

International Society for Neuroethology Newsletter November 2006

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The ISN President's Column

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A short President's Report – March 2007

The International Congress in Vancouver: The most important item for consideration by the membership at this time is our upcoming Congress in Vancouver, Canada (July 22-27, 2007). This is destined to be a spectacular meeting organized by Barb Beltz (Chair), Ron Harris-Warrick and Sten Grillner (Vice Chairs), Cathy

Rankin (local Chair) and a very hard-working committee who put together a series of outstanding Plenary Speakers (10) and Symposia (14). We owe them all a vote of thanks for the hard work and effort that went into the making of a super program. Add in a superb group of Young Investigators speaking at the Bullock Young Investigator Lecture Session and poster sessions that hopefully involve all of you, and we expect that this meeting may even top the highly successful series of earlier Congresses. Cathy Rankin has also arranged for several Congress-related ancillary events that you will not want to miss. One is a wrap-up banquet at the famous Museum of Anthropology on the Thursday evening of the meeting. Another two are on Wednesday afternoon (a visit to the Aquarium) and Wednesday evening (a dinner boat ride in the harbor, dancing to a DJ, and a fireworks display over the harbor). These are very likely to sell out, so register early for the Congress and sign up for the extra-scientific events as well. Go to the Congress website (http://neuroethology.org/meetings/) to learn more and to sign up NOW. The deadline for abstracts is April 10. 2007 and the deadline for early registration (and for a reduction of \$100 in registration fees) is April 20. 2007.

Travel awards to the Congress: We are awaiting word on two pending applications for funding for travel awards for the Congress. We have high hopes that we will receive at least one of these awards. Probably the bulk of the awards will target funding for younger investigators (students, post-docs, younger faculty), but hopefully we also will be able to fund awards for folks who do not have sufficient funding of their own to attend the Congress. As soon as we hear news of the status of these grant applications, we will send an email to the membership. In the meantime, and right now, we have available the Heiligenberg travel awards for students, and information on these awards is available at our website.

The 2010 Congress: At the Business Meeting at the Congress in Vancouver, we will select the site of the 2010 Congress. Formal presentation will be made to the membership at the meeting by representatives from host cities. We have one candidate site now and hope that we can offer the membership at least one additional possibility. If you think you would like to be a host for the 2010 Congress, please get in touch with Martin Heisenberg (our President-elect) at heisenberg@biozentrum.uni-wuerzburg.de and he will discuss the next steps with you.

Until late July: See you at the Congress. I'm practicing my disco, waltz and fox-trot steps starting now (I know they're old fashioned), and promise to dance with whoever is interested in dancing with me on the boat with the fireworks going off overhead --- (doesn't that sound great!!) Ed Kravitz.

New Book Title

I. A. Meinertzhagen (iam@dal.ca) Dalhousie University, Halifax, NS, Canada

An Introduction to Nervous Systems

By Ralph J. Greenspan, *The Neurosciences Institute, San Diego, CA, USA*

An Introduction to Nervous Systems presents the principles of neurobiology from an evolutionary perspective from single-celled organisms to complex invertebrates such as flies — and is ideal for use as a supplemental textbook. Greenspan describes the mechanisms that allow behavior to become ever more sophisticated from simple avoidance behavior of *Paramecium* through to the complex cognitive behaviors of the honeybee -and shows how these mechanisms produce the increasing neural complexity found in these organisms. The book ends with a discussion of what is universal about nervous systems and what may be required, neurobiologically, to be human. This novel and highly readable presentation of fundamental principles of neurobiology is designed to be accessible to undergraduate and graduate students not already steeped in the subject.

 2007, 184 pp., illus., bibliography, glossary, index

 Hardcover \$65
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 Paperback \$45
 ISBN 978-087969-821-8

About the author: Dr. Greenspan has worked on the genetic foundations of behavior in the fruit fly Drosophila almost since the inception of the field, studying with one of its founders, Jeffrey Hall, at Brandeis University, where he received his Ph.D. in biology in 1979. He subsequently conducted research at Princeton University, the Roche Institute of Molecular Biology, and New York University before joining The Neurosciences Institute in San Diego in 1997 where he is the Dorothy and Lewis B. Cullman Fellow in Experimental Neurobiology. Dr. Greenspan's research activities have included the demonstration that the fly has sleep-like and attention-like behaviors similar to those of humans, the molecular identification of genes underlying natural variations in behavior, and studies of the principles governing gene networks underlying behavior. Dr. Greenspan has been awarded fellowships by the Helen Hay Whitney Foundation, the Searle Scholars Program, the McKnight Foundation, the Sloan Foundation and the Klingenstein Foundation. In addition to numerous research papers, he has also authored an article for Scientific American and several books, including Genetic Neurobiology with Jeffrey Hall and William Harris and Fly Pushing: The Theory and Practice of Drosophila Genetics.

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This issue of the Newsletter

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In this issue of the Newsletter, we present not only the recollections of one of the founders of our field, Franz Huber, but also the first article from a trainee neuroethologist, Kaushik Ghose. Kaushik is a PhD graduate who has remained as a postdoc in the lab of Cindy Moss at the University of Maryland, and he writes about the excitement of discovery from the perspective of his first exposure to research. So, we see in these two articles, the two ends of the spectrum of scientific experience. Kaushik writes about the training environment at the University of Maryland in an article that I hope will serve as both an example and a challenge to other young trainees who might want to write about their early or current experiences in the lab, and the training environment in which they work.

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Experiences and highlights during my time in Seewiesen 1973-1993

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Prologue

Already as a student in Munich I had become interested in the behavior of insects and in my doctoral thesis had made an early attempt to bridge the gap between behavior and its underlying neural mechanisms. This was long before the field was called neuroethology, which is concerned with the analysis of the neural bases that underlie natural behavior. Such an approach has to integrate ethological approaches with neurobiologial concepts and methods at all levels.

An attempt to reach this goal was already made in 1973. Before leaving my former position in Cologne, I organized a scientific farewell symposium, entitled "Neural Basis of Behavior". Speakers from the US (among them, for the first time, Eric Kandel), the UK and Germany covered cellular and systems approaches to the nervous system in different groups of animals, including humans.

Reasons for taking the position in Seewiesen

I had several reasons to accept an invitation of the Max-Planck-Society to take a leading position within the Max-Planck-Institute of Behavioral Physiology in Seewiesen, shortly after Karl von Frisch, Konrad Lorenz and Nicolaas Tinbergen were honored with the Nobel –Prize, and after the retirement of Konrad Lorenz and his departure from Seewiesen: (1) I was fascinated with the research of Karl von Frisch on honeybees, with Konrad Lorenz's comparative studies on geese, ducks and fish and with his far-reaching concepts in animal behavior, also with Nico Tinbergen's famous introduction to "The Study of Instinct" and finally with Erich von Holst's physiological approach, which later gave the name to the Institute for Behavioral Physiology in Seewiesen.

