International Society for Neuroethology
Newsletter
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International Society for Neuroethology
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Next International Congress: August 9-13, 2004. Hotel Nyborg Strand, Nyborg, Denmark

This Issue Includes

The ISN President's Column

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The journal affiliation poll is closed. Below is the final tally of votes as of June 3, 2002.

Option	Number of votes	Percent
1. Exclusive affiliation with JCP-A	75	38%
2. Exclusive affiliation with Elsevier/AP	8	4%
3. Non-exclusive affiliation with an established journal	50	25%
4. No formal affiliation with any journal	65	33%

Total number of responses = 198 (out of 560 total members contacted).

While Option 1 received the largest number of votes, two other options (Options 3 and 4) also received significant support. According to the rules that were announced, the choice of Option 1 is not binding. The ISN

Executive Committee has decided to invoke Rule 3 (If there is no clear winner, the top two options will be returned to the members for a re-vote) and to conduct a run-off poll between Option 1 and Option 4. In order to proceed, the EC also decided that it was necessary to lower the 50% criterion for a quorum to 100 members (see Rationale below). The top option in the run-off poll will still require a 25% or greater margin to be binding. We will open the new poll shortly, once the on-line poll is set up.

Rationale: For the journal affiliation poll, we originally required participation by >50% of members, but in hindsight, this criterion was unrealistic. Although members' participation in ISN polls has consistently been strong, averaging close to 200, it has never exceeded 268, or 48% of the membership. Requiring >50% participation would thus invalidate this and all previous (and perhaps all future) polls and elections. A survey of the Bylaws of other societies reveals that most do not specify the minimum number of votes for a quorum. Even the enormous Society for Neuroscience requires only a plurality of mail voters, or 100 members at a business meeting, in order to conduct business. Presently, the ISN Bylaws specify that a simple majority of respondents is sufficient to vote to change the Bylaws, without requiring a quorum of a certain number. Therefore, the >50% requirement for the journal affiliation poll is not sensible and will be changed to 100 members.

About the Newsletter

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This is the first issue of the newsletter to be distributed to the membership electronically in PDF format, rather than in hard copy via the postal service. The electronic version is now the default option but anyone wishing a mailed copy can request one via Panacea Associates (see contact information on page 1). Moving to an electronic format permits us to include color images and to save on printing and postage. I'd appreciate feedback on this change, and any other aspect of your newsletter. Information on submitting material for the next newsletter appears on the last page.

Visit to 2004 Congress Site

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In early June, several of us from the Center for Comparative and Evolutionary Biology of Hearing program at the University of Maryland, College Park, visited with colleagues at the Center for Sound Communication at Odense University, Denmark. During our visit we had the pleasure of visiting Nyborg, the site of the 2004 ISN Congress. We thought that other ISN members might like to hear our thoughts about this venue.

Nyborg is located one hour by direct train from Copenhagen airport. The station in Nyborg is a one-minute cab ride or 15 minute walk from the meeting site, the Hotel Nyborg Strand. There are many other hotels and hostels nearby for those looking for a somewhat less expensive place to stay.

If our one lunch was typical, food at the hotel is very fine. The sleeping rooms are moderate size and very nicely appointed. The meeting rooms are excellent – they are large, chairs are comfortable, and AV should work very well. The auditorium, which seats about 220 (there are other rooms for larger groups), is one of the nicest such rooms that any of us has ever seen. What particularly pleased us is that the hotel is spread out (though meeting rooms are close to one another) so attendees will be able to find many places, both indoors and outdoors in a lovely grassed area and in gardens, to have informal get-togethers. The hotel is on the body of water called the Great Belt that separates the islands of Sealand and Funen. While none of us attempted to swim, there were swimmers on the beach.

In summary, we were very pleased with this venue. It is convenient to get to, and people accompanying members to the meeting should find it easy (though a bit expensive) to get into Copenhagen and to relax around the lovely hotel. We particularly liked the fact that most (if not all) participants can be accommodated in a single hotel, and that the hotel itself is ideally set up for a meeting of our size.

Nick Strausfeld elected to Britain's Royal Society

ISN member Nicholas J. Strausfeld has been elected to Britain's Royal Society, the "independent scientific academy of the United Kingdom dedicated to promoting excellence in science." The Royal Society was founded in 1660. Strausfeld, a Regents' Professor at the University of Arizona (USA), has won international distinction for research into the structure and function of the insect nervous system. He is one of 42 new Fellows and 6 Foreign Members recently elected to the Society.

ISN Web Oversight and Education Committee

The Executive Committee of the ISN is pleased that the following members have agreed to serve on this committee: Zen Faulkes (Chair), Frederic Libersat, Brian Mulloney, Mark Nelson, Caroly Shumway, Annemarie Surlykke, Barbara Webb. The general charges of the Committee are: (1) To determine the needs and wishes of the membership with regard to the content of the Society homepage. (2) To design the Society homepage, add new features (including but not limited to incorporation of educational materials appropriate for the public and for researchers in neuroethology and other fields) and revise the existing features. (3) To make the Society homepage an up-to-date, useful and convenient source of information for its members. It is hoped that the Society homepage will soon become a valuable resource for research and education in neuroethology.

Young investi-'gator' discovers ancient sensory system on snouts of crocodilians

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Apparently, no one ever told Daphne Soares that curiosity kills the cat, as she rode one muggy day in the bed of a rugged old pickup driving along a Louisiana back road, jaw to jowl with a full grown *Alligator mississippiensis*, the kind with full-grown teeth. "I wonder what those dots are?" she thought to herself, noting thousands of raised bumps that lined the face of the hog-tied 'gator, top and bottom, like a beard.

A trip that began as a collecting excursion for young alligators, as part of her graduate work on the auditory system in birds and crocodilians, and curiosity, led the University of Maryland (USA) student to the discovery of the function and natural history of a novel sensory system, "dome pressure receptors," she says, two years later. These receptors, as Daphne showed in a paper published recently in *Nature* ("An Ancient Sensory Organ in Crocodilians," *Nature*, 16 May 2002, **417**:241-242), appear to underlie the crocodilians' ability to detect prey as they lie in wait at the water's surface, half-submerged. To put it all into context, Daphne says, "these ancient animals have really solved the problem of wearing a suit of armor, for protection, and yet still being able to be sensitive to the environment." Crocodilians, after all, survived through the age of the dinosaurs and into the age of the mammals (all the more to eat, one supposes.)

