March 1, 2018

Comparative and Evolutionary Physiology Executive Committee,

This is a nomination of Roger Seymour for the August Krogh award. I have met Roger at multiple meetings, read many of his papers, and was motivated to make this nomination based on his extensive and important contributions to comparative physiology. Roger has published 226 papers, 15 book chapters, 1 edited book, and 12 popular science articles and web essays. The papers are predominantly published in core animal physiology journals (e.g. AJP, J. Experimental Biology, Physiology, Physiological and Biochemical Zoology, Journal of Insect Physiology, Journal of Comparative Physiology, Comparative Physiology and Biochemistry, Respiration Physiology, but also with many in high-profile general journals or high-ranking journals in other fields (Science, Nature, PNAS, Proceedings of the Royal Society, Biology Letters, Evolution, J Animal Ecology, Plant Cell Environment, J Exp Botany). A general point that I will make is that Roger has made very significant contributions to many aspects of comparative physiology including (but not limited to) gas exchange and cardiovascular physiology of snakes, diving physiology of reptiles, the respiratory physiology of avian and amphibian eggs, the role of gravity in vertebrate cardiovascular systems, cardiovascular physiology of birds and mammals, insect gas exchange, paleophysiology, and thermoregulation in flowers. I will begin by summarizing what I see as some of his most important contributions to our field, and then have included supporting material from my co-nominators, Harvey Lillywhite, Tony Farrell, Phil Matthews and Craig White.

Roger has done foundational work in the scaling of cardiovascular physiology in vertebrates. He demonstrated that blood pressure increased with size in mammals, and has shown how this is driven by overcoming effects of gravity. Also, he has shown that scaling of heart morphology permits ventricular wall stresses to be independent of size. Roger was responsible for disproving an often-cited idea that siphons within the vasculature allow the heart to only work against the resistance of the system, not against gravity. Roger and colleagues demonstrated that collapsible veins in the system above the heart prevent any effective siphons, and that the pressure developed by the heart depends only on the height of the blood column and the resistance of the non-collapsed part of the system.

Dr. Seymour, often in collaboration with Harvey Lillywhite, provided the first documentation of adaptive blood pressure differences in snakes, showing that arboreal snakes have higher blood pressures and greater capacities to regulate blood pressures than aquatic snakes. He also provided evidence that sea snakes utilize cutaneous gas exchange and cardiac shunting to prevent buildup of nitrogen that could cause the bends during diving.

Drying of the egg-shell is critical to the gas exchange function of avian eggs, which increase dramatically in gas conductance during ontogeny. However, mechanisms responsible for this drying and increases in oxygen permeability were unclear before Roger’s 1988 Respiration Physiology paper with Johannes Piiper. They developed an ingenious method to measure the capillary forces in avian shells by measuring the water extruded from the shell under defined pressures. This allowed them to demonstrate that as the water in the shell evaporates, air pores appear, increasing oxygen permeability. However, the water in the shell is partially replaced from the albumen, thus the oxygen permeability of the shell depends on passive balance between capillary forces in the cell (which depend on pore size) and colloid osmotic pressure of the albumen.
Dr. Seymour has also made major contributions to our understanding of the respiratory physiology of vertebrate embryos. He has beautifully demonstrated that larger amphibian embryos can be oxygen-limited due to constraints on oxygen conductance across the capsule, especially at high temperatures. This limits the size of amphibian embryos, though amphibians employ many techniques to overcome these limitations, such as embedding the eggs in foam, spreading the eggs, or incorporating algae into the egg mass. He points out that reptile eggs abandoned the capsule-type egg in favor of a fibrous eggshell that permits the use of air-channels through the shell of oxygen transport, enabling reptiles (and birds) to utilize much larger eggs. This is really a lovely, under-appreciated story in comparative physiology.

Dr. Seymour and his students have also made many contributions to our understanding of the respiratory physiology of insects. A series of papers has examined oxygen transport in locusts, demonstrating close matches between transport capacities and maximal metabolic rates. A recent paper utilized inert gas techniques to demonstrate that convective, not diffusive steps are the major sites of resistance in oxygen delivery to locust flight muscle. Seymour and his students have also done lovely work on the respiratory physiology of aquatic backswimmers. Briefly, they have shown that the air bubble functions both as a buoyancy apparatus and a gas gill. During the dive, the insects consume oxygen from hemoglobin and the bubble, as well as from the water via the gas bubble/gill, with the bubble size being maintained to enable neutral buoyancy. Again, these are brilliant, fascinating insights.

