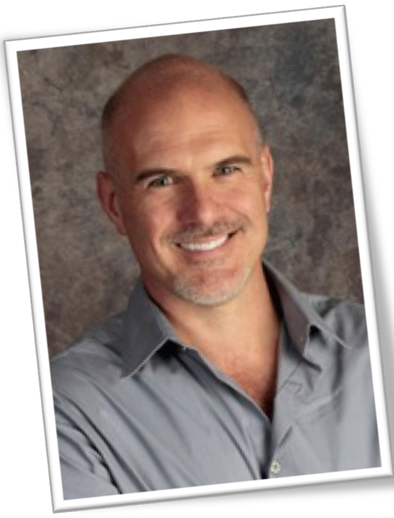
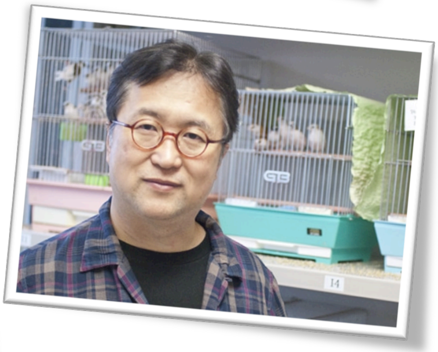
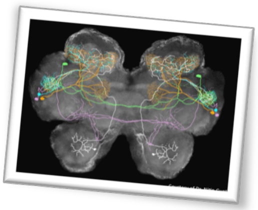
International Brain Research Organization (IBRO)
ADVANCED SCHOOL of NEUROETHOLOGY

Hokkaido University, Sapporo, Japan July 24-28, 2014

Program







	Thursday 24-Jul	Friday 25-Jul	Saturday 26-Jul	Sunday 27-Jul	Monday 28-Jul
9:00		Lecture 1a Mark Stopfer "Neural codes for odors"	Lecture 2a Alison Mercer "Social modulation of learning behavior"	Lecture 4a Kazuo Okanoya "Evolution of song complexity in Bengalese finches: Tinbergen's four questions and beyond "	Joint to Social psychology sympo "Making of Humanities: Biological Roots of Mathematics and Cooperation A joint workshop of Social Psychology and Neuroethology"
10:00		Tea break	Tea break	Tea break	
11:00		Lecture 1b Mark Stopfer "Neural codes for odors"	Lecture 2b Alison Mercer "Social modulation of learning behavior"	Lecture 4b Kazuo Okanoya "Evolution of song complexity in Bengalese finches: Tinbergen's four questions and beyond "	
12:00		Lunch break	Lunch break	Lunch break	
13:00	Introduction	Lab class 1 Nobuaki Tanaka "Electroantennogram recording from Drosophila melanogaster"	Lecture 3a Michel Platt "Neuroethology of decision-making in primates"	Lab class 2 Kazuhiro Wada "Sound recording and analysis for vocal communication in songbirds"	Joint to Social psychology sympo
14:00	Student presentation, 12 x 10min		Tea break		
15:00	tea		Lecture 3b Michel Platt "Neuroethology of decision-making in primates"		
16:00	Student presentation, 13 x 10min		Poster discussion		
17:00		Discussion & presentation		Discussion & presentation	
18:00			party		
19:00					

Lecture 1, 25-July AM

"Neural codes for odors"

Dr. Mark Stopfer (NIH/NICHD)

The job of the olfactory system is challenging: it detects vast numbers of volatile chemicals in wide ranges of concentration, and translates these encounters into the spiking language of neural activity. In insects as well as vertebrates, the neural representations of odors are dramatically transformed into a series of neural codes as they traverse successive populations of neurons. In the periphery, olfactory receptor neurons with different sensitivities respond to odorants with patterns of spikes that vary with the odorant. Concentration changes are reported to downstream neurons mostly as changes in the size of the population of receptor neurons responding to the odorant. In insects, olfactory receptor neurons activate follower cells in the antennal lobe including projection neurons and local neurons. The antennal lobe circuitry creates patterns of spiking in projection neurons that are more broadly distributed, and more temporally complex, than in the periphery. Specialized local neurons in this circuitry also mediate oscillations that transiently synchronize populations of projection neurons in an odor-dependent manner. Projection neurons extend to the mushroom body (where the responses of Kenyon Cells are remarkably specific with respect to an odor's identity and concentration, and remarkably sparse, consisting of just a few well-timed spikes upon a nearly silent background) and to the lateral horn (where many types of neurons appear to serve several functions). At each step along the olfactory pathway, the neural code serves useful functions for processing information about odors.

References:

1) Tanaka, N., Ito, K., Stopfer, M. (2009) Oder evoked neural oscillations in *Drosophila* are mediated by widely branching interneurons The Journal of Neuroscience, 29(26):8595– 8603

2) Reiter, S., Stopfer, M (2013) Spike timing and neural codes for odors. In: Spike Timing: Mechanisms and Function, eds: P. DiLorenzo, and J.D. Victor, CRC Press, 273-298.