After that fateful Louisiana trip, and being the person she is, Daphne pursued the question upon her return from the swamplands and discovered that no one knew much about these organs. Some German in the last century described them, of course, but no function was known. So, in her spare time from working on her dissertation, she described the receptors with electron microscopy and light level microscopy. Using a tracer dye, she discovered that the fibers running to the receptors innervated via the 5th nerve a hypertrophic trigeminal ganglion ("huge," says Daphne). Interestingly, the trigeminal nerve appears to subserve two other highly specialized modalities: the electrosensory organs in the platypus, and infrared organs in snakes. In the alligator, the trigeminal formed dense branching patterns directly under the "bumps," which lacked pores or hairs. These nerve bundles, on their way from the skin surface to the brain, course through hundreds of holes in the jawbones, making a beehive-like pattern in the bone.

After testing various stimuli like electrical current, light, and "stinky things," she found that disrupting the water by placing her hand in the tank caused the nerve to fire.

To determine their function, some physiology was clearly called for. Daphne received a Grass Fellowship to work the summer of 2001 at the Marine Biological Laboratory in Woods Hole, Massachusetts (USA), training grounds for many a prominent physiologist. With her junior alligators in a water tank and recording electrode snug around the trigeminal nerve, she began to test what stimuli would activate the receptors. After testing various stimuli like electrical current, light, and "stinky things," she found that disrupting the water by placing her hand in the tank caused the nerve to fire. Ripples! Pressure waves on the water surface are what these receptors like. To test the responses she used a fancy pressure wave stimulator (aluminum beer can attached to a speaker), and found that the nerve fired in phase to the waveform, and fired with increasing probability with increasing water pressure. To determine that this was due to the receptors themselves, she used a piezoelectric "poker" to apply mechanical stimulation to the receptors directly, and the skin surface in between. Only poking the receptors elicited a response.

But did the 'gators respond behaviorally to such stimuli? Daphne showed that little hungry 'gators turn toward the source of a surface disruption caused by as little as a single drop of water, as if hunting. In complete darkness, and with their ears filled with Vaseline, she found that the 'gators would turn and bite at the exact location of the odorless water drop, with less than 10% error rate, over nearly the entire testable tank space.

These animals were accurate in both direction and range and, remarkably, could perform the task even with considerable continuous random surface disruption noise. "They're *really* good at this," she says. She showed that the dome pressure receptors are necessary for the behavior: 'gators with beauty mask goo covering their receptors failed to lunge at the drops. Furthermore, only 'gators sitting at the air-water interface would perform the task (submerged animals and lazy ones sitting on rocks out of the water do not).

When did alligators and crocodiles evolve such an elegant solution to "combining armor with tactile sensitivity?" By looking for telltale foramina patterning (the beehive in the jawbones through which the nerve bundles pass) in the skull bones of various species, one can determine who had these receptors and who didn't, including species now extinct. Among living reptiles, all water-dwelling crocodilian species had the pattern, while terrestrial crocodilian species and lizards did not. Evidence from fossil specimens of extinct crocodilia show that the modern pattern goes back into the Early Jurassic period, over 200 million years ago.

News of the crocodile's recently discovered sensitive side seems to have struck a fascination nerve with the media. Daphne's work has made headlines worldwide, with the story covered by *London Times*, *New York Times*, *Washington Post*, *Der Spiegel*, CNN, BBC, National Public Radio (USA); the Discovery Channel and National Geographic have each taped interviews of Daphne and her "crocs." Daphne, taking it all in stride, used the opportunity to introduce the general public to the wonderful world of animal behavior and brains: "I said 'neuroethology' every chance I had!"

None of this is terribly surprising for Daphne's thesis advisor, Catherine Carr. "Daphne is driven by a real passion for comparative neurobiology, and is very creative and extremely hard working. She always has more ideas than time, but I have noticed that she finishes what she starts." Not one to be shy, Daphne "talked to every crocodile paleontologist in the world" and "spent weekends at the Smithsonian working on fossil skulls," says Catherine. Prolific, hardworking and ever curious, she has a number of awards to show for it, including a Graduate Research Award from the University of Maryland, College Park, a Minority Travel Award from the Society for Neuroscience, the Grass Fellowship, and a National Science Foundation fellowship to pursue postdoctoral studies with ISN member Mark Konishi at the California Institute of Technology (USA).

Are there crocodiles in the future for this researcher? "Oh, yes," she smiles. ◆

Browsing through fragile and dusty pages

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> *"I could not suppress my curiosity about this mysterious city (Harar, now in Ethiopia). It had been described to me as the head-quarters of slavery in Eastern Africa, and its territory as a land flowing, with milk and honey; the birthplace of the coffee-plant, and abounding in excellent cotton, tobacco, saffron, gums, and other valuable products. But when I spoke of visiting it, men stroked their beards, and in Oriental phrase declared that the human head once struck off does not regrow like the rose."*

The beginning of a historical novel, right? Well, if not that, then what is this and why quote it here? This, after all, is a column where essays relating to science and science ethics are supposed to appear. Well, I reply, despite the elegant prose, this actually is from a scientific journal. It is, in fact, one of the discoveries of my voyages of exploration through the stacks of the Marine Biological Laboratory/Woods Hole Oceanographic Institution (MBL/WHOI) Library in Woods Hole, Massachusetts (USA). The quote comes from the Journal of the Royal Geographic Society, Volume 25, pages 136-159 published in June 1855, and was written by one of the greatest scholars, adventurers, and some would add rogues of the 19th century, Sir Richard F. Burton.

