.R. Jones.** Univ. of British Columbia.
- 86 **24.12** Heart rate, rate of oxygen consumption and abdominal temperature during diving in macaroni penguins. **J.A. Green, P.J. Butler, T.J. Woakes and I.L. Boyd.** Univ. of Birmingham and Univ. of St. Andrews, UK.
- 87 **24.13** Can diving optimality models predict adjustments in the diving behaviour of tufted ducks? **L. Halsey, P. Butler and T. Woakes.** Univ. of Birmingham, UK.
- 88 **24.14** Factors influencing the proximate composition of milk in a sub-polar otariid, *Callorhinus ursinus*. **M. E. Goebel and D. P. Costa.** NOAA/Antarctic Ecosystem Res. Div. and Univ. of California, Santa Cruz.
- 89 **24.15** Voluntary underwater submergence in conscious rats activates pre-sympathetic brainstem nuclei. **P. McCulloch.** Midwestern Univ.
- 90 **24.16** Antioxidant protection in marine birds and mammals. **T. Zenteno-Savín, R. Elsner and P.J. Ponganis.** Ctr. de Invest. Biol. del Noroeste, La Paz, Mexico, Univ. of Alaska, Fairbanks and UCSD.

TUESDAY, AUGUST 27

Plenary Lecture

- 25.0 INSIGHTS INTO RESPIRATORY MECHANICS: LESSONS FROM THE ELEPHANT**
TUES. 8:00-9:00 AM—TOWN & COUNTRY RM.

Speaker: **John B. West**, UCSD

Symposium

26.0 PHYLOGENETIC APPROACHES TO UNDERSTANDING PHYSIOLOGICAL EVOLUTION

TUES. 9:00 AM-1:00 PM—TOWN & COUNTRY RM.

Chair: **Theodore Garland, Jr.**

- 9:00 **26.1** Introduction. **Theodore Garland, Jr.** Univ. of California, Riverside.
- 9:05 **26.2** What are Phylogenies and Why do they Matter? **Wayne P. Maddison**, Univ. of Arizona.
- 9:30 **26.3** Phylogenetically Based Statistical Methods: When, Why, and How to Use Them. **Theodore Garland, Jr.**, Univ. of California, Riverside.
- 9:55 **26.4** What are the Appropriate Tests of Mechanistic and Historical Explanations for Evolutionary Patterns? **Kellar Autumn**, Lewis & Clark Col., Portland, OR.
- 10:20 **26.5** A Phylogenetic Perspective on the Evolution of Vertebrate Surfactants. **Christopher B. Daniels**, Univ. of Adelaide, Australia.
- 10:45 Break
- 10:55 **26.6** Using Phylogenies to Understand the Evolution of Function and Behavior in Lizards. **Duncan J. Irschick**, Tulane Univ.
- 11:20 **26.7** The Evolution of Complex Systems: Oxygen Secretion in the Eye and Swim Bladder of Fishes. **Michael Berenbrink**, The Univ. of Liverpool.
- 11:45 **26.8** Use of Phylogenetic Information to Understand the Evolution of Anuran Thermal Biology. **Carlos Arturo Navas**, Univ. of São Paulo, Brazil.
- 12:10 **26.9** Evolutionary Physiology of Larks along Temperature and Moisture Gradients. **Joe Williams**, Ohio State Univ.
- 12:35 **26.10** Evolutionary Physiology of Habitat Transitions. **Carol E. Lee**, Univ. of Wisconsin, Madison.

DAILY SCHEDULE

Symposium

27.0 THE COMPARATIVE PHYSIOLOGY OF CARBONIC ANHYDRASE TUES. 9:00 AM-1:00 PM—SAN DIEGO RM.

Supported by an unrestricted educational grant from the Thomas Maren Foundation.

Cochairs: **Katie Gilmour** and
Steve F. Perry

- 9:00 **27.1** A Comparative Approach to Carbonic Anhydrase: The Work of Tom Maren. **Erik R. Swenson**, Univ. of Washington.
- 9:30 Carbonic Anhydrases in an Autotrophic Animal, the Symbiotic Tubeworm *Riftia pachyptila*. **Marie-Cecile De Cian**, CNRS-UPMC Britany, France. (32.5)
- 9:45 **27.2** Environmentally Mediated Expression of Carbonic Anhydrase in the Gills of Euryhaline Crustaceans. **Raymond P. Henry**, Auburn Univ.
- 10:15 Comparative Analysis of Carbonic Anhydrase in the Midgut of Different Species of Mosquito Larvae: Do Different Species Regulate their Midgut pH by the Same Mechanism? **Maria del Pilar Corena**, Univ. of Florida. (32.1)
- 10:30 **27.3** Comparative Molecular Physiology and Evolution of Vertebrate Carbonic Anhydrases. **Bruce Tufts**, Queen's Univ.
- 11:00 **27.4** The Critical Role of Carbonic Anhydrase in Calcium Homeostasis and Water Absorption in Marine Teleost Fish. **Rod Wilson and Martin Grosell**, Univ. of Exeter, UK and Univ. of Copenhagen, Denmark.
- 11:15 **27.5** Comparative Physiology of Pulmonary Carbonic Anhydrase. **Erich K. Stabenau and Thomas A. Heming**, Bradley Univ., Peoria and Univ. of Texas Med. Branch, Galveston.
- 11:45 **27.6** Physiological Functions of Extracellular Carbonic Anhydrases in Different Locations—Theoretical and Experimental Evidence. **Gerolf Gros**, Hannover Med. Hochschule, Germany.

Symposium

28.0 THE INFLUENCE OF COMPARATIVE PHYSIOLOGY ON ENGINEERING: NEUROMUSCULAR BIOLOGICAL INSPIRATION TOWARD THE DESIGN OF ARTIFICIAL MUSCLE & ROBOTS TUES. 9:00 AM-1:00 PM—GOLDEN WEST RM.

Chair: **Robert Full, Jr.**

- 9:00 **28.1** Inspiration from Comparative Physiology in the Design of Artificial Muscles, Skeletons and Control Systems. **Robert J. Full**, Univ. of California, Berkeley.
- 9:30 **28.2** The Components of Muscle Power Output. **Robert K. Josephson**, Univ. of California, Irvine.
- 10:00 **28.3** Facilitating Control Using Intelligent Mechanics in Animals and Machines. **Reinhard Blickhan**, Friedrich-Schiller-Univ., Jena, Germany.
- 10:30 **28.4** The Myosin Heavy Chains: The Design of an Evolutionarily Constrained Molecular Motor. **Richard Lieber**, UCSD and VA Med. Ctr., San Diego.
- 11:00 Break
- 11:15 **28.5** Intelligent Transtibial Prostheses with Muscle-Like Actuators. **Glenn K. Klute**, VA Rehab R&D Ctr. Seattle and Univ. of Washington.
- 11:45 **28.6** Electro Active Elastomers as Artificial Muscle. **Roy Kornbluh**, SRI International, Menlo Park, CA.
- 12:15 **28.7** Dynamic Locomotion and Energetics of RHEX, A Six-Legged Robot. **Martin Buehler**, McGill Univ.

DAILY SCHEDULE

Symposium

- 29.0 RELAXED HOMEOTHERMY**
TUES. 9:00 AM-1:00 PM—CALIFORNIA RM.
- Cochairs: **Peter Frappell** and
Pat Butler
- 9:00 **29.1** Relaxed Homeothermy in Hibernating Mammals. **Brian Barnes**, Univ. of Alaska, Fairbanks.
- 9:30 **29.2** Body Temperature and Metabolic Rate During Natural Hypothermia in Mammals. **Gerhard Heldmaier**, Philipps Univ., Marburg, Germany.
- 10:00 **29.3** Relaxed Homeothermy in Bats. **John Speakman**, Univ. of Aberdeen, UK.
- 10:30 **29.4** Regulated Decrease in Body Temperature (Anapyrexia) in Birds when Migrating and Foraging at Sea. **Pat Butler**, Univ. of Birmingham, UK.
- 11:00 **29.5** Behavioural Heterothermia. **Peter Frappell**, La Trobe Univ., Australia.
- 11:30 **29.6** The Role of Hyperthermia in the Water Economy of Birds and Mammals. **Irene Tieleman**, Univ. of Groningen, The Netherlands.
- 12:00 Hypothalamic Thermosensitivity and Body Temperature Set-point Changes in Hypoxic Squirrels. **Glenn Tattersall**, Univ. of Oulu, Finland. (7.29)
- 12:15 Fasting-induced Shallow Hypothermia in Birds: Effect of Repeated Fasts. **Esa Hohtola**, Univ. of British Columbia. (34.5)

Symposium

- 30.0 HOST-PARASITE INTERACTIONS: A COMPARATIVE APPROACH**
TUES. 9:00 AM-1:00 PM—PACIFIC BALLROOM
- Supported by the Society for Experimental Biology*
- Chair: **Gert Filk**
- 9:00 Welcome and Introduction.
- 9:15 **30.1** New Developments in our Understanding of Host-Parasite Interactions Between the Salmon Louse, *Lepeophtheirus salmonis* and its Hosts. **Stewart C. Johnson**, National Research Council, Halifax, Nova Scotia.

