S1

Adaptations for Salt and Water Balance in Vertebrates

Organizers: **Thomas Pannabecker** (Univ. Arizona, USA)
Yoshio Takei (Univ. Tokyo, Japan)

Maintenance of appropriate salt and water balance is essential for normal function of all organs. Fluid and solute fluxes across renal and non-renal epithelia and endothelia are associated with many active and passive transport pathways across cell membranes and through the paracellular pathway. Regulation of these transport pathways by multiple hormones produces systems with wide flexibility and diversity. This symposium focuses on fluid and solute transport across membranes and epithelia of renal and non-renal systems in vertebrates. Various mechanisms by which transport is achieved are considered for mammals, fish, and birds at organ, cellular, and molecular levels. For water balance, the diverse impact of aquaporins is emphasized. Hormonal systems that regulate transport pathways for fluid and solutes, and thereby influence renal hemodynamics and urine flow, through direct and indirect effects are also considered.

Speakers:

1) **Thomas Pannabecker** (Univ Arizona, USA)
Functional architecture of the urinary concentrating mechanism in desert rodents
2) **Hiroko Nishimura** (Univ. Tennessee, USA)
Avian aquaporin water channels and their regulation
3) **Minoru Uchiyama** (Univ. Toyama, Japan)
Urea and ammonia transporters in the cane toad, *Bufo marinus* and the amphibious blenny, *Andamia tetradactyla*
4) **Christopher Cutler** (Georgia Southern Univ., USA)
Characterization of aquaporin 8 isoform expression in eel (*Anguilla* sp.) intestine
5) **Susumu Hyodo** (Univ. Tokyo, Japan)
Identification and mapping of urea- and ion-transporting molecules in the kidney of cartilaginous fish

S4

Membrane Lipids in the Life of Organisms

Organizers: Paul L Else (University of Wollongong, Australia)
Edouard Kraffe (Univ. Bretagne Occidentale, France)

The image of membrane lipids as balls with two sticks poking out organized in two perfectly opposing rows (the bilayer) with 'protein icebergs' is far away from the dynamic environment that lipids in membranes represent. This image dates back ~40 years when Singer and Nicholson proposed the 'Fluid Mosaic Model of Membranes'. Since then research has progressed rapidly from understanding the lipid structure of membranes and types of lipids that make it, to the properties of lipids and how these influence membrane properties. More recently the focus has been on the functional consequences of the non-random distribution of lipids across the bilayer and structures such as 'rafts', and most recently on how these simple molecules serve as signal compounds. In comparative physiology and biochemistry research has largely been dominated by understanding relationships between membrane lipid composition and organismal adaptation, diet, phylogeny, body size and life history. In this symposium our speakers will tackle a broad range of topics begining with aspects of lipid-protein interactions in adaptive examples that include estivation in African lungfish, salinity changes experienced by salmonid fish and the effects of membrane composition and fluidity on carnitine palmitoyltransferase in a rainbow trout model. Other speakers examine complex lipid structures originating from marine invertebrates and how they can provide information on bivalve predatory feeding habits, phylogeny and their evolutionary history in highly variable environments. Finally, differences in membrane phospholipid species due to changes in mammalian body size and how membrane lipid acyl composition may impact upon the longevity of species are examined.

Speakers:

Paul L Else and **Edouard Kraffe:** Welcome and Brief Introduction

- General overview of some of the roles lipids play in life's processes –

1) James S Ballantyne (Dept. Integrative Biol., Univ. Guelph, Ontario Canada): Decoupling membrane lipid/protein interactions: an adaptive strategy.

2) Grant B McClelland, Chris Le Moine and Andrea Morash (Dept. Biol., McMaster Univ., Canada): Genomic and nongenomic regulation of mitochondrial fat oxidation.

3) Natalie V Zhukova (Inst. Marine Biol., Far East Branch of Russian Acad. Sci., Vladivostok, Russia): Unusual fatty acid composition of marine nudibranch mollusks: Mirror of feeding and bacterial symbiosis.

4) Edouard Kraffe[1], Fabienne Le Grand[1,2], Philippe Soudant[3], Yanic Marty[1] (**[1]**Univ. Bretagne Occidentale, France, [2]GEPEA UMR-CNRS, Univ. Nantes, France, [3]Inst. Univ. Européen de la Mer, France): Cardiolipin and plasmalogens in marine mollusk bivalves – contributions to resistance and adaptation to prevailing environmental conditions.

5) Paul L Else, Jessica Nealon, Todd W Mitchell and Colin Cortie (Metabolic Res. Centre, School of Health Sci., Univ. Wollongong, Australia): Changes in membrane phospholipid composition in mammalian tissues with body mass and a potential secret of cardiolipin

6) Megan A Kelly and **Anthony J Hulbert** (School of Biol. Sci., Univ. Wollongong, Australia): Membrane lipids and longevity: insights from vertebrates and invertebrates.

S5

Control of Breathing in Reptiles

Organizers:

William K. Milsom (Dept. Zool., Univ. British Columbia, Canada)
Tobias Wang, (Dept. Biol. Sci., Univ. Aarhus, Denmark)

There have been several recent advances into various aspects of the control of breathing in reptiles. New insights have been gained into the evolution of aspiration breathing in tetrapod vertebrates. There have been recent advances in our understanding of the structure and function of reptilian lungs and the evolution of the avian respiratory system that would be addressed by Colleen Farmer. There have also been recent advances in our understanding of the relative roles of various chemoreceptor groups in both the control of ventilation as well as the control of central cardiac shunts. These would be addressed by Catalina Reyes and Tobias Wang. There have also been exciting new advances in our understanding of the control of reptilian blood pressure that will be addressed by Nini Skovgaard. We feel that the ICCPB meeting would be both timely and a perfect venue for the synthesis of this new work.

Speakers:

1) **Colleen Farmer** (Dept. Biol., Univ. Utah, USA): The reptilian lung and the evolution of the avian respiratory system.
2) **Wilfried Klein** (Dept. Biol., FFCLRP, Univ. São Paulo, Brazil): Buoyancy control and ventilation in turtles
3) **Bill Milsom** (Dept. Zool., Univ. British Columbia, Canada): Chemoreceptor control of breathing in reptiles
4) **Tobias Wang** (Dept. Biol. Sci., Univ. Aarhus, Denmark): Control of shunting versus control of breathing

S6

New Insights into Structure/Function Relationships in Fish Gills

Organizers:

William K. Milsom (Dept. Zool., Univ. British Columbia, Canada)

Steven F. Perry (Dept. Biology, University of Ottawa, Canada)

There have been several notable advances in studies of the structure and function of fish gills in recent years. We feel that the ICCPB meeting would be both timely and a perfect venue for the synthesis of this new work.