Perhaps the area of Roger’s recent research that may be of the most interest to the EB audience are his projects examining the cardiovascular physiology of extinct animals. His recent Physiology article arguing that depictions of sauropods with upright heads may well be incorrect due to problems with blood delivery to the brain is fascinating and very plausible. He has also examined the scaling of the internal carotid foramina in hominin skulls, and shown that it is likely that blood flow to the brain increased faster than brain volume during hominin evolution, suggesting an increase in metabolic intensity of the brain during evolution of our lineage. Together these studies demonstrate Roger’s willingness to expand the reach of comparative respiratory physiology to major questions in evolutionary biology.

Here I insert the comments from my co-nominators.

Tony Farrell:

It is with immense pleasure that I am able to contribute to the nomination of Dr. Roger Seymour for the 2019 August Krogh Distinguished Lectureship of the APS Comparative and Evolutionary Section. As you will see from his c/v, there is absolutely no doubt that Roger is a distinguished scientist who has made major and meritorious contributions to the scientific areas represented by the APS Comparative and Evolutionary Physiology Section. I hope my brief comments that follow help convince the evaluation committee that Roger should receive this year’s prestigious award - he is very deserving of its most prestigious award.

I know Roger’s intellect and experimental skills well. Besides following Roger’s remarkable contributions to the scientific literature, I have had the great fortune of working at the research bench on several projects (ranging from air breathing fishes to antelopes).
Roger is foremost a comparative physiologist. His high standing in this field reflects a skill that few have - applying basic principles to broad questions of fundamental interest to biologists. Of course the father of this experimental approach was none other than August Krogh. In fact, I suspect that, had they lived in similar eras, Roger and August Krogh could have been marvellous soulmates at the research bench. Both are known to provide simple solutions to complex and interesting biological problems by using sound mathematical and physical principles. Also, both used technical innovations to answer the questions they were studying.

While Roger’s publication record in top flight journals clearly attest to his scientific skills, he stands apart from others because of his creative and thorough approaches to answering research questions. Roger is particularly interested in questions that pertain metabolic rate, respiratory and cardiac physiology and evolution. Here are a few examples.

After studying gas movements across egg membranes, Roger’s lab recently studied the respiration of beetles that use gas bubbles when they dive. Technically these are difficult animals to study, but Roger’s group has propelled the field to a whole new height with an innovative application of optode technology to measure gas tensions in the gas bubble while the beetle is underwater.

Prior to this, Roger made a major contribution to the debate about central arterial blood pressure in long-necked animals. Indeed, he even raised doubts that images in books and models in natural history museums that displayed large, long-necked dinosaurs with their necks near vertical were likely incorrect – he showed that, in such a position, it is unlikely that their heart could not generate adequate blood pressure for blood flow to reach the head.

More recently, Roger has been exploring a rather elegant but simple way to assess metabolic rates - using the diameter of the foramen in bones through which arteries must pass. This vessel diameter can then be related to blood flow rate and hence metabolic rate. His lab has already used this approach with fossilized primate skulls to evaluate the evolution of the cortex of the brain. Now his lab is examining femurs from fossilized dinosaurs to answer questions regarding the evolutionary of endothermy. Besides working on vertebrates and invertebrates, Roger’s studies of thermoregulatory lotus plants are seminal!

So Roger is truly a comparative and evolutionary physiologist who has a considerable range of material to draw from to deliver the 2019 August Krogh Distinguished Lectureship.

I hope you select him. You will not be disappointed.

All the very best,

A. P. Farrell, Ph.D., Dir. Fil. h.c., FRSC, FRCGS
Professor, Canada Research Chair (Tier I)
Phil Matthews:

I am writing in strong support for Prof. Roger S. Seymour’s nomination for the APS Krogh plenary lecture. Roger has made an outstanding contribution to the field of comparative physiology during his 40+ years as a leading researcher, mentor and teacher. He is an amazingly versatile comparative physiologist who has advanced our understanding of the physiology of animals and plants, both living and extinct. His major achievements include his exploration of scaling effects on the cardiovascular systems of animals, the evolutionary and physiological limits to amphibian egg and clutch sizes, as well as discovering the first ‘hot’ flowers capable of precisely regulating their temperature. Roger has made significant contributions to all of these areas, and many others besides, publishing 226 peer-reviewed papers in top journals, including Nature and Science.