- 10:00 **30.2** Avian Coccidiosis: A host-Parasite Relationship to be Restored. **Arno N. Vermeulen**, Intervet International BV, Boxmeer, The Netherlands.
- 10:45 **30.3** Tick Modulation of Host Immunity: Immunobiology, Genomics, and Proteomics. **Francisco Alarcon-Chaidez**, Univ. of Connecticut Hlth. Ctr.
- 11:30 **30.4** The Pathophysiology in Piscine and Mammalian Haemoflagellate Diseases. **Patrick T.K. Woo**, Univ. of Guelph.
- 12:15 **30.5** Physiological Stress and Disease Resistance. **Gert Filk**, Univ. of Nijmegen, The Netherlands.

Posters

31.0 PHYLOGENETIC APPROACHES TO UNDERSTANDING PHYSIOLOGICAL EVOLUTION
TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board

- 1 **31.1** Interpopulational differences in behavior and exercise physiology in an anuran species. **F.B. Oliveira** and **C.A. Navas**. Univ. of São Paulo, Brazil.
- 2 **31.2** An objective ancestry test for fossil bones. **J.A. Mastropaolo**. California State Univ., Huntington Beach.
- 3 **31.3** A discussion of the "comparative method" and the mechanisms of correlated evolution. **W.I. Lutterschmidt** and **G.M. Sanford**. Sam Houston State Univ., Huntsville, TX.
- 4 **31.4** Delta-9-Desaturase—a complex evolutionary tale? **H. Evans**, **A.R. Cossins** and **A. Gracey**. The Univ. of Liverpool, UK.
- 5 **31.5** The phylogeny of paenungulates: a clue from bile salt composition. **L.R. Hagey**. Zoological Society of San Diego.
- 6 **31.6** Reproductive constraints on adaptive differences in escape performance among guppy populations. **C.K. Ghaleb** and **D.N. Reznick**. Univ. of California, Riverside.
- 7 **31.7** Rapid evolutionary changes in endurance and sprint speed in *Tropidurus* sister species: relationships with morphology and physiology. **T. Kohlsdorf**, **R.J. Ames**, **R.S. Wilson** and **C.A. Navas**. Univ. of Sao Paulo, Brazil, Coventry Univ., Coventry, UK and Univ. of Antwerp, Belgium.

DAILY SCHEDULE

- Board #
- 8 **31.8** Aerobic capacity of South American stingless bees. **O.I. Franoso Jr. and J.E.P.W. Bicudo.** Univ. of So Paulo, Brazil.
- 9 **31.9** Post-hatching yolk consumption and stored energy reserves in hatchling snapping turtles, *Chelydra serpentina*. **M. S. Finkler and B.T. Kressley.** Indiana Univ., Kokomo.
- 10 **31.10** Metabolic costs of egg production: evidence for energy reallocation? **F. Vezina and T.D. Williams.** Simon Fraser Univ.
- 11 **31.11** Effects of meal type on postprandial calorogenesis in *Python molurus*. **M.D. McCue, A.F. Bennett, and J. W. Hicks.** Univ. of California, Irvine.
- 12 **31.12** Stomach pH and the cost of gastric digestion for the Burmese python. **S.M. Secor.** Univ. of Alabama, Tuscaloosa.
- 13 **31.13** Evolution of water conservation mechanisms in *Drosophila* Species. **A.G. Gibbs.** Univ. of Arizona.

Posters

32.0 THE COMPARATIVE PHYSIOLOGY OF CARBONIC ANHYDRASE
TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board #

- 14 **32.1** Comparative analysis of carbonic anhydrase in the midgut of different species of mosquito larvae: do different species regulate their midgut pH by the same mechanism? **M. del Pilar Corena, J.K. Nayar, J.W. Knight, H. Zhong, C. Brock, C. Tu, T.J. Seron, and P.J. Linser.** The Whitney Lab., St. Augustine, FL, Univ. of Florida, Florida Med. Entomology Lab., Vero Beach, PHEREC-FAMU, Panama City and Univ. of Florida, Gainesville.
- 15 **32.2** Oyster Carbonic Anhydrase. **M.G. Hamilton and M. Amatulli.** Fordham Col. at Lincoln Ctr., New York.
- 16 **32.3** The distribution and physiological significance of carbonic anhydrase in fish gills. **K.M. Gilmour and S.F. Perry.** Carleton Univ. and Univ. of Ottawa.
- 17 **32.4** Quantitation and expression of larval aedes aegypti midgut carbonic anhydrase. **T.J. Seron, J.D. Ochrieter, and P.J. Linser.** Univ. of Florida and The Whitney Lab, St. Augustine.

- 18 **32.5** Carbonic anhydrases in an autotrophic animal, the symbiotic tubeworm *Riftia pachyptila*. **M. De Cian, X. Bailly, S. Boulben, J. Strub, A. Van Dorsselaer and F. H. Lallier.** CNRS-UPMC, Britany, France and CNRS-ULP, UMR, Strasbourg, France.

Posters

33.0 THE INFLUENCE OF COMPARATIVE PHYSIOLOGY ON ENGINEERING: NEUROMUSCULAR BIOLOGICAL INSPIRATION TOWARD THE DESIGN OF ARTIFICIAL MUSCLE AND ROBOTS

TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board #

- 19 **33.1** Biologically inspired self-evolving interfaces for the warfighter mission. **P. Gao, C. Harvey, S. Narayanan, L. Rothrock, C. Phillips, P. Smith, M. Haas, W. Nanry, S. Ogan, M. Buck, M. Deckard, A. Darisipudi, A. Seth and M.G. Wheatly.** Wright State Univ., Ohio State Univ., Air Force Res. Lab. & Air Force Institute of Tech., Dayton.
- 20 **33.2** Contribution of cytological studies of the intrinsic nerve plexus of the rat heart to the conception of artificial cardiac pace-makers. **J. Moravec and M.L. Moravec.** INSERM, Bron, France.
- 21 **33.3** Modulation of power output in cockatiels. **T.L. Hedrick, B.W. Tobalske and A.A. Biewener.** Harvard Univ. and Univ. of Portland.
- 22 **33.4** Dynamic properties of isolated gecko setal arrays. **S. Sponberg, A. Gasset, W. Hansen and K. Autumn.** Lewis & Clark Col., Portland, OR.
- 23 **33.5** Voltage clamping with digital signal processor based feedback control. **J. Wu, R.B. Hill, L.P. Collis and Y. Sun.** Univ. of Rhode Island, Kingston.
- 24 **33.6** The scaling of damping: importance for control. **A.M. Peattie, M.S. Garcia, A.D. Kuo, T. Libby, K. Meijer, P.C. Wang and R.J. Full.** Univ. of California, Berkeley and Univ. of Michigan.

DAILY SCHEDULE

Board #

- 25 **33.7** Compliant damped legs of arthropods inspire the design of robot legs. **D.M. Dudek, X. Xu, M.R. Cutkosky and R.J. Full.** Univ. of California, Berkeley and Stanford Univ.

Posters

34.0 RELAXED HOMEOTHERMY
TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board #

- 26 **34.1** Does natural hypothermia improve the five performance of muskrats? **A.G. Hindle, R.W. Senkiw and R.A. MacArthur.** Univ. of Manitoba.
- 27 **34.2** Hibernating black bears retain skeletal muscle protein and strength. **T.D. Lohuis, P.A. Iaizzo and H.J. Harlow.** Univ. of Wyoming and Univ. of Minnesota, Minneapolis.
- 28 **34.3** Effects of pyrogen-induced fever on peak metabolic rates in the nine-banded armadillo (*Dasybus novemcinctus*). **J.G. Holmes.** Univ. of New Orleans.
- 29 **34.4** Functional significance of cold-induced fever. **P. Boily, F.M. Knight.** Univ. of New Orleans and Univ. of the Ozarks, Clarksville, AR.
- 30 **34.5** Fasting-induced shallow hypothermia in birds: effect of repeated fasts. **E. Hohtola, T. Piltto, M. Laurila and S. Saarela.** Univ. of Oulu, Finland.
- 31 **34.6** Body temperature profiles associated with muscle activity and strength retention in hibernating black bears. **H.J. Harlow, T.D. Lohuis and P.A. Iaizzo.** Univ. of Wyoming and Univ. of Minnesota.
- 32 **34.7** Torpor upregulates UCP2 and UCP3 in mouse tissues. **N. Stephens, G. Garber, H. Akeda-Yamazaki, P.D. Neuffer, and S. Swoap.** Williams Col., Williamstown, MA, John B. Pierce Lab. Fndn. and Yale Univ.
- 33 **34.8** Thermal liability in the smallest marine mammal, the sea otter (*Enhydra lutris*). **L. Yeates and T.M. Williams.** Univ. of California, Santa Cruz.
- 34 **34.9** Metabolic depression, temperature regulation and pregnancy in hibernating black bears. **O. Toien, J. Blake, D. Grahn, H.C. Heller, D.M. Edgar and B.M. Barnes.** Univ. of Alaska, Fairbanks, Stanford Univ. and Hypnion Inc., Worcester, MA.

Board #

- 34a **34.10** Bigeye thresher sharks possess large orbital retina mirabilia and have a wide thermal niche. **K.C. Weng and B.A. Block.** Hopkins Marine Station, Stanford Univ.