Speakers:

1) Katie Gilmour (Dept. Biology, Univ. Ottawa, Canada):
New insights into nitrogen excretion at the gulf toadfish gill: The role of Rh glycoproteins.

2) Pat Wright, (Dept. Integrative Biology, Univ. Guelph, Canada):
New insights into gill epithelial transport: Linking ammonia excretion and sodium uptake.

3) **Scott Kelly** (Dept. Biology, York Univ., Canada):
New insights into gill osmoregulation: Control of paracellular permeability.

4) Colin Brauner (Dept. Zoology, Univ. British Columbia, Canada):
New insights into the role of the developing gill – gas transfer or ionic regulation?

5) Bill Milsom (Dept. Zoology, Univ. British Columbia, Canada):
New insights into gill chemoreception: Neuroepithelial cells as multi-functional O_2, CO_2 and ammonia sensors.

S7

Acid Base Regulation in Aquatic Animals

Organizer: Greg Goss (Dept. Biol. Sciences, Univ. Alberta, Canada)

Blood and intracellular acid-base regulation in aquatic animals involves the interplay between production and excretion to the water of the relevant acid base equivalents, primarily H^+ and HCO_3^-. This symposium will examine, using comparative models, the distinct and common mechanisms of acid-base regulation in a variety of aquatic species including insects, crustaceans, fishes, amphibians and reptiles.

Speakers:

1) Pung-Pung Hwang (Academia Sinica, Taiwan, Republic of China): Functional regulation of acid secretion in zebrafish during acclimation to acidic environment

2) Yusuke Kumai (Dept. Biology, University of Ottawa, Canada): TBA

3) Agnieszka Dymowska (Dept. Biol. Sciences, Univ. Alberta, Canada**):** A proposed novel mechanism for Na^+ transport in rainbow trout gills

4) Greg Goss (Dept. Biol. Sciences, Univ. Alberta, Canada): Models of anterior gut alkalinisation of the *Aedes aegypti* mosquito midgut: new pH regulatory paradigms

S8

Conflicts & Compromises: Interfaces Between Osmoregulation and Other Physiological Systems in Fish

Organizers: Suzie Currie (Mount Allison University, Canada)
Pat Wright (University of Guelph, Canada)

The theme of this symposium is the tradeoffs that occur between physiological systems in fish when homeostasis is challenged on multiple fronts. We have chosen to focus on the crossover between osmoregulation and other physiological systems because of the relatively high energetic cost of maintaining osmotic balance, the multiple tissue sites involved in fish and the intense international research interest in osmoregulation. Speakers will be challenged to consider whether there is evidence within their own research for conflict or compromise between osmoregulation and other physiological systems (e.g. respiration, acid-base balance, digestion, cellular stress, development).

Speakers:

1) Chris Wood (McMaster University, Canada):
Osmoregulation and digestion

2) Martin Grosell (RSMAS, University of Miami, USA):
Osmoregulation and acid-base balance

3) Patricia Schulte (University of British Columbia, Canada):
The role of alternative isoforms as an evolutionary strategy for mitigating potential conflicts between osmoregulation and other physiological systems

4) Junya Hiroi (St. Marianna University School of Medicine, Japan):
Osmoregulation and the developmental program

5) Suzie Currie (Mount Allison University, Canada):
Conflicts & compromises: TMAO as an osmolyte and chemical chaperone in elasmobranchs experiencing environmental stress

S10

RNA interference:
Comparative Studies of Gene Functions in Invertebrates

Organizer : Klaus H. Hoffmann (Univ. Bayreuth, Germany)

Synopsis: The increasing availability of invertebrate genomes has revealed a large number of genes without functions. RNA interference (RNAi) or posttranslational gene silencing has emerged as a powerful tool for down-regulating gene expression in insects and other invertebrates, such as nematodes, molluscs, crustaceans or spiders. This suppression of gene expression by injection or feeding of double-stranded RNA has become a widely used technique in analyzing gene functions in vivo, especially in non-model organisms. Moreover, the possibility of studying the functions of homologous genes in different taxa may give us a comparative and evolutionary insight into their life processes. Finally, ingested double-stranded RNAs can act as species-specific insecticides in an ecologically friendly pest control.

Speakers:

1) Kenji Tomioka (Okayama University, Japan):
Molecular dissection of an insect circadian clock with RNAi

2) Klaus H. Hoffmann (University of Bayreuth, Germany):
Using RNA interference in analyzing the role of juvenile hormone in insect reproduction

3) Taro Mito (University of Tokushima, Japan): Ancestral development mechanisms in insects revealed by RNAi analysis of cricket genes

4) Wenquing Zhang (Sun Yat-sen University, Guangzhou, China):
RNAi studies in insects in China.

5) Yasuhiko Kato, Hajime Watanabe (Osaka University, Japan):
Development of an RNA interference method in the cladoceran crustacean *Daphnia magna*.

S12

Comparative Aspects of Respiratory Rhythm Generation and Control of Breathing

Organizer : Marc Zelter
(Faculté de Médecine Pierre et Marie Curie, Paris France)

Breathing in vertebrates depends on rhythmic contractions of respiratory muscles. In fish and tadpoles, rhythmic contractions of the mouth floor propel water over the gills. In aerial vertebrates, rhythmic muscular activation drives air into the lungs. All these rhythmic behaviors depend on neural oscillators that, in spite of some differences, share many characteristics. This suggests a possible homology that may justify to study lower vertebrates to gain insight into the mechanisms of respiratory rhythm generation in higher vertebrates. Furthermore, instead of being regular, human breathing exhibits high variability and complexity. The symposium will focus on compararative respiratory rhythm generation in various animal species to try to envision how the complex dynamics of breathing in humans stem from evolution.

