

Division of Comparative Physiology & Biochemistry (DCPB): 2002 Fall Newsletter

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Message from the Chair

Nora B. Terwilliger

It is with great sadness that we acknowledge the deaths of Peter Hochachka and C. Ladd Prosser, two outstanding scientists and leaders in the field of comparative physiology and biochemistry. George Somero has shared some of his thoughts on Peter Hochachka and Linda Mantel has written an essay in memory of Ladd Prosser that I have included below in this newsletter.

The recent APS Intersociety Meeting, "The Power of Comparative Physiology: Evolution, Integration and Application," held in San Diego in August 2002, was a resounding success. The organizing committee, Jim Hicks, Al Bennett, Barbara Block, Steve Hand, Don Jackson and Steve Wood, and APS Executive Director Marty Frank, put together a stimulating and informative program that highlighted recent accomplishments and provided a forum for new approaches in comparative physiology. Participation by members of the American Physiological Society, Society of Experimental Biology, Canadian Society of Zoology, European Society for Comparative Physiology and Biochemistry, German Society for Zoology, Australian and New Zealand Society for Comparative Physiology and Biochemistry, and of course the Society for Integrative and Comparative Biology/ Division of Comparative Physiology and Biochemistry, insured strong presentations, stimulating conversations and new opportunities for collaboration and learning.

Three graduate students won cash awards for their outstanding poster presentations at the San Diego meeting. Congratulations to John Zehmer, Arizona State University, who won the DCPB/SICB award for his poster authored by Zehmer, A. Sanchez and J. Hazel, "Plasma Membrane Rafts of Rainbow Trout are Subject to Thermal Acclimation". Kudos also to Todd Gillis, Simon Fraser University, winner of the APS Scholander Award, for his work on "Sequence Mutations in Teleost Cardiac Troponin C that are Permissive of Cardiac Function at Low Temperature" by Gillis, C. Moyes and G. Tibbits. The SEB award winner was Scott Kirkton, Arizona State University, "Oxygen Delivery Problems May Reduce Jumping Performance In Larger Locusts", another excellent poster authored by Kirkton, G. Timmons, D Hartung, J. Niska and J. Harrison.

This is a stimulating time for researchers in Comparative Physiology and Biochemistry. As Jon Harrison, DCPB Program Officer, describes below in more detail, our annual SICB meeting in Toronto in early January 2003 will feature excellent symposia, talks, posters, the Bartholomew Award Lecture and special sessions sponsored by DCPB and the other divisions. The following month, February 2003, another significant international gathering of comparative physiologists will occur in Australia. This meeting, the sixth

International Congress of Comparative Physiology and Biochemistry, continues a series that began in Liege in 1984 and has continued every four years. These opportunities to share data and ideas with our colleagues in the US and around the world lead to exciting science and positive global interactions. I look forward to seeing you at these meetings.

Newsflash! This year's recipient of the Bartholomew Award is Adam Summers, U.C. Irvine. Congratulations to Adam and a reminder to all to include his Bartholomew Award lecture in your schedule at the January 2003 SICB meeting in Toronto.

Message from the Program Officer

Jon Harrison

The 2003 Toronto meeting will, as usual, have an excellent set of symposia relevant to comparative physiologists and biochemists. Three symposia are sponsored or co-sponsored by DCPB:

- Comparative and Integrative Vision Research, organized by Mason Posner, Todd Oakley and Sonke Johnsen (Mon. Jan. 6).
- Comparative Biology of Cystic Fibrosis Transmembrane Conductance Regulator, organized by William Marshall (Sun. Jan. 5).
- 30 years of Biochemical Adaptation: A Symposium Honoring Peter W. Hochachka, organized by Raul Suarez (Wed. Jan. 8). This symposium will bring together an outstanding set of scientists to pay tribute to Peter's intellect, leadership, and most of all, enthusiasm for our field.