I first met Roger in 2002 when I took his undergraduate ‘Ecophysiology of Animals’ course at Adelaide University, and was introduced to the field of comparative physiology. His class was a revelation. It was taught with the same enthusiasm, insightfulness, and wit that Roger brings to his research program, starting with a solid grounding in physical principles. How could any biology student not be hooked? I then had the great fortune to undertake both an honours degree and a PhD in his lab. There, I was exposed to a truly eclectic and exciting array of research topics: from the physics of gas diffusion through air-filled pores, through to considering the effects of animal size on heart function, how to estimate the blood pressure and metabolic rate of a dinosaur, or tease apart the heat generating mechanisms of thermogenic flowers. Roger’s particular interest in organisms from extreme environments has taken him around the world, from African deserts to South American jungles. I was privileged to accompany him on one of these expeditions during my PhD, joining him on a trip to Guyana to study the thermogenic flowers of the giant Victoria water lily. This trip showed me what it means to be an exceptional field biologist: Roger’s ability to assemble and deploy instrumentation in the field, and his resourcefulness in keeping it working and collecting data, was a lesson in itself. Indeed, the next generation of comparative physiologists lucky enough to have had Roger as a mentor have all been inculcated with his inventive approach to research: always go back to first principles, develop your questions by careful observation of the natural world, and keep your experimental setups as simple and robust as possible. He also trains his students to be resourceful when it comes to their experimental work, often cleverly repurposing off-the-shelf items into sensitive physiological apparatus. Adopting this approach has served his former students well, many of whom are now heading their own comparative physiology labs at Universities around the world.

As a comparative physiologist, Roger is at the forefront of his field. He has revealed many new and exciting physiological adaptations, amassed a masterful volume of work in numerous journal articles and book chapters, and has passed his extensive knowledge and approach to research to the next generation of scientists. In my opinion he is highly deserving of the honor of receiving the 2019 August Krogh Distinguished Lectureship of the APS.

Sincerely,

Dr Philip G. D. Matthews
Assistant Professor, Department of Zoology, UBC
Harvey Lillywhite:

Roger Seymour is an exceptionally outstanding comparative physiologist. He is both a personal friend and colleague, and someone I admire for his achievements, insights, mentorship, and modesty. I have known Roger since he was a fellow graduate student with George Bartholomew at UCLA. He and I were two persons who focused our doctoral research on amphibians, taxa which Bart had declined to mentor prior to our coming. Roger was an excellent graduate student, and someone who worked carefully and diligently. After completing his graduate training, Roger pursued his academic career in Australia where he has been based ever since. However, the world has been Roger’s laboratory, and he has traveled frequently to many sites where he has pursued scientific curiosities both in the laboratory and in the field. What I admire most about Roger as a scientist is his insight into important questions, his skill and finesse in the laboratory, and his application of laboratory technology to biological problems and testing of hypotheses. Roger has a keen curiosity, and he has engaged numerous broad areas of investigation with both skill and passion. I will not enumerate the numerous awards granted to Roger, which are no doubt listed elsewhere in the application, but one is impressed by the quality and number of awards and distinctions that Roger has earned including research grants, fellowships, DSc, teaching awards, visiting and editorial appointments. He has mentored graduate students of high quality. Like a handful of renowned physiologists before him, Roger has made significant contributions to science based on a unique ability to combine technical and quantitative skills with both field and laboratory measurements and observations, while applying insights and sensitivity to knowing good questions. The fruits of Roger’s work have had perhaps most impact in the areas of energetics, respiratory gas exchange, cardiovascular adaptations, thermogenesis of flowering plants, and the paleophysiology of dinosaurs. The influence of Roger’s contributions extend broadly to evolutionary biology, gravitational physiology, thermoregulation, embryonic adaptations, and anthropology. The success of Roger’s work is based in his passion and understanding of the environment, including extreme habitats, first principles of physics and physiology, and curiosity and insight regarding organisms. He is simply a superb exemplar of comparative and evolutionary science and someone who positively influences anyone lucky enough to know him. He is an extraordinary gentleman and scholar.

Harvey B. Lillywhite
27 February 2018

Craig White:

It is my very great pleasure to write in support of Professor Roger Seymour’s nomination for the 2019 August Krogh Distinguished Lectureship Award.

It is difficult to imagine a researcher whose body of published work more neatly demonstrates the value of Krogh’s principle that “for such a large number of problems there will be some animal of choice, or a few such animals, on which it can be most conveniently studied.” It is all but impossible to comprehensively summarise his many contributions to the field of organismal physiology in a succinct way, and so I will limit myself to mentioning a few of my personal favourites.