Speakers:

1) **Hiroshi Onimaru (**Showa Univ. School of Medicine, Japan): Respiratory rhythm generation and central chemoreceptors in rodents
2) **Christian Straus** (Fac. Médecine Pierre et Marie Curie, France): Non linear dynamics of respiration, from frog to humans
3) **Steven F. Perry** (Inst. Zoology, Univ. Bonn, Germany): Breathing and Thermoregulation in Sauropod Dinosaurs: Size Matters.
4) **Peter Frappell** (Univ. Tasmania, Australia): TBA

S14

Challenges to Respiratory Gas Transport in Vertebrates

Organizer: **Michael Berenbrink (**Liverpool, UK)

Maintaining aerobic scope for activity, *e.g.* locomotion, digestion, growth and reproduction in animals requires an adequate capacity for respiratory gas transport of O_2 and CO_2 between the environment and respiring tissues. This session explores mechanisms by which the respiratory gas transport system of vertebrates from fish to man can respond to the challenges of life in extreme and/or changing environments, such as high altitude, deep sea, hot and cold climates and/or climate warming and ocean acidification. The physico-chemical parameters of these environments may affect aerobic scope of animals twofold. Either by increasing metabolic cost of homeostasis, leaving less energy for other activities, or by affecting the capacity for respiratory gas transport directly, *e.g.* under hypoxia or as proposed in the hypothesis of oxygen and capacity limited thermal tolerance. Invited speakers for this session are internationally recognized experts that cover the breadth of vertebrate responses to respiratory challenges.

Speakers:

1) Steve Perry (Ottawa, Canada): The Respiratory Challenges Imposed by Gill Remodelling in Fish

2) Roy Weber (Aarhus, Denmark): High altitude adaptation in Andean frog hemoglobin

3) Tobias Wang (Aarhus, Denmark): Respiratory challenges in digesting reptiles

4) Kevin Campbell (Winnipeg, Manitoba, Canada): Thermal sensitivity of hemoglobin from the extinct mammoth

5) Jay Storz (Lincoln, Nebraska, USA): High altitude adaptation in deer mice hemoglobin

6) Michael Berenbrink (Liverpool, UK): Evolution of myoglobin molecular surface and whole organism diving capacity in mammals and birds

S16

Evolution of Physiological Traits: Natural and Artificial Selection

Organizer: **Pawel Koteja** (Jagiellonian Univ., Poland)
Marek Konarzewski (Univ. Bialystok, Poland)

Experimental evolution - experiments with artificial selection or laboratory natural selection - provide a straightforward and methodologically strong method of testing hypotheses concerning correlated evolution of complex morpho-physiological adaptations. The experiments can be used to find out how selection on a defined trait, or selection for an ability to cope with a defined environmental challenge, changes other traits of the organisms. The selected lines provide also a superb model to study biochemical and molecular mechanisms underlining adaptations observed at organismal level. The selection experiments, however, do not provide any information on whether the traits of interest are subject to natural selection. Such an information can be obtained only by studying free-living populations under natural conditions. Recently, modern molecular methods allowed also to get insights into selection processes in ancestors of extant species. However, because of tremendous complexity of natural environment and relations among individuals in the free-living populations, a research on natural selection on physiological traits can hardly provide results allowing strong inferences concerning causal factors. This symposium will provide a platform of communication for evolutionary physiologists and ecologists who approached the questions concerning evolution of physiological adaptations related to energy metabolism applying the two research lines.

Speakers:

1) **Monika Wieczorek** (Polish Acad. Sci., Poland): Natural selection on body mass and metabolic rates in root voles, Microtus oeconomus
2) **Edyta Sadowska** (Jagiellonian Univ., Poland): Inter-population variation and natural selection on metabolic traits in the bank vole, *Myodes glareolus*.
3) **Vincent Careau** (Univ. California, USA): Links between activity, exploratory behavior, and energy metabolism: lessons from various types of experimental evolution
4) **Aneta Ksiazek** (Univ. Bialystok, Poland): Physiological and molecular consequences of divergent selection for basal metabolic rate (BMR) in laboratory mice
5) **Sebastian Maciak** (Univ. Bialystok, Poland): Genome and cell size as factors determining metabolic rate scaling.
6) **Pawel Koteja** (Jagiellonian Univ., Poland): Correlated responses to a multidirectional artificial selection in the bank vole, *Myodes glareolus*.

S19

Interplay Among Thermoregulation, Physiological Function, and Behavioral Performance in Amphibians and Reptiles

Organizers: **Denis V. Andrade** (UNESP, Brazil)
José E.Carvalho (UNIFESP, Brazil)

Energy metabolism, cardio-respiratory function, osmotic balance and other basic physiological processes underly the ability of amphibians and reptiles to perform diverse behaviors. Also, since these animal groups are dependent on external heat sources to regulate body temperature, their physiological function and behavioral performance are both highly impacted by environmental temperature. As such, changes in ambient temperature can impose restrictions on the functioning of physiological systems that will affect behavioral performance. On the other hand, the engagement in different activities can impose demands on physiological systems which will require (or cause) thermoregulatory adjustments. In this symposium, we will welcome researchers around the world interested in the mechanisms, evolution and adaptive significance involved in the interplay among body temperature regulation, physiological function, and behavioral performance in amphibians and reptiles.

Speakers:

1) Denis Vieira Andrade (Unesp, Rio Claro, SP, Brazil):

Thermoregulation in a basking frog inhabiting the Espinhaço mountain range in eastern Brazil.

2) Carlos Arturo Navas (USP, São Paulo, SP. Brazil):

Amphibians and reptiles in South American extreme environments.

3) José Eduardo de Carvalho (Unifesp/Diadema, SP, Brazil):
Ecophysiology of anurans from the semiarid “Caatinga” region of northeastern Brazil.

4) Fernando Ribeiro Gomes (Univ. Estadual Paulista, SP, Brazil):
Habitat fragmentation and physiological evolution of anurans.

5) Rafael Parelli Bovo (Unesp, Rio Claro, SP, Brazil):
Thermoregulation of a viperid snake endemic of a small island at the south Atlantic of Brazil.