Each of the society-wide SICB, PAC-funded and CSZ symposia also have significant physiological/biochemical components:

- Selection and Evolution of Performance in Nature, organized Joel Kingsolver and Ray Huey (Sun. Jan. 5).
- Biology of the Canadian Arctic, organized by Saber Saleuddin, Rudy Boonstra and David Hik (Mon. Jan. 6).
- Recent Developments in Neurobiology, organized by Rich Satterlie (Tues. Jan. 7)
- NSF Integrated Research Challenge in Environmental Biology: Biological Stoichiometry from Genes to Ecosystem, organized by me (Tues. Jan. 7)!

Other symposia will also be of interest to many DCPB members, please check the SICB website for specifics. I look forward to seeing you there! I will be soliciting judges for the DCPB best student paper/poster competition soon. If you would like to volunteer for this important role, please email me (j.Harrison@asu.edu).

Planning is moving ahead for an excellent New Orleans (2004) meeting. DCPB symposium approved for New Orleans are:

- Ontogeny of physiological regulatory mechanism: Fitting into the environment, organized by Carl Reiber.
- Selection Experiments as a Tool in Evolutionary and Comparative Physiology: Insights into Complex Traits, organized by John Swallow and Ted Garland.

The society-wide symposia will also be of interest to our members:

- Integrative Biology: A Symposium Honoring George A. Bartholomew, organized by Ray Huey
- The Integration of Comparative Genomics and Ecological/Evolutionary Studies, organized by R. Scott Winters
- In Vino Veritas: The Comparative Biology of Ethanol, organized by Robert Dudley and Michael Dickinson.

Other meetings of interest:

- The 6th International Congress of Comparative Physiology and Biochemistry, February 2–7, 2003, Mt. Buller, Australia. (<http://www.zoo.latrobe.edu.au/iccpb/>).
- Society for Experimental Biology annual meeting, March 31–April 4, 2003, Southampton. (<http://www.sebiology.org/meetings/2003/Southampton/index.htm>).
- XXXV International Congress of Physiological Sciences: From Genes to Function. March 31–April 5, 2005, San Diego, CA (<http://www.iups2005.org/>).

Message from the Secretary

Mary E. Chamberlin

This year there was some confusion as to whether DCPB was having a best student talk and poster competition. A new link on the SICB website was added for students to follow when entering the competition, but this link only described the Bartholomew award. We will need to discuss how to rectify this problem at the DCPB business meeting in Toronto. Please come to the DCPB business meeting and participate in this discussion!

Martin Feder wants to remind you that every year the Annual Review of Physiology includes a section entitled "Comparative Physiology". If you have suggestions, nominations, or self-nominations for reviews to appear in this section, please contact Martin Feder (m-feder@uchicago.edu, 773-702-8096). Topics could be within comparative physiology, but also evolutionary, ecological, and environmental physiology as well as comparative biochemistry and physiological ecology.

Message from the Graduate Student/Postdoc Representative

Jennifer Head

After attending this summer's APS meeting (The Power of Comparative Physiology: Evolution, Integration, and Application), my eyes were opened to myriad potential directions for my research that I had not previously considered. It seems that many biologists are exploring a more "top down" approach to solving the questions that we have been striving to answer, made possible by the ever evolving technologies available to comparative physiologists. Thanks to techniques such as microarrays, physiologists can now study arrays of transcripts expressed under certain conditions and identify the genes upregulated (or down regulated), not

only helping to substantiate the roles of the genes that we anticipate to be expressed under a given set of conditions, but also to establish new roles for those whose expression was more unexpected. Tools such as these will be instrumental in fully understanding the mechanisms by which certain organisms deal with changes in the conditions that they are exposed to on a daily or seasonal basis, for example, and perhaps untangle the complex web of genetic interactions involved that we have only begun to understand.