Posters

35.0 BIOCHEMICAL ADAPTATIONS
TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board #

- 35 **35.1** Comparison of plasma and red blood cell fatty acids as predictors of diet in captive harbor seals. **T.L. Mau, M.A. Castellini and J.M. Kennish.** Univ. of Alaska, Fairbanks and Univ. of Alaska, Anchorage.
- 36 **35.2** Effects of early nutritional supplementation of linoleic acid on memory. **V.M. Holloway, F. Close, E. Oriaku and M. Soliman.** Loyola Med. Ctr. and Florida A&M Univ.
- 37 **35.3** Numbers, longevity and dynamics of the free pulmonary macrophages (FRMs) in the chicken and the rat. **L.N. Nganpiep and J.N. Maina.** Univ. of the Witwatersrand, Parktown, South Africa.
- 38 **35.4** A further look into the Cheng-Prusoff equation for determination of dissociation constants. **H.C. Cheng.** Aventis Pharmaceuticals Inc.
- 39 **35.5** Fatty acid metabolism of rainbow trout: different preferential metabolism of palmitate and oleate. **J. Weber, G. Brichon and G. Zwingelstein.** Univ. of Ottawa and Univ. of Lyon, France.
- 40 **35.6** Putative convergent evolution of A₄-lactate dehydrogenase in *Chromis* species (Pomacentridae) from across the pacific: evidence for key sites in biochemical adaptation to temperature. **G.C. Johns and G.N. Somero.** Stanford Univ., Pacific Grove.
- 41 **35.7** Alterations in hepatic metabolism of sulfur-amino acids by ethanol in rats. **Y.C. Kim, S.K. Kim, Y.S. Jung, Y.R. Chae and J. M. Seo.** Seoul National Univ., Republic of Korea.

DAILY SCHEDULE

Board #

- 42 **35.8** Sugar preferences and enzyme activities in a frugivorous bird, the yellow-vented bulbul. **I.G. van Tets, A.K. Green, T.J. McWhorter and B. Pinshow.** Ben-Gurion Univ. of the Negev, Israel, Univ. of Wisconsin, Madison and Univ. of Arizona.
- 43 **35.9** Purification and characterization of alanine racemase from the muscle of black tiger prawn *Penaeus monodon*. **H. Abe and N. Yoshikawa.** Univ. of Tokyo.
- 44 **35.10** Cortisol metabolism and inter-population variation in glycolytic enzyme expression. **P.M. Schulte and L. DeKoning.** Univ. of British Columbia and Univ. of Waterloo, Canada.
- 45 **35.11** Responses to and tolerance of temperature extremes differ among phosphoglucose isomerase genotypes in a montane leaf beetle. **E.P. Dahlhoff and N.E. Rank.** Santa Clara Univ. and Sonoma State Univ., Rohnert Park, CA.
- 46 **35.12** Effects of temperature on locomotory performance of two species of California willow beetles. **D.M. McMillan, N.E. Rank, D.J. Irschick and E.P. Dahlhoff.** Santa Clara Univ., Sonoma State Univ., Rohnert Park, CA and Tulane Univ.

Posters

36.0 TEMPERATURE AND THERMOREGULATION

TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
 Authors present posters 2:30-5:30 PM

Board #

- 47 **36.1** Toxin ingestion: a behavioral adaptation of mammalian herbivores to cold? **L.O. Santos, J.S. Sorensen-Forbey, J.D. McLister and M.D. Dearing.** Univ. of Utah.
- 48 **36.2** Behavioral thermoregulation in the amphibious purple shore crab *Hemigrapsus nudus*. **I.J. McGaw.** Univ. of Nevada.
- 49 **36.3** Active regulation of brain temperature in yellowfin tuna. **K.E. Korsmeyer and R.W. Brill.** Hawaii Pacific Univ., Kaneohe and National Marine Fisheries Service, Honolulu.

Board #

- 50 **36.4** The relationship between body temperature, heart rate and rate of oxygen consumption in Rosenberg's goanna (*Varanus rosenbergi*) at various levels of activity. **T.D. Clark, P.J. Butler and P.B. Frappell.** La Trobe Univ., Melbourne, Australia and Univ. of Birmingham, UK.
- 51 **36.5** Correlations between energy metabolism, thermal environment, and activity in anuran amphibians from genus *scinax* (*Amphibia / Hylidae*). **J.E. Carvalho, F.R. Gomes, C.R. Bevier and C.A. Navas.** Univ. of São Paulo, Brazil and Colby Col., Waterville, ME.
- 52 **36.6** Modification of the physiological stress response in green sturgeon, *acipenser medirostris*: the influence of time of day and temperature. **S.E. Lankford, T.E. Adams and J.J. Cech, Jr.** Univ. of California, Davis.
- 53 **36.7** Direct observation of cooling in cerebral arterial blood in pigeons, *Columba livia*. **T.F. Gallegos and M.H. Bernstein.** New Mexico State Univ., Las Cruces.
- 54 **36.8** Diet and the evolution of thermoregulatory energetics in the woodrats *Neotoma albigula* (a generalist) and *Neotoma stephensi* (a specialist). **J.D. McLister, J.S. Sorensen-Forbey and M.D. Dearing.** Univ. of Utah.
- 55 **36.9** Measuring temperatures and heat flux from dolphins in the eastern tropical pacific: is thermal stress associated with chase and capture in the tuna purse-seine fishery? **D.A. Pabst, W.A. McLellan, E.M. Meagher, A.J. Westgate, M.D. Scott and K. Forney.** Univ. of North Carolina, Wilmington, Duke Univ., Inter-American Tropical Tuna Commission, La Jolla and National Marine Fisheries Service, Santa Cruz.
- 56 **36.10** Comparative physiology of heat production and its response to dehydration: is it connected to habits and habitats? **A. Haim, N. Palgi and S. Koon.** Univ. of Haifa–Oranim and Kiryat Tivon, Israel.

DAILY SCHEDULE

Posters

37.0 HEART AND CIRCULATION

TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
 Authors present posters 2:30-5:30 PM

Board #

- 57 **37.1** Cardiovascular responses of the terrestrial hermit crab *Coenobita clypeatus* to changes in body position. **C.S. Knehr and C.L. Reiber**. Univ. of Nevada, Las Vegas.
- 58 **37.2** The effect of continuous and intermittent exercise and temperature on ghost crab heart rate. **R.B. Weinstein and M.F. Eleid**. Univ. of Arizona.
- 59 **37.3** Endothelial cells from the eel, *Anguilla rostrata*, a system to study the response to environmental changes. **R.A. Garrick, B.R. Woodin, R.L. Cox and J.J. Stegeman**. Fordham Univ. at Lincoln Center, NY and Woods Hole Oceanographic Inst.
- 60 **37.4** Effect of temperature on the sarcoplasmic reticulum Ca^{2+} ATPase from tuna hearts. **A.L. Fernandez, J.M. Morrisette, J.M. Blank and B.A. Block**. Hopkins Marine Station, Stanford Univ.
- 61 **37.5** Measurement of Ca^{2+} release transients in cardiac myocytes of tuna and mackerel using confocal microscopy. **J.M. Morrisette, S.H. Thompson and B.A. Block**. Hopkins Marine Station, Stanford Univ.
- 62 **37.6** Vascular anatomy of skipjack tuna gills. **H. Dewar, J.B. Graham, R.W. Brill and K.R. Olson**. Pflieger Inst. of Environ. Res., Oceanside, CA, Scripps Inst. of Oceanography, UCSD, Natl. Marine Fisheries Service, Southwest Fisheries Sci. Ctr., Honolulu and Indiana Univ. Sch. Med., Notre Dame.
- 63 **37.7** Transvascular and intravascular fluid transport in rainbow trout. **K.R. Olson, D.W. Kinney and D.W. Duff**. Indiana Univ. Sch. Med., Notre Dame.
- 64 **37.8** The β adrenergic receptor system of the rainbow trout. **T.W. Moon, J. Nickerson, S.G. Dugan and G. Drouin**. Univ. of Ottawa.
- 65 **37.10** The importance of preload on cardiac performance in bullfrogs and turtles. **S.J. Warburton, D.C. Jackson, V.I. Toney and T. Wang**. New Mexico State Univ., Brown Univ., and Aarhus Univ., Denmark.
- 66 **37.9** Stretched dog and pig femoral arteries relax to acetylcholine through different endothelium-dependent mediators. **N.E. Woodley and J.K. Barclay**. Ohio Northern Univ., and Univ. of Guelph.

Board #

- 67 **37.11** Delayed depolarization of the cogwheel valve and pulmonary-to-systemic shunting in alligators. **D.A. Syme, K. Gamperl and D.R. Jones**. Univ. of Calgary, Memorial Univ. of Newfoundland, and Univ. of British Columbia.
- 68 **37.12** Regulation of systemic resistance and changes in blood flow distribution in the red-eared slider (*Trachemys scripta*) during anoxic submergence. **J.A.W. Stecyk, J. Overgaard, T. Wang and A. Farrell**. Simon Fraser Univ. and Aarhus Univ., Denmark.
- 69 **37.13** Molecular diagnostic in long QT syndrome in Mexican patients. **H.M. Barajas, A.G. Ramirez, A. Cordero, R. Bloise and S. Priori**. Univ. of Guadalajara-CUSUR, Mexico, IMSS, Guadalajara, and Inst. of Molec. Cardiol., Pavia, Italy.
- 70 **37.14** Kidney of giraffes: hypertensive ruminants. **N.S.R. Maluf**. Cleveland, OH.
- 71 **37.15** Cardiac hormone as a protection against volume overload. **V. Tervonen, O. Vuolteenaho and M. Nikinmaa**. Univ. of Turku, Finland and Univ. of Oulu, Finland.

