International Society for Neuroethology

Newsletter

May 2010

International Society for Neuroethology

International Society for Neuroethology
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ISN Officers

This Issue Includes

Anticipating the 9th International Congress of Neuroethology, Salamanca, 2 – 7 August 2010

This year our Society is in for a wonderful treat. The 9th International Congress of the ISN promises to be an exciting event, similar to our previous meetings, when science, camaraderie, local fun and culture, converging in a great city. Salamanca has a unique and special atmosphere that will please those who admire the old and majestic, but also those who enjoy the dynamism of modern Europe.

The location, the program is outstanding. We are all looking forward to reconnecting with old friends and colleagues and discovering new people and new ideas in the field. Imagine a balmy evening in central Spain, with outdoor restaurants, music in the background, good food and good wine, and friendly tournaments of scientific jousting.

Symposia and organizers

The role of chemosensation in sexual behavior
Y. Ben-Shahar
Neural information processing in cephalopod cognition
F. Grasso
Novelty processing in neurons and large-scale neural populations to build auditory objects: evidence from animals and humans
M. S. Malmierca & C. Escera
Neuroeconomics and decision in small neuronal circuits
R. Gillette
The knowledge base of insect navigation
J. Zeil
Neuroethology of adaptive locomotor responses to the environment - Using your brain!?
M. Gruhn & R. Ritzmann
Sensory neuroecology: The Sensory-Neural Bases of Natural Behavior Viewed from an Environmental perspective
J. Hildebrand & J. Riffel
Habituation - an evolutionary conserved mechanism of sensory information processing?
S. Schmid
Spatial orientation and object identification with sensory arrays: from neurons to robots
J. Mogdans & H. Bleckmann.
Environmental cues guiding behavior: the effect of ethanol on behavior
H.Scholz
Living in a flying crowd
P. J Simmons
Visual-auditory integration: converging evidence from animal physiology and behavior.
Y.Gutfreund
The neuroethology of context-dependent locomotion
K. Mesce
Computational mechanisms in temporal processing
B. Carlson
Coupled robot-animal systems
M. MacIver.
An integrative theoretical view: the neuroethological approach to computational neuroscience
J. L. Peña
Trichromacy and beyond: colour vision from molecules to perception
A. Kelber & N. Hempel de Ibarra
Networks for communication: between human, ape, monkey and bird brains
Ch. I. Petkov

Plenary Lectures

John Simmers (CNRS, France)**;**
Eric Warrant (Lund University, Sweden)
Cynthia Moss (University of Maryland, USA);
Heiner Römer (University of Graz, Austria);
Adriana Briscoe (University of California, Irvine, USA);
Astrid Prinz (Emory University, USA);
Hans Hofmann (University of Texas, USA);
Dan Margoliash (University of Chicago, USA);
Susana Martínez-Conde (Barrow Neurological Institute, Phoenix, AZ USA);
Ed Kravitz (Harvard University, USA);
Sten Grillner (Karolinska Institute, Sweden).

Abstract Deadline: June 1st, 2010
Registration Deadline: June 30th, 2010
http://www.seatra.org/neuroethology/

Analyzing frog choruses

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I stood by the edge of a large swamp, listening on a humid summer evening in South Texas. The sweat dripped down my face to my damp shirt, and I swore under my breath as I swatted mosquitoes settling on my neck and arms. Nothing kept the mosquitoes away. These were Asian tiger mosquitoes, bold, savage, and monstrously large. I stood listening in the humid evening with my friend and collaborator, Doug Jones. Tall mixed hardwood trees ringed the swamp, and in the darkness they created a dense black wall that left a rim opening into the sky. Up above, Scorpio hung in the Southern sky with the Milky Way scattered across the heavens like silver dust. It was dark and we could barely see ten yards into the swamp. Just visible were young Bald cypress in the waist-deep water, surrounded by Cat-tails. A Yellow-crowned night heron was roosting on the branch of a cypress. We could not see the array of fifteen microphones that we had deployed on tripods earlier that evening. All we could see were the bundles of cables feeding into the computer. In the stillness, the computer silently logged data from the microphones, capturing the ambient background of an evening by a swamp in Texas.