(2) The unexpected offer to take a position in Seewiesen after 10 years of successful work in Cologne was mainly due to the recommendation of an international committee that included Ted Bullock, Nico Tinbergen, Seymour Benzer and Peter Marler, and not to the suggestions by members of Seewiesen at that time, who had other ideas for recruitment.

(3) After thorough discussions with my early mentor Kenneth Roeder, and considering the high international reputation of the Institute in Seewiesen, I accepted the offer, which also provided a firmer financial basis for my research, and filled a gap in Seewiesen for a "neuroethological approach".

(4) Perhaps my strongest impact of my moving from Cologne to Seewiesen was the full freedom it would give me for research, and for the change in my scientific interests it would allow, away from sound production mechanisms to hearing and central nervous processing of biologically important sounds in insects.

(5) Last but not least I was very lucky that ambitious coworkers, Ph.D. students and especially visiting scientists from several countries (USA, UK, Russia, Poland, Portugal Israel and Slovenia) who later joined my group could introduce different approaches and methods. Physicists, neurobiologists and students of animal behavior worked together and seven distinguished Alexander von Humboldt-Awardees incorporated their expertise. They all had complete freedom to select their own field of research (Fig. 1).



Figure 1. My team in the late 80's, arranged like the Rembrandt picture "The Anatomy of Dr. Tulp, Den Haag 1632

New experimental approaches

Cricket Phonotaxis on the Kramer Kugel. Shortly after arriving in Seewiesen and after constructing a sound proof room in the new building, called Huber house (Fig. 2), we adapted a method developed by Ernst Kramer, a spherical treadmill, the so-called Kramer Kugel. In cooperation with John Thorson, a physicist and former Ph.D. student of Ted Bullock and a friend since 1961, we



Figure 2. Huber house in Seewiesen

used a wide variety of experimental designs and testing procedures to study female phonotaxis (Fig. 3).



Figure 3. Franz Huber in the sound-proof room with the Kramer treadmill and a cricket

One conclusion we drew from the outcome of our experiments was that pulse rate is the most important temporal property used in signal selection by female crickets. Females exhibit a behavioral tuning (a band pass property) to the specific range of pulse rates emitted in the songs.

Miniature angle detectors and the clockwork cricket. Already in Cologne, Harald Nocke, a biologist with great interest in physics and stimulated by Axel Michelsen who as a postdoc in my lab had studied the biophysical properties of hearing organs in locusts, showed that the nearly pure tone signals of cricket songs are mainly determined by a sharply resonant part of the wing called the harp. Later, Uwe Koch, a physicist with considerable expertise in high-resolution electronics and interested in biological questions, developed miniature anglemovement detectors. Together with Chris Elliott, a postdoc from England, he demonstrated that each tooth impact on the scraper (plectrum) elicits a single sound wave: thus the tooth impact rate determines the carrier frequency of the cricket song radiated by the harp. In this respect, cricket stridulation is comparable to a clockwork system with an escapement mechanism.

Leg phones to study sound conduction in the cricket. Cricket ears are located in the proximal part of the foreleg tibiae and connected to each other by a specialized tracheal system. This system combines the internal surface of the tympanic membrane of one ear with that of the other ear and with the ipsilateral and contralateral spiracular openings. Hans-Ulrich Kleindienst, another physicist who joined my group for Ph.D work in neurobiology, developed leg phones for each ear (Fig. 4).



Figure 4. Interference experiment to demonstrate sound conduction from one ear to the other

With such leg phones, each ear could be stimulated by sound separately. A highlight was the interference experiment carried out by Kleindienst David Wohlers, a Ph.D. student from the US with skilled in intracellular recording, and Ole Naesbye-Larsen, a postdoc from Michelsen's lab in Odense Denmark. In short: Sound generated within the closed chamber (leg phone) on one side is guided through the tracheal tube and elicits tympanal membrane vibration (measured with a laser vibrometer) in the opposite ear. This vibration can be canceled by an external sound directed to it. Neural responses are recorded simultaneously from omega cells, known to collect most of the auditory input. As soon as tympanal membrane vibration ceases the response of the ipsilateral omega cell is lost.

On the history of the omega-neuron in crickets. Already during my final years in Cologne cooperation with John Stout, a postdoc and later an Alexander von Humboldt-Awardee from the US, turned my interest to the cricket auditory pathway. The aim was to search for single neurons and to find out how such neurons copy and process species-specific sounds. Some influence to this approach came from Axel Michelsen and his pioneering work on insect ears, partly also from a highly active group of acousticians and neurobiologists in the nearby Bochum University led by Johann Schwartzkopff, and from Bob Capranica and his group at Cornell University who studied the auditory pathway in frogs.

In Seewiesen the first intracellular recording of a local prothoracic interneuron, later called the omega-neuron because of its shape, was already made by John Stout and his student Jim Hall in 1975, however without structural characterization. This neuron became a center for a cellular approach in the cricket auditory pathway, mainly through David Wohlers, who was the first to identify the omega-neuron and several ascending neurons within the auditory pathway of crickets by means of intracellular recording and staining. It was he and later Alan Selverston, another Alexander von Humboldt-Awardee, who demonstrated ipsilateral excitation and contralateral inhibition in the two-cell omega network, with far reaching conclusions to sound processing and sound localization in crickets (Fig. 5).



Figure 5. Alan Selverston's recording from both Omega neurons to demonstrate excitation and inhibition

The discovery of band-pass filters in the brain. My interest in the insect brain goes back to my doctoral thesis in Munich and to the years in Tübingen where, first with local lesions and then with local electrical stimulation, songs and associated courtship and rivalry behavior could be elicited. In Seewiesen, phonotaxis of female crickets on the treadmill had shown a "Band pass property" to a specific range of pulse rates. This finding gave rise to search for correlates within the nervous system having selective responses to species-specific pulse rates. Earlier studies had shown that two types of ascending auditory neurons send information to the brain but that these are not specifically tuned to pulse rates attractive for phonotaxis.

A breakthrough was achieved when local brain neurons with low- high- and band-pass properties were identified by Klaus Schildberger during his time in Seewiesen. The neurons with band-pass properties make them most likely candidates for decoding pulse rate information: (a) they are sensitive to the calling song frequency; (b) their preferred pulse rate is relatively intensity independent; and (c) they transform the unselective synchronization code of ascending auditory neurons to a pulse-rate selective rate code. It is suggested that the band-pass is formed by low- and high- pass filters, but the mechanisms for this transformation await further studies (Fig. 6).