Posters

38.0 RESPIRATION AND ACID-BASE

TUES.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
 Authors present posters 2:30-5:30 PM

Board #

- 72 **38.1** Laplace's law and the alveolus: a misconception of anatomy and a misapplication of physics. **H. Prange**. Indiana Univ., Bloomington.
- 73 **38.2** Comparison of oxygen carrying capacity of a new perfluorocarbon (PFC) blood substitute in rats breathing room air or 100% Oxygen. **R.M. Kiral, R.W. Nicora and D.P. Evitts**. Synthetic Blood International Inc., Costa Mesa.
- 74 **38.3** Avian intrapulmonary chemoreceptors: role of L-type calcium channels in CO_2 sensing. **S.X. Egan and S. C. Hempleman**. Northern Arizona Univ., Flagstaff.
- 75 **38.4** Central glutamatergic control of cardioventilatory function in catfish. **M.L. Burleson, J. Turesson, M. Hedrick and L. Sundin**. Univ. of Texas, Arlington, Goteborg Univ., Sweden and California State Univ, Hayward.

DAILY SCHEDULE

- Board #
- 76 **38.5** Function of the postpulmonary septum in lung ventilation in *Varanus*. **T. Owerkowicz and J.W. Hicks**. Harvard Univ. and Univ. of California, Irvine.
- 77 **38.6** Pre-exercise inhalation of nedocromil sodium (an inflammatory/mast cell stabilizer) does not mitigate exercise-induced arterial hypoxemia in thoroughbred horses. **M. Manohar, T.E. Goetz, S. Humphrey and T. DePuy**. Univ. of Illinois, Urbana-Champaign.
- 78 **38.7** The physiology of overwintering in the common snapping turtle (*Chelydra serpentina*) and the softshell turtle (*Apalone spinifera*). **S.A. Reese, D.C. Jackson and G.R. Ultsch**. Univ. of Alabama, Tuscaloosa and Brown Univ.
- 79 **38.8** Anemia: a basis for the cost of reproduction? **T.D. Williams, W. Challenger, J. Christians, M. Evanson and F. Vezina**. Simon Fraser Univ.
- 80 **38.9** Cutaneous CO¹⁸ (and thus O₂) diffusing capacity decreases in response to dehydration in the toad, *Bufo Woodhouseii*. **W. W. Burggren and T. Z. Vitalis**. Univ. of North Texas, Denton and GeneMax Pharmaceuticals Inc., Vancouver, Canada.
- 81 **38.10** Effects of chronic cold and submergence on blood oxygen transport in hibernating map turtles. **L.A. Maginniss, S. A. Ekelund and G. R. Ultsch**. DePaul Univ. and Univ. of Alabama, Tuscaloosa.
- 82 **38.11** Modulation of periodic breathing by altered patterns of lung inflation in an amphibian, *Bufo marinus*. **S.G. Reid and N.H. West**. UCSD and Univ. of Saskatchewan.
- Posters
- 39.0 OSMOTIC AND IONIC REGULATION**
TUES.—EXHIBIT HALL, LOWER LEVEL
- Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM
- Board #
- 83 **39.1** Fluorescent measurement of calcium transport in crustacean cells. **F.P. Zanutto, M.G.W. Wheatly, P. Chavez-Crooker and G.A. Ahearn**. Univ. of São Paulo, Brazil, Wright State Univ., Univ. de Antofagasta, Casilla, Chile, and Univ. of North Florida.
- 84 **39.2** Expression of PMCA3 mRNA and protein in crustacean during molting. **P. Gao, L. Kelly, Z. Zhang and M.G. Wheatly**. Wright State Univ.

- Board #
- 85 **39.3** Gill Na⁺/H⁺ exchangers (NHE) in marine and freshwater adapted fish. **J.B. Claiborne, S.L. Edwards, D. Gunning, N. Hair, B. Wall and A.I. Morrison-Shetlar**. Georgia Southern Univ., Statesboro.
- 86 **39.4** Regulatory volume decrease and increase in northern fur seal red blood cells. **H. Fujise, K. Nishiki, T. Fukuoka and K. Kohyama**. Azabu Univ., Sch. of Vet. Med., Sagamihara, Japan and Izu-Mito Sea Paradise, Numazu, Japan.
- 87 **39.5** Localization and molecular characterization of the crayfish NCX. **L.M. Stiner, Z. Zhang, P.Gao and M.G. Wheatly**. Wright State Univ.

WEDNESDAY, AUGUST 28

Plenary Lecture

40.0 PATTERNS OF SUCCESS AND OF DEATH IN HIMALAYAN MOUNTAINEERING

WED. 8:00-9:00 AM—TOWN & COUNTRY RM.

Speaker: **Raymond B. Huey**,
Univ. of Washington.

Symposium

41.0 DEVELOPMENTAL PHYSIOLOGY: PLASTICITY AND CONSTRAINTS

WED. 9:00 AM-1:00 PM—TOWN & COUNTRY RM.

Cochairs: **Donal T. Manahan** and
Steven C. Hand

9:00 **41.1** Dual Purpose Genes and the Re-unification of Physiology and Development. **Robert E. Maxson**, Univ. of Southern California, Norris Hosp.

9:30 **41.2** Physiology of Marine Invertebrate Development: Starvation Survival and Metabolic Regulation. **Donal T. Manahan**, Univ. of Southern California.

10:00 **41.3** Temporary Suspension of Developmental Programs: Requirements and Mechanisms for Surviving Environmental Stress. **Steven C. Hand**, Louisiana State Univ., Baton Rouge.

10:30 **41.4** Functional Ontogeny of the Circulatory System in Fish. **Bernd Pelster**. Univ. of Innsbruck, Austria.

DAILY SCHEDULE

- 11:00 **41.5** Patterns of Gene Expression During Insect Diapuse. **David L. Denlinger**, Ohio State Univ.
- 11:30 **41.6** Developmental Constraints on the Evolution of Physiological Systems. **Timothy J. Bradley**, Univ. of California, Irvine.
- 12:00 **41.7** Oxygen Regulation in Crustacean Development. **Nora Terwilliger**, Oregon Inst. of Marine Biology, Univ. of Oregon.

Symposium

- 42.0** **PHYSIOLOGICAL AND GENETIC RESPONSES TO ENVIRONMENTAL STRESS**
WED. 9:00 AM-1:00 PM—SAN DIEGO RM.
- Chairs: **Gretchen Hofmann** and **Martin Feder**
- 9:00 **42.1** Introduction. Environmental Stress: A Multifaceted Concept in Integrative Physiology. **Gretchen Hofmann**, Arizona State Univ.
- 9:05 **42.2** Adaptation to Stressful Conditions in *Drosophila*: Insights from a Broad and Multifaceted Approach. **Ary Hoffmann**, La Trobe Univ., Australia.
- 9:30 **42.3** Heat Shock Proteins and the Stress Response: Transcriptional Regulation of HSP Genes. **Martin E. Feder**, Univ. of Chicago.
- 9:55 **42.4** Genomic Response of Yeast to Anaerobiosis. **Kurt Kwast**, Univ. of Illinois, Urbana-Champaign.
- 10:20 **42.5** Intracellular Osmotic Stress Signaling in Euryhaline Telosts: Role of 14-3-3. **Dietmar Kultz**, Whitney Labs, Univ. of Florida.
- 10:45 **42.6** Adaptations to Anhydrobiosis: Lessons from Nature. **John Crowe**, Univ. of California, Davis.
- 11:10 **42.7** Corticosterone and Inclement Weather: Mechanisms underlying Adaptive Behavioral Responses in Mountain Birds. **Creagh Breuner**, Univ. of Texas, Austin.
- 11:35 **42.8** The Scale of Stress: Time and Topography on Wave-Swept Shores. **Mark Denny**, Stanford Univ.

- 11:55 **42.9** Evolved Thermotolerance and the Expression of Heat Inducible Genes in Thermally Adapted *Escherichia coli*. **Michelle Riehle**, Univ. of California, Irvine.
- 12:20 **42.10** Ecological Consequences of Environmental Stress and Stress Resistance: Diving into Comorant Evolution from the Cretaceous to the Present. **Warren Porter**, Univ. of Wisconsin, Madison.

Symposium

- 43.0** **ACCLIMATIZATION TO HYPOXIA: SUPPLY VS DEMAND STRATEGIES**
WED. 9:00 AM-1:00 PM, GOLDEN WEST RM.
- Chair: **Frank L. Powell**
- 9:00 **43.1** Comparative Physiology of Acclimatization to Hypoxia. **Frank L. Powell**, UCSD.
- 9:30 **43.2** Interactions of Thermal, Metabolic and Respiratory Control in Hypoxic Homeotherms. **William K. Milsom**, Univ. of British Columbia.
- 10:00 **43.3** Physiological Signals and Comparative Responses to Decreased Oxygen Supply. **Donna F. Boggs**, Eastern Washington Univ.
- 10:30 Break
- 10:45 **43.4** Effects of Hypoxia on Gene Expression: Evolutionary Origins and Functional Significance. **Randall S. Johnson**, UCSD.
- 11:15 **43.5** Molecular Mechanisms of Oxygen Sensing and Apoptosis in Mammalian Cells. **Navdeep S. Chandel**, Northwestern.
- 11:45 **43.6** Metabolic Responses to Intermittent and Chronic Hypoxia in Fishes. **Nancy M. Aguilar**, White Mountain Res. Station, UCSD and Univ. of California, Irvine.
- 12:15 Break
- 12:30 Regulation of Systemic Resistance and Changes in Blood Flow Distribution in the Red-eared Slider (*Trachemys scripta*) during Anoxic Submergence. **Jonathan Anthony William Stecyk**, Simon Fraser Univ. (37.12)
- 12:35 Does Chronic Hypoxia During Postnatal Development Elicit Long-Lasting Changes in Chemosensitivity in Rats? **Ryan W. Bavis**, Univ. of Wisconsin. (7.21)