Professor Seymour adopted Krogh’s principle early in his career, with the first years of his published work including studies of spadefoot toads\textsuperscript{1,2}, tarantulas\textsuperscript{3}, snakes\textsuperscript{4,5}, and dinosaurs\textsuperscript{6}. A 1972 study of Philodendron inflorescences\textsuperscript{7}, accompanied by a tale involving a party at George Bartholomew’s
house that I hope he would tell in an honorary award lecture at the EB Meeting, even revealed an interest in plant physiology that continues to this day. Professor Seymour has studied the physiology of diverse animals in interesting places throughout his career, working with golden moles in the Namib desert to determine how endotherms can survive in one of the driest and least productive places on earth, travelling to French Guiana to discover that Philodendron provide direct energy rewards to their beetle pollinators in the form of heat, and examining gas exchange in the physical gills of diving bell spiders in Germany. He has also produced substantial bodies of work examining the cardiovascular physiology of long-necked animals and the exchange of respiratory gasses in the mound nests of megapode birds. Among many recent highlights has been the demonstration that the geometry of bone nutrient foramina can be used to infer blood flow rates in living and extinct species. He has continued to undertake hands-on empirical research throughout his long career, and I find it remarkable that he is the first author of the great majority of these highlights.

In addition to his published body of work, Professor Seymour has, probably more than any other individual, shaped the landscape of animal physiology in Australia as a supervisor and mentor. A significant portion of animal physiologists in academia in Australia count themselves members of the Seymour academic lineage comprising the PhD graduates he has supervised and the postdoctoral researchers he has mentored. These include Professor Mike Thompson (University of Sydney), Dr David Booth (University of Queensland), Professor Fritz Geiser (University of New England), Associate Professor Nicola Mitchell (University of Western Australia), myself (Monash University), and Dr Tim Clark (Deakin University); international members include Dr James Pearson (National Cerebral and Cardiovascular Center, Japan), Dr Philip Matthews (University of British Columbia) and Dr Casey Mueller (California State University San Marcos).

Professor Seymour is a gifted communicator of science. In addition to his career-spanning record of high-impact publications, including papers in Nature and Science, his oral presentations are consistently outstanding. Indeed, his talks are so good that many attendees at the annual meetings of the Australian and New Zealand Society for Comparative Physiology and Biochemistry fear to follow him; I know that I certainly do. If selected as the 2019 recipient of the August Krogh Distinguished Lectureship Award, I have no doubt that his honorary award lecture would be inspirational.

Professor Seymour has made major scientific contributions to the field of animal physiology, has shaped the field of animal physiology in Australia and left an enduring legacy, and I have no hesitation whatsoever in recommending him to you as a worthy recipient of the August Krogh Distinguished Lectureship Award.

Faithfully,

[Signature]

Professor Craig R. White
Literature cited

To conclude, Dr. Roger Seymour has made extensive, important contributions to many aspects of comparative physiology. He is major leader of our field, as evidenced by his mentorship of many outstanding scientists, extensive contributions to major theoretical issues in our field, and impact on related broader controversies in biomedicine and evolution. Dr. Seymour is both highly deserving, and an excellent public speaker who will deliver an outstanding August Krogh Distinguished Lecture.

Thank you for your work on behalf of APS in considering these nominations.

Sincerely,

[Signature]

Professor
CURRICULUM VITAE

NAME: Roger S. Seymour

DATE OF BIRTH: 4 March 1945

PLACE OF BIRTH: Los Angeles, California, U.S.A.

NATIONALITY: American/Australian

MARITAL STATUS: Married to Robin H. Seymour (Australian)
                Two children: Kathryn (37 years)
                Julia (35 years)

EDUCATION:

University of California, Los Angeles. Zoology. 1968-1972 (Ph.D.)
    (Thesis Committee Chairman - G.A. Bartholomew)
California State University, San Diego. Zoology. 1967-1968
University of California, Riverside. Zoology. 1965-1967 (B.A.)
California State University, Northridge. Biology. 1964-1965
University of California, Riverside. Zoology. 1963-1964

PROFESSIONAL APPOINTMENTS:

Emeritus Professor, University of Adelaide, 2014 - present
Professor, University of Adelaide, 2001 - 2014
Associate Professor, University of Adelaide, 1994 - 2001
Senior Lecturer, University of Adelaide, 1981-1994
Lecturer, Department of Zoology, University of Adelaide, 1976-1981
Senior Teaching Fellow (Senior Tutor), Monash University, Victoria, Australia, 1972-1976
Research Assistant, University of California, Los Angeles, 1971-1972
Teaching Assistant, University of California, Los Angeles, 1968-1971
Teaching Assistant, California State University, San Diego, 1967-1968