S20

Organismal Biology's Roles in Physiology, Science and Society in the 21st Century

Organizers:
Enrique Caviedes-Vidal (Univ. Nac San Luis, Argentina)
William H. Karasov (Univ. Wisconsin-Madison, USA)

In recent years we have witnessed in biology a burgeoning increase in the documentation of patterns of physiological variation at large spatial and temporal scales. Analysis of the mechanisms underpinning these variations and their ecological significance has always been pivotal to support these documentations. Recently, molecular work continues a long tradition of reductionism in biological science that has greatly advanced our knowledge about the mechanisms underlying physiological variation at large scales. However, interpreting the functional significance of the vast amounts of the mechanistic processes, and their genomic expressions requires an integrative systems analysis and an evolutionary approach. Such an approach relies on understanding the organ and whole organismal function, as well as an analysis of the perspective that seeks the evolutionary origin of the variation and the conditions that are required to maintain it. Furthermore, organismal perspectives are necessary to link genomic information with ecological processes important to society such as responses of ecological systems to climate change, provisioning of ecosystem services, and conservation and management of biodiversity. Thus, we advocate that the classical reductionism continues to be of importance in this task, especially if the focus includes identifying and understanding in an integrated fashion the network of mechanisms that give rise to the biological process we see at the whole-organism, population, community, and ecosystem level.

This symposium brings together a number of biologists whose work, in total, spans the molecular to the ecosystem. They focus on a wide range of physiological features such as energy and water balance, digestive and kidney function. But all place their work within the integrative contexts that are the overarching theme of the symposium. Thus, this symposium is a special opportunity to highlight the integrative research perspective that has been overshadowed by the ascendency of molecular biology and the reductionist approach.

Speakers:

1) Enrique Caviedes-Vidal (Univ.Nac San Luis, Argentina):
Ontogeny: Digestive mechanisms and ecological consequences.

2) Denise Dearing (Univ. Utah, USA):
Transcending Plant-Herbivore Interactions in the Time of Omes.

3) Todd McWhorther (Univ. Adelaide, Australia): Water balance in nectar-feeding birds: the intestine as an osmoregulatory organ.

4) William H. Karasov (Univ. Wisconsin-Madison, USA):
Intestinal absorption: a view from molecules to ecosystem.

5) Francisco Bozinovic (Pontificia Univ. Católica, Chile):
Environmental thermal mean and variance interact to determine physiological tolerance and fitness. Implications for climate change.

S21

Circadian Clocks and Their Physiological Roles in Insects

Organizers: **Kenji Tomioka** (Okayama Univ., Japan)
Elzbieta Pyza (Jagiellonian Univ., Poland)

Circadian rhythms are commonly observed in many physiological functions including vision, olfaction, learning and memory, and locomotor activity. The rhythms are regulated by an endogenous timing mechanism called a circadian clock. The circadian clock exerts its influences not only to daily but also to seasonally timed events. Recent studies revealed that the clock is based on the molecular oscillatory network consisting of so-called clock and clock-related genes and their product proteins. Recent progress in molecular studies makes it possible to understand clock-controlled systems at molecular and cellular levels. In this symposium, the circadian timing system and its influences on various physiological functions in insect models will be discussed at molecular and cellular levels.

Speakers:

1) **Elzbieta Pyza** (Jagiellonian Univ., Poland): Circadian regulation of neuronal and glial cell activity and plasticity in the fly's visual system.
2) **Terry L. Page** (Vanderbilt Univ., USA): Circadian regulation of olfactory learning and memory.
3) **Norio Ishida** (AIST, Japan): Molecular approach to understand circadian mating behavior of *Drosophila*.
4) **Kenji Tomioka** (Okayama Univ., Japan): The circadian clock regulates physiological functions through a neuropeptide PDF in the cricket *Gryllus bimaculatus*..
5) **Sakiko Shiga** (Osaka City Univ., Japan): Circadian clock neurons presumably involved in photoperiodism in the blowfly *Protophormia terraenovae*.

S22

Regulatory Mechanisms of Biological Rhythm and Photoperiodism

Organizers: **Yoshitaka Fukada** (Univ. Tokyo, Japan)
Satchidananda Panda (Salk Institute, USA)

Light is a very important ambient signal for animals, as it affords information for regulation of a variety of physiological functions, such as vision, circadian rhythms, photoperiodism, hormone regulation, pupil contraction, body color change, etc.. These responses are considered as being the outputs from the animals that utilize light information as a spatial cue or a temporal one. The latter aspect of light signaling is one of the particular issues that we would focus in this symposium. In circadian clock systems, the pace and phase of the central oscillator are regulated by ambient light, while an array of slave clocks present in a variety of peripheral tissues are regulated by non-photic signals. These clock systems converge on a significant daily variation of behavior and physiology. The regulatory mechanism of the connection among the central and peripheral clocks is another issue that is discussed in this session. The temporal information is further combined with signals from light onset and offset within the day, providing the basis for photoperiodism underlying seasonal regulation of animal physiology. Many other light-responses are also of particular importance. Recent studies in this decade have identified molecules and the mechanisms responsible for these chronobiological events and their photic and non-photic regulation.

Speakers:

1) **Kyungjin Kim** (Seoul National Univ., Korea): Genetic and molecular approaches to the circadian clock system in mice.
2) **Yoshitaka Fukada** (Univ. Tokyo, Japan): Light-dependent regulation of the chick pineal gene expression and functions.
3) **Satchidananda Panda** (Salk Institute, USA): Light reception in rodent retinal ganglion cells and its role in the clockwork.
4) **Takashi Yoshimura** (Nagoya Univ., Japan): How birds and mammals recognize the seasonal change of the daylength?
5) **Hideharu Numata** (Kyoto Univ., Japan): Circannual rhythm in a beetle, and its relationship to the circadian clock.

S23

Evolutionary Biochemistry and Physiology of Photoreception in Animals

Organizers: **Kentaro Arikawa** (Sokendai-Hayama, Japan)
Akihisa Terakita (Osaka City Univ., Japan)

Structure and function of photoreceptors are diverse due to the animals' behavioral characteristics, and have been extensively studied from the molecular to the systems level. Diversity of photoreceptors has highlighted their evolutionary history. Recent development of this field has greatly indebted to the detailed analyses of opsin-based photopigments. These studies have revealed that invertebrate and vertebrate visual photoreception evolved independently, and have also indicated clear evolutional linkage between the invertebrate visual and vertebrate non-visual photoreceptions. To elucidate how photoreception has evolved, analysis of photoreceptor proteins is indispensable, but proteins are not the only factor: some insects have photoreceptors of different spectral sensitivities using the same photopigment molecule. . In this symposium, evolution and diversity of photoreceptors will be discussed with recent findings on opsin-based pigments as well as other factors.