Figure 6. Relative response magnitudes of auditory brain neurons with band-pass responses to chirps varying in pulse rates (circles and curve) correlate with band-pass behavior during phonotaxis (hatched area)

Plasticity in the auditory pathway. An unexpected discovery was made when studying phonotactic tracking of a female cricket which had lost one ear, probably as a result of the regeneration of one foreleg during larval development. The female nevertheless showed correct tracking to the sound source. Subsequent studies confirmed that female larvae after the amputation of one foreleg prior to the sixth instar regenerate that leg to its full length and size, but without an auditory organ. This led us to look for changes in known auditory interneurons, and we found structural as well as functional reorganization, a clear sign of neuronal plasticity. Dendrites grew across the midline where central projections of

auditory nerve fibers from the intact ear terminate, and frequency as well as intensity responses of such neurons were restored. Such a change connected monaural input to the normally bilateral ascending auditory pathway and provided a basis for "monaural tracking" (Fig. 7).

Schildberger and several technicians in my group then started a set of experiments which led them conceptually



Figure 7. Right omega neuron as one example of structural plasticity within the auditory pathway

deeper to consider the events in neural development and differentiation that underlay the development of cricket acoustic behavior.

In short: If the foreleg of a sixth-instar larva with a fully developed ear and with projections to the prothoracic ganglion, but without a tympanal membrane, is transplanted on to the femur stump of the ipsilateral middle leg, the auditory organ previously existing disappeared in the adult animal and a subgenual organ was present instead, as in a normally developed middle leg. The reciprocal transplantation of the middle leg tibia with no auditory organ onto an ipsilateral femur stump of the foreleg revealed an ear in the adult. Obviously there are factors in the prothoracic segment or the proximal parts of the foreleg favoring ear differentiation, factors that are missing in the mesothoracic segment or leg. No one so far has continued these experiments to gain a deeper insight into "such a segmental induction processes".

Initiation of several conferences in Seewiesen

Already in 1975 I founded together with Norbert Elsner and Axel Michelsen the first Bioacoustic Meeting of Insects, followed by many subsequent meetings inside and outside the country. In 1979 I was initiator of the socalled Insect-Brain conferences, again with subsequent meetings until today.

Just before my retirement in 1993, Edward Kravitz, an Alexander von Humboldt-Awardee from Harvard, Willi Honegger (at present a scientist at Vanderbilt University in Nashville) and myself organized the first "Summer school" in Seewiesen, a new course for graduate students concentrating on an "Interdisciplinary Approach to Behavior: Molecular biology, Integrative Neurobiology, Ethology". Foreign and German instructors were part of the faculty. Twenty selected outstanding graduate students from different Universities took part and our initiative gave rise to the continuation of summer schools in Seewiesen that has occurred since 1993.

Epilogue

In retrospect, I consider my time in Seewiesen as successful in research mainly because of the combination of concepts, methods and abilities and the cooperation of highly dedicated coworkers, students and guests. However, the communication and exchange of ideas with other groups in Seewiesen was rather weak, so that as a result we concentrated our efforts mainly within the Huber House and to institutions outside Seewiesen.

Finally I would like to repeat my view of neuroethology as outlined in my first contribution to an ISN newsletter: "One should search for a suitable model system, study its behavioral tactics in the field, select those that can be treated under controlled conditions, with no hesitation adopt a variety of methods to solve riddles at the molecular, cellular and network levels. But behind all is curiosity for the living world and how it evolved."

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*My contribution is dedicated to the late Theodore H. Bullock who influenced my own research in neurobiology.

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Flights into the unknown

Kaushik Ghose (kghose@umd.edu) University of Maryland, College Park, MD, USA

When I came to Cynthia (Cindy) Moss' batlab at the University of Maryland, "the bat" in my mind was an abstract construct. For the previous five years I had trained in a field in which people had spent a century understanding and distilling empirical knowledge into neat, analytically tractable portions. I was trained to think of giant, com-

plex pieces of machinery in terms of simple 'equivalent circuits'. A hydroelectric turbine - tons of wires and metal scaffolding rotating thousands of times a minute. converting the kinetic energy of last year's rainfall into megawatts of electricity - was represented on a regular sized sheet of paper by a few abstract differential equations based on a little circuit diagram. It was a powerfully seductive way of looking at things. The reality was violent and chaotic. The abstraction was serene and understandable. The abstraction gave the comforting vision that we understood and controlled some of the powerful forces of nature and man. As sophomore electrical engineers, however, we had been shown, for example, that transformers would get hot, would hum and would sometimes explode, behaviors that our little circuit diagrams could not explain [1]. It had been my first tantalizing glimpse into the unknown; into lands that lav beyond the vague and short boundaries of what we knew and had plowed into equations and diagrams.

When I started my PhD course I wanted to model "the brain". For my Master's I had moved on from circuit diagrams and transformer design to signal processing, computer vision and pattern recognition. These engineering problems were always being "solved". They would be solved for this dataset and that dataset, but they would never be *solved* in the broad sense. You could write a program to recognize 90% of a set of handwritten digits, but not 95%. A human, on that set, would do about 100%. How could a human do 100%? What kind of program could model the human brain, when, for instance, it was analyzing speech? That seemed to be a good question to study. I did not know it at that time, but I had stumbled across one of the biggest mysteries of our time - a giant continent, largely untraveled and unmapped, full of mystery and surprise.

The first few months in the batlab I puttered around with this abstract bat that had an abstract brain with abstract neurons and lived in a computer (well, mostly in a dogeared notebook). Cindy quickly introduced me to Timothy (Timmer) Horiuchi who had just joined the University of Maryland. Timmer was planning to make robot bats with brains made of resistors, capacitors and transistors. He called it the 'microchipoptera' project. To say this was how the brain worked, and to put it on a robot and let the robot loose in the hallway, was to put one's money where one's mouth was. When everything sat inside a computer, on the other hand, you could potentially "solve" and "explain" anything. You were modeling both the brain and the environment it would interact with. The temptation to model the brain and the environment so that they fit and worked would be great. But it would possibly lead to a tautology, a circular argument hidden under layers of sophisticated mathematical reasoning and computer code. When you put your model brain on a robot and let it interact with the real world, there would be less opportunity to succumb to this philosophical disease. Until then, I had some vague idea of what bats did. I had never seen a real bat before, I had never done animal experiments, and I was a little afraid of the fact that bats bit and could carry rabies. And I didn't know if I could learn to do surgeries. On the other hand, I could code computer programs and design electrical circuits. I got very excited by the idea of this robot bat. It seemed something I could do. A science fiction fan could hardly turn down the opportunity to build a robot bat! It turned out to be an excuse. I wanted to launch an expedition into uncharted territory, but I was afraid of dark corners.

Some time into simulating electrical circuits that would be used to model attention in Timmer's Computational Sensorimotor Systems Lab I got my rabies pre-exposure shots, which meant that I could go into the animal area. More importantly I could sit in on behavioral experiments that people were running in the lab. I went in one day when Jeff Triblehorn was running one of his experiments. Jeff was researching down the hall in David Yager's insect hearing laboratory. He was running a collaborative experiment with our lab, studying how praying mantises responded to bat attacks. I went into this darkened room where Jeff was releasing mantises and video taping bats fly after them. I watched through the monitor. I watched the slow motion recording as the bat flapped its wings, as the mantis whirred, as the bat dipped, weaved, looped and spiraled after it. I watched as it reached out its wing in mid flight, as it tipped the flying mantis into its tail membrane, as it grabbed it in its mouth, as it pulled up inches from the floor. "I want to study THAT", I said. "I want to know THAT, I want to understand THAT. I want to build a robot model of THAT. I want to know how neurons do THAT". The bat wasn't an abstract concept anymore. It wasn't a "model system", a "problem", a "research topic". It was an animal, a living being that did something, and did it well. And I wanted to understand THAT. My desire to explore had overcome my fear of the unknown.