DAILY SCHEDULE

- 12:40 Neurotransmitter Receptors in Nos-Expressing Neurons of the Rat Glossopharyngeal Nerve. **Veronica Andrea Campanucci**, McMaster Univ. (7.4)
- 12:45 Hypoxia Regulation of Gene Expression in Crustaceans: A Potential HIF-1 System. **Jennifer Mary Head**, Oregon Institute of Marine Biology, U. Oregon. (47.14)
- 12:50 Variation in Oxygen Sensitivity in Insects of Different Size and Age. **Kendra J Greenlee**, Arizona State Univ. (7.5)

Symposium

- 44.0 REGULATION OF VERTEBRATE RENAL FUNCTION: A COMPARTIVE APPROACH**
WED. 9:00 AM-1:00 PM—CALIFORNIA RM.
- Cochairs: **William H. Dantzler** and **Eldon J. Braun**
- 9:00 Introduction.
- 9:05 **44.1** Regulation of Renal Blood Flow and Glomerular Filtration. **Stanley Yokota**, West Virginia Univ. Sch. of Med.
- 9:35 **44.2** Regulation of Proximal and Distal Tubule. **William H. Dantzler**, Univ. of Arizona.
- 10:05 **44.3** Regulation of Water Movement. **Hiroko Nishimura**, Univ. of Tennessee.
- 10:35 **44.4** Regulation of Nitrogen Excretion. **Patrick J. Walsh**, Univ. of Miami.
- 11:05 Break
- 11:20 **44.5** Regulation of Renal and Lower Gastrointestinal Function: Role in Fluid and Electrolyte Balance. **Eldon J. Braun**, Univ. of Arizona.
- 11:50 **44.6** Regulation of Salt Gland and Renal Interactions. **Maryanne Hughes**, Univ. of British Columbia.

Posters

45.0 DEVELOPMENTAL PHYSIOLOGY: PLASTICITY AND CONSTRAINTS WED.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board

- 1 **45.1** Ontogeny of the cutaneous permeability barrier in hatchling king snakes. **H.B. Lillywhite, J.G. Menon, G.K. Menon and M.C. Tu**. Univ. of Florida, William Paterson Univ. of New Jersey, California Academy of Sci., San Francisco and National Taiwan Normal Univ., Taipei.
- 2 **45.2** The ontogeny of energy consumption in leatherback and olive ridley marine turtle hatchlings. **T.T. Jones, R.R. Reina and P.L. Lutz**. Florida Atlantic Univ., Boca Raton and Drexel Univ.
- 3 **45.3** Plasticity and constraints of grunion developmental timing. **K.L. Martin, E.A. Smyder and A.J. Walker**. Pepperdine Univ.
- 4 **45.4** Oxygen consumption and temperature in larvae of the Antarctic starfish *Odontaster validus*. **L.S. Peck and E. Prothero-Thomas**. British Antarctic Survey, Cambridge, UK.
- 5 **45.5** Changes in blood chemistry during hypoxic exposure in embryos of the domestic chicken. **D.A. Crossley II and J.W. Hicks**. Univ. of California, Irvine.
- 6 **45.6** Comparative locomotor function in turtles: can species differences in adult motor patterns be traced to juveniles? **R.W. Blob, E.L. Scanga, M.W. Westneat**. Clemson Univ. and Field Museum, Chicago.
- 7 **45.7** Non-skilled motor behavior lateralization during the early postnatal development in white rats. **M. Erlikh and A. Vol'nova**. St.-Petersburg State Univ., Russian Federation.
- 8 **45.8** Molt cycle changes in tissue-specific abundance of cryptocyanin and hemocyanin mRNA in the dungeness crab, *Cancer magister*. **N.B. Terwilliger, D.W. Towle and M. Ryan**. Oregon Inst. of Marine Biology, Univ. of Oregon and Mt. Desert Island Biol. Lab., Salsbury Cove, ME.
- 9 **45.9** Developmental expression and actions of corticotropin-releasing hormone in tadpoles of *Xenopus laevis*. **G.C. Boorse, K.A. Glennemeier and R.J. Denver**. Univ. of Michigan.

DAILY SCHEDULE

Board #

- 10 **45.10** Effect of photoperiod and melatonin on growth and development of neonatal gerbils (*Meriones unguiculatus*). **S.B. Chaplin, T.L. Kelly and S.C. O'Connell.** Univ. of St. Thomas, St. Paul, MN.

Posters

46.0 **PHYSIOLOGICAL AND GENETIC RESPONSES TO ENVIRONMENTAL STRESS**

WED.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
 Authors present posters 2:30-5:30 PM

Board #

- 11 **46.1** Phosphoserine and other unusual osmolytes in deep-sea vesicomyid bivalves: correlations with depth. **P.H. Yancey, J. Fiess, H. Hudson, J. Hom and C. Kato.** Whitman College, Walla Walla, WA and JAMSTEC, Yokosuka, Japan.
- 12 **46.2** Environmental salinity reduction leads to increased abundance of Na⁺/K⁺/2Cl⁻ cotransporter mRNA in gills of the blue crab *Callinectes sapidus*. **D.W. Towle, P. Peppin and D. Weihrauch.** Mt. Desert Island Biol. Lab., Salsbury Cove, ME and Univ. of Illinois, Chicago.
- 13 **46.3** Recovery of water, ion content, and energy stores following desiccation in *Drosophila melanogaster*. **D.G. Folk and T.J. Bradley.** Univ. of California, Irvine.
- 14 **46.4** Pelvic skin blood flow and water uptake in toads, *Bufo alvarius*. **A.L. Viborg and S.D. Hillyard.** August Krogh Institute Univ. of Copenhagen, Denmark and Univ. of Nevada, Las Vegas.
- 15 **46.5** Paracellular permeability and chemosensory function of toad skin. **S.D. Hillyard and E.H. Larsen.** Univ. of Nevada, Las Vegas, August Krogh Institute and Univ. of Copenhagen, Denmark.
- 16 **46.6** The role of NaK ATPase and V type H ATPase in ion transport in euryhaline mosquito larvae. **M.L. Patrick and S.S. Gill.** Univ. of California, Riverside.
- 17 **46.7** Species-specific variation in sulfide physiology between closely related vesicomyid clams. **S.K. Goffredi and J.P. Barry.** Monterey Bay Aquarium Res. Inst., Moss Landing, CA.

Board #

- 18 **46.8** Deleterious effects of mild overwintering temperatures on survival and potential fecundity of rose-galling Dipolepis wasps (Hymenoptera: Cynipidae). **R.E. Lee, Jr., J.B. Williams and J.D. Shorthouse.** Miami Univ., Oxford, OH and Laurentian Univ., Sudbury, Canada.
- 19 **46.9** Cross-tolerance in tidepool sculpins (*Oligocottus maculosus*): a strategy for life in the intertidal zone. **A.E. Todgham and G.K. Iwama.** Univ. of British Columbia and National Research Council, Halifax, Nova Scotia.
- 20 **46.10** Modulation of the stress response: effects of breeding stage, season and relationship to nest abandonment. **O.P. Love, F. Vezina, and T.D. Williams.** Simon Fraser Univ.
- 21 **46.11** Recent thermal history altered the thermal resistance and Hsp70 accumulation in tissues of the tidepool sculpin (*Oligocottus maculosus*) under acute heat stress. **K. Nakano and G.K. Iwama.** Univ. of British Columbia and National Research Council, Halifax, Nova Scotia.
- 22 **46.12** Extreme resistance to desiccation and microclimate related differences in cold-hardiness of overwintering gall wasps (Hymenoptera: Cynipidae) on roses in southern Canada. **J. Williams, J.D. Shorthouse and R.E. Lee, Jr.** Miami Univ., Oxford, OH, Laurentian Univ., Sudbury, Canada.
- 23 **46.13** Influence of thermal stress on rates of protein synthesis and metabolism in an intertidal crustacean. **N.M. Whiteley and L.S. Faulkner.** Univ. of Wales, Bangor, U.K.
- 24 **46.14** CO₂ release pattern in female *Culex tarsalis* and effect of age, flight, egg production and blood-feeding. **E.M. Gray.** Univ. of California, Irvine.
- 25 **46.15** Physiological and behavioral sensitivity to environmental stressors measured by changes in fish guild structure in urbanized streams. **D.S. Millican, W.I. Lutterschmidt and B. Deal.** Sam Houston State Univ. and Construction Engineering Res. Lab., Champaign, IL.
- 26 **46.16** Urine composition in water stressed cricetid rodents: sodium oxalate. **I. Vatnick, C. Korine, I. van Tets and B. Pinshow.** Widener Univ., Chester, PA and Ben-Gurion Univ. of the Negev, Israel.