Speakers:

1) **Eric Warrant** (Lund Univ., Sweden): Signal, noise and informatio n in the photoreceptors of a nocturnal bee
2) **Michiyo Kinoshita** (Sokendai-Hayama, Japan): Relationship betw een retinal organization and visual functions in *Papilio* butterflies
3) **Takashi Nagata** (Osaka City Univ., Japan): Molecular basis of vision in a jumpping spider.
4) **Mitsumasa Koyanagi** (Osaka City Univ., Japan): Evolution of opsin-based pigments and photoreceptor cells
5) **Daisuke Kojima** (Univ. Tokyo, Japan): Non-visual photoreception in vertebrates.

S24

Comparative Physiology and Biochemistry of Animal Reproductive Behavior

Organizers: **Ishwar Parhar** (Monash Univ., Malaysia)
Hironori Ando (Kyushu Univ., Japan)

Most animals exhibit mysterious and unique reproductive behavior that is fundamental for production of offspring. The occurrence of reproductive behavior in animals is controlled by both inner specific physiological conditions and outer environmental signals in conjunctions with social cues. Various neuronal and humoral integrative systems play important roles in making animal reproduction successful. Recent rapid developments of biochemical, molecular, and genetic techniques have accumulated data on the molecular mechanism of reproductive behavior, such as neuronal changes in sensory nervous systems, neuroendocrine regulation by neuropeptide and neurosteroid hormones, communication of individuals by pheromones, and the interaction of animals with environmental signals. In this symposium, we focus on the animal reproductive behavior from physiological as well as biochemical points of views with special reference to evolutionally aspects from invertebrates to vertebrates. These unique reproductive behaviors of various animal species will have great contribution to open new interdisciplinary research fields in comparative physiology and biochemistry. *This symposium is supported by the Japan Society for Comparative Endocrinology (JSCE)*.

Speakers:

1) **Michiyasu Yoshikuni** (Kyushu Univ., Japan): Spawning behaviors induced by neurosecretory hormones in echinoderms
2) **Fumiyo Toyoda** (Nara Medical Univ., Japan): Involvement of multiple hormones in the newt reproductive behavior
3) **Hironori Ando** (Niigata Univ., Japan): Molecular basis of neuroendocrine control of spawning migration in grass puffer
4) **Tomoko Soga** (Monash Univ., Malaysia): Role of RF-related peptide in male reproductive behavior in mice

S25

Discovery of New Hormones and Functions: From Comparative to General

Organizers: Kazuyoshi Tsutsui (Waseda Univ., Japan)
Hubert Vaudry (Univ. Rouen, France)

Comparative studies are generally recognized to be performed by researchers who love a specific group of animals. However, these studies have a potential to contribute more generally to other animals groups or throughout animal kingdom as all extant animals are related with each other via a history of evolution that is imprinted in their genome. Therefore, this symposium provides an excellent opportunity to introduce how much comparative studies can satisfy the interest of wide range of researchers even that of clinical researchers. We select six researchers who are world leaders in comparative endocrinology and identified new hormones in various vertebrate species or new functions of known hormones by way of comparative studies using physiological, biochemical and genomic techniques. We believe that this symposium will add value to the ICCPB2011 by introducing the importance of comparative studies from an endocrinological discipline and attract attention of many researchers in the field of comparative physiology and biochemistry. *This symposium is supported by the Japan Society for Comparative Endocrinology (JSCE).*

Speakers:

1) **Hubert Vaudry** (Univ. Rouen, France): Identification and functional characterization of novel neuropeptides: from frogs to humans
2) **Kazuyoshi Tsutsui** (Waseda Univ., Japan): Discovery and evolutionary history of gonadotropin-inhibitory hormone (GnIH), a new key neuropeptide controlling reproduction
3) **Jae Young Seong** (Korea Univ., Korea): Molecular co-evolution of kisspeptins and GPR54s
4) **Billy Chow** (Univ. Hong Kong, China): Analysis of VPAC and secretin receptors in vertebrates: its implications on molecular and functional evolution of the secretin receptor family
5) **Yoshio Takei** (Univ. Tokyo, Japan): Reverse phylogenetic approach to discovery of novel adrenomedullins in mammals
6) **Honoo Satake** (Suntory Inst. for Bioorganic Res., Japan): Homologous and unique structures and functions of ascidian peptidic signaling molecules

S26

Analysis and Synthesis in Invertebrate Neuroscience: From Genes, Neural Networks, and Behavior to Robots

Organizers:
Ryohei Kanzaki (Res. Center Adv. Sci. Tech., Univ. Tokyo, Japan)
Mark A. Willis (Dept. Biol., Case Western Reserve Univ., USA)

For many decades, neuroethology has provided insights into how nervous systems organize and generate behavior. Important contributions from work in invertebrate preparations, particularly insects, have been made to brain research in the past, expanding our general understanding of sensory and motor systems. Insects are uniquely suited for multidisciplinary studies in brain research involving a combined approach at various levels, from molecules over single neurons to neural networks, behavior, modeling, and robotics, owing to their seamless accessibility to a wide variety of methodological approaches. In this symposium, we focus on the numerous interdisciplinary contributions of insect models to our recent understanding of sensory and motor control by central nervous systems. Interdisciplinary approaches combining biology, informatics, theory, and engineering will be important for expanding our understanding of nervous systems.

Speakers:
1) **Mark A Willis** (Case Western Reserve Univ., USA): Environment, locomotion and sensor structure interact to structure odor-tracking
2) **Takeshi Sakurai** (Univ. Tokyo, Japan): A single sex pheromone receptor determines chemical response specificity of sexual behavior in the silkmoth *Bombyx mori*
3) **Hidetoshi Ikeno** (Univ. Hyogo, Japan): Neuroinformatics in invertebrate: neuromodeling of insect sensory motor system
4) **Zenon Mathews** (Univ. Pompeu Fabra, Spain): The usage of forward models in dynamic landmark navigation: from insects to robotic mapless autonomous navigators
5) **Hirotaka Sato** (Univ. California at Berkeley, USA): Remote radio control of insect flight
6) **Ryohei Kanzaki** (Univ. Tokyo, Japan): Insect-robot hybrid system for understanding the neural basis of adaptive behavior

S27

Integrative Approach in Behavioral Neurobiology.