To be at my best when I write, particularly when writing review articles or essays, I require an appropriate setting. My favorite spot is the corner desk on the third floor of the stacks at the MBL/WHOI Library, facing out to what used to be a view of the tennis court, the aquarium, the public dock and yacht club and a corner of Great Harbor. Unfortunately the view now is blocked by the new, rather large, Ecosystems Center (which may necessitate a future move on my part across the stacks, to a view of the MBL collecting boat and Eel Pond, but with that nasty morning sun in your eyes). I liked the old spot because you didn't get too much sun, there always was a nice breeze (yes, you could open the windows), you could smell the ocean, and it was quiet. The library and the stacks are always open, at least if you have an MBL i.d. card, so one can work there at any time of day or night. Before sitting down, I make sure that one of the old desk chairs are at "my spot," the ones with the straight wood-slatted back that doesn't tip back, the bottom-contoured seat, and the rolling wheels. And yes, those are the chairs that my son and wife embarrassed me with one time when caught by the night-watchman zooming around the cement floors of the stacks heel-peddling backwards at high speed. My wife tells me that one can toe-pedal in a forward direction too, but I never witnessed that advanced skill. Next, I turn on the old-

fashioned, goose-necked, 40 watt desk lamp, and begin to work. Finding needed journal articles requires trips up and down narrow steel staircases, searching through alphabetically, and now chronologically, arranged rows of bookshelves, reading small, often outdated signs identifying journals supposedly found along the rows, pulling a small chain that turns on the overhead globe-enclosed incandescent light, and ultimately gathering the journals. Somehow or other, the journals I want are always there — at least someplace. The stacks, by the way, are made the old-fashioned way, with steel support beams bearing the weight of the books running the entire height of the building, and with floors with cutouts for the beams bearing only the weight of people.

"But save the civil equipments for Japanese students. When you are through with your job here notify to the University and let us come back to our scientific home. (signed) The last one to go."

The copy machines (I still call them Xerox machines) are a short walk away, where the central offices of the library are found, along with the comfortable Grass Reference and Bay Reading rooms. The shelves lining those rooms display the hundreds of journals received by the library the past week and recent issues of the thousand or so journals subscribed to by the library. Prominently positioned on a wall above the copy machines is the famous "Study Nature Not Books" sign from the Anderson School of Natural History on Penikese Island (the sign was placed above the school entrance by Louis Agassiz for its first summer in 1873 — the school lasted just one further summer after the death of Agassiz). Nearby, not as prominently displayed any longer, is the also famous (and my favorite) note left by Katsuma Dan on the door of the University of Tokyo Oceanographic Institute at Moroisi Ko on Sagami Wan at the end of World War II. During the waning phases of the war, the Institute had been converted to a miniature submarine base by the Japanese Imperial Navy. Dan, hearing American and Japanese officers arguing about the dismantling of the base at the end of the war, and worried that the Institute would not survive, posted this message: "This is a marine biological laboratory with her history of over 60 years. If you are from the Eastern Coast, some of you might know Woods Hole or Mt Desert or Tortugas. If you are from the West Coast you may know Pacific Grove or Puget Sound Biological station. This place is like one of these. Take care of this place and protect the possibility for the continuation of our peaceful research. You can destroy the weapons and war instruments. But save the civil equipments for Japanese students. When you are through with your job here notify to the University and let us come back to our scientific home. (signed) The last one to go." My MBL tours for newcomers invariably pause before this simple, yet powerful note — to me it conveys what really is important in the world.

But I digress — where and how does Burton fit in all of this? I find that I can't read for long periods of time without sensing an urgent need to stand up, stretch and wander the stacks of the library. Actually (and secretly), I look forward to these wanderings as much as to my journal reading. On these trips I search for rows that look like they have not been visited in decades. One journey led me to Volume 1, Number 1 of the *Journal de Chimie* and an early article by Lavoisier. Another to Volume 1, Number 2 of *Nature* (November 11, 1869). There I found that an important issue of the day, discussed in the editorial "Lectures to Ladies," was whether higher education was appropriate for women. The writer of the editorial believed this to be a good idea, but only if the "ladies" would be serious about the lectures. One of my greatest discoveries, however, was finding the *Journal of the Royal Geographic Society*. This Society, which was founded in 1830 and continues to the present day, sponsored journeys of discovery by its members. At its meetings, great debates of the 19th century were held. Thus, this was the organization that sent Richard Burton, John Hanning Speke, and David Livingstone to search for the source of the Nile, a quest that led to acrimonious debate and ultimate tragedy for Speke, who it turned out was correct after all. In the 20th century, the Royal Geographic Society sent Robert F. Scott and Ernest Shackleton, of recent movie and book fame, to the Antarctic to chart that continent and the route to the South Pole. Certainly, the 19th century explorations were entwined with matters of missionary zeal and the imperialistic ambitions of England. Just as certainly, though, for the explorers, the voyages were for adventure, in what was for most of them a constrained society,

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and for the fame and glory that followed discovery. Like novellas, the prose of these early adventurers leads the reader through the planning, hardships, dangers and excitement of travels to uncharted lands. As I remove the leather-bound journals containing these reports from their shelves, slowly open the dusty brown-edged pages, and carefully unfold the fragile-with-age, sketchily-drawn maps that outline in thin orange lines the routes of exploration, my sense of anticipation grows. What will I find next? The Burton article was an early discovery. Not only does it describe Burton's visit to Harar, it details an attack by bandits on their camp after the departure from Harar that cost the life of one of their party, the capture of another (Speke — who subsequently escaped), and the serious wounding that almost ended Burton's life. The same issue of the journal, by the way, contains another article by Burton on his journey to Mecca and one by Livingstone on his explorations into the interior of Africa.

I admit it's convenient to have journals on-line that can be accessed from anyplace in the world. Of course,

for me, the anyplace in the world usually is my office at Harvard Medical School or my third floor study at home with its panoramic view of Belmont and Arlington. I know it's easier to print out an article of exceptional image quality from my terminal, than it is to travel to oft-broken-down departmental or library copy machines and generate poorer image-quality copies. I recognize that I can search dozens of different databases for articles by subject, author, year, journal, or whatever, and surely find anything I am looking for (and many things I'm not looking for). And, I suspect that, within 10 years, paper versions of scientific journals will cease to exist altogether and libraries as we now know them will be gone forever. The megaliths that are campus libraries are expensive to run, difficult to maintain, and a constant drain on the economies of academic institutions. Moreover, paper versions of journals cost countless trees in a planet where the space to grow trees is diminishing at an accelerating rate. Most of the paper copies of journals I receive end up in the trash-heap. I feel badly about this. So badly, that I tried once to give my old journals to a library someplace — anyplace — but no one wanted them. Even the problem that on-line versions of most journals first were offered in the mid 1990s (and hence, as I found out from reading student theses, science began in the mid-1990s) will disappear soon as J-Stor and other commercial services provide on-line coverage of journals dating to their origins.