We heard the wave progressing on the far bank, moving from right to left, a slow rising wave of sound. And then it became silent as the wave receded to the far bank. It rounded the curve, and we heard it approach us from our left. It rose in intensity, still diffuse and hard to disambiguate, and then a lone frog started calling close to us as it caught the leading edge of the wave. Soon we were surrounded by calling frogs. A dense "Quank! Quank!" of male green treefrogs (*Hyla cinerea*). The calls alternating, colliding, and pausing, sometimes shifting to find a spot in the rhythm of the chorus. It lasted less than a minute and then it subsided and the wave progressed to our right and swept along the bank. The chorus continued every two minutes or so. It had started slowly at about nine o'clock in the evening, and we had heard three participants in our "local group". It peaked a couple of hours later with more individuals joining in. Then it ebbed at about two o'clock in the morning, winding down to the occasional caller. During the most dense part of the chorus, which must have lasted between one to two hours, the green tree frog called with clockwork regularity. The individuals moved little, but they were always shifting their calling pattern to maintain some sort of structure and harmony.

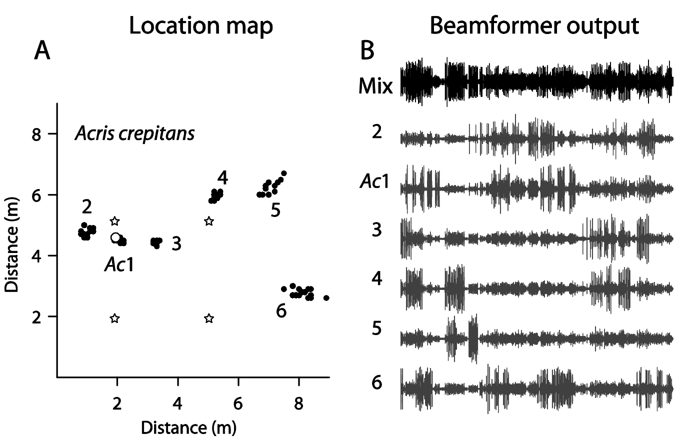


Figure 1*. The locations of calling male cricket frogs (A) and their extracted calls (B). Six individuals were located on flat ground (viewed from top in A), of which Ac1 was visually identified (open circle). The microphone locations are indicated by open stars. In (B) the mixed trace from a single microphone is shown ("Mix") along with the beamformer output for each individual.*

Was there a pattern to their calling? We knew the well-established theories of male-male interactions (see Gerhardt and Huber, 2002) which posited that in most species of calling frogs, males sought to avoid acoustic jamming by temporally adjusting the call spacing and timing. Many elegant experiments had shown how call-timing was adjusted to minimize call overlap, and how frogs paid attention to their calling neighbors (Brush and Narins, 1989; Schwarz, 2001). But Doug and I were interested in details. We wanted two pieces of information from a natural chorus: 1) we wanted the precise location of each calling male, and 2) we wanted to "unmix" the chorus, and extract the individual calls. In other words, we wanted to determine the space-time structure of a chorus, over the entire duration of calling. Once we had the location and source information, we felt that we could analyze male-male interactions in much greater detail, and determine the mechanisms underlying vocal interactions.

Locating the position of a sound source is an old engineering problem. Locating the position of a sound source is an even older biological problem. That is why humans have two ears. With two ears we can determine the azimuthal direction of the sound with respect to our position. We do this by comparing the minute differences in the arrival times of a sound at the two ears. The physiological basis for locating sounds in this way was proposed by Jeffress (1948) and demonstrated in the barn owl (Konishi, 1992). We can employ the same principles with pairs of microphones, except that we are no longer constrained by how to place the microphones, nor are we constrained by how many we choose to place (Jones and Ratnam, 2008). This technique has been used before for locating frogs (reviewed in *ibid*.) An advantage with deploying many microphones is that we can obtain a directional fix to a calling frog using many pairs of microphones. And then, by a process of triangulation, we can determine the exact position of the frog in three dimensions. But this solved only the first of our problems, namely determining the location of a caller. To solve the problem of extracting the voice of the caller we resorted to a technique called "acoustic beamforming". This is a form of spatial filtering that selectively allows sounds to be passed from a given direction while suppressing sounds from all other directions. Doug Jones had earlier developed an acoustic beamformer for application in digital hearing aids. It came out of the Intelligent Hearing Aid Project at Illinois, spearheaded by Albert Feng (see Lockwood *et al.*, 2004). Doug modified the beamformer and tuned it to work on frog choruses. Acoustic beamforming has been used in many other disciplines, but surprisingly it has not been used to extract bioacoustic sources (see Jones and Ratnam, 2008).