Organizers:
Hiroto Ogawa (Dept. Biol. Sci., Fac. Sci. Hokkaido Univ.)
Hideaki Takeuchi (Dept Biol. Sci., Grad. Schl. Sci., Univ. Tokyo)

The brain is a very complex system with anatomically and functionally hierarchical structure, which consists of gene, signaling molecule, synapses, neuron, and network. To understand the brain function underlying individual behaviors, therefore, an integrative approach combining molecular biology, functional anatomy, electrophysiology, optical imaging and computational analysis is required. In this symposium, we will introduce a recent advance in various types of methods for monitoring the neural activity and for analyzing neuronal dynamics of the nervous system involved in variety of behaviors. Further we would like to introduce recent studies on neural system using various species of animals, which provide suitable materials for studies of different levels of behaviors in the neuroscience field.

Speakers:

1) **Kotaro Kimura** (Dept. Biol. Sci., Grad. Schl. Sci., Osaka Univ) : An integrative and quantitative analysis of dopamine-dependent odor avoidance behavior of the nematode *C. elegans*
2) **Fabrizio Gabbiani** (Dept. Neurosci., Baylor College of Medicine) : Collision Detection as a Model for Sensory-Motor Integration
3) **Hiroto Ogawa** (Dept. Biol. Sci., Fac. Sci. Hokkaido Univ.) : Directional-dependent plasticity in neural and behavioral responses to air currents in the cricket
4) **Hideaki Takeuchi** (Dept Biol. Sci., Grad. Schl. Sci., Univ. Tokyo) : Neural basis underlying female mating preference in medaka fish
5) **Masanori Murayama** (Brain Sci. Inst., RIKEN) : Fiberoptic Ca2+ imaging of dendrites in freely moving rats

S28

Comparative Physiology and Biochemistry of Lipophilic-Ligand Carriers

Organizers:

Koichi Ozaki (Fac. of Life and Environ. Sci., Shimane Univ., Japan)

Mamiko Ozaki (Grad. Schl. of Sci., Kobe Univ., Japan)

Lipid is an important component of biomembranes as well as major substance for metabolic energy store. Lipophilic vitamins and hormones are also indispensable for various physiological regulations. Because lipid and lipophilic substances are insoluble in aquatic environment such as body fluid and cytoplasm, water-soluble proteins that carry lipophilic molecules are essential for their transport and physiological actions, and thus have been attracting considerable attention of researchers in the wide field of physiology and biochemistory. For example, several kinds of lipophilic substance-binding proteins have been found to function in the chemosensory reception both in the vertebrate and invertebrate animals. In vision, vitamin A-binding proteins are essential for the synthesis of visual pigments, and dysfunction of these proteins causes blindness in various animals. For the lipid transport in blood and hemolymph, particular lipoproteins have been identified in vertebrate and insects, respectively, each having unique characteristics. Like these, a lot of studies on the lipophilic substance-binding proteins have been conducted extensively, and elucidated a wide variety of physiological functions of these proteins. However, recent increase of knowledge in this field is extremely rapid, which therefore requires comprehensive and comparative discussion for further development of the research in this field. The aim of this symposium is to compare knowledge obtained from various kinds of lipophilic substance-binding proteins found in a variety of animals, and to integrate them comprehensively in order to find new lines of study that show promise in future development.

Speakers:

1) **Koichi Ozaki** (Shimane Univ., Japan): Retinoid-binding proteins involved in the insect photoreception.
2) **Ken Sawada[1], Tadashi Nakamura[2], Tatsuo Iwasa[1]** ([1]Muroran Inst. Tech., [2]Univ. Electro-Commun., Japan): Lipocalin family proteins found in the olfactory epithelium of Japanese common newt.
3) **Takashi Matsuo** (Tokyo Metropolitan Univ., Japan): Evolution of two odorant-binding protein genes, Obp57d and Obp57e, in Drosophila
4) **Jean-Francois Picimbon** (Shandong Acad. Agricult. Sci., China): Comparative biochemistry and physiology of moth OBPs and CSPs
5) **Takahiro Shiotsuki, Rintaro Suzuki, Zui Fujimoto, Mitsuru Momma, Wataru Tsuchiya, Akira Tase, Mitsuhiro Miyazawa, Toshimasa Yamazaki** (National Inst. of Agrobiol. Sci., Japan): Structural analysis of hemolymph juvenile hormone-binding protein of silkworm, Bombyx mori.

S29

Front Edge of Neuroethology and Comparative Physiology in Asia

Organizers:
Etsuro Ito (Kagawa Sch. of Pharmaceutical Sci., Tokushima Bunri Univ., Japan)
How-Jing Lee (Entomology Dept., National Taiwan Univ., Taiwan)

Recent development in Asian countries has allowed a rapid increase in both the number and the sophistication of studies by neuroethologists and comparative physiologists in this region. However, development of scientific exchanges has been slow or even hindered by the lack of an Asian 'hub': Asian scientists often get to know each other and communicate via indirect and coincidental links to laboratories in the U.S. or Europe. The goal of this symposium is to encourage these people to meet, get to know each other and build up direct collaborative networks. Selected talks by distinguished scientists will highlight how we can best collaborate to stimulate further development of neuroethology and comparative physiology in Asia.

Speakers:
1) **How-Jing Lee** (National Taiwan Univ., Taiwan): Regulation of circadian locomotion of the German cockroach
2) **Long Zhang** (China Agricultural Univ., China): Cellular and molecular mechanisms on olfaction of locust (Insecta, Orthoptera: *Locusta migratoria*)
3) **Ryota Matsuo** (Tokushima Bunri Univ., Japan): DNA endoreplication in the brain neurons during body growth of an adult slug
4) **Ishwar S. Parhar** (Monash Univ. Sunway Campus, Malaysia): Comparative neuroendocrine mechanisms in the control of reproduction
5) **Yuichi Takeuchi** (Nagoya Univ., Japan): Lateral difference in hunting behavior in the scale-eating cichlid fish, *Perissodus microlepis* in Lake Tanganyika

S30

Neurobiology of Cognition and Emotion in Fishes

Organizers: **Fernando Rodríguez** (Univ. Sevilla, Spain)
Masayuki Yoshida (Hiroshima Univ., Japan)

Fishes have adaptively radiated to various aquatic environments while conserving the basic physiological and behavioral features seen in a wide range of vertebrate species. Recently, notable progress has been made in studies in relation to brain mechanisms that play roles in cognitive and emotional behaviors such as spatial learning, fear conditioning, aggression and appetitive behavior. Quantitative observations of selected behaviors in conjunction with modern neurobiological techniques have enabled comparative analysis of physiological, morphological and developmental basis of higher-order brain functions in fishes. Selection and assessment of behavioral repertoires in fishes which can be directly or indirectly compared with other vertebrates are also important for revealing brain mechanisms conserved through vertebrate evolution. This session aims to explore biological basis of cognition and emotion and the underlying neural mechanisms in vertebrates by focusing on fish behavior and brain function.