It's a truism, that with progress we give things up. Telephone operators are a thing of the past, and instead, we have those maddening phone trees. We are told that they are more efficient than switchboards, that they don't cause needless busy signals and delays, and that they don't make incorrect connections. I suppose all of that is true, but when four steps into the tree, I accidentally hit the wrong number on the phone keypad, I really miss having a person on the other end of the line. Phone trees only are a nuisance: the death of libraries may be more than that. Not only will the disappearance of libraries stop my wanderings and voyages of discovery, it also will stop the wanderings of future generations of scholars. Mind you, I don't mean only that finding exotic articles in obscure journals will cease. True scholarship requires the time to find and digest information, and the patience to seek out the origins of ideas and their evolution. In the busy, competitive, high-pressure academic world that surrounds us these days, that kind of scholarship and the edifices that embody them, the libraries of the past, seem to have become unnecessary luxuries. ◆

Comparative neurophysiology in the 20th century: the foundations of 21st century neuroscience

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In the March 2002 Newsletter, Ed Kravitz presented a detailed and historically illuminating account of the discovery of GABA as an inhibitory synaptic transmitter in the nervous system. Much of the evidence in support of this discovery was obtained from experiments with crustacean preparations, although the road to acceptance was at times twisted in controversy. Ed used his account and the multiple roles played by crustacean systems in the identification of GABA as an inhibitory transmitter, to argue in favor of a more eclectic acceptance by the neuroscience community toward research with non-vertebrate animals. It's not easy addressing a subject already dealt with so authoritatively and eloquently by Ed Kravitz, but since my own early academic career encompassed a period during which the then new techniques associated with intracellular recording were being applied with astounding success to a multitude of invertebrate preparations, I thought it appropriate to expand a little on his theme.

What I try to remind the undergraduate students who do research in my lab, or who enroll in my course in neuroethology, is that a wealth of concepts has emerged from neurophysiological examination of different invertebrate nervous systems. Literally dozens of new operational principles, forming the foundations of our present-day neurophysiological understanding, were being uncovered in invertebrate preparations during the late 1940s, the 1950s and the 1960s; many, if not most, of these have been of lasting significance. I think it is important to emphasize a few of the more seminal findings.

In 1952, Keffer Hartline and his colleagues Ed MacNichol and Henry Wagner reported their important discovery of the generator potential in the eccentric cells of the *Limulus* lateral eye, thereby answering a decades-old question concerning a possible role for graded slow membrane potential changes in the generation of action potentials. This accessible preparation was then exploited by M.G.F. Fuortes to reveal the underlying conductance changes associated with photic stimulation, so well later described in a *Journal of Physiology* paper (1959) by William Rushton.

In the mid-1950s, the elegant work by Stephen Kuffler, Charlie Edwards and Carlos Eyzaguirre with the abdominal stretch receptor neurons in lobsters and crayfish permitted additional studies of the generator potential (now called the receptor potential) in an accessible primary sensory neuron, revealing important, novel differences in conductance states between the receptor potential and the action potential. Furthermore, the crustacean stretch receptor preparation presented a conveniently accessible postsynaptic neuron with which to study the physiology of inhibitory synaptic transmission and in which, unlike the inhibitory transmission upon the cat spinal motoneurons studied *in vivo* by the Eccles group, the external ionic concentration could be readily manipulated. These studies convincingly established a role for chloride ions in synaptic inhibition. Kuffler then turned his skills to the crustacean neuromuscular junction where, with Josef Dudel, he discovered the physiological basis for presynaptic inhibition at excitatory motor terminals. These observations were extended, as Ed alluded to, by the biochemical identification of GABA in carefully-dissected single crustacean inhibitory axons (try that with any vertebrate preparation!) and by demonstrating the role of GABA as an agonist at the crustacean neuromuscular junction.

This finding added an interesting twist to a long-standing controversy that had just about been resolved, namely, whether interneuronal synaptic transmission was mediated via the release of a chemical transmitter, or whether it was strictly electrical.

In the late 1950s, Ed Furshpan and David Potter discovered the existence of electrical synaptic transmission between the lateral giant interneurons and the motor giant neurons of the crayfish abdominal segments. This finding added an interesting twist to a long-standing controversy that had just about been resolved, namely, whether interneuronal synaptic transmission was mediated via the release of a chemical transmitter, or whether it was strictly electrical. Incontrovertible evidence for chemical transmission came from studies of the vertebrate neuromuscular junction, and eventually similar types of evidence were arrayed in support of chemical transmission in the vertebrate central nervous system. Furshpan and Potter then generated the first experimental data from any animal that electrical transmission occurred at selected interneuronal connections. Electrical synapses were later described in vertebrate systems as well, such as the electromotor nucleus of weakly electric fish and the ciliary ganglion in chicks.

In the early 1960s, Don Maynard turned his neurophysiological skills toward the crustacean stomatogastric ganglion, a restricted and accessible small system of interconnected neurons that held promise for unraveling network properties, which could be applied to more complex neural systems, such as the brain. Jim Preston and Don Kennedy had already started to bring intracellular recording technology to the multisegmental interneurons of the crayfish abdominal nerve cord, working out the complexities of these neurons having such highly distributed sensory input. Later, Kennedy and his colleagues would thoroughly analyze the abdominal motor systems, discovering a family of command interneurons that triggered consistently recognizable abdominal behaviors, and then elucidating the role of primary afferent depolarization in helping to prevent reafference effects following startle responses generated by the lateral giant fibers.

Late in 1961, Don Wilson arrived at Berkeley, fresh from his postdoc in Torkel Weiss-Fogh's laboratory in Denmark. He revived an old debate about the neural organization underlying rhythmic locomotory behavior: did chain reflexes govern it, or was it centrally organized? Wilson's careful and insightful experiments with the locust *Schistocerca* provided convincing evidence for the existence of a central pattern generator (CPG) in organizing the motor output to the locust flight muscles, leading the way for similar analyses, using up-to-date recording techniques, in other invertebrate and vertebrate preparations. Keir Pearson's work has since established the important role played by various sense organs in regulating the frequency of the CPG in locusts, critically extending early work started by Wilson.