As everyone is aware, there is an annual SICB meeting rapidly approaching. For those of you who will be attending this year's meeting, don't forget to enter yourself into the DCPB divisional "best student talk and poster" competition. You can enter the competition directly by sending an e-mail with your name and presentation title to Jon Harrison, program officer, at: j.Harrison@asu.edu. In addition, there are several other student award programs not associated with the meeting such as GIAR and FGST. Consult the website for more information.

For those of you who are graduate students and are more interested in science and technology policy issues, an internship program has been brought to my attention. It is called The Christine Mirzayan Science and Technology Policy Internship Program of the National Academies (in Washington, D.C.) For more information see national-academies.org/internship.

Hope to see you all at SICB in January. As always, feel free to e-mail me with questions, comments, and/or suggestions. Until next time! Happy researching.

PETER HOCHACHKA

1937–2002

Per F. Scholander, one of the founders and giants of comparative physiology, titled his autobiography, "Enjoying a Life in Science." I can think of no better phrase to describe the career of another giant of our field, Peter Hochachka, who died of cancer at age 65 on September 16th. For over three decades, Peter was the continuously ebullient catalyst of our field. He stimulated us with his creative insights into the mechanisms of adaptation to the environment and he encouraged us to enjoy the pleasures that exploration—intellectual and geographical—of the natural world had to offer. Like Per Scholander and a handful of other great figures in comparative physiology, Peter showed the intellectual and hedonistic merits of combining field and laboratory work in a creative manner. Such an approach to biology can lead to critical new insights into the mechanisms that enable organisms to perform their tasks in widely different habitats and into how these adaptive mechanisms are fabricated during evolution. The field plus laboratory focus also keeps biologists working in the "real world," where the abundance of different types of organisms allows one to address important questions that narrowly focused studies of so-called "model" organisms cannot approach. Peter's curiosity about nature was unbounded in both taxonomic and geographic senses. His study subjects included deep-sea fishes, Antarctic seals, Amazon fishes, squid, salmon, shrews, race horses, turtles and high-altitude-adapted members of our own species. And, of major importance for those of us who had the honor and pleasure of having him as our mentor, his curiosity was highly infectious. The forty-two graduate students he mentored and the large number of postdoctoral scholars and visitors who arrived at his laboratory from all over the world lived in a research environment that tended to bring out one's best, scientifically and personally. Whether the research site happened to be Peter's laboratory at the University of British Columbia, where he enjoyed a 36-year career, on a ship off the Galapagos Islands or on the Amazon

River, in a shack on a mountainside in the Andes, or in a small hut on the Antarctic ice, the working environment had the special qualities that made research under Peter's tutelage so unique. What were these qualities? In a classic study, the sociologist of science Robert Merton sought to determine what accounted for the fact that a disproportionate fraction of distinguished scholars in a field cut their scientific teeth in a very small number of laboratories. Merton discovered that the key feature of these distinguished mentors was not hands-on instruction in technique or continual over-the-shoulder inspection of the student's progress. Rather, it was the intellectual atmosphere—the "bright ambience" to quote Merton—of these special laboratories that attracted the best young scholars and led so effectively to their intellectual growth. All who experienced the atmosphere of Peter's laboratory would agree that Merton was right on target in his analysis of what makes a lab a great learning environment. We were always encouraged to engage in a sort of intellectual play, where novel conjectures could be tested and new species brought into study. Rather than engage in work on sure-things—the "collection of stamps"—we were challenged to do something new, even if it meant taking some intellectual risks in the process. Moreover, Peter's encouragement for his associates to be creative and productive came with the clear message to be an open and interactive person willing to share excitement and data with others. He was a role model in showing us how to conceive and do science and how to work most effectively and honestly with one's peers.