Speakers:

1) **Fernando Rodríguez** (Univ. Sevilla, Spain): Neuropsychology of fish behavior and cognition
2) **Kouhei Matsuda** (Univ. Toyama, Japan): Behavioral effect of octadecaneuropeptide and neuropeptide Y related to feeding regulation in goldfish
3) **Yoshitaka Sakakura** (Nagasaki Univ., Japan): Aggressive behavior and TTX in puffer fish
4) **Robert T. Gerlai** (Univ. Toronto, Canada): Quantitavie characterization of zebrafish behavior: Learning performance and fear responses
5) **Hitoshi Okamoto** (RIKEN, Japan): Habenula as the multimodal switching board for controlling behaviors

S31

The Advances in Functional Genomics and its Relevance in Studies of Animal Adaptation: Emphasis in Tropical Species In Honnor to Peter W. Hochachka

Organizers: Vera Maria F. Almeida-Val (INPA-LEEM, Brazil)
Adalberto Luis Val (INPA-LEEM, Brazil)

Adaptations of organisms to long- and short-term environmental changes are one of the basic concepts of evolution. These adaptations involve genetic changes that result in either metabolic/physiological adjustment to short-term changes or in changes at population and species levels. During the evolution, individuals must cope with short- and long-term variations of the same physical parameters, i.e., temperature, pressure, and oxygen. In most cases, functional responses involve adjustments in metabolic processes which depend on the genetic make-up and may, in addition, result in anatomical and morphological variation. Evolutionary changes rely on genetic mutation and selection in the broad sense, but a quantitative assessment of genetic variation alone fails to consider the phenotype range of variation of any given genotype. Thus, these two adaptation processes are interdependent: metabolic adaptation and long-term genetic changes will alter different spectra – the spectrum of selection is altered by physiological changes, and the spectrum of physiological and metabolic patterns will be altered by genetic mutation over evolutionary time. Currently, the interplay between metabolic and genetic adaptation may be the reflection of gene regulation processes: regulatory loci directly respond to specific environmental stimuli by triggering a specific series of "changes" and, in consequence, induce metabolic adjustments during transcriptional phase. Subsequently, other changes in metabolism, which may be post-transcriptional, may take place to induce the fine adjustments that allow for a perfect interaction between organisms and environment. In fact, the discovery of regulation of many genes reconciles the apparent paradox between "unity versus diversity" suggested by Peter W. Hochachka in 1988, in which the relative constancy of chemical structure opposes with genotypic and phenotypic diversity within and between species. The present symposium will bring an up to date view of the importance of gene regulation in the adaptation of living organisms to their environment.

Speakers:

1) **Adalberto Luis Val, Sergio Ricardo Nozawa, Vera Maria Fonseca de Almeida-Val** (National Inst. for Res. of the Amazon, Amazonas, Brazil): Transcriptomic studies in aquatic organisms of the Amazon: current status
2) **J. Eduardo P. W. Bicudo** (Dept. Physiol., Biosci. Inst., Univ. Sao Paulo, Brazil): Physiological acclimatization and phenotypic plasticity in indigenous populations of the Upper Rionegro, Amazon, Brazil
3) **Renata Guimaraes Moreira** (Dept. Physiol., Biosci. Inst., Univ. Sao Paulo, Brazil): Anthropogenic impacts on fish reproduction: from hormones to genes
4) **David Randall, Carrie Hung** (Dept. Biol. Chem., City Univ. of Hong Kong): Changes in gene expression during hypoxia and starnation in fish
5) **Vera Maria Fonseca de Almeida-Val, Nayara Castro, Daniel Raid, Adalberto Luis Val** (National Inst. for Res. of the Amazon, Amazonas, Brazil): Amazon fish LDH as model for studies of temperature adaptations

S32

Comparative Mechanobiology from Monad to Human

Organizers: **Keiji Naruse** (Okayama Univ., Japan)
Borris Martinac (Victor Chang Cardiac Research Institute, Australia)
Hitoshi Tatsumi (Nagoya Univ., Japan)

Mechanotransduction plays critical roles in the life of every organism from monad to human being. Not only specialized mechanosensors such as the inner ear and tactile sensors, but also nonsensory cells are capable of mechanosensing. Recently, remarkable progress has been made in the study on the mechano-electrical coupling in rodent cardiac cells, stretch-induced responses of human endothelial cells, gravity sensing in plant cells, and the ear in insects. Furthermore, molecular biological and biophysical studies of mechanosensory molecules such as mechanosensitive ion channels are establishing a firm basis of mechanobiology.

The objectives of this symposium are to share recent outstanding results in this field and to stimulate colleagues with potential interests to the field of mechanobiology. We believe this timely symposium will attract much attention of a wide variety of comparative biologists.

Speakers:

1) Borris Martinac (Victor Chang Cardiac Research Institute, Australia)
Membrane bilayer-mediated clustering and functional interaction of MscL, the mechanosensitive channels of large conductance from E. coli

2) Hitoshi Tatsumi (Nagoya Univ., Japan)
Cellular and molecular mechanisms involved in sensing mechanical stimuli

3) Azusa Kamikouchi (Tokyo Univ. Pharmacy and Life Sciences, Japan)
The gravity- and sound-sensing systems in the fruit fly

4) Chao-Min Cheng (Harvard Univ., USA)
Probing sensory nerve mechanotransduction via localized elastomeric matrix perturbation

5) Gentaro Iribe (Okayama Univ., Japan)
Role of SAKCa channels in stretch-induced extrasystoles

S33

Understanding Higher-Order Processing of Sensory Information Using Insects as a Model

Organizers: **Kei Ito** (IMCB, University of Tokyo, Japan)
Nicholas J. Strausfeld (Univ. Arizona, USA)

The brain of the animal should process sensory information to determine adequate behavioral responses to the rapidly changing environment. Little is understood, however, about how sensory signals sent to the primary sensory centers are transmitted to higher-order centers and used for the decision making of behavior. Because of the relatively simple and easily accessible neural architecture, and thanks to the technical advances to identify, monitor and regulate the functions of neural components, the insect brain serves as a good model system to address this question. Even in insect neurobiology, however, studies tend to concentrate on the lower-level steps of sensory processing. This session discusses recent advances in the researches on the neural networks and their functions for higher-order processing steps of sensory information. The neural architecture of the brain regions that are supposed to be responsible for sensory integration and decision-making will be discussed from comparative and developmental viewpoints. Cutting-edge behavioral analyses by modulating, blocking, or activating specific subsets of neurons in these neural circuits using genetic and biochemical techniques will be presented. This multi-disciplinary symposium will give the audience an overview of the ongoing research about this important brain function to promote comparative physiological research in this field.