These techniques are referred to as "blind localization" and "blind source separation" in the engineering literature. They are not easy to solve, but by a stroke of luck, they are tractable for individuals in a frog chorus. This is because the unique and rather stereotypical nature of frog calling behavior allows us to exploit the structure to solve the problem.

Armed with a microphone array, and algorithms for localizing and beamforming individual callers, we returned to the field. In our first trials in 2007, we set up four microphones in a chorus that contained two species: the Gulf-coast toad (*Bufo valliceps*) and Blanchard's cricket frog (*Acris crepitans blanchardi*). We first separated the microphone data into the frequency bands of each species (they are non-overlapping), and for each species, we located the calling individuals, and used a beamformer to separate the callers. Figure 1 shows the results for one of the species, the cricket frog (Jones and Ratnam, 2008). The location map provided an estimate of the callers positions (one of the callers *Ac1* was visually sighted and confirmed, as indicated by the open symbol), and the microphone signals were then "unmixed". Temporal interactions between two callers can be readily assessed by cross-correlating the beamformer outputs for the individuals (not shown).

The call extractions are obtained at high temporal resolutions (at the sampling frequency of 20 kHz). The locations are determined with an accuracy of about 1-2 cm with a temporal resolution of several hundred milliseconds. The temporal and spatial resolutions are sufficient to monitor the spatio-termporal dynamics over very fine time scales. It provides information on the caller's interaction with any given neighbor, how many of neighbors the caller is attending to, and how his interaction varies with distance from his neighbors.

My intention here is to demonstrate how we can use some clever engineering to solve problems in ethology. The detailed spatio-temporal information obtained from a microphone array allows us to formulate problems in hearing and vocal motor control in frogs. For example, we can ask what are the neural mechanisms that allow frogs to sense neighbors, and make decisions about call timing so as to avoid jamming? In this context, precise and detailed ethological measurements using the localizer/beamformer can help us to understand the details of acoustic communication behavior, and pave the way for novel neurophysiological investigations.

(This ongoing project is in collaboration with Douglas L. Jones, Department of Electrical Engineering, University of Illinois at Urbana-Champaign.)

Brush, J. S., and Narins, P. M. (1989). “Chorus dynamics of a neotropical amphibian assemblage: comparison of computer simulation and natural behavior,” Anim. Behav. 37, 33–44.

Gerhardt, H. C., and Huber, F. (2002). *Acoustic Communication in Insects and Anurans* (University of Chicago Press, Chicago, IL).

Jeffress, L. A. (1948). “A place theory of sound localization,” J. Comp. Physiol. Psychol. 41, 35-39.

Jones, D. L., and Ratnam, R. (2009). "Blind location and separation of callers in a natural chorus using a microphone array". J. Acoust. Soc. Am. 126(2), 895-910.

Konishi, M. (1992). “The neural algorithm for sound localization in the owl,” The Harvey Lect. Ser. 86, 47-64.

Lockwood, M. E., Jones, D. L., Bilger, R. C., Lansing, C. R., O’Brien Jr., W. D., Wheeler, B. C., and Feng, A. S. (2004). “Performance of time- and frequency-domain binaural beamformers based on recorded signals from real rooms,” J. Acoust. Soc. Am. 115, 379-391.

Schwartz, J. J. (2001). “Call monitoring and interactive playback systems in the study of acoustic interactions among male anurans,” in *Anuran Communication*, edited by Ryan, M. J., (Smithsonian, Wash. DC), pp. 183-204.

AARON S. ANDALMAN
SIMON PERON
CO-WINNERS
CAPRANICA NEUROETHOLOGY PRIZE 2009

The nominees for the Capranica Foundation’s 2009 Award of $6,000 were evaluated by a Selection Committee of Drs. John G. Hildebrand (University of Arizona), William B. Kristan (University of California at San Diego), and Masakazu Konishi (California Institute of Technology). Competition was based on selection of the most outstanding paper published by a young neuroethologist during 2007-2009. A total of 13 candidates applied and the scope of their research was incredibly broad-ranging in animals studied, techniques used, and behaviors characterized. Every paper that was submitted was a strong contender and the Committee viewed the overall collection of applicants as the finest group of young neuroethologists that they have ever judged for this Prize. Given the overall excellence of the papers that were submitted, selection of the most outstanding was not an easy task. Following lengthy discussions and thoughtful deliberation, the members of the Committee unanimously recommended Dr. Aaron S. Andalman and Dr. Simon Peron to be co-awardees of the 2009 Prize. Even in this year’s outstanding field of nominees, Drs. Andalman and Peron stood out as equally outstanding on the basis of the papers they submitted for consideration as well as their personal statements, academic records, and strong letters of support from their sponsors. It is also noteworthy that they represent research of the highest quality in both vertebrate (Andalman) and invertebrate (Peron) systems.