Arthropod preparations of course weren't the only invertebrates generating rich yields in basic neurophysiology during this period. In 1957, Ted Bullock and Susumu Hagiwara had introduced the squid stellate ganglion preparation to neuroscience. The stellate ganglion houses synapses between second-order giant interneurons and third-order giant motor axons. The importance of "Nature's gift to the synaptologist," as this nexus was described by Hirsch Gerschenfeld, is the fact that, as with the crayfish lateral giant-motor giant synapse, pairs of microelectrodes can be inserted simultaneously into both pre- and postsynaptic neurons, *across the synapse*, so that voltage-dependent currents in both fibers can be studied under rigid experimental control. Bernard Katz and Ricardo Miledi admirably exploited this preparation in the mid-to-late 1960s, providing us with a rich and abiding conceptual base about the role of voltage-gated calcium conductances leading to a rise in presynaptic intracellular free calcium during the process of synaptic transmission. Later, Rodolfo Llinas and his colleagues would expand this understanding using the calcium-sensitive, light-emitting probe aequorin, demonstrating unequivocally the consequential influx of calcium ions into the terminal of the second-order giant axon during the presynaptic action potential. The techniques of using the protein aequorin as a probe for changes in intracellular free calcium ions, and, incidentally, one of the first direct demonstrations of the increase in intracellular calcium ions associated with muscular contraction, had been developed by Ridgway and Hoyle with the very large single fibers of the adductor muscle in the giant Pacific barnacle *Balanus nubilis* (Susumu Hagiwara and his colleagues had previously used these giant muscle

fibers to demonstrate the existence of calcium action potentials, a novel finding at the time but of incomparable importance when considering its broad physiological ramifications that we now take for granted).

An additional seminal study with molluscan preparations must be noted here. In 1972, Bob Meech made the crucial discovery that injection of small amounts of calcium ions into cells R15 and R2 of the *Aplysia* abdominal ganglion caused an increase in membrane potassium conductance. These calcium-dependent changes in potassium channel conductance have now been seen in other invertebrate and vertebrate neurons and, needless to say, have had enormous theoretical ramifications; large families of calcium-sensitive potassium channels are now recognized as regulating excitable properties in all central neurons and many receptor cells. Furthermore, Meech's observations have led directly to other studies investigating the influences of calcium ions in a multitude of intracellular signal transduction pathways.

Reducing the brain to its biochemical substrates in a Waring blender . . . destroys most of its intrinsic, operationally relevant information content.

Many other now-recognized universal properties of neurons were either introduced, or most propitiously studied, in invertebrate preparations. Included among these, but not limited to them, are the discovery of heterosynaptic facilitation in the abdominal ganglion of *Aplysia* by Eric Kandel and Ladislav Tauc in the 1960s and, later, of course, the cellular basis for modifications of neural pathway properties following simple learning paradigms by Kandel and his numerous colleagues; the discovery of glutamate as an excitatory neural transmitter in locusts by Peter Usherwood; the demonstration of neuromodulatory peptides as transient modifiers of neural circuit properties in crustacean stomatogastric networks by the work of Eve Marder and Ron Harris-Warrick; the seminal contributions of Bernard Katz and Paul Fatt who discovered the quantal nature of synaptic transmission, much of it gleaned from studies of the crustacean neuromuscular junction; Connor and Stephens' revealing studies of the various time- and voltage-dependent ionic currents underlying autorhythmic electrical activity in molluscan neurons; the first-time demonstration of *bona fide* circadian rhythms of membrane conductance in single molluscan visual neurons by Gene Block's group; and, most recently, the discovery of changes in behaviorally/socially-induced neural circuit modifications in crustaceans involving the neuromodulatory, serotonin, by Don Edwards and his colleagues. While the list goes on and on, this brings us back to Ed Kravitz who, along with Margaret Livingston, convincingly demonstrated in 1980 the control of behavioral state in lobsters by both serotonin and octopamine.

This account is of course not meant to detract from the beautiful work being done with the vertebrate central nervous system during much of the same period. One need only mention Vernon Mountcastle's insightful observations on the primate somatosensory cortex, John Dowling and Frank Werblin's work with the mudpuppy retina, and David Hubel and Torsten Wiesel's groundbreaking experiments on the cat visual cortex. However, the preceding account ought to make clear to all but the most obdurate students of nervous system physiology that studies with invertebrate preparations spearheaded most of the successful research into basic functioning of nerve cells from the 1940s into the 1980s. In light of what Ed refers to as HVCs ("higher vertebrate chauvinists"), I believe it behooves all of us who are committed to and understand the crucial importance of basic research and comparative neurobiology to carry this message to the review panels and study sections with which we may be associated and, especially, to our own graduate and undergraduate students. Furthermore, we need to emphasize the fact that the nervous system operates through genetically- and developmentally-determined patterns of *anatomical* connections. Molecular and biochemical studies can teach us a great deal about intracellular signal transduction pathways, the expression of neuroactive substances and cell surface molecules. Reducing the brain to its biochemical substrates in a Waring blender, however, destroys most of its intrinsic, operationally relevant information content. ◆

Remembering Irving Kupfermann, 1938 - 2002

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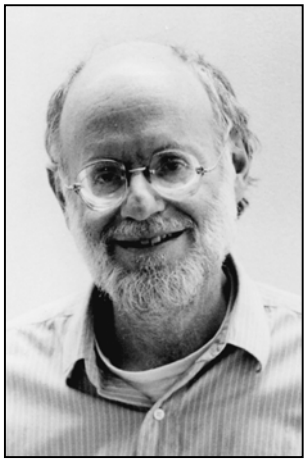

On February 19, 2002, the field of neuroethology lost an important contributor, the faculty of the Center for Neurobiology and Behavior at Columbia University (USA) lost a valued colleague, and many of us who knew him lost a wonderful friend. This is the day Irving Kupfermann died in his home in Port Washington, New York, of Creutzfeld-Jacob disease.

Irving was born in New York City in 1938. He received his undergraduate education at the University of Florida and his Ph.D. in biopsychology at the University of Chicago in 1964. In 1965 he joined the laboratory of Eric Kandel at Harvard University with the goal of applying cellular methods to the study of behavior and learning. In 1966 he moved with the Kandel group to New York University Medical School, where he made two significant contributions to neuroethology. First, he discovered the egg-laying neurohormone in the marine mollusk

Aplysia and showed that it is released from a cluster of uniquely identifiable neuroendocrine cells in the central nervous system. Second, together with other colleagues in the Kandel laboratory, he delineated the neural circuit for a simple defensive reflex that exhibits several forms of learning. Each of these model systems helped to lay the foundation for the then-emerging field of the cellular neurobiology of behavior and learning.