Lab class 1, 25-July PM

"Electroantennogram recording from *Drosophila melanogaster*"

Dr. Nobuaki Tanaka (Hokkaido Univ.)

We often record mass activity of neurons. Three popular methods of the measurement are the electroencephalography, electroretinography, and electroantennography. The spatial resolution of these methods is limited, but is useful to reveal the state of sensory organs or the brain. In *Drosophila*, this mass recording method has been adopted to analyze the origin of mutant phenotypes such as abnormal behaviors. The electroretinogram (ERG) recording from compound eyes was for example used to analyze visual mutants. The electroantennogram (EAG) recording from antennae, the olfactory organ of insects, was used to analyze mutants which showed abnormal jump responses to a pungent smell. These mutants showed reduced/enhanced activity of ERG/EAG, which suggested that the mutant phenotypes were originated from the dysfunction of sensory organs.

This lab class includes this EAG recording from flies puffed with natural odorants and also the analyses of the recorded data. Students will compare the EAG amplitude between fed and starved flies to investigate if body conditions can affect the odor response, measure the EAG amplitude to repeated or long lasting stimuli to study how adaptation to olfactory stimuli occurs, or record the EAG from transgenic/mutant flies to see the effect of the genetic manipulation of olfactory sensory neurons on the EAG. We hope this course deepens your knowledge of basic electrophysiology and the development of genetic tools to study the nervous system.

Lecture 2, 26-July AM

"Social modulation of learning behavior"

Dr. Alison Mercer (Univ. of Otago)

Newborns that rely on a caregiver for survival have the ability to identify and form an attachment with their caregiver, regardless of the quality of care they receive. Rat pups, for example, approach and show a preference for their mother's odor, even if the odor is associated with punishment[1]. These young animals display two striking characteristics; their aversion learning is highly attenuated, and stressful events fail to generate a stress response[1]. An interesting parallel exists in the honey bee, *Apis mellifera*[2]. The complex bouquet of chemical messages (pheromones) released by egg-laying queens includes compounds that impair aversive learning in young worker bees and reduce their responsiveness to stress. Is this adaptive, or simply coincidence? Worker bees do not form a close attachment with their mother, nor do they receive any care from her. Why then might it be advantageous to the queen to reduce aversive learning and stress reactivity in young worker bees.

This lecture will outline what is known currently about the cellular and molecular mechanisms that support pheromone modulation of learning behavior in the honey bee and identify key questions that remain to be resolved. It will consider also the possible adaptive value of social modulation of learning in this highly social insect.

References:

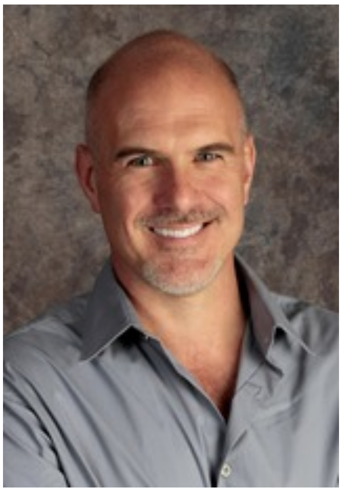
1) Moriceau S, Roth TL, Sullivan RM (2010) Rodent model of infant attachment learning and stress. *Developmental Psychobiology* 52, 651-660.

2) Urlacher E, Devaud J-M, Mercer AR (2013) Pheromones acting as social signals modulate learning in honeybees. In: R Menzel and PR Benjamin (Eds), *Invertebrate Learning and Memory*, San Diego, Academic Press, 2013, pp442-449.

Lecture 2, 26-July PM

“Neuroethology of decision-making in primates”

Dr. Michael Platt (Duke Inst. for Brain Science)



Neurobiological studies of choice behavior have uncovered neural correlates of value that incorporate information about outcome probabilities and magnitudes independently of reward type. These findings support neuroeconomic models that posit the brain uses a common currency to evaluate different types of rewards prior to making a decision. By contrast, neuroethological studies study decision-making in more natural contexts, including foraging, mate choice, and social interactions. Such decisions are among the most frequent and most important made by animals, and are likely to have played a key role in shaping the circuits that mediate behavior. Here, I review this ethological turn, its relation to normative choice models in economics, and its convergence with studies in social neuroscience and comparative biology. I argue that this turn toward fundamental, ancestral decisions offers unique potential for new insights into the structure and function of the neural circuits underlying decision making and motivated behavior.