Peter was also a master of communication, whether at the podium or the word processor. His participation in scientific meetings was legendary. He seemed to be present whenever and wherever an exciting meeting on comparative physiology was held. The correlation here certainly suggests an underlying cause-effect linkage: Peter's activities at meetings, whether in presenting one of his multi-screen plenary lectures, in asking insightful questions after a talk or in discussing physiological issues over beers into the wee small hours of the next morning, provided the type of stimulating give-and-take that can make science so exciting. The impact of his publications was—and continues to be—enormous. This impact cannot adequately be measured only in terms of raw numbers of publications (about 400 papers and seven books). Rather, the impact of his writing must be seen especially in terms of how he has set the directions and raised the challenges for many sub-disciplines within comparative physiology. Peter was a master in writing a provocative theoretical paper in which a novel hypothesis was presented to the community, effectively challenging his peers to see if this bright idea had merit. It usually did—and it usually set into motion research programs in many other laboratories!

Taking the broadest possible view of Peter's contributions to comparative and evolutionary physiology, I think it's fair to say that he gave life, excitement, and relevance to the 'metabolic map.' Each of us who has taken a class in biochemistry has had to confront the complex and often bewildering inter-linked chains of chemical transformations that constitute 'metabolism.' It is common for these reactions to be presented as an abstract 'map' that entirely lacks signposts giving information about just who is carrying out these reactions and under what circumstances various functions are or are not needed. Peter's studies of metabolism provided unique insights into the ways that a relatively common set of metabolic reactions, such as those providing the ATP needed to do cellular work, could be modified adaptively to give organisms the ability to work under a vast array of environmental conditions, notably those of limiting oxygen availability. These metabolic studies taught us how invertebrates withstand exposure to low tides, how migrating salmon shuttle their energy resources to keep the locomotory muscles functioning, how seals manage to spend considerable periods of time in breath-hold diving beneath the ice, how goldfish survive hypoxia by producing ethanol, how training shapes muscle function, how—and why—metabolism varies as it does with body size, and how humans in the Andes and Himalayas have adapted to the hypoxic stress found at high altitude. His creativity in coining questions was paired with an ability to learn and adapt whatever technologies were needed to find the answers he sought. He moved easily between in vitro biochemistry, field studies in extreme environments, and whole animal magnetic resonance spectroscopy.

The achievements Peter made in science brought him many rewards. He won a Guggenheim Fellowship, a Killam Research Prize, a Science Council Gold Medal, the NSERC Gold Medal for Science and Engineering

and the Canada Council/Killam Memorial Prize. He was a Fellow of the Royal Society of Canada and was awarded the Order of Canada in 2000. The latter is approximately the Canadian equivalent of British Knighthood, but I doubt that any of us would have felt it appropriate to address our friend and colleague formally as "Sir Peter"! He will receive posthumously the Commemorative Medal for the Golden Jubilee of Her Majesty Queen Elizabeth II.

In a moving letter written to his academic offspring a few days before he died, Peter not only re-affirmed his joy in having had such a wonderful career, but also offered us well-considered advice about our science: Don't 'collect stamps' in doing comparative work, don't worship technology for its own sake, and keep the organism and its environmental relationships squarely in focus. If contemporary philosophy can be described as penning 'footnotes to Plato', much of what we do in comparative physiology can be seen as creating 'footnotes to Peter'. His creative impact will be with us for decades. Suffice to say that he figuratively and literally 'wrote the book' of biochemical adaptation.

At the final research conference that Peter was involved in organizing, one sponsored by the Company of Biologists and held at Dunsmuir Lodge in Canada shortly before his death, a final evening of tributes to him ended just as the Aurora Borealis began brilliantly to light up the dark northern sky. What a fitting way for the nature he so loved to study to applaud the "bright ambience" that characterized this wonderful man's life and work. His research accomplishments and his personal example of how to conduct science will continue to serve as a powerful beacon to light the path of future research in our field.