Those of us who had the opportunity to work with Irving came to appreciate not only his scientific skills but his fundamental humanity. We loved his warmth, his humor, and his openness to innovative and unconventional ideas.

In 1970 Irving set up his own laboratory at New York University, where he began to study the neurobiological basis of motivation, focusing on the feeding behavior of *Aplysia*. He subsequently moved to Columbia University and the New York State Psychiatric Institute. Over the next thirty years Irving and his colleagues made several key discoveries and introduced and developed many concepts that have made a major impact on the field of neuroscience. The most important of these concepts was neuromodulation, which holds that the activity of modulatory neurons does not in itself initiate behavior. However, if these cells are coactive with neurons that generate behavior (mediating neurons), the characteristics of behavior are significantly modified. Irving and his colleagues showed that modulatory neurons can participate in generating motivational states, such as arousal, whereas other neurons are directly responsible for implementing behavior. Neuroethologists around the world knew of Irving's work, and valued his scientific breadth and scholarship. One particular article he co-authored with his long-time friend and collaborator Klaudiusz Weiss provided a clear set of criteria for the application of the "Command Cell" concept, criteria that now routinely guide research in this area.

Those of us who had the opportunity to work with Irving came to appreciate not only his scientific skills but his fundamental humanity. We loved his warmth, his humor, and his openness to innovative and unconventional ideas. He consistently championed the intellectual underdog. He relished a good argument. He had an undying affection for language, often stringing together a steady stream of puns that, much to his delight, typically evoked loud groans of approval from his listeners.

Irving had several passions. Chief among them were his wife of thirty-seven years, Kerstin Kupfermann, and his children, David and Celina, whom he loved unconditionally. He summed up the rest of his passions in a piece entitled "All About Irving" that he wrote for a high school reunion. "I do three things: I go to movies and plays with my wife Kerstin. I take photographs — almost exclusively of fire hydrants. And I play golf, which I started to do around five years ago in my near dotage, and am slowly proving the adage about old dogs and new tricks."

I shared countless experiences with Irving, as our families lived in the same town, and Irving, Vince Castellucci, and I commuted to New York City on a daily basis. On these trips Irving and I constantly played speed-chess, often earning looks of amused consternation from fellow travelers on their way to Wall Street. Of all the experiences Irving and I shared, one is particularly memorable. In the summer of 1972, we undertook a field study of *Aplysia* in their natural habitat, the coastal waters of Southern California. Our home base was the Scripps Institute of Oceanography, where Ted Bullock was our gracious host. In preparing for the study we both needed to become certified as scuba divers. This was no simple matter for Irving, as he had no experience in diving, or even being in water over his head for that matter. He tackled the training with equal parts courage and comedy, and in the end he earned his certification. During our study we carried out several dawn-to-dark dives that were physically quite challenging, but Irving never lost his resolve or his wry sense of humor. By summer's end, the field study was a success, in large measure because of Irving's insatiable curiosity and his dedication to the work. He was a terrific partner.

It still amazes me that Irving is gone. He left us all too soon. But he leaves behind enduring legacies as a thoughtful scientist, a loving husband and father, and a remarkable friend to all who knew him.

Remembering Choonilal Keshav "C.K." Govind, 1938 - 2002

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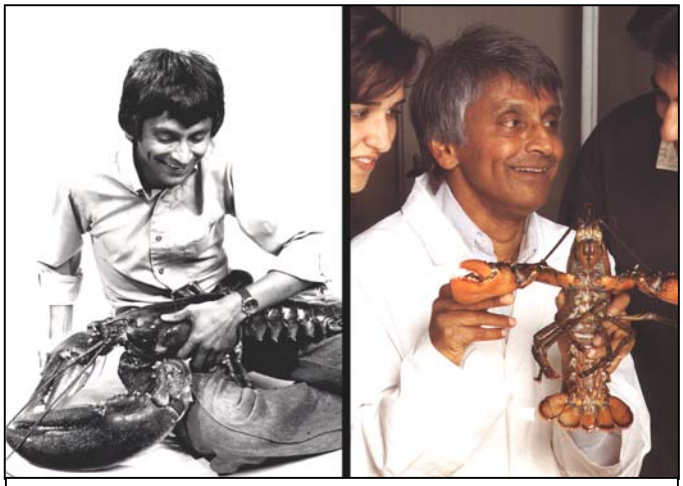
On May 24, 2002 Dr. Choonilal Keshav Govind passed away after a long battle with pulmonary fibrosis and cancer. He was affectionately known as "CK." CK was born to a large family in South Africa in 1938, during the apartheid era. He received his B.Sc. at Rhodes University in 1961, and an Honors distinction and M.Sc. from University of Natal, all in South Africa. He earned his Ph.D. in 1971 from the University of Manitoba, Canada, working with Dr. Trevor Dandy on the functional basis of flight in the milkweed bug. CK worked with Dr. Harold Atwood as a NRC postdoctoral fellow in the Dept. of Zoology, University of Toronto, St. George Campus, where he began his studies on crustacean neuromuscular systems. A year later (1972) he joined the faculty of Life Sciences Division, University of Toronto at Scarborough (Canada) and after 30 years planned to retire in June 2002.

In collaboration with Joanne Pearce, his research associate of many years (as well as many students and



***Left**, CK poses with a 20 lb American lobster purchased from fishermen for use in a study on growth- and age-related changes occurring at the neuromuscular junction (1979). **Right**, CK demonstrates the speed of claw closure using a 1 lb American lobster at Scarborough Campus, University of Toronto (1997).*

postdocs), CK described the environmental and physiological basis for handedness in the American lobster (see his review "Asymmetry in Lobster Claws," *American Scientist*, **77**:468-242, 1989). In recent years his research focused on regeneration of claws in the snapping shrimp as well as on synaptic differentiation and regeneration of phasic and tonic motor nerve terminals in crayfish. CK published over 150 peer-reviewed articles in leading journals and 18 invited book chapters. He was the recipient of numerous research grants, including continuous NSERC funding from 1973 to present. He served NSERC at numerous levels, including most recently as Group Chair for all NSERC grant selection committees in Life Sciences. Dr. Nigel Lloyd, Executive Vice President of NSERC, spoke at the memorial for CK held by Scarborough College. With great emotion and affection, Dr. Lloyd described the impact CK had on NSERC — both to enhance the organization's performance and on the individuals he met.