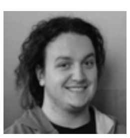
Aaron S. Andalman and Michael S. Fee “A basal ganglia-forebrain circuit in the songbird biases motor output to avoid vocal errors” Proceedings National Academy Sciences,” 106: 12518-12523 (2009). Songbirds learn their songs by trial-and-error, gradually refining initially very variable vocalizations to converge on a memorized tutor through a process that depends on auditory feedback. The vocal learning critically depends on a basal-ganglia forebrain circuit, known as the “anterior forebrain pathway (AFP), which provides excitatory input to the motor pathway that is responsible for song production. Dr. Andalman discovered that the AFP generates vocal variability that is biased to reduce auditory error during the induced vocal learning stage to eventually become consolidated in the motor pathway into a match to the memorized song. His finding that the AFP biases motor output toward improved vocal imitation is a very significant advance in the neuroethology of songbird communication. His work, moreover, raises a very fundamental question of whether the mammalian basal ganglia-forebrain circuits might function similarly during acquisition of motor skills. Dr. Andalaman’s work is a magnificent model of incisive and powerful neuroethological reasoning and experimentation. He is destined for great success in the future as a leading neuroethologist of his academic generation.

Simon Peron and Fabrizio Gabbiani “Spike frequency adaptation mediates looming stimulus selectivity in a collision-detecting neuron brain of an insect” Nature Neuroscience 12: 318-326 (2009). In Ortopteran insects, a circuit comprising a pair of identifiable neurons – the Lobula Giant Movement Detector (LGMD) and the Descending Contralateral Movement Detector (DCMD) – subserves the behaviorally important neural computation that underlies avoidance collision with a looming stimulus. The LGMD detects the looming stimulus, and the DCMD relays the impending-collision signal to downstream motor centers responsible for avoidance behavior. The paper submitted by Dr. Simon Peron presents findings from a multidisciplinary investigation of the biophysical substrate of the computation performed by the LGMD. Specifically the paper presents evidence that a particular type of calcium-sensitive potassium channel performs a general "veto" function in the LGMD, preventing maladaptive behavioral responses to non-threatening stimuli. This work is a beautiful case study of the link between cellular biophysics and animal behavior and is a paradigm of analytical thinking. Dr. Peron represents a new generation of neurophysiologists, equally well trained in experimental and theoretical techniques from the start of their careers.

The Young Investigator Awards

Dr Jeffrey A. Riffel (post-doc. with John Hildebrand, University of Arizona)

Dr Michael R. Markham (research scientist with Harold Zakon, University of Texas at Austin)



Dr María de la Paz Fernández (post-doc with Ed Kravitz, Harvard Medical School)

Bart R. H. Geurten (PhD student w ith Martin Egelhaaf, Bielefeld University)

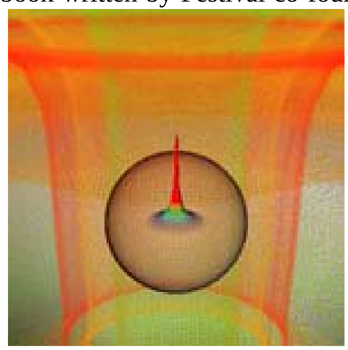
Congratulations!

The Third Annual World Science Festival

New York City, June 2-6, 2010

The best and brightest minds in science will descend on New York City for the **2010 World Science Festival** from June 2-6. The highest profile event of its kind in the United States is now in its third year and will feature 40 unique programs in scientific disciplines ranging from astronomy, physics and genetics to neuroscience, robotics and mathematics. The Festival's programs will also integrate traditional arts disciplines – dance, theatre, music and the visual arts – to underscore that science is everywhere.