FELLOWSHIPS AND AWARDS:

Japan Society for the Promotion of Science, visiting fellowship (2012, 2016)
Alexander von Humboldt Foundation Lifetime Research Prize (2006)
Personal Chair, Department of Environmental Biology, University of Adelaide (2001)

Doctor of Science, University of Adelaide, Studies in Comparative Physiology (1999)

Campus Review Independent Teaching Survey: one of eight ‘Most respected teachers’ in biology nationally (1996)

Dean’s Certificate for Excellence in Teaching (1995)

Alexander von Humboldt Foundation Research Fellowship, Max-Planck-Institut für Experimentelle Medizin, Göttingen, West Germany (1985-1986)

American Society of Ichthyologists and Herpetologists Stoye Award for best student paper in herpetology (1971)

NSF grant for improving doctoral dissertation research in the field sciences, GB-28594 (1971-1973)


United States National Science Foundation (NSF) stipend for undergraduate research (1966-1967)

**RESEARCH INTERESTS:**

Quantitative interactions and exchanges between organisms and their environments, with a broadly based comparative and evolutionary approach and often involving the effects of body size.

Respiration, metabolism and energetics of vertebrate embryos.

Cardiovascular and respiratory physiology of animals, particularly vertebrates. Emphasis has been placed on the roles of diffusion and convection of respiratory gases in animals in extreme environments, for example, diving and burrowing species.

Comparative thermoregulation of diverse organisms, including plants and insects.

Physiology and biology of archosaurs.

**CURRENT RESEARCH:**

Structure, function and evolution of the vertebrate cardio-respiratory systems with particular relevance to the evolution of endothermy.

Respiration in flying and diving insects.

Energetics, gas exchange and molecular biology of thermogenic plants and the role of floral temperature regulation in pollination ecology.

Paleophysiology and anthropology: Estimating rates of organ metabolism by the size of supply vessels passing through fossil bones.
COMPETITIVE RESEARCH GRANTS (non-institutional):

Australian Research Council

ARC Large grants (3-year; sole or first investigator):


- Scaling of structure, function and energetics of the vertebrate cardiovascular system, DP120102081 (2012-2015) (co-CIs: S. Maloney, University of Western Australia; A. Farrell, University of British Columbia) $380,000.

- Diversity of pollination biology in heat-producing flowers, DP0771854 (2007-2011) (Partner Investigators: G. Gottsberger, University of Ulm, Germany; I. Lamprecht, Free University of Berlin, Germany; M. Gibernau, Paul Sabatier University, France; K. Ito, Iwate University, Japan) $325,000.


- Matching of gas exchanger structure and function with activity and environment in air-breathing fishes, DP0344717 (2003-2005) (co-CIs: M.B. Bennett, University of Queensland; R.V. Baudinette, University of Adelaide; R.M.G. Wells, University of Auckland) $194,000.


- Respiration in vertebrate embryos: Constraints on amphibian reproductive mode, A19602654 (1996-1998) (co-Cl: J.D. Roberts, University of Western Australia) $163,500.


- Respiration in vertebrate embryos, A18616297 (1986-1988) $81,442.

- Physiology of avian embryos, D1 78/15101 (1979-1984) $124,745.

- Cardiovascular physiology of snakes, D1 76/15345 (1977-1978) $10,325.

**ARC Large grants (3-year; not first investigator)**

Large-volume, multi-use micro-computed tomography, LE180100136 (2018+) Dr Egon Perilli (Flinders University) and ten others $557,000.

The evolution of periodic ventilation in insects, DP0879605 (2008-2010) Dr CR White (UQ); Prof RS Seymour (Adelaide); Mr PG Matthews (Adelaide); Prof KA Christian (Charles Darwin); Dr SI Runciman (Flinders U); Prof TM Blackburn (Birmingham). $400,000.

Digestive physiology of crocodilians: Towards an improved diet and feeding regime for use by the farming industry, LP0882478 (2008-2010) Prof KA Christian (Charles Darwin); Prof RS Seymour (Adelaide); Dr GJ Webb (Wildlife International). $252,000.

**ARC Small grants (1-year; all sole or first investigator):**


The energy cost of burrowing in mammals (2001) $10,000.

Respiration, metabolism and locomotion in an air-breathing fish (2000) $10,000.

Osmotic control of gas exchange in amphibian eggs (1999) $10,000.

Physiological ecology of thermoregulating flowers (1998) $10,000.