DAILY SCHEDULE

Board #

- 27 **46.17** Characterization of very-low density lipoprotein particle size during avian egg production. **K.G. Salvante, M. Wallowitz, R.L. Walzem and T.D. Williams.** Simon Fraser Univ. and Texas A&M Univ., College Station.
- 28 **46.18** Molecular basis of angiogenetic disturbances in Baltic salmon early mortality syndrome. **K.A. Vuori, A. Soitamo, P.J. Vuorinen and M. Nikinmaa.** Univ. of Turku, Finland and Finnish Game and Fisheries Res. Inst., Helsinki, Finland.
- 29 **46.19** Neonates of the common map turtle (*Graptemys geographica*) overwinter terrestrially in northern Indiana: does hatchling cold hardiness influence geographic distribution? **P.J. Baker, J.P. Costanzo and R.E. Lee, Jr.** Miami Univ., Oxford, OH.
- 30 **46.20** Cold hardiness and desiccation resistance in hatchling *Emydoidea blandingii*. **S.A. Dinkelacker, J.P. Costanzo and R.E. Lee, Jr.** Miami Univ., Oxford, OH.
- 31 **46.21** Are physical factors facilitating marine species invasions? **C.E. Braby, G. N. Somero.** Stanford Univ., Pacific Grove.
- 32 **46.22** Characterization of oxidative stress in *Saccharomyces cerevisiae* mutants lacking superoxide dismutase. **K.M. O'Brien, R.P. Dirmeier, M.M. Engle and R.O. Poyton.** Univ. of Colorado, Boulder.
- 33 **46.23** Fluorescein transport in malpighian tubules of the cricket, *Acheta domesticus*: affinity and specificity characteristics. **R.M. Kauffman, A.K. Jenner and D.S.G. Neufeld.** Eastern Mennonite Univ., Harrisonburg, VA.
- 34 **46.24** Physiological responses, desaturase activity and fatty acid composition in milkfish (*Chanos chanos*) under cold acclimation. **S. Hsieh and C. Kuo.** National Pingtung Univ. of Sci. and Tech., Taiwan.
- 35 **46.25** The pathway to heat acclimation: does HIF-1 plays a role? A lesson from *C. elegans* mutants. **M. Horowitz, H. Jiang, J. Powell-Coffman, Z. Bromberg, J. Shleir, M. Treinin.** The Hebrew Univ., Jerusalem, Israel; Iowa State Univ.

Board #

- 36 **46.26** Stressor-dependent regulation of heat shock response in Zebrafish, *Danio rerio*. **S. Airaksinen, C.M.I. Råbergh, A. Palomäki, A. Lahti, L. Sistonen, M. Nikinmaa.** Turku Centre for Biotechnology and Univ. of Turku, Finland.
- 37 **46.27** A Comparative study examining the utility of Hsp70 mRNA and protein in red blood cells as bio-indicators of acute and chronic temperature stress in the thermo-sensitive brook trout (*Salvelinus fontinalis*). **S.G. Lund, M.E.A. Lund and B.L. Tufts.** Queen's Univ., Kingston, ON, Canada.
- 38 **46.28** A Role for Hsp90 in the estrogenic response of juvenile rainbow trout (*Oncorhynchus mykiss*) to β -Estradiol and 4-Nonylphenol. **S. Currie and D.L. Chaput.** Mount Allison Univ., Sackville, NB, Canada.
- 39 **46.29** Phenostasis and patterns of growth: a framework from which to interpret adaptive capacity. **J.M. Szewczak.** Univ. of California, White Mountain Research Station, Bishop.
- 40 **46.30** Basal metabolic rate may not be related to body composition. **H.I. Ellis and J.R. Jehl, Jr.** USCD and Smithsonian Inst., Washington, D.C.

Posters

47.0 ACCLIMATIZATION TO HYPOXIA: SUPPLY VS. DEMAND STRATEGIES
WED.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM—7:00 PM
Authors present posters 2:30—5:30 PM

Board #

- 41 **47.1** Intracellular pH regulation of rainbow trout (*Oncorhynchus Mykiss*) hepatocytes: hypoxia stimulates sodium/proton exchange. **E. Rissanen, A. Tuominen, A. Bogdanova and M. Nikinmaa.** Univ. of Turku, Finland and Univ. of Zurich, Switzerland.
- 42 **47.2** Depression of lipolysis in CARP; a possible hypoxia protection mechanism. **G. van den Thillart and G. Vianen, J. Zaagsma.** Leiden Univ., and the Univ. of Groningen, Netherlands.

DAILY SCHEDULE

- Board #
- 43 **47.3** Hypoxia induces gross-morphological changes in crucian carp gills. **J. Sollid, P. De Angelis, K. Gundersen and G.E. Nilsson.** Institute of Biology, Oslo, Norway and Institute of Pathology, Oslo, Norway.
- 44 **47.4** Effect of hypoxia on fish: what role(s) does apoptosis play? **W.L. Poon and D. Randall.** City Univ. of Hong Kong.
- 45 **47.5** Developmental plasticity in tadpole shrimp: cardiac and respiratory responses to chronic hypoxic exposure. **C.L. Reiber and S. Harper.** Univ. of Nevada, Las Vegas.
- 46 **47.6** Effect of reproductive state and hypoxia on cardiovascular responses in the grass shrimp *Palaemonetes pugio*. **L.A. Jones, J.A. Guadagnoli and C.L. Reiber.** Univ. of Nevada, Las Vegas.
- 47 **47.7** Metabolic and thermal acclimation to hypoxia in rats. **S. Lacefield and D.F. Boggs.** Eastern Washington Univ.
- 48 **47.8** 2,3-DPG changes in horses, mules and burros with exposure to altitude. **M.J. Hurson, H.M. Greene, J.M. Szwczak and S.J. Wickler.** California State Polytechnic Univ. and UCSD, Bishop.
- 49 **47.9** Respiratory consequences of mouthbrooding and hypoxia in coral reef fish. **G.E. Nilsson and S. Ostlund-Nilsson.** Univ. of Oslo, Norway.
- 50 **47.10** Effects of hypoxia and epinephrine on erythrocytes of high-altitude acclimated pigeons, *Columba livia*. **E.S. Quintana and M.H. Bernstein.** New Mexico State Univ., Las Cruces.
- 51 **47.11** Properties of skeletal muscle in mice with an inherited capacity for hypoxic exercise tolerance. **G.S. Adams, J.D. Luedeke, M.H. Ernst, R.D. McCall and S.T. Kinsey.** Univ. of North Carolina, Wilmington.
- 52 **47.12** Amino acid sequences of the embryonic globin chains of a marsupial, the tammar wallaby (*Macropus eugenii*). **R.A. Holland, K.H. Gill, R.M. Hope, D. Wheeler, S.J. Cooper and A.A. Gooley.** Univ. of New South Wales, MacQuarie Univ., Adelaide Univ., South Australian Museum, Adelaide and Proteome Systems Limited, NSW, Australia.
- 53 **47.13** Inhibition of hypoxic pulmonary vasoconstriction reduces high altitude pulmonary edema in rats. **J.T. Berg, S. Ramanathan and E.R. Swenson.** Univ. of Hawaii, Honolulu and Univ. of Washington.

- Board #
- 54 **47.14** Hypoxia regulation of gene expression in crustaceans: a potential HIF-1 system. **J.M. Head and N.B. Terwilliger.** Oregon Institute of Marine Biol., Univ. Oregon, Charleston.
- 55 **47.15** HIF-1 α , erythropoietin and adaptation to excessive erythrocytosis. **M. Gassmann.** Univ. of Zurich, Switzerland.
- 56 **47.16** Acute and long-term neuroprotective responses to hypoxia in snail neurons. **P. Donohoe, E. Court and R. Boutilier.** Univ. of Cambridge, U.K.
- 57 **47.17** Microcalorimetric evidence of an oxyconformism in tissue metabolism of mammalian neonates. **D. Singer, A. Ince and B. Hallmann.** Univ. of Würzburg and Univ. of Göttingen, Germany.

Posters

48.0 REGULATION OF VERTEBRATE RENAL FUNCTION: A COMPARATIVE APPROACH WED.—EXHIBIT HALL, LOWER LEVEL

Posters on display 8:00 AM – 7:00 PM
Authors present posters 2:30-5:30 PM

Board

- 58 **48.1** Sipping human, gulping camel: the story behind future sweat. **M.L. Halperin, D.Z. Cherney, P.S. Aujla, D.N. Glick and M.A. Shafiee.** St. Michael's Hospital, Univ. of Toronto.
- 59 **48.2** Endothelin inhibits NaCl transport across the fish gill by release of nitric oxide and prostaglandin E. **D.H. Evans and P.M. Piermarini.** Univ. of Florida.
- 60 **48.3** Redistribution of body water and salt tolerance in wild ducks. **M. R. Hughes and D.C. Bennett.** Univ. of British Columbia.
- 61 **48.4** Distribution and possible function of aquaporin water channels in amphibian skin. **D.R. Powers, P.W. Gramenz, T.L. Baker and D.J. Kimberly.** George Fox Univ., Newberg, OR.
- 62 **48.5** Comparison of renal and salt gland function in three species of wild ducks. **D.C. Bennett and M.R. Hughes.** Univ. of British Columbia.
- 63 **48.6** Renal structure and function in *Notomys alexis* and *Mus musculus domesticus*. **J.R. Roberts and L.J. Godge.** Univ. of New England, NSW, Australia.

DAILY SCHEDULE

Board #

- 64 **48.7** A novel, non-invasive electrophysiological technique for analysis of organic cation transport by isolated cells and tissues. **M.J. O'Donnell and M.R. Rheault.** McMaster Univ.
- 65 **48.8** Contribution of cytoskeletal elements to rapid fluid transport in insect malpighian tubules. **J.H. Spring and R. Hazelton-Robichaux.** Univ. of Louisiana, Lafayette and Louisiana State Univ., Eunice.
- 66 **48.9** Cell-to-lumen taurine efflux during net secretion by primary monolayer cultures of flounder renal epithelium. **S. Benyajati and J.L. Renfro.** Univ. of Oklahoma Hlth. Sci. Ctr. and Univ. of Connecticut.