George Somero
October 9, 2002

IN MEMORY OF C. LADD PROSSER

May 12, 1907–February 3, 2002

The DCPB and the field of Comparative Physiology lost one of its founding fathers with the death of Dr. C. Ladd Prosser on February 3, 2002, at the age of 94. His textbook, Comparative Animal Physiology, which appeared first in 1950 and went through three subsequent editions, was the "bible" for many of us who were students in the 1950s–1980s and was instrumental in defining the field. Dr. Prosser's main interests, neurophysiology, contractile cells, and physiology of adaptation, occupied him simultaneously throughout his career and were the topics of exploration for his 45 Ph.D. students and many post-docs.

Ladd Prosser was raised in upstate New York and attended the University of Rochester, from which he received an A.B. in Biology in 1929 and was elected to Phi Beta Kappa. He entered the doctoral program at Johns Hopkins University and spent a summer at Mt. Desert Island with Dr. S.O. Mast working on the effects of temperature, pH, and salts on *Amoeba proteus*, which resulted in his first publication. For his thesis work, he studied phototaxis in *Lumbricus sp.* and development of the brain and behavior in *Eisenia foetida*. He completed his degree in 1932 and the resulting papers were published in 1934.

As a post-doctoral fellow in the lab of Hallowell Davis at Harvard, Ladd took advantage of the

opportunity to record electrical activity from the nervous system of invertebrates with an oscilloscope. He was the first to find that central ganglia lacking sensory input showed spontaneous electrical activity; he also discovered the photoreceptive properties of the sixth abdominal ganglion in crayfish. After a year of neurophysiology research in England, at both Cambridge and Oxford, Ladd took a position at Clark University, where he taught physiology and continued his research. In 1939, he was invited to join the Zoology Department at the University of Illinois, where he remained for the rest of his career, except for a few years of service to the government during World War II. He was named Professor Emeritus in the Department of Physiology and Biophysics in 1975, but retained his research, collaborations, and mentorship of young scientists for another 20 years.

Much of Ladd Prosser's research on marine organisms was carried out at the Marine Biological Laboratory at Woods Hole, MA, where many of his students and colleagues became part of that scientific community. I spent three summers there as a graduate student and had the opportunity to meet many of the major players in physiological research.

Ladd played an important role in expanding the boundaries of physiology beyond the medical area. He served as President of the American Society of Zoologists (the predecessor of SICB), of the Society for General Physiology, and of the American Physiological Society. He was elected to the National Academy of Sciences in 1974 and served as head of their section on Physiology for three years. He was on many editorial boards and served as American editor of the *Journal of Comparative Physiology and Managing editor of Physiological Zoology*. He traveled extensively to Europe, Japan, and Australia and had many colleagues and collaborators abroad. Particularly in his later years, he thought and wrote deeply about the broader questions of adaptational biology, evolution, and the relationship of molecular biology to comparative physiology.

On a personal level, Ladd Prosser was a most supportive mentor, even though my work was unrelated to that of anyone else in the lab. He introduced me to everyone who came through Champaign–Urbana or Woods Hole. He was an excellent role model, who inspired me to treat my own students as well as I had been treated. I was finally able to close the circle by coming to Woods Hole as a faculty member in the Experimental Invertebrate Biology course in 1977. Over the years, I enjoyed keeping up with Ladd's news and meeting the new students at the annual ASZ meetings.

I last saw Ladd in March of 1998, when I visited him and Hazel in their retirement home. Hazel had had a stroke, but I am sure she recognized me. Ladd complained that when he sent "the boys" to the library to get things for him, they never found quite the right items. Although his knees were not in good shape, his head and his sense of humor were the same as ever.

The scientific world has lost a unique and wonderful fount of information and superb teacher. Scientists with Ladd's vision and breadth of interests aren't made any more, and we are all poorer for that.

Linda H. Mantel
October 10, 2002

Reference: C. Ladd Prosser, *Scientific Autobiography and Personal Memoir*, edited and produced by Essie Meisami and Ian Meinertzhagen. Stipes Publishing Co., Champaign, IL. 2001.