**Aquafin Cooperative Research Centre**


**Deutsche Forschungsgemeinschaft**


**National Geographic Society:**


**Conservation Commission of the Northern Territory**

Effects of capture on salt-water crocodiles. $5,000.

**National Heart Foundation of Australia:**

Cardiovascular dynamics in snakes (1980)

Evolution of the renin-angiotensin-aldosterone system, G.1248 (1978)

**The Australian Kidney Foundation:**
Evolution of the renin-angiotensin-aldosterone system, AKF G 28/78 (1978)

Earthwatch field grants:

U.S. National Science Foundation (through Alpha Helix Program):
Gas transport in snakes, DES 74-24129, OFS 74-02888, OFS 74-01830 (1975)
Sea snake diving physiology, GA-35835, GA-34948, GD 34462 (1972-1973)

TEACHING EXPERIENCE:
Coordinator and Lecturer in a general introductory Biology course
Lecturer in introductory Cell Physiology at second year level
Lecturer in Evolution course at third year level
Coordinator and Lecturer in Comparative and Environmental Physiology at third year level
Coordinator and Lecturer in Ecophysiology of Animals at third year level
Coordinator of Honours year Program, 1995-1998; 2003-2011
Supervisor of seventeen PhD., two Masters, and many Honours students
Workshop of plant and animal physiology. Brawijaya University, Malang, Indonesia, International Development Program of Australian Universities and Colleges; 1988
PhD. Examiner: University of Sydney, University of New England, University of Adelaide, Flinders University, University of Queensland and others
HIGHER DEGREE STUDENTS

Caragh B. Heenan. 2013. The structural and thermal properties of avian cup-shaped nests. [currently Visitor Officer, Parks Australia · Uluru-Kata Tjuta National Park]

Edward P. Snelling. 2011. Design of the insect respiratory system: a test case for symmorphosis. [currently South African Claude Leon Foundation Postdoctoral Fellowship at the University of the Witwatersrand, South Africa]

Casey A. Mueller. 2011. Developmental energetics and gas exchange in amphibians and lungfish. [currently Assistant Professor, California State University, San Marcos, USA]

Philip D.G. Matthews. 2008. Convergence in the physics and physiology of gas exchange in plants and animals. [currently Assistant Professor, University of British Columbia]

Quinn Fitzgibbon. 2007. Metabolic physiology of Southern Bluefin Tuna and Mulloway. [currently post-doctoral fellow, University of Tasmania, Australia]

Craig R. White PhD. 2004. Allometric studies in mammalian metabolism. [currently Professor, Monash University, Melbourne, Australia]

Nicola J. Mitchell PhD. 2000. The ecophysiology of terrestrial nesting in Australian ground frogs (Anura Myobatrachinae). [currently Associate Professor, University of Western Australia]

Kerstin Wagner PhD. 2000. Effect of local changes to shell permeability on the gas exchange of the avian embryo. [currently scientific and technical translator, Edinburgh, Scotland]

Emma R. Cronin PhD. 2000. Morphology, respiration and energetics of the eggs of the giant cuttlefish, Sepia apama. [currently ecological consultant]

Kate R. Rodda PhD. 2000. Development in the Port Jackson shark embryo. [currently research scientist, aquatic sciences, South Australian Research and Development Institute, Australia]

James T. Pearson PhD. 1994. A comparative study of the energetics of avian reproduction. [currently Director, Department of Cardiac Physiology National Cerebral and Cardiovascular Center Research Institute, Osaka Japan]

Peter J. Whitehead MSc. 1987. Respiration and energy utilization in the eggs of the Australian Freshwater Crocodile, Crocodylus johnstoni (Krefft 1873). [received PhD at University of Northern Territory; currently Principal Research Fellow at Charles Darwin University and Director Key Centre for Tropical Wildlife Management]

David T. Booth PhD. 1985. Ecological physiology of malleefowl (Leipoa ocellata). [currently Senior Lecturer, University of Queensland, Australia]
Michael B. Thompson PhD. 1983. The physiology and ecology of the eggs of the pleurodiran tortoise *Emycura macquarii* (Gray), 1831. [currently Professor, University of Sydney, Australia]

**EDITORIAL AND PROFESSIONAL WORK:**


Member, Interunion Commission on Comparative Physiology of the International Union of Physiological Sciences (1994-2003)


Editor of symposium volume, "Respiration and metabolism of embryonic vertebrates", I.U.P.S. satellite symposium, Australia 1983, Junk, Dordrecht

Referee for journals: [approximately 30 per year]


Referee of grant proposals: [approximately 10 per year]