It turns out that the University of Maryland is a great place in pursuit of THAT. In Timmer's lab while I was trying to build a model of how a bat would use its echolocation system to deal with complex environments, I ran into many questions the answers to which were necessary to build a useful model. Cindy's lab with its behavioral and electrophysiological setups was the ideal place to try and answer some of those questions. I made extensive use of the high-speed cameras and large flight room in the Batlab to study where bats directed their sonar beam while chasing insects. During this time, another researcher in the lab, Murat Aytekin, got intensely interested in the question of how a bat can use echo information to localize objects. In collaboration with Jonathan Simon at the Department of Electrical Engineering, Murat and Cindy came up with a general theory of how animals could use sound alone to develop a sense of space. A pertinent question, since in bats vision is a low acuity sense, whereas echolocation seems spatially to be an extremely fine-grained sense.

During the course of my experiments, Cindy introduced me to P.S. Krishnaprasad. PSK studies control systems of both the inanimate and animate kinds. His particular specialty is in taking complex real-world systems and applying strange and wonderful results from the world of mathematics to pull out (of the hat, as it were) an analytical understanding of, say fish schooling, bats swarming, or people on uni-cycles. Together, PSK, Timmer, Cindy and I showed mathematically how the trajectory bats follow when chasing an erratically moving prey is time-optimal, a useful thing if you only have a fraction of a second to catch your lunch.

During this period, as I was eagerly foraging in this mysterious land of bat behavior I was impressed by how important the whole community is to one's research. Every Friday at 11:00am, during the school year, everyone in Maryland interested in the neural basis of behavior gathers to hear talks by people at Maryland. This diversity of ears makes for a challenging presentation, since a talk on bat echolocation should be accessible to people working on molecular mechanisms of learning in rats (Betsy Quinlan's lab) as well as people mapping spatio-temporal receptive fields in ferret auditory cortex (Shihab Shamma's tribe). However, from this diverse and lively group come diverse and lively comments on your approach and your results. I have received, on several occasions, questions and comments that forced me to think outside my box. Jens Heberholz, for example, who is currently studying social interactions in crayfish, looks at my results on sonar beam patterns in echolocating bats and thinks of evolutionary questions. Stephen V. David looks at the same data and thinks of parallels to the visual system in primates, which he studied before joining here. Kate McCloud, from Catherine Carr's lab asks challenging questions about anatomical substrates of sonar beam shape. Todd Troyer looks at some pursuit data from bat-insect chases and thinks of patterns of play in American Football. Not only is doing the science fun, but so is presenting it to such a lateral-thinking audience.

Right, now, as I write this I'm trying to build a model of a subset of neurons in the inferior colliculus of the bat. People suspect that these neurons have something to do with sound localization in the bat, but they have some puzzling timing properties. I'm wondering if I put together a model of these neurons, whether their projected population response will tell me something that is not obvious from their known single-unit properties. But I'm stymied by some conflicting reports in the literature I'm going through. Perhaps a quick presentation at one of those 11:00am Friday meetings will help me come up with some ideas to get unstuck. It might even help me avoid a certain philosophical disease that afflicts people making computer models...

[1] These particular phenomena are actually reasonably well understood and modeled, unlike the human brain.

An open letter to members of the ISN

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Proposal to establish a fund to support the undergraduate Neuroethology program at the Universidad San Francisco in Quito, Ecuador.

In the November 2006 ISN newsletter I found the article by Winfried Wojtenek describing his efforts to establish an undergraduate curriculum in Neuroethology at the Universidad San Francisco in Quito, Ecuador. I know Winfried from his Ph.D. work in Germany with Horst Bleckmann, and I admire him for his courageous endeavor in a country where very little infrastructure is available to support such a science program. I also know some details about the project that Winfried has not mentioned, i.e. that he is paying for some of the operating expenses out of his own pocket and also has supported some of the students financially. I therefore would like to propose that the Society become a partner in his efforts and establish a fund to support his program. The creation of such a fund would require the financial participation of many ISN members and the readiness to pledge a certain amount per year to make the funding permanent. I, for example, would be willing to contribute \$200 or more annually. If only 50% of the ISN members would follow my example a sizable fund could be established. From the fund, the neurobiology program in Ecuador could draw money for equipment, running expenses and/or tuition or travel, but only after justifying to an ISN panel why and for what purpose the money is needed. Such support by a distinguished international society would definitely raise the status of Wojtenek's neurobiology/ethology program at Universidad San Francisco and might initiate a willingness on the part of the university administration to match the funded money. (Matching could actually be set as a prerequisite for ISN to fund the program.)

In discussing this idea with some friends, it became clear that if such a fund were established, other groups in "developing countries" should also have access, perhaps on a competitive basis.

I know that my request will be received by some members with a moan about yet another cause requesting a pledge of money at a time when each of us receives tons of mail to support all kinds of charities, graduate and other programs. However, to support the hope of young people in one developing country to be part of a privileged group that contributes to the advancement of science and knowledge would have my highest priority. We are all privileged to pursue science in a wealthy environment, and many of us might consider it as one of our duties to help students in poorer countries to do research under similar circumstances. I would like to encourage the members of ISN to express their opinions about my proposal, either to me directly, to the President, Secretary or other members of the Executive Committee or ISN Council. Maybe we can discuss this topic in a forum at the next ISN meeting in Vancouver, but the earlier the Society takes action, the better.

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Cognitive and Computational Neuroethology: Roots of the NS&B course at Woods Hole

Alan Gelperin (agelperin@monell.org)

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"Perhaps these insects are little machines in a deep sleep, but looking at their rigidly armored bodies, their staring eyes, and their mute performances, one cannot help at times wondering if there is anyone inside."

This sentence concludes a remarkable paper published in 1964 by Vincent Dethier, in which he considers the evidence that the cognitive abilities of insects are equivalent to those of mammals (Dethier, 1964). Since that time, the comparative study of cognition has expanded considerably, particularly in the area of linguistics, tool use and social organization. For example, arousal and cognition are now studied in flies and bees. The neurochemistry of aggression has been dissected in crayfish and Drosophila. These recent advances were presaged by Dethier who took seriously the evolutionary prediction that elements of complex mammalian behaviors were to be found in other branches of the tree of life. It was within this framework, while a student in Dethier's laboratory at the University of Pennsylvania, that I developed my own views of the heuristic value of a comparative approach to cognition, which would later find expression during the creation of the Neural Systems and Behavior (NS&B) course at the Marine Biological Laboratory (MBL) in Woods Hole, USA.