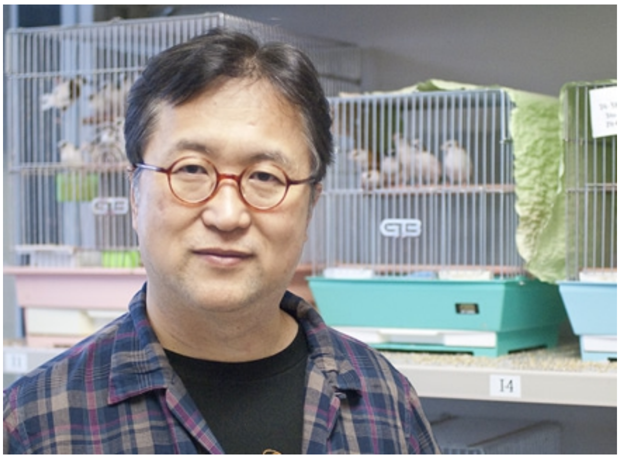
References:

1) Adams, G.K., Watson, K.K., Pearson, J., Platt, M.L. (2012) Neuroethology of decision-making. Current Opinion in Neurobiology 22:982–989
2) Changa,S.W.C., Brenta,L.J.N., Adamsa,J.K., Kleinc, J.T.,Pearsona,J.M., Watsona,K.K., Platt, M.L. (2013) Neuroethology of primate social behavior. Proceedings of the National Academy of Sciences 110 suppl. 2:10387–10394
3) Brent,L.J.N, Chang,S.W.C.Gari ´epy,J.-F., Platt, M.L. (2013) The neuroethology of friendship. Annals of the New York Academy of Sciences 1296:1–17

Lecture 3, 27-July AM

"Evolution of song complexity in Bengalese finches: Tinbergen's four questions and beyond "

Dr. Kazuo Okanoya (Univ. of Tokyo)



Bengalese finches (BFs) are domesticated strains of wild white-rumped munias (WRMs) imported from China to Japan 250 years ago. BF songs are composed of multiple chunks. Each chunk is a combination of 2-4 song notes. Chunks are arranged in a finite-state probabilistic automaton. We studied how and why BFs sing complex songs. We found the following facts. 1) The ancestral strain sings simpler songs. 2) There is high learning specificity in WRMs but not in BFs. 3) BFs have larger song control nuclei and higher level of glutamate receptor gene expressions than WRMs. 4) Both BF and WRM females prefer complex songs as measured by the nest string assay and males with complex songs are physically fitted than the males with simpler songs. These results promoted sexual selection scenario of song complexity in BFs. We further examined factors related with domestication. We examined songs of WRMs in subpopulations of Taiwan. Where there is a sympatric species to WRMs, songs were simpler. This leads to a hypothesis that in the wild songs needed to be simple to secure species identification, but under domestication this constrains was set free. We also examined socio-emotional indexes. All indexes suggested that WRMs have higher level of stress and social shyness, which should be adaptive under natural environment, but could be limiting opportunities for learning complex songs. Evolution of song complexity involves not only factors related with sexual selection and species identification, but also socio- emotional factors due to domestication.

1) Okanoya K. (2012) Behavioural Factors Governing Song Complexity in Bengalese Finches. International Journal of Comparative Psychology, 25:44–59.
2) Bolhuis, J.J., Okanoya, K., Scharff, C. (2010) Twitter evolution: converging mechanisms in birdsong and human speech Nature Reviews, Neuroscience 11: 747–759.

Lab class 3, 27-July PM

"Sound recording and analysis for vocal communication in songbirds"

Dr. Kazuhiro Wada (Hokkaido Univ.)

Acoustic signals are one of crucial ways for animal communication in many species. Acoustic signals include a variety of biological information of each individual, such as species-specificity, sex, and age. Approximately 3000 species of the world's songbirds have species-specific song patterns. In turn, like human speech, birdsong is acquired by learning that is coordination of auditory input and vocal output to mimic memorized tutor's song. This means that song acquisition in songbirds is influenced by both genetic and epigenetic factors. However, in many animal species including songbirds, it is poorly understood how vocalization is developed and how its related neural substrates contribute to acquisition of such species-specific vocal patterns.

This lab class is set out to learn how to use a recently developed method for automated recording and sound analysis for studying acoustic communications. Especially, at this section, we learn species-difference of song at syllable phonological features and syntax levels in two songbird species, the Bengalease finch and zebra finch. We also examine acoustical effects on songs by unilateral section of their tracheosyringeal nerve.

Joint workshop of Social Psychology and Neuroethology

Making of Humanities

Biological roots of mathematics and cooperation

28 July 2014

Session 1: 9:30 – 11:30am
Session 2: 13:00 – 15:00pm

Venue: Alumni Hall "Frate"
School of Medicine,
Hokkaido University
(Sapporo)

Spearkers & Commentators

- Giorgio Vallortigara (University of Trento)
- Elizabeth Brannon (Duke University)
- Tetsuro Matsuzawa (Kyoto University)
  - Shinsuke Shimojo (California Institute of Technology)

- Shinya Yamamoto (Kobe University)
- Naoki Masuda (University of Bristol)
- Tatsuya Kameda (Hokkaido University)
  - Michael Platt (Duke University)

Organizers: Toshiya Matsushima
Tatsuya Kameda
Masaki Tanaka
(Hokkaido University)

http://www.icn2014.jp/satellite/joint.html

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