Speakers:

1) **Kei Ito** (Univ. Tokyo, Japan): Mechanisms of sound and gravity sensation of the Drosophila brain
2) **Masayuki Koganezawa** (Tohoku Univ., Japan): The neural circuitry contributing to male courtship behavior of Drosophila
3) **Li Liu** (Chinese Acad. Sci., China): Role of the central complex in the visual learning of flies.
4) **Zhefeng Gong** (Chinese Acad. Sci., China): Two pairs of neurons control Drosophila larval light preference
5) **Yoichi Seki** (Max Planck Inst. for Chem. Ecology, Jena): Neural circuits underlying olfactory coding in the Drosophila antennal lobe
6) **Nicholas J. Strausfeld** (Univ. Arizona, USA): Evolutionary and comparative analysis of the insect neural circuits responsible for sensory information processing.

S34

Origin and Evolution of the Nervous System

Organizer: Osamu Koizumi (Fukuoka Women's Univ., Japan)
Kiyokazu Agata (Kyoto Univ., Japan)

Nervous system of animals is full of diversity. Insects have micro brains; cephalopods such as squid and octopus have vertebrate-like large brain. These nervous system of Protostome has main components in the ventral side (ventral cord), and called as gastroneuralia. In contrast, the nervous system of vertebrates has the main components in the dorsal side (dorsal code), and called as notoneuralia. Cnidarians have the diffuse nerve net. Echinoderm has a characteristic radial nervous system.

Considering the history of the nervous system after first nervous system appeared in the earth, three epoch-making milestones are expected. The first is the advent of nerve cells, and the second is the advent of the brain, the third is the emergence of the neural tube. Emergence of the neural tube in amphioxus (cephalochordate) led to the prosperity of vertebrates.

In this session of the symposia, we will discuss the origin and evolution of the various nervous systems. Philosophy and many experimental techniques of comparative neurobiology, molecular phylogeny, and evolutional developmental biology make it possible.

Speakers:

1) Osamu Koizumi (Fukuoka Women's University, Japan):
Origin and evolution of the nervous system viewed from the diffuse nervous system: Nerve ring of cnidarians

2) Kiyokazu Agata (Kyoto University, Japan):
How did the central nervous system evolve?

3) Shuichi Shigeno (Japan Agency for Marine-Earth Science and Technology, Japan): Design principles of convergent brain evolution: A case of the most specialized marine invertebrates

4) Yasunori Murakami (Ehime University, Japan):
Origin and evolution of vertebrate brain

5) Takehiro Kusakabe (Konan University, Japan): The tunicate nervous system: insights into the origin of vertebrate-specific traits

S35

Evolution and Diversity of Innate and Adaptive Immune Systems

Organizers: **Teruyuki Nakanishi** (Nihon Universiry, Japan)
Miki Nakao (Kyushu University, Japan)

Immune system of aminals is classified into innate immunity and adaptive immunity. Innate immunity has an ancient origin and conserved throughout the evolution, whereas the adaptive immunity involving immunoglobulin-type antigen receptors seems a unique property of jawed vertebrates. Recent progress of researches in comparative immunology at the molecular and cellular levels have revealed conserved and diversified aspects of immune system in a wide range of animals. This symposium will deal with various forms of immunity in both invertebrates and vertebrates and discuss functional implication of the specification of immune system.

Speakers:

1) **Shoichiro Kurata** (Tohoku Univ., Japan): A receptor guanylyl cyclase mediates humoral and cellular responses in *Drosophila* immunity
2) **Masanori Kasahara** (Hokkaido Univ., Japan): Structure and Function of Variable Lymphocyte Receptors: An Update
3) **Miki Nakao** (Kyushu Univ., Japan): Structural and functional diversity of the complement system, an innate immune factor, in fish
4) **Teruyuki Nakanishi** (Nihon Univ., Japan): Diversified isotypes of immune-related genes in teleost

Y1 Young Researchers' Workshop

Comparative Neurobiology of Arthropod Behavior

Organizers: **Noriyasu Ando** (Univ. Tokyo, Japan)
Hidehiro Watanabe (Fukuoka Univ., Japan)
S. Shuichi Haupt (Univ. Tokyo, Japan)

To a large extent, animal behavior results from hierarchical operations in the nervous system. Sensory systems receive information from the environment and convey it to higher center of the central nervous system, where multimodal integration and information processing influenced by learning and memory occur. Finally, motor commands and the subsequent motor patterns are generated in the motor systems. To reveal how nervous systems fulfill these three basic tasks is a major goal of scientists interested in the mechanisms of animal behavior. To tackle this problem, researchers have focused on model species that exhibit particularly conspicuous behaviors, and have analyzed the neural basis of these behaviors at the level of single neurons and neural networks in the chain of sensory, integrative, and command neurons. For this workshop, we have invited six young scientists studying the neural basis of arthropod behavior at the level of the sensory nervous system, the central nervous system, and the behavioral output system using model species especially suited to their research hypotheses to provide an overview over the state of the art in neuroethology.

Speakers:

1) **Hidehiro Watanabe** (Fukuoka Univ., Japan): Neural basis of general odor processing in the cockroach antennal lobe
2) **Sonja Bisch-Knaden** (Max Planck Inst. Chem. Ecology, Germany): Evolution of olfactory coding in moths: different resolutions for different needs?
3) **S. Shuichi Haupt** (Univ. Tokyo, Japan): Sugar perception and plasticity in antennal system of the honey bee
4) **Jean-Christophe Sandoz** (Laboratory for Evolution Genome Speciation, CNRS, Gif-sur-Yvette, France): Neural plasticity related to olfactory long-term memory in the honeybee
5) **Katsushi Kagaya** (Hokkaido Univ., Japan): Sequential synaptic activation in the brain for voluntary initiation of walking in the crayfish, *Procambarus clarkii*
6) **Noriyasu Ando** (Univ. Tokyo, Japan): Exploring insect adaptability with the insect-controlled robot