In his youth, CK was an accomplished athlete and participated in several marathons. In his dealings with all of his acquaintances, he did everything with a personal touch. He was generous with his time and enthusiastically volunteered for official student functions. After learning of his illness, he spent an afternoon each week as a volunteer to counsel students. He did this for several years on top of his heavy teaching load, research responsibilities and duties at NSERC.

In a scientific climate that selects for self-promotion, CK was an exception. This came naturally for CK (given his modest nature), but perhaps it also came easily for CK, because the quality and volume of his work spoke for itself. He was a tireless promoter of others, especially young people trying to establish themselves in a competitive job market. One could refer to these lucky students, postdocs and collaborators, as CK's scientific offspring, because he treated them as if they were a part of his family. He was a wonderful role model for so many of us because of the intelligent and fair approach he took in his research and in dealings with his peers, his absolute honesty and integrity, his clarity of thought, his clear and concise writing, his wisdom, the excitement he showed at new discoveries and his incredible work ethic. CK could be a forceful presence when he wanted to be. To emphasize a point he was making in an attempt to convince a student or collaborator, he would often finish his argument with a forceful 'lilt' in his voice: "You get it!? You get it!?"

CK was the recipient of the Scarborough College Teaching Award. It is easy to understand why, for those fortunate to witness one of his seminars. He relished the opportunity to communicate with students and peers and had a flair for the theatrical. One of his former undergraduate students spoke at the memorial service about the respect and affection that Scarborough students had for him, recalling one of CK's lectures (usually given early in the semester), in which CK presented a brief account of his research using amusing slides. During these lectures, CK would poke fun at himself and the students loved it.

In a scientific climate that selects for self-promotion, CK was an exception. . . He was a tireless promoter of others, especially young people trying to establish themselves in a competitive job market.

CK also used his well-developed sense of humor during invited research seminars. For instance, when discussing the transformation of juvenile lobster claws into the massive crusher phenotype, he would first display an image of himself (he possessed a slim, almost petite, physique) exercising with a large bar-bell and dressed only in Speedos, followed by a composite image with his head mounted on the frame of a giant body-builder. These slides were synchronized to music such as "Macho-Macho Man," by The Village People, the Beatles' "In My Life," and Barbara Striesand's "The Way We Were." This not only forged a memory of his work but also would disarm and amuse his audience, and elicit a chuckle from even the most stern of personalities.

CK was a persistent kidder. On one occasion we were invited to give a joint seminar at a symposium. He was creating artwork to complement our studies on the lobster swimmeret system and to capture and amuse the audience. One piece on the drawing board was that of a lobster with an especially well-endowed first pair of swimmerets. It took some doing, but I convinced CK that we shouldn't use this particular artwork for fear of offending some of our audience (the drawing was, shall we say, not 'politically correct'). In retrospect, I'm sure CK could have shown the slide to great effect in a presentation given by himself, without offending anyone.

I often wonder how different (*i.e.*, less interesting and less enriched) my life would have been if I had never met CK. We first met in the summer of 1978, when I was a naïve first year graduate student. CK had just started his annual summer treks to the Marine Biological Laboratory in Woods Hole, MA, USA (a trip that he made 18 consecutive years, usually accompanied by his immediate family) and was working in the lab of his close friend and collaborator, the now late Dr. Fred Lang (Boston University Marine Program). [After Fred Lang's premature death in a tragic car accident in 1978, CK spent the entire following year in Woods Hole, helping all of Fred's students graduate and move on in their careers.] I went to the Lang laboratory in search of a graduate student acquaintance that worked in Fred's lab at that time. There was CK slaving over a lobster claw-ganglion preparation. All I did was say "Hi" and CK's warm and supportive personality took over, and like so many others before and after me, I had made a friend for life. For me (and I'm sure many others), CK also became an important mentor and over the years I always felt that I could confer with CK about all matters, personal or professional. When he called me, I knew instantly who was on the line because of his distinctive and affectionate tone: "Kirk! How are you!?" When his wife Preshiel and adult daughters, Karuna and Nisha, shared with me the many letters and cards of condolence, it became even clearer how many lives CK had touched and enriched.

CK made it plain to me that his first priority in life was to establish a secure financial future for his family. I'm sure the importance of this to CK derived from values instilled by his parents and the difficult childhood he shared with his brothers and sisters under apartheid in South Africa. It must also have been during these formative years that CK developed his monumental work ethic and his respect for people in all walks of life.

To honor CK's memory, an endowed scholarship for students has been established at Scarborough College: **The C.K. Govind Excellence Award**. Contributions can be directed to The Office of Advancement, Room S407B, University of Toronto at Scarborough, 1265 Military Trail, Toronto, Ontario, M1C 1A4. Donations can also be made to the United Way (CK's favorite charity), research for lung disease, or the Cancer Society.

I'll finish with words from one of CK's favorite musical lyrics ("In My Life," by John Lennon and Paul McCartney). He used them often and to such great effect in his seminars.

"There are places I'll remember
All my life though some have changed
Some forever not for better
Some have gone and some remain
All these places have their moments
With lovers and friends I still can recall
some are dead and some are living
In my life I've loved them all"

We'll miss you CK and we'll never forget. ◆

Meetings and Courses

Conference on the Behavioral Neurobiology of Bird Song, December 2002

H. Philip Zeigler (hzeigler@hunter.cuny.edu)
Hunter College, New York, New York, USA

December 12-14, 2002, Hunter College (City University of New York; CUNY). Sponsored by The Gene Center, Hunter College (Research Centers in Minority Institutions: NIH) and Biopsychology Doctoral Program, CUNY. Organizing Committee: Cheryl Harding (Hunter College, USA), Richard Mooney (Duke University, USA), J. Martin Wild (Auckland University, NZ) and H. Philip Zeigler (Hunter College, USA). This will be the first major conference on this topic and will provide opportunities for interaction among several generations of researchers. The program (below) reflects the early stages of planning and additional participants are expected. As plans progress, specific topics and participants for each panel will be announced and a call for posters related to conference themes will be issued. Proposals for support of the conference have been submitted to NIH and NSF. Funding priority will be given to doctoral students, postdoctoral researchers and junior faculty. Details on applications for such support should be announced by early summer. [Note: Hotel rates in New York are very high. In order for us to take advantage of the lower rates available through group booking, it is advisable to inform us of your decision to attend as soon as possible]. For additional information and hotel reservations contact Phil Zeigler, hzeigler@hunter.cuny.edu.