The 2010 World Science Festival kicks off with a gala performance at Alice Tully Hall honoring legendary physicist **Stephen Hawking**. Among the other highlights of the five-day event: the official New York City introduction of NASA's **James Webb Space Telescope,** the powerful successor to the famed Hubble Space Telescope, which will launch in 2014; the announcement of the **2010 Kavli Prize** laureates; and the world premiere of ***Icarus at the Edge Of Time***, an orchestral work composed by **Philip Glass** and based on the children's book written by Festival co-founder and Columbia University physics professor **Brian Greene.**



The Festival will conclude with the World Science Festival Youth and Family Street Fair in Washington Square Park on June 6. This free, day-long public event showcases the intrigue and pure fun of science via a non-stop program of interactive exhibits, experiments, games, and shows, from Web-chats with NASA astronauts aboard the International Space Station to meeting scientists with "cool jobs."

A complete schedule of the Festival's programs and ticket information will be posted on the official Festival website, www.worldsciencefestival.com.

Call for Applications
ESF-EMBO Symposium:

Functional Neurobiology in Minibrains: From Flies to Robots and Back Again

17-22 October 2010 - Spain

Chair: Matthieu Louis, CRG-Centre for Genomic Regulation, EMBL-CRG Systems Biology Unit, ES
Co-Chairs: Richard Benton, University of Lausanne, CH
Bertram Gerber, Wuerzburg University, DE

Understanding the mechanisms allowing brains to collect sensory input and control adaptive behaviour represents one of the most challenging endeavours in science. The goal of this symposium is to review progress towards an integrated understanding of the genetic, molecular, and neuronal basis of behaviour in the fruit fly, Drosophila melanogaster. We will examine how our knowledge about biological neural processes can influence (and be influenced by) the design of robotic neural systems. Our aim is to bring together researchers from the]]Drosophila and insect community with experts in computational neurobiology and robotics. We will promote discussion on how to quantitatively describe working hypotheses about brain functions and behavioural control, and how bio-inspired robots may be used to test the validity and limits of our current models.

Conference format:

- lectures by invited high level speakers
- short talks by young & early stage researchers
- poster sessions, round table and open discussion periods
- forward look panel discussion about future developments

Invited speakers will include:

- Alexander Borst - NEURO-MPG, DE
- Michael Dickinson - Caltech, US
- Barry Dickson - Research Inst. of Molecular Pathology, AT
- Dario Floreano - Swiss Federal Inst. of Tech. (EPFL), CH
- Nicolas Franceschini - The Inst. of Movement Sciences, FR
- Mark Frye - University of California, Los Angeles, US
- Steven Fry - Swiss Federal Inst. of Technology (ETH), CH
- Martin Goepfert - University of Cologne, DE
- Bill Hansson - Max Planck Inst. for Chemical Ecology, DE
- Martin Heisenberg - University of Wuerzburg, DE
- Mikko Juusola - The University of Sheffield, UK
- Holger Krapp - Imperial College London, UK
- Gero Miesenböck - University of Oxford, UK
- Gerry Rubin - HHMI-Janelia Farm Research Campus, US
- Marla Sokolowski - University of Toronto Mississauga, CA
- Roland Strauss - Johannes Gutenberg University, DE
- Barbara Webb - University of Edinburgh, UK

A certain number of grants will be available for young researchers to cover the conference fee and possibly part of the travel costs. Grant requests should be made by ticking appropriate field(s) in the paragraph "Grant application" of the application form.

Full conference programme and application form accessible online from www.esf.org/conferences/10324. ESF contact for further information: Jean Kelly - jkelly@esf.org

Closing date for applications: 17 August 2010

This conference is organized by the European Science Foundation (ESF) in partnership with the European Molecular Biology Organization (EMBO).

2009 Financial Report of the INS

International Society for Neuroethology
Annual Report 2009

Total Assets as of 1/1/2009		
Cash	$174,661.48	
Investments	$218,096.33	
Total Assets		$392,757.81
Revenue		
Membership Dues	$20,750.00	
Interest on cash deposits (Schwab)	$18.38	
Bank Credits	$6.64	
Donations	$2,595.00	
Other (mailing list fee)	$200.00	
Cash Revenues for 2009		$23,570.02
Net Investment Gain/(Loss) for 2009		$19,344.83
Expenditures		
Summer School Expenses	$8,000.00	
2010 Congress Document mailing	$39.32	
Investment Expenses	$49.95	
Operating Expenses	$26,726.38	
Total Cash Expenditures for 2009		$34,815.65
Net Gain/(Loss) for 2009		$8,099.20
Total Assets as of 12/31/2009		
Cash	$68,606.85	
Investments	$332,250.15	
Total Assets		$400,857.00

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