The birth of the NS&B course at the MBL is bound up with the evolution of other courses at the MBL and the evolution of the field of neuroethology in the 1960s and 1970s. It is also bound up with my own evolutionary trajectory as a combination of these general and personal intellectual antecedents led me to propose creation of the NS&B course in 1977. I therefore beg your indulgence for a short biographical journey.

As the Dean of the University of Kansas medical school welcomed me back to his office after a day of interviews at his medical school, he told me in quite cheery tones "I am going to admit you to make your own mistake". When pressed for some amplification of this pithy statement, he added that he did not think me unfit for medical school but rather thought it a mistake to forsake my

senior year of college to enter medical school after my junior year. With this comment he effectively saved me from a career choice that would have pleased my father but probably led to a life as a street person. Since I had gone to college with no high school diploma, leaving college with no college diploma and then finding medical school did not suit me, I would have been on the street with no credentials of any kind. Happily I took the Dean's statement cum advice quite seriously and declined the offer of admission to the University of Kansas medical school. By the end of the ensuing summer, my second spent in full-time research in the laboratory of my college Biology professor, I knew quite firmly that research, not medicine, was the life for me.

Two encounters with eminent neuroethologists during my college years had a vital impact on my research trajectory. Vincent Dethier give a talk at Carleton and introduced me and the assembled students to the wonders of chemosensory science and its linkage to studies of feeding behavior in the blowfly Phormia regina. During my second summer of research at Carleton, our ecology professor led a cavalcade of students to the summer meeting of the Animal Behavior Society at Purdue University, where I was mesmerized by Kenneth Roeder and his lecture relating nerve cell activity to insect behavior, particularly during courtship and mating in the praying mantis. Who could escape being captivated by movies of a headless male mantis completing its mating behavior and insemination of a female mantis who had just dined on its head, thereby removing cephalic inhibition of the male mating motor program? The encounter with Vince Dethier led me to apply to the University of Pennsylvania for graduate study under the joint auspices of the Department of Biology and the Institute of Neurological Sciences. Upon completion of my doctoral work I became a postdoctoral fellow with Kenneth Roeder.

The Institute of Neurological Sciences at the University of Pennsylvania was one of the first neuroscience training programs that was truly interdisciplinary and interdepartmental, bringing together a group of legendary intellects united by a shared interest in brain science, mutual respect for the intellectual prowess of their colleagues and a social network of personal relationships which allowed cohesion to survive heated disagreements on matters of scientific interpretation. I internalized this model of how to think about problems from multiple perspectives and integrate analytical approaches at many levels, behavioral, cellular and biophysical, in attacking a particular phenomenon. This approach would also find expression in the construction of the NS&B.

My training a the University of Pennsylvania occurred in the early 1960s, during the flowering of data from multiple invertebrate model systems showing how bits of behavior could be understood in cellular terms, whether in crayfish swimming, mollusk feeding, leech swimming, cricket singing, fly vision, locust flying, honeybee communication, and many other situations in which the activity of single nerve cells could be tightly linked to be-

havioral acts or perceptual decisions. Even the cellular analysis of learning, my passion since college days, was beginning to yield some of its secrets in both mammalian hippocampus and molluscan ganglia. These events led to the emergence of the field of neuroethology, characterized by a focus on how cellular interactions in the nervous system account for species-typical behavior relevant to adaptation of an animal to its Umwelt or characteristic sensory world. These were heady days where in our hubris we wrote about "simple systems," thinking that functional dissection of a nervous system containing a few thousand neurons would be "simple" compared with analysis of the mammalian brain. At this point it is not clear that even "simpler systems" is an accurate characterization, as we learn of the multiple functions carried out by different parts of a single neuron. We can confidently talk about "compact" nervous systems but we are wise enough now to avoid naïve term like "simple".

My own first encounter with the idea that insects had many of the classes of behavior ordinarily thought of as strictly mammalian was during the weekly "feeding seminars" under the auspices of the Institute of Neurological Sciences at the University of Pennsylvania. A collection of local luminaries, such as Eliot Stellar, John Brobeck, Jim Sprague, Vince Dethier and Alan Epstein, would gather with graduate and postdoctoral students to share data and ideas on the control of feeding behavior. Vince and Alan Epstein had a particularly interesting set of exchanges over the course of many weeks during which Alan Epstein championed the view that what separated mammals from insects was the operation of a higher-order behavioral mechanism called motivation. Motivation was in some ways like pornography. It was hard to define but you knew it when you saw it. Alan Epstein would construct a definition of motivation designed to make clear the separation of insects and mammals. Vince Dethier would take this as a challenge to design experiments probing the feeding behavior of the blowfly Phormia to see whether evidence of motivated behavior could be found, and in due course return to the feeding seminar to present data showing that the latest version of the definition of motivation applied equally well to rats and Phormia (Dethier, 1966). This exchange went though several cycles, resulting in a series of insect studies on higher-order aspects of fly feeding behavior, such as central excitatory states set up by brief intense taste stimuli. As you can readily imagine, this set of interactions was extremely educational to a young graduate student still constructing the intellectual framework within which to understand how to optimally proceed with cellular analysis of higher-order categories of behavior (Gelperin et al., 2006).

Another strand in the tapestry that would become NS&B was the hubris of the "simple systems" approach to the cellular analysis of behavior, which flowered during the 1960s and 1970s. The demonstration that many invertebrates possessed sensory, motor and interneurons

that could be repeatedly identified from animal to animal, coupled with the notion that having thousands of neurons rather than millions would make the complete analysis of behavioral control circuits practical, produced great enthusiasm for the enterprise of cellular circuit analysis. It seemed that if we could mobilize a sufficiently clever and determined army of neuroethologists armed with sharp microelectrodes and fluorescent dyes for intracellular injection, we would soon have complete cellular and circuit understanding of crayfish swimming, locust flight, leech swimming, lobster stomatogastric ganglion, slug feeding, honeybee navigation, fly vision, and sundry other circuit bytes and behavioral bits. Feeding this euphoria was the demonstration that certain interneurons, called command neurons in their early incarnation, seemed to be the sites of decision making as to whether a piece of behavior (e.g., crayfish tail movement, seaslug defensive swim, goldfish swim initiation) would be elicited by an epoch of relevant sensory input. Although modified by later analysis, the concept of the command neuron encouraged the view that intensive cellular analysis of selected behavioral control circuits could reveal general rules of circuit function of wide generality, including relevance to mammalian behavioral control systems.



Figure 1. Charles Otis Whitman on Oct. 10, 1908, in his pigeon cage feeding a hand-reared flicker taken by Whitman from a nest on a previous field trip

The MBL in Woods Hole has a long tradition of work in evolutionary studies, animal behavior and cellular neurophysiology. The first director of the MBL, Charles Otis Whitman (1842-1910) had been a student of Louis Agassiz, whose admonition to "Study animals, not books" is prominently displayed at the MBL to this day. Whitman enjoyed natural history fieldwork, and had an uncanny ability to successfully rear a variety of delicate bird species, such as ringdoves and passenger pigeons.