Plenary Lecture

**49.0 SCHOLANDER AWARD BANQUET
LECTURE**

WED.—8:00 PM, GRAND BALLROOM

Title: The Fire Inside: Saving Atlantic Bluefin Tuna.

Speaker: **Barbara Block,** Hopkins Marine Station, Stanford Univ.

The Power of Comparative Physiology: Evolution, Integration and Application

Abstracts of Invited and Contributed Presentations

SUNDAY

| | | |
|------|---|-----|
| 1.0 | Plenary Lecture: George Somero | 285 |
| 2.0 | The Power of Integration..... | 285 |
| 3.0 | Polar Molecular Biology: Proteins and Enzymes at their Lower Temperature Extremes | 288 |
| 4.0 | Integration of Motor Function: Mechanisms that Reduce Energy Cost and/or Enhance Performance..... | 290 |
| 5.0 | Cellular and Molecular Responses to Depressed Metabolism and Low Temperature | 293 |
| 6.0 | Neuropeptides Integrating Physiological Processes in Invertebrates: and Evolutionary and Comparative Approach..... | 295 |
| 7.0 | Scholander/SICB/SEB Award Competition (Posters)..... | 297 |
| 8.0 | The Power of Integration (Posters) | 305 |
| 9.0 | Polar Molecular Biology: Proteins and Enzymes at their Lower Temperature Extremes (Posters)..... | 307 |
| 10.0 | Integration of Motor Function: Mechanisms that Reduce Energy Cost and/or Enhance Performance (Posters) | 309 |
| 11.0 | Cellular and Molecular Responses to Depressed Metabolism and Low Temperature (Posters)..... | 312 |
| 12.0 | Neuropeptides Integrating Physiological Processes in Invertebrates: and Evolutionary and Comparative Approach (Posters) | 313 |

MONDAY

| | | |
|------|---|-----|
| 14.0 | DNA Microarrays: Applications to Comparative Physiology..... | 314 |
| 15.0 | Homeostasis of Essential Yet Toxic Metals | 315 |
| 16.0 | Linking Muscle Genes to Structure and Physiology, A Comparative Approach..... | 318 |
| 17.0 | Mitochondrial Responses to Environmental and Physiological Challenge..... | 320 |
| 18.0 | Diving: Where Have We Been and Where are we Going? | 322 |
| 20.0 | DNA Microarrays: Applications to Comparative Physiology (Posters) | 325 |
| 21.0 | Homeostasis of Essential Yet Toxic Metals (Posters)..... | 326 |
| 22.0 | Linking Muscle Genes to Structure and Physiology, A Comparative Approach (Posters)..... | 327 |
| 23.0 | Mitochondrial Responses to Environmental and Physiological Challenge (Posters) | 328 |
| 24.0 | Diving: Where Have We Been and Where are we Going? (Posters) | 329 |

TUESDAY

| | | |
|------|---|-----|
| 25.0 | Plenary Lecture: John B. West | 332 |
| 26.0 | Phylogenetic Approaches to Understanding Physiological Evolution..... | 332 |
| 27.0 | The Comparative Physiology of Carbonic Anhydrase | 335 |
| 28.0 | The Influence of Comparative Physiology on Engineering: Neuro-Muscular Biological Inspiration Toward the Design of Artificial Muscle and Robots | 337 |
| 29.0 | Relaxed Homeothermy | 339 |
| 30.0 | Host-Parasite Interactions: A Comparative Approach..... | 341 |
| 31.0 | Phylogenetic Approaches to Understanding Physiological Evolution (Posters) | 342 |
| 32.0 | The Comparative Physiology of Carbonic Anhydrase (Posters)..... | 345 |
| 33.0 | The Influence of Comparative Physiology on Engineering: Neuro-Muscular Biological Inspiration Toward the Design of Artificial Muscle and Robots (Posters)..... | 346 |
| 34.0 | Relaxed Homeothermy (Posters) | 347 |
| 35.0 | Biochemical Adaptations (Posters)..... | 349 |
| 36.0 | Temperature and Thermoregulation (Posters) | 351 |
| 37.0 | Heart and Circulation (Posters)..... | 352 |
| 38.0 | Respiration and Acid-Base (Posters) | 356 |
| 39.0 | Osmotic and Ionic Regulation (Posters) | 358 |

WEDNESDAY

| | | |
|------|--|-----|
| 40.0 | Plenary Lecture: Raymond B. Huey | 359 |
| 41.0 | Developmental Physiology: Plasticity and Constraints | 359 |
| 42.0 | Physiological and Genetic Responses to Environmental Stress | 362 |
| 43.0 | Acclimatization to Hypoxia: Supply vs Demand Strategies | 365 |
| 44.0 | Regulation of Vertebrate Renal Function: A Comparative Approach | 367 |
| 45.0 | Developmental Physiology: Plasticity and Constraints (Posters)..... | 369 |
| 46.0 | Physiological and Genetic Responses to Environmental Stress (Posters) | 371 |
| 47.0 | Acclimatization to Hypoxia: Supply vs Demand Strategies (Posters) | 376 |
| 48.0 | Regulation of Vertebrate Renal Function: A Comparative Approach (Posters)..... | 379 |
| 49.0 | Scholander Award Banquet Lecture: Barbara Block..... | 381 |

| | |
|---------------------------|-----|
| AUTHOR INDEX | 383 |
|---------------------------|-----|

The Power of Comparative Physiology: Evolution, Integration and Application
AUTHOR INDEX

A

Abe, H., 35.9
Adams, G., 10.15, 47.11
Aguilar, N., 7.3, 43.6
Ahearn, G., 15.2
Ahn, A., 4.5
Airaksinen, S., 46.26
Alarcon-Chaidez, F., 30.3
Altringham, J., 4.4
Andrade, F., 10.7
Andrews, M., 5.5
Andrews, R., 18.8
Andziak, B., 11.10
Aprille, J., 17.6
Askew, G., 4.6
Autumn, K., 26.4

B

Backey, J., 8.5
Bailey, D., 7.52
Baker, P., 46.19
Balesaria, S., 21.1
Barajas, H., 37.13
Barnes, B., 29.1
Bavis, R., 7.21
Benjamin, P., 6.3
Bennett, D., 48.5
Benyajati, S., 48.9
Berenbrink, M., 26.7
Berg, J., 47.13
Bernstein, S., 16.7
Bidani, A.,
Biewener, A., 4.1
Blickhan, R., 28.3
Blob, R., 45.6
Block, B., 2.2, 34.10, 49.0
Blust, R., 15.7
Bobbert, M., 4.8
Boggs, D., 43.3
Boily, P., 34.4
Boorse, G., 45.9
Borg, K., 24.11
Bosch, T., 6.1
Bourne, G., 10.14
Bowles, V.,
Braby, C., 46.21
Bradley, T., 41.6
Braun, E., 44.5
Breuner, C., 42.7
Buchanan, C., 10.17
Buck, L., 11.1
Buckley, B., 7.35
Buehler, M., 28.7
Burggren, W., 38.9
Burluson, M., 38.4
Burns, J., 18.6
Bury, N., 15.6
Butler, P., 18.9, 29.4
Bystriansky, J., 9.1

C

Campanucci, V., 7.4
Carey, H., 5.1, 5.8
Carr, J., 10.8
Carvalho, J., 36.5
Castellini, M., 18.1, 24.6
Chamberlin, M., 23.5
Chandel, N., 43.5
Chaplin, S., 45.10
Cheng, C., 3.3
Cheng, H., 35.4
Cinar, Y., 7.50
Claiborne, J., 39.3
Clark, T., 36.4
Clarke, A., 9.7
Corena, M., 32.1
Cornick, L., 24.3
Cossins, A., 5.2, 13.0
Court, E., 23.2
Crawford, D., 14.2
Creelman, C., 7.25
Crossley II, D., 45.5
Crowe, J., 42.6
Currie, S., 46.28

D

Dahlhoff, E., 35.11
Daniels, C., 26.5
Dantzler, W., 44.2
Darveau, C., 7.48
Davis, R., 18.7
De Boeck, G., 21.4
De Cian, M., 32.5
Denlinger, D., 41.5
Denny, M., 42.8
DeVries, A., 3.2
Dewar, H., 37.6
Dickson, K., 2.9
Dinkelacker, S., 46.20
Donley, J., 7.49
Donohoe, P., 47.16
Dudek, D., 33.7
Duerr, J., 23.1
Dutto, D., 10.4
Dzialowski, E., 7.32

E

Eads, B., 23.8
Eastman, J., 3.7
Egan, S., 38.3
El Haj, A., 16.5
Ellerby, D., 10.9
Elliott, N., 24.2
Ellis, H., 46.30
Entin, P., 10.16
Epperson, E., 11.8
Erlikh, M., 45.7
Evans, H., 31.4
Evans, D., 48.2

F

Farley, C., 4.7
Feder, M., 42.3
Filk, G., 30.5
Finkler, M., 31.9
Fleck, C., 11.3
Florant, G., 5.6
Flück, M., 20.3
Folk, D., 46.3
Françoso Jr., O., 31.8
Frappell, P., 29.5
Fraser, K., 9.3
Fujise, H., 39.4
Full, R., 28.1