Australian Research Council
US National Science Foundation
National Sciences and Engineering Research Council of Canada
United States-Israel Binational Science Foundation
The Israel Science Foundation

**VISITING SCIENTIST:**


Cryobiofrontier Research Center, Iwate University, Morioka, Japan (2004-2017)

Biology Department, University of Crete, Heraklion, Greece (2007, 2008, 2013)

Laboratoire d'Evolution et Diversité Biologique, Université Paul Sabatier, Toulouse, France (2002)

Beaver Island Research Station, Central Michigan University, Mount Pleasant, Michigan (2002)
Department of Medical Biochemistry, Federal University of Rio de Janeiro (2000)
School of Biological and Environmental Sciences, Northern Territory University (1999)
Department of Zoology, University of Western Australia (1999)
Department of Zoology, University of Guelph, Ontario, Canada (1998)
Desert Ecological Research Unit of Namibia. (1992, 1996)
Department of Avian Sciences, University of California at Davis, U.S.A. (1993)
Department of Zoology, University of Zimbabwe, Zimbabwe (1992-1993)
Department of Zoophysiology, University of Aarhus, Denmark (1986)
Department of Veterinary Physiology, State University of Utrecht, The Netherlands (1986)
Department of Physiology, Max-Planck Institute for Experimental Medicine, Göttingen, West Germany (1985-1986)
Department of Biology, University of California at Los Angeles (1979)
Physiological Research Laboratory, Scripps Institution of Oceanography (1979)

EXPEDITIONARY FIELD BIOLOGY:


Brazil (thermogenic magnolia and philodendron flowers) (2009)

Canada, Ontario (thermoregulation of skunk cabbage flowers) (1998)

Caroline Islands, R/V Alpha Helix expedition Arafura Sea and Northern Australia (sea snake physiology) (1972)

Corsica (thermoregulation of Helicodiceros inflorescences) (2002)

French Guiana (thermogenesis of aroids and insects) (2007-2013)


Guyana (pollination biology of Amazon water lily) (2005)


Namibia, Fish River region (heat production of Hydnora) (2008)
Namibia, Gobabeb Research Station (undersand respiration and field energetics of Golden Moles) (1992, 1996)
Philippine Islands, R/V Alpha Helix expedition, Visayan Sea (sea snake physiology) (1975)
South Africa, Oudtshoorn (ostrich embryos) (1987)
South Africa, Dinokeng Reserve (antelope heart physiology) (2015)
United States of America (frog egg gas exchange) (1993)
Zimbabwe, Zambezi River (foam nesting frogs) (1992)

INVITED PRESENTATIONS AT INTERNATIONAL CONFERENCES:

Society for Vertebrate Paleontology; Recent advances in understanding the origins and evolution of tetrapod endothermy; Adam Huttenlocker and Colleen Farmer (Org.); Salt Lake City, USA; 2016; unpublished

The 9th International Congress of Comparative Physiology and Biochemistry; Interspecific scaling of metabolic rate: Time for synthesis?; J. Kozlowski and M. Konarzewski (Orgs.); The evolution of endothermy; B. Lovegrove, R. Nespolo, P Koteja (Orgs); Krakow, Poland; 2015; unpublished

Scandinavian Physiological Society; Plenary Lecture on any topic, plus another on blood pressure and heart position; Bergen, Norway; 2011; unpublished; international travel fully funded

Society for Experimental Biology, Under pressure: Costs and benefits of high systemic blood pressure; Glasgow, UK; 2011; unpublished; local travel funded

International Society for Biological Calorimetry, 15th Conference; Dénes Lorinczy (Org.); Pécs, Hungary, 2008; plenary speaker; unpublished

Workshop on sauropod gigantism; Martin Sander (Org.), Bonn, Germany, unpublished, 2008; international travel fully funded


Size as a Determinant of Biological Processes; E.R. Weibel, H. Hoppeler, R. B. Boutilier (Org.), Ascona, Switzerland, 2004, published

Shaping the Embryo: Dynamics of Early Vertebrate Development; J. van Leeuwen (Org.), Wageningen, The Netherlands, 2003, unpublished, international travel fully funded

Evolution of Airbreathing; T. Wang, J.Graham (Org.), International Congress of Comparative Physiology and Biochemistry, Victoria, Australia, 2003, published

An International Roundtable on Comparative Developmental Physiology; W. Burggren (Org.), Glen Rose, Texas, 2002, published

Paleophysiology; A. Russell (Org.), Calgary, Canada, 1999, international travel offered, but conference cancelled