He is shown in Fig. 1 with a flicker he had hand reared in order to study its color pattern. In the last half of the 20th century neurophysiological work at the MBL on electrogenesis in the squid axon, basic aspects of chemical synaptic transmission at the squid giant synapse, discovered by Ted Bullock and Susumu Hagiwara at the MBL, among many other aspects of neuronal biophysics, made the summer neuroscience community at the MBL extraordinarily stimulating and attractive to both students and established researchers in the field. Stephen Kuffler established a legendary Neurobiology course at the MBL that focused on cellular neuroscience, and provided a model for how to organize an intensive lecture and laboratory summer course that would attract both first-class faculty and students from around the world.

It was my great good fortune to start a relationship with the MBL in 1966, as a Grass Fellow in Neurophysiology. This summer as a Grass Fellow was tucked neatly between the completion of my postdoctoral study with Kenneth Roeder at Tufts University and the start of my academic career at Princeton University. This summer fellowship provided the intellectual equivalent of drinking from a fire hose. I learned much from my fellow Grass Fellows, particularly Bill Kristan, from attending lectures in the MBL summer courses, the Monday evening lecture series in neuronal biophysics (also known as the Monday night fights) and the fabled Friday evening lecture series. This was combined with access to a world class open-stack biomedical library, situated adjacent to Eel Pond, which allowed thorough and efficient exploration of the biomedical literature while listening to the gulls call and watching the sailboats swinging at anchor. This was literature consumption before the World Wide Web was invented and internet access to the biomedical literature became the norm. The combination of worldclass science and the sea was intoxicating and addictive.

Imagine my surprise to be invited to teach the following summer in a new incarnation of the first course to be offered at the MBL in 1888, originally called Experimental Zoology. The course traditionally surveyed the structure and function of marine invertebrates representing the full range of invertebrate phyla. The laboratory component of the course revolved around the fruits of weekly field trips to diverse ecological domains to collect living creatures of every type and size and bring them to the laboratory for identification. The new version of this venerable course, to be called Experimental Invertebrate Zoology, would condense the phylogenetic survey into two weeks and use the other ten weeks for lectures and laboratory exercises in comparative physiology. Jim Case was the course director, and fellow faculty such as Michael Greenberg and Bob Josephson helped guide my initial forays into this new terrain. I was assigned the Echinoderms for my lecture contribution to the phylogenetic survey, which gave me new appreciation for the amazing bioengineering incorporated into these armored creatures. My experience in this course and its next iteration directed by Bob Josephson furthered my understanding of the potential for creative pedagogy offered by the summer course format at the MBL.

Michael Greenberg followed Bob Josephson as Director of the Experimental Invertebrate Zoology course. As Greenberg's tenure as course Director came to a close in 1977, I anticipated being considered as a candidate for the next Director. Stimulated by this possibility I designed a new course that I thought would fit logically as a summer course offering, to complement the cellular Neurobiology course and bridge the gap between cellular neurobiology and behavior. The outline for the NS&B course was thus in my mind when the Director of the MBL, Paul Gross, called me to his office. As I anticipated, he offered me the Directorship of the Experimental Invertebrate Zoology course. I countered with my proposal for a new course, NS&B, with an explanation as to why the new course would fit naturally with the existing Neurobiology course, my initial suggestions for course faculty, and the nature of the laboratory exercises the suggested faculty would implement. With remarkable prescience and alacrity, Paul Gross agreed to my proposal and marshaled the needed resources to begin recruiting faculty for the new course. Then a miracle happened. Each and every one of the potential faculty I called agreed to join me in this new venture. The siren call of the neurobiology community at the MBL and the prospect of teaching a group of extraordinarily talented



Fig. 2. Faculty and students of the Neural Systems and Behavior course, 1978.

students selected from an international pool of candidates proved irresistible. It was also an auspicious time

in the evolution of work in cellular and systems neurobiology – the field was growing, the future looked bright, grant funds were available and enthusiasm was high. If I had not invented NS&B, someone else would have, as it was a logical next step in the development of the discipline of neuroethology.

The first year of NS&B was a heady and hectic affair. Course lectures were given by James Gould, Ad Kalmijn, Ron Hoy, David Prior, John Nicholls, Bill Kristan, Alan Gelperin, Randolf Menzel, Tom Eisner and Fernando Nottebohm. It is left as an exercise for the reader to find these individuals in Fig. 2. In addition to these regular course lectures at 8:00 AM, NS&B sponsored a Wednesday evening lecture series, which featured lectures by George Gerstein, Robert Capranica, William Quinn, Eric Kandel, Tom Eisner and Larry Cohen during our first iteration of NS&B. Further intellectual seasoning was provided by Special Lectures from Michael Bennett, Donald Griffin, Eduardo Macagno, John Arnold, who demonstrated an orgy of squid mating, and Gunther Stent. We had a closet full of canaries and boxes and hives full of invertebrate brain donors matching the many and varied interests and expertise of our course faculty. Our 8:00 AM lecture series also nucleated one neurobiological union whose F1 attended Carleton College, thus bringing the story full circle.

Two fields with significant overlap with neuroethology, namely comparative cognition and computational neuroethology, are now growing apace and cross-fertilizing neuroethology. There is a Comparative Cognition Society that will have its 14th annual international conference in Melbourne, Australia, on March 14-17, 2007. More generally, cognitive science as a field bridging psychology, linguistics, neuroscience and computer science is rapidly growing, aided and abetted by the application of functional magnetic resonance imaging techniques to the domain of brain computations occurring during cognitive tasks.

Computational neuroscience is another area of rapid growth, currently represented by a summer course at the MBL called Methods in Computational Neuroscience, in which I have enjoyed giving lectures on computational olfaction for the last several years. A subdivision of this area, computational neuroethology, seeks to meld cellular studies of neural interactions controlling behavior with mathematical models of the neural interactions to both understand the computation carried out by known circuit elements and clarify deficiencies in current understanding, particularly the roles of hierarchy and multiple feedback loops in behavioral control systems. An essential contribution of the neuroethological perspective is the constant focus on the natural stimuli the neural system is built to process and the need to analyze natural units of behavior with some understanding of the ecological niche to which the animal containing the circuit of interest is adapted. The use of recording methods in awake behaving animals while they perform computations involving the circuit being monitored is an increasingly common way to insure that the recorded cellular interactions are relevant to the normal operation of the circuit. This is not a new idea but recent work has involved many channels of simultaneous neural recording and new algorithmic approaches to interpreting multiunit activity.