Draft Program. Birdsong neurobiology: an overview; Cell birth and death in the song circuit; Auditory input and song development; Sensorimotor transformation in the song circuit; Producing the song; Steroidal modulation of the song circuit; Gene expression studies: what have they taught us?; Comparative mechanisms: sex and species differences; Roundtable: What is bird song a model of?

Partial list of participants. Gregory Ball, Sarah Bottjer, Eliot Brenowitz, David Clayton, Timothy DeVoogd, Alison Doupe, Manfred Gahr, Franz Goller, Cheryl Harding, Erich D. Jarvis, John Kirn, Mark Konishi, Daniel Margoliash, Peter Marler, Claudio Mello, Richard Mooney, Kathy Nordeen, Fernando Nottebohm, Steve Nowicki, Kazuo Okanoya, David Perkel, Constance Scharff, Roderick Suthers, Ofer Tchnernichovski, David Vicario, Juli Wade, Martin Wild, and Heather Williams. ◆

New Books by ISN Members

Acoustic Communication in Insects and Anurans: Common Problems and Diverse Solutions by the University of Chicago Press. Authors are H. Carl Gerhardt and Franz Huber. Approx. 520 pp.; Hardback $100.00; Paperback $35.00. The book considers

mechanisms of sound production, processing of signals by the peripheral and central auditory systems, sound localization, sound pattern recognition, male-male competition and female choice based on acoustic signals, causes and consequences of chorusing, and broad-scale patterns of evolution.

Biorobotics: Methods and Applications, edited by Barbara Webb and Thomas R. Consi AAAI Press/MIT Press 2001 (300pp. ISBN 0-262-73141-X $35 softcover) This book focuses on the use of robots as tools to probe issues in animal behavior and brain function. The papers range from biorobotic work on sensor and motor systems in invertebrates to higher brain functioning and humanoid robots, with a prolog and epilog discussing the context and future of work in this area.

Behavior and its Neural Control in Gastropod Molluscs, by Ronald Chase. Oxford University Press, 2002, ISBN 0-19-511314-4 (www.oup-usa.org). The book emphasizes the principal species used in neurobiological research but it also covers many lesser known species. Four initial chapters review the broader aspects of molluscan biology and draw attention to the special features of the gastropod nervous system. Subsequent chapters examine different types of behavior, emphasizing cases in which control can be attributed to identified neurons and identified neural circuits. There is an extensive bibliography and separate indexes for taxonomic and neuronal entries.

Positions available

Two postdoctoral positions to study sensory processing in the central auditory system of echolocating bats are available at the University of Washington in Seattle (USA). One position focuses on studies of the nuclei of the lateral lemniscus. The other position focuses on the processing of temporal patterns of sound in the inferior colliculus. Both positions provide the opportunity to gain experience with a variety of neuroanatomical and electrophysiological techniques including extracellular and intracellular recording and neuropharmacology. Our research program emphasizes an integrative approach to studying the neural circuitry and mechanisms that operate at multiple levels of the mammalian central auditory system. Interested individuals should send letter describing long-term research interests and goals, a CV, and two letters of reference to: Ellen Covey or J.H. Casseday, Dept. of Psychology, Box 351525, University of Washington, Seattle, WA 98195, USA. E-mail inquiries: ecovey@u.washington.edu, casseday@u.washington.edu.

Postdoctoral opportunity in systems neuroscience/neuroethology/comparative neurobiology, investigating the neural mechanisms and circuitry underlying feeding and food sorting behavior in goldfish. This behavior is mediated by a large, laminated hindbrain structure equivalent to the nucleus of the solitary tract. The laboratory utilizes a variety of techniques to explore the neurotransmitters, receptors and neuronal architecture of this laminated primary gustatory nucleus. See: http://www.uchsc.edu/gs/cdb/faculty/finger.htm. I am seeking an individual trained in either physiological or anatomical techniques to study the organization of circuits in this brainstem gustatory nucleus. Expertise or aptitude in any of the following is desirable: *in vitro* or *in vivo* electrophysiology, functional imaging, *in situ* hybridization, immunocytochemistry, or fluorescent pathway tracers. The starting date is flexible (2002-2003). Please send inquiries and applications (cover letter, CV, names of 3 references), to: Thomas E. Finger, Dept. CSB, Univ. Colorado Med. School, 4200 E. Ninth Ave., Denver CO 80262, USA. E-mail preferred: Tom.Finger@uchsc.edu.

Interdisciplinary Graduate and Postdoctoral Program, "*Strategies and Optimisation of Behaviour.*" Available are **11 Doctoral Positions** and **1 Postdoctoral Position.** It is the aim of the DFG-funded graduate and postdoctoral education and research programme to establish close, interdisciplinary connections between those areas of biology, psychology, informatics and economics which are involved in investigating the behaviour of animals, humans and technical systems. The graduate programme will focus on behavioural strategies and their optimisation by employing a wide range of different but complementary approaches. These combine investigations on animals and humans at the behavioural and neuronal level, model simulations as well as the application of biological principles to technical systems. Whereas the doctoral positions are available in any of the following research fields: behaviour, neurobiology, neuroethology, neuropsychology, biological cybernetics, informatics, robotics and economics, the postdoctoral position will focus on the modeling of behavioural strategies from an evolutionary perspective. For further information contact Prof. Dr. Martin Egelhaaf (martin.egelhaaf@biologie.uni-bielefeld.de; http://www.techfak.uni-bielefeld.de/GK518/).



Material for Future ISN Newsletters

We welcome material for future newsletters in a number of categories. Advertisements for positions are limited to 150 words. Announcements of new books (copyright 2002) *written or edited by ISN members* should include the full citation information (including ISBN) plus a 40-50 word description of the book (note: if an ISN member contributes only a chapter to a book it is not appropriate for inclusion in the newsletter).

We also welcome announcements of future meetings, reports on recent meetings, discussions of research areas or topics of interest to neuroethologists, laboratory profiles, editorials, and obituaries. Word limits depend on the type of article. Have an idea for an article that you or someone else would write? Contact the Secretary!

All material must be submitted electronically, preferably as a file attached to an e-mail message. Send queries or submissions to Janis Weeks (weeks@uoneuro.uoregon.edu). The deadline for the November issue is **October 1, 2002**.



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