Aquatic Organisms, Terrestrial Eggs; K. Martin and R. Strathmann (Orgs.), Boston, 1998, published Amer. Zool.; international travel fully funded

Australia and New Zealand Society for Comparative Physiology and Biochemistry, 14th annual meeting; A.J. Hulbert, P.L. Else and W.A. Buttemer (Orgs.), Woolongong; 1997; keynote address

Homeostasis and Environment during Development--A Workshop; S. Warburton and R. Fritsche (Orgs.), Fiskebäckskil, Sweden, 1997; unpublished; international travel mostly funded

International Ecological Congress, Y.L. Werner (Org.), Jerusalem, 1996; plenary speaker, published, ISEEQS; international travel fully funded

Symposium on the Physiological Ecology of Taiwan; Y.C. Kam (Org.), National Changhua University of Education, Taiwan; 1996; plenary speaker (twice); unpublished; international travel fully funded

International Society for Biological Calorimetry, 9th Conference; I. Lamprecht (Org.); Berlin; 1994; plenary speaker; international travel fully funded

Second World Congress of Herpetology; Adelaide; 1993; plenary speaker

Gordon Conference: Gravity Effects on Animal Systems; New Hampshire; 1992; international travel fully funded

First World Congress of Herpetology; Canterbury; 1989; co-convenor of one-day symposium on environmental physiology

Very Early Behavior Development in Animals and Man; K. Immelmann (Org.); Bielefeld, F.R.G.; 1986; international travel fully funded

Society for Experimental Biology; C.R. Bridges (Org.); Nottingham, U.K.; 1986

Thermoregulation and Autonomic Regulation; W. Rautenberg (Org.); Bochum, F.R.G.; 1986; European travel fully funded

Terrestrial vs. Aquatic Life: Contrasts in Design and Function; L. Bolis, P. Dejours (Org.); Crans-sur-Sierre, Switzerland; 1986; published, Liviana Press-Springer Verlag; European travel partly funded

Crocodile Conservation and Management Conference; P. Whitehead (Org.); Darwin, Australia; 1985; published, Surrey Beattie; domestic travel fully funded

Cardiovascular Adaptations in Reptiles; H. Lillywhite and W. Burggren (Orgs.); Denver, U.S.A.; 1984; published, Amer. Zool.; international travel fully funded

Respiration and Metabolism of Embryonic Vertebrates; R. Seymour (Org.); I.U.P.S. satellite symposium; Adelaide, Australia; 1983; published, Dr. W. Junk

Breath-hold Diving and Asphyxia; R. Elsner et al. (Org.); I.U.P.S. satellite symposium; Port Stephens, Australia; 1983
Physiology of the Avian Egg; D. Hoyt (Org.); International Ornithological Congress, Moscow, U.S.S.R.; 1982; published

Gas Exchange, Gas Transport and Acid-Base Regulation in Lower Vertebrates; N. Heisler and J. Piiper (Org.); Göttingen, F.R.G.; 1982; international travel partly funded

The Avian Egg: Structure, Function, and Environment; H. Rahn (Org.); Buffalo, U.S.A.; 1979

Physiology of the Avian Egg; C. Carey (Org.); Tampa, U.S.A.; 1979; published, Amer. Zool.; international travel fully funded

Respiratory Function of Birds, Adult and Embryonic; J. Piiper (Org.); I.U.P.S. satellite symposium; Göttingen, F.R.G.; 1977; published, Springer-Verlag; international travel fully funded

Respiration of Amphibian Vertebrates; G.M. Hughes (Organizer); I.U.P.S. satellite symposium; Bhagalpur, India; 1974; published, Academic Press

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PUBLICATIONS

Ten most significant publications


Seymour, R.S. 1974. How sea snakes may avoid the bends. *Nature (Lond.)* 250: 489-490. [first description of a unique combination of cutaneous gas exchange and cardiac shunting that eliminates nitrogen while obtaining oxygen from the seawater]
Research papers in peer-reviewed journals:


196. Snelling, E.P., **R.S. Seymour**, S. Runciman, P.G.D. Matthews and C.R.White. 2012. Symmorphosis and the insect respiratory system: a comparison between flight and...


200. **Seymour, R.S.** 2013. Maximal aerobic and anaerobic power generation in large crocodiles *versus* mammals: Implications for dinosaur gigantothermy. *PLoS ONE* 8(7): e69361. DOI:10.1371/journal.pone.0069361


**Edited book:**

Chapters in books or symposium volumes:


Articles in popular journals:


Other significant publications