I had completed planning for the second summer of the NS&B course when family circumstances in the Spring of 1979 led me to relinquish the Directorship of the course and turn to my friend and course colleague Ron Hoy to take over the Directorship position. Ron wisely decided to share the Directorship with Eduardo Macagno. They jointly improved the course and put it on a firm foundation for growth and evolution into the future. It is with some satisfaction, perhaps even a bit of nachis, that I have observed the NS&B course mature and become one of the most highly regarded summer courses at the MBL, as judged by both student ratings of their experiences and ratings by the NIH panels that evaluate the periodic applications for student support. Will a summer course at the MBL in cognitive neuroscience be next?

Frog Hearing and Acoustic Communication: Satellite Meeting to 8th International Congress of Neuroethology, Saturday, 21st July 2007

Seth Horowitz (<u>Seth_Horowitz@brown.edu</u>) Brown University, Providence, RI, USA

Call for Presenters: DEADLINE MAY 1, 2007

The Frog Hearing and Acoustic Communications Satellite Meeting will be an opportunity for the anuran audition and communication community to hear, present and discuss new directions and opportunities for research in this widely known but still little understood group of organisms. We are organizing 12 oral presentations focusing on entirely new work and directions for research using the frog model, as well as a DataBlitz. This invitation is extended to people at all stages of their career, from students through senior faculty. We would like to invite you to present a 15-minute talk (with 5 minutes for guestions following) on your current research in frog communication and hearing. The scientific organizing committee (Mark Bee, Sabrina Burmeister, and Seth Horowitz) will select speakers from among submitted abstracts. Themes can include but are not necessarily limited to:

• Perception and sensation • Hearing in the real world • Recent advances in neuroanatomy • Mechanisms of vocal production • Hormonal influences • Evolution of

communication systems

Our general guidelines are: 1) If you are presenting at the main Neuroethology meeting, your frog satellite meeting presentation cannot be based on the same data. 2) We are only soliciting presentations of new data (as opposed to old stories). 3) Submission for a talk should be in the form of an abstract (250 word limit please).

The DataBlitz

In addition to the invited talks, everyone is invited to the Frog Communications Datablitz, which will take place after the reception. For those unfamiliar with the format, all participants will get 1 minute to present 1 data slide. This data slide can be a chart, an image, an animation, a video or a sound file, but you are strictly and harshly limited to 1 minute to get the point across. At the end of the datablitz, everyone will receive a CD with all of the collected slides and contact information for the presenter. We hope this will be a fun and interesting way to get people communicating about and cross-fertilizing their research within (and beyond) the frog hearing and communication community. The slide can be submitted embedded in a Powerpoint (PPT) format or as individual files (<10M please). If submitting individual files, please use DOC or TXT (for text), JPG/TIFF (for graphic), AVI, MPG or MOV (for video), or WAV, AIFF, MP3 (for audio). Submission for both presentations and Datablitz should be sent by 1 MAY 2007 to: Seth Horowitz@brown.edu.

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Gastropod Neuroscience: Past Successes and Future Prospects

Friday Harbor Laboratories Centennial Symposium June 5- June 9, 2007

Paul Katz

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Applications are now available online to attend the Friday Harbor Labs Centennial Symposium entitled: http://depts.washington.edu/fhl/centsymp/2007gastropod s.html

The purpose of this multi-day symposium is to summarize the important contributions of neuroscience research using gastropod molluscs and to lay out ideas for future directions. Gastropods such as *Tritonia*, *Aplysia*, *Helisoma*, *Helix*, *Lymnaea*, *Clione*, *Melibe*, *Hermissenda*, and *Pleurobranchaea* have served as important model systems in neuroscience, in particular for studying motor pattern generation, learning, memory, development, ion channels and signal transduction. What future do these model systems hold? By gathering together some of the leaders in this field, we hope to create an opportunity to brainstorm about which directions Gastropod neuroscience show go and plot courses to get it there.

There are over twenty invited speakers, representing a broad range of gastropod preparations and approaches. The speakers will summarize the important advances that have been made using their model systems. We will have round-table discussions that unite the themes of the talks and address the questions of "Where do we go from here?" and "What tools do we need to get there?"

The schedule for the meeting, including a list of invited speakers, is posted as a pdf file at the following address: http://depts.washington.edu/fhl/assets/nonImageResourc es/gastroschedule.pdf

Please note that the size of the meeting is limited. The deadline for applying is March 15, 2007. Applicants will be selected based upon relevance to the meeting. We will also try to accept a diversity of participants based on other factors. The registration fee for the meeting is \$150. On-campus housing is \$60/day. Meal service during the meeting is \$185. We are offering up to \$400 travel reimbursement for a limited number of students and postdocs. Participants, particularly students and postdocs, are invited to give a poster presentation of their work. Please fill out the registration form at the following address

http://depts.washington.edu/fhl/centsymp/GastropodApp. html

and include a title and abstract for the poster. If you would like to receive news about Gastropod Neuroscience, even if you won't be attending the symposium, please join the GastropodNet list serve.

http://mailbox.gsu.edu/mailman/listinfo/gastropodnet.

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Positions Available

Postdoctoral positions in *Drosophila* neuroscience and behavior

Two postdoctoral positions are available in my laboratory (http://www.hhmi.org/research/fellows/reiser.html) at the

Janelia Farm Research Campus of the Howard Hughes Medical Institute (http://www.hhmi.org/janelia/). The work in the lab draws upon experimental and theoretical approaches to investigate the processing of multisensory information in the flight control system of *Drosophila*. We use tethered-flight experiments in a variety of virtualreality flight simulators to quantify motor responses to controlled multisensory stimuli; models of these behaviors are used to constrain the computational properties of the supporting neural architecture.

The postdoctoral researchers will be involved in designing and conducting quantitative behavior experiments. The work will include a significant component of data analysis, which will require creative application of a variety of techniques. Over the course of the appointment, the project will proceed to an investigation of the neuronal circuits controlling identified multisensory processing using molecular-genetic tools and imaging.

Candidates for the first position should have a strong background in biology, with a focus on *Drosophila* genetics, electrophysiology, biological imaging, and/or quantitative behavior. The second position will emphasize computational approaches and the design of laboratory instrumentation. Those with a technical background in Engineering/Physics/Mathematics and a keen interest in Neuroscience are especially encouraged to apply. A strong applicant should have some experience in several of the following areas: signal processing, control theory, machine learning, computer vision, embedded system design, laboratory instrumentation, and/or scientific computer programming (especially MATLAB experience).

Applicants should have a Ph.D. in Neuroscience/Biology/Engineering or a related field. Interested applicants should contact me by email. Please include your curriculum vitae and a letter of research interests, and arrange for three letters of reference to be sent to:

Michael Reiser Howard Hughes Medical Institute Janelia Farm Research Campus 19700 Helix Drive Ashburn, VA 20147 USA Email: reiserm@janelia.hhmi.org

Postdoctoral position(s) in auditory neurophysiology and behavior

Applications are invited for one or more NIH-funded postdoctoral positions to study the neuroethology of auditory perception and acoustic communication in songbirds. Join the UCSD neuroscience community and our growing group to examine the neural mechanisms that guide the perception and cognition of complex, temporally patterned sounds. Candidates should have a PhD in neuroscience, psychology, or a related discipline with technical experience in one or more of the following areas: *in vivo* electrophysiology in anesthetized and/or behaving animals, computational neuroscience, or animal behavior. One-year appointment with opportunity for annual extensions up to five years. Pay commensurate with experience.