G

Gabaldon, A., 4.2
Gallegos, T., 36.7
Gao, P., 33.1, 39.2
Gardner, M., 7.14
Garland, Jr., T., 2.3, 26.1,
26.3
Garrick, R., 37.3
Gasch, A., 14.6
Gassmann, M., 47.15
Gatesy, S., 2.7
Gawlicka, A., 8.2
German, D., 8.1
Gerrits, M., 23.6
Ghalambor, C., 31.6
Gibbs, A., 31.13
Gillis, T., 7.42
Gilmour, K., 32.3
Goebel, M., 24.14
Goffredi, S., 46.7
Gracey, A., 14.5
Gray, E., 46.14
Green, J., 24.12
Greenlee, K., 7.5
Gros, G., 22.5, 27.6
Grosell, M., 15.3
Grove, T., 9.8
Guynn, S., 3.4

H

Hagey, L., 31.5
Haim, A., 36.10
Halperin, M., 48.1
Halsey, L., 24.13
Hamilton, M., 32.2
Hamilton, J., 24.10
Hand, S., 41.3
Harlow, H., 34.6
Harrison, J., 10.13
Hartzler, L., 7.16
Hatle, J., 7.33
Hazel, M., 7.8
Head, J., 47.14
Hedrick, T., 33.3

Heldmaier, G., 29.2
Heming, T.A., 27.5
Henry, R., 27.2
Higham, T., 10.10
Hill, R., 12.2
Hillyard, S., 46.5
Hindle, A., 34.1
Hobson, K., 11.2
Hochscheid, S., 24.7
Hoffmann, A., 42.2
Hoffmann, K., 6.8
Hofmann, G., 42.1
Hogstrand, C., 15.5
Hohtola, E., 34.5
Holland, R., 47.12
Holloway, V., 35.2
Holmes, J., 34.3
Hoppeler, H., 17.8
Horn, M., 8.3
Horowitz, M., 46.25
Hoyt, D., 10.5
Hsieh, S., 46.24
Huberman, H., 6.4
Huey, R., 40.0
Hughes, M., 44.6, 48.3
Hulbert, A., 17.5
Hung, C., 20.1
Hurson, M., 47.8

I

Ianowski, J., 7.7
Irschick, D., 26.6

J

Johns, G., 35.6
Johnsen, D., 10.6
Johnson, S., 30.1
Johnson, R., 43.4
Johnson, M., 7.13
Johnston, I.A., 16.3
Jones, D., 18.2
Jones, T., 45.2
Jones, L., 47.6
Josephson, R., 28.2

K

Kajiura, S., 7.15
Kamel, K., 8.6
Kanatous, S., 24.9
Kauffman, R., 46.23
Kearney, M., 7.47
Kille, P., 14.1
Kim, Y., 35.7
Kinsey, S., 10.15
Kiral, Ph.D, R., 38.2
Kirkton, S., 7.31
Kiss, A., 9.5
Klute, G., 28.5

AUTHOR INDEX

Knehr, C., 37.1
Knower, T., 24.6
Kohlsdorf, T., 31.7
Korine, C., 8.9
Kornbluh, R., 28.6
Korobov, S., 8.8
Korsmeyer, K., 36.3
Kültz, D., 42.5
Kwast, K., 42.4

L

Lacefield, S., 47.7
Ladeira Fernandez, A.,
37.4
Lankford, S., 36.6
Lauder, G., 2.5
Lee, C., 26.10
Lee, H., 7.46
Lee, D., 10.3
Lee, Jr., R., 46.8
Lemasters, J., 17.3
Lieber, R., 28.4
Lillywhite, H., 45.1
Logue, J., 9.6
Lohuis, T., 34.2
Long, A., 14.3
Lorenz, M., 6.5, 12.1
Love, O., 46.10
Lucassen, M., 3.6
Lund, S., 46.27
Lutterschmidt, W., 31.3

M

MacArthur, R., 24.1
Maddison, W., 26.2
Maginniss, L., 38.10
Maluf, N., 37.14
Manahan, D., 2.1
Manohar, M., 38.6
Marcinek, D., 23.4
Marden, J., 16.6
Marjanovic, M., 9.2
Marsh, R.L., 4.3
Marshall, C., 3.5
Martin, S., 5.4, 20.4
Martin, K., 45.3
Mastropaolo, J., 31.2
Mau, T., 35.1
Maule, A., 6.2
Maxson, R., 41.1
McCue, M., 7.43, 31.11
McCulloch, P., 24.15
McGaw, I., 36.2
McLister, J., 36.8
McMillan, D., 35.12
McWhorter, T., 7.10
Medler, S., 22.2
Millican, D., 46.15
Milsom, W., 43.2
Moerland, T., 9.4

Monti, R., 10.11
Moon, T., 37.8
Moravec, J., 33.2
Morrissette, J., 37.5
Moyes, C., 17.1
Munns, S., 7.17
Murphy, A., 17.2
Murray, P., 7.40
Muylle, F., 21.3

N

Nakano, K., 46.11
Navas, C.A., 26.8
Nganpiep, L., 35.3
Nilsson, G., 47.9
Nishimura, H., 44.3
Noren, S., 7.28

O

O'Brien, K., 46.22
O'Connor, T., 11.10
O'Donnell, M., 48.7
Oliveira, F., 31.1
Olson, K., 37.7
Ortiz, R., 7.11
Owerkowicz, T., 38.5

P

Pabst, D., 36.9
Patrick, M., 46.6
Peattie, A., 33.6
Peck, L., 45.4
Pelster, B., 41.4
Petzel, D., 3.0
Phillips, J., 6.6
Place, S., 7.34
Podrabsky, J., 14.4
Polasek, L., 7.22
Ponganis, P., 18.5
Poon, W., 47.4
Porter, W., 42.10
Portner, H., 3.6
Powell, F., 43.1
Powers, D., 48.4
Prange, H., 38.1
Prolla, T., 5.3
Pruitt, N., S5.0, 11.4
Prum, R., 2.8

Q

Qiu, A., 21.2
Quintana, E., 47.10

R

Rea, L., 24.4
Reese, S., 38.7
Reiber, C., 47.5

Reich, T., 7.26
Reid, S., 38.11
Reiser, P., 22.4
Reynolds, J., 23.7
Rheault, M., 7.19
Richmond, J., 7.27
Riehle, M., 2.4, 42.9
Rissanen, E., 47.1
Roberts, J., 48.6
Roberts, S., 10.12
Rock, J., 22.1
Rosenberger, A., 23.3
Ruehl, N., 11.5
Russeth, K., 11.7

S

Salvante, K., 46.17
Sane, S., 2.6
Santos, L., 36.1
Schaeffer, P., 7.39
Schulte, P., 35.10
Schumaker, P., 5.6
Secor, S., 31.12
Sepulveda, C., 10.1
Seron, T., 32.4
Shadwick, R., 10.2
Shaw, A., 11.9
Shiels, H., 7.45
Shumacker, P., 5.7, 17.4
Sidell, B., 3.1
Singer, D., 47.17
Skinner, L., 7.24
Sollid, J., 47.3
Somero, G., 1.0
Sorensen-Forbey, J., 7.12
Southwood, A., 7.37
Speakman, J., 29.3
Sponberg, S., 33.4
Spring, J., 48.8
Spudich, J., 16.0
Stabenau, E., 27.5
Stecyk, J., 7.6, 37.12
Stephens, N., 34.7
Stillman, J., 7.36
Stiner, L., 39.5
Suarez, R., 17.7
Summers, A., 10.18
Swank, D., 22.3
Swenson, E., 27.1
Syme, D., 37.11
Szewczak, J., 46.29

T

Tattersall, G., 7.29
Tervonen, V., 37.15
Terwilliger, N., 41.7, 45.8
Thiele, D., 15.1
Thornton, S., 7.51
Tibbits, G., 16.4
Tieleman, I., 29.6

Todgham, A., 46.9
Toien, O., 34.9
Tomanek, L., 7.2
Toney, V., 7.20
Towle, D., 46.2
Trumble, S., 7.44
Tufts, B., 27.3

V

van Breukelen, F., 7.41
van den Thillart, G., 47.2
Van der Horst, D., 6.7
van Ginneken, V., 8.4
van Tets, I., 35.8
Van Voorhies, W., 11.6
Vanier, C., 20.2
Vatnick, I., 46.16
Vermeulen, A., 30.2
Vezina, F., 31.10
Viborg, A., 46.4
Vuori, K., 46.18

W

Walsh, P., 44.4
Warburton, S., 37.10
Warren, D., 7.18
Watabe, S., 16.2
Watson, R., 7.23
Weber, J., 35.5
Weinstein, R., 37.2
Weng, K.C., 34.10
West, J., 25.0
West, J., 7.9
West, J., 24.8
Whiteley, N., 46.13
Williams, Joe, 26.9
Williams, J., 46.12
Williams, D., 21.5
Williams, T.M., 18.4
Williams, T., 38.8
Wilson, R.P., 18.3
Wilson, R., 27.4
Wilson, J.,
Woo, P., 30.4
Wood, C., 15.4
Woodley, N., 37.9
Woods, H., 8.7
Wu, J., 33.5

Y

Yancey, P., 46.1
Yeates, L., 34.8
Yokota, S., 44.1

Z

Zakhartsev, M., 7.38, 9.9
Zanotto, F., 39.1
Zehmer, J., 7.1
Zenteno-Savín, T., 24.16
Zimmer, B., 7.30