Interested applicants should send a CV, a cover letter stating professional goals and interests, and three references to: Timothy Q. Gentner, Department of Psychology, University of California, San Diego, 9500 Gilman Dr. MC0109, La Jolla, CA 92093-0109, USA. For more information contact: tgentner@ucsd.edu

Postdoctoral position in cellular and systems neuroscience, Howard University College of Medicine, Washington, DC, USA

An NIH-funded post-doctoral position is available immediately to study neurons and circuits of the olfactory and limbic system. We are looking for a scientist to perform electrophysiological (patch-clamp) studies in olfactory bulb and amygdala slices from rats and mice. Experiments will examine mechanisms of neuronal interactions and signaling. Experience with electrophysiology is required. Initial appointment is for 1 year with renewal contingent on performance. Interested applicants should send *curriculum vitae*, statement of research interests, and names and addresses of three references to:

Dr. Thomas Heinbockel, Howard University College of Medicine, Dept. of Anatomy, 520 W St., N.W., Washington, DC 20059, USA.

Phone: 202-806-9873;

Fax: 202-265-9873;

E-mail: theinbockel@howard.edu.

Websites: www.gs.howard.edu/gradprograms/anatomy; www.test.med.howard.edu/hucm/index.php/anatomy

Howard University is an Equal Opportunity Employer.

Research Associate, Department of Biology, University of Leicester, U.K.

Available for up to 2 years. Salary Grade 7- £27,465 to £31,840 per annum. Ref: R3145

Applications are invited for a 2-year BBSRC-funded postdoctoral position to work on the neuronal control of aimed limb movements in insects. The post will be filled by an electrophysiologist, preferably trained in sharpelectrode recording techniques and behavioural analyses. You will work alongside a computational neuroscientist who is skilled in computer modelling and programming. Together you will analyse neuronal plasticity and the role of joint stiffness in the control of aimed leg movements.

Applicants should have a PhD in an appropriate area and enthusiasm for solving biological questions. The project offers the opportunity to join a very active research group working in modern facilities. There are additional funds available for substantial research visits to our collaborator's lab in Cologne. Informal enquiries are welcome and should be made to Dr. Tom Matheson (tm75@le.ac.uk or telephone: 0116 223 1263). Further information is available at: http://www.le.ac.uk/biology/tm/Matheson.htm.

Downloadable further particulars and application forms are available by following the links. If you require a hardcopy please contact Personnel Services. Tel: 0116 252 5110; fax: 0116 252 5140; e-mail: recruitment4@le.ac.uk; web-link: www.le.ac.uk/personnel/jobs

Please note that CVs will only be accepted in support of a fully completed application form. Closing date: 2 March 2007.

Post-doctoral position, Louisiana State University

Applications are invited for a post-doctoral position studying auditory physiology in vertebrates. Technical experience in either cellular or systems neurophysiology is required. An interest in neuroethology, computational neuroscience and psychoacoustics is beneficial. Research for this position will focus on the underlying mechanisms of auditory filtering and complex processing in central auditory nuclei and auditory hair cells. Techniques will include sharp and whole-cell patch clamp recordings. Position holds a two-year appointment with the potential for extension.

Applicants should send (email is preferred) their CV, a brief description of research interests and expertise, and two letters of reference to:

Dr. Hamilton Farris, Research Assistant Professor, Center for Neuroscience, Louisiana State University Health Science Center, 2020 Gravier St., New Orleans, LA 70112, USA.

hfarri@lsuhsc.edu

http://www.medschool.lsuhsc.edu/neuroscience/

Postdoctoral Position (Akademische/r Rätin/Rat auf Zeit) in **Auditory Neuroscience**, at the Institute for Cell Biology and Neuroscience in **Frankfurt a. M., Germany**, beginning immediately. The position is available for 3 years with an option for additional 3 years. Applicants are encouraged to conduct independent research projects in auditory neuroscience of mammals and/or insects. For information on our research please see: http://www.uni-frankfurt.de/fb/fb15/institute/inst-2-zellb-neuro/AK-Koessl/index.html

The following methods are currently available in our group: electrophysiology (*in vivo* single-cell and multiple electrode recordings), neuropharmacological and histological techniques, *In vitro* techniques (intracellular, patch-clamp), measurement of cochlear mechanics and otoacoustic emissions, bioacoustical methods, psychoacoustic techniques.

Participation in teaching (for students in the Biology Bachelor/Master program, language: German) is expected and to pursue an Habilitation is encouraged. Please direct further inquiries and applications (including a CV and a statement of research interests) to:

Prof. Manfred Kössl Institut für Zellbiologie und Neurowissenschaft Siesmayerstr.70A 60323 Frankfurt/M. Phone: +49 69-78624761 koessl@bio.uni-frankfurt.de

Material for Future ISN Newsletters

The Editor would welcome, indeed wholly depends upon, material for future newsletters to fill the various sections of each issue. Reference to past issues will reveal the scope and style of contributions, the breadth of their variation and the depth of their originality. Material is solicited for meetings, courses, and job opportunities which might include some aspect of neuroethology and therefore be of interest to readers of the Newsletter. Advertisements for positions (faculty or trainees) should generally aim to be not longer than 200 words, or 300 words for multiple jobs advertised in a single submission. Announcements of new books (copyright 2005) written or edited by ISN members should include the full citation information (including ISBN) plus a 40-50 word description of the book. (Note that books containing chapters contributed by an ISN member are not appropriate for inclusion.) We also welcome announcements of awards to ISN members, and of courses and future meetings, reports on recent meetings, discussions of research areas or topics of interest to neuroethologists, laboratory profiles, and editorials. We also regretfully publish occasional obituaries and memorials. Word limits depend on the type of article.

Material should be submitted no earlier than one month before the next issue (in this case, July, 2007). Have an idea for an article that you or someone else would write? Contact the Secretary prior to submission to determine the length and suitability of material to be submitted. For those who may feel their particular interest (research field, geographical region, chromosomal complement, age group, whether to dress to the left or right, etc) has been under-represented in past Newsletters, please see this as both an invitation and challenge to offset the perceived lack of representation. Remember: the Newsletter represents us all, but an empty Newsletter represents nobody, or worse still, may actually represent nothing. All material must be submitted electronically, preferably as an attached file to an e-mail prepared in MS Word and sent to Ian Meinertzhagen at iam@dal.ca

Add our Link to Your Website!







Adding a link to ISN (http://neuroethology.org) on your website helps raise our profile in the scientific community.

International Society for Neuroethology P.O. Box 1897 Lawrence, KS 66044 USA



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TO: