Division of Zoology

STAFF

- **Professors**
  - Mats Amundin (adjunct professor)
  - Per Jensen
  - Matthias Laska

- **Associate professor**
  - Jordi Altimiras (head of division)

- **Assistant professors**
  - Lars Höglund
  - Thomas Östholm
  - Jennie Håkansson (adjunct)

- **Junior lecturer**
  - Eva Mattson
  - Örjan Lönnévik

- **Guest lecturer**
  - Christer Blomqvist

- **Post doc**
  - Dominic Wright

- **PhD-students**
  - Annelie Andersson
  - Markus Jöngren
  - Anna-Carin Karlsson
  - Isa Lindgren
  - Daniel Nätt
  - Josefin Starkhammar (LU)
  - Anna Wirén

- **Administrative staff**
  - Anna Sundin (Administrator)
  - Ingevald Abrahamsson (Engineer)

RESEARCH AND PHD TRAINING. The research activities of the division involve the study of fundamental and applied aspects of animal biology, animal physiology and animal behaviour with special emphasis on birds and mammals. The division includes four research groups: the Sensory and Behavioral Physiology Group led by professor Matthias Laska, the Animal Biology Group led by adjunct professor Mats Amundin, the Applied Ethology Group (ApE) led by professor Per Jensen and the Cardiovascular Development Lab (CADE) led by associate professor Jordi Altimiras.

Research in the Sensory and Behavioral Physiology Group focuses on odor structure-activity relationships, that is, on determining the properties of stimulus molecules that are critical for the interaction with an olfactory receptor and thus for the odor quality they evoke. A second research topic concerns correlations between chemosensory performance and ecological niches. With both topics, a comparative approach including human subjects and a variety of mammalian animal models is employed.

Ronald Jildmalm testing a white-handed gibbon for food preferences as part of his Master project in Applied Ethology

Research in the Animal Biology Group focuses on the study of communication and sonar in marine mammals. At Kolmården’s Djurpark, adjunct professor Mats Amundin in collaboration with the Electrical Measurement Department at Lund’s University, is exploring a new dolphin-human interface called ELVIS (Echolocation Visualization and Interface System). The new version of ELVIS has expanded from a 16 hydrophone matrix to a 47 hydrophone matrix to measure the full 150 kHz bandwidth of dolphin sonar clicks and the variations in the sonar beam. Its functionality was tested at the Roatan Institute of Marine Science in Honduras. ELVIS can also be configured as an acoustically operated “touch screen”. When the dolphin aims its sonar beam at a symbol projected on the screen and increases the sonar sound pressure above a set level, a reward signal is played and the dolphin receives the fish chosen. This interface can be used to study a variety of cognitive aspects of dolphin behaviour.

Dr Jacob Tougaard at Danmarks Miljøundersøgelser, MSc Daniel Wennerberg, Kolmården, and MSc Karolina Bördin, Kolmården, calibrate the porpoise listening system used to collect essential data on harbour porpoise sonar behaviour at Fyns Hoved, Denmark.

A second area of work at Kolmarden involves the census of harbour porpoises in the Baltic Sea using Porpoise Click Loggers (PCL), developed by Kolmarden. During 2008 a new version of the PCL was tested and the essential characteristics of porpoise sonar and behaviour were studied in Danish
coastal waters. In the end of 2008 a LIFE+ application was submitted for a large 5-year international project aiming at assessing the total abundance of porpoises in the Baltic. All countries around the Baltic Sea, except Germany, joined in this application. If funded, almost 300 PCL:s will be deployed and kept in operation over 2 years. New statistical methods will be developed to calculate total abundance based on these data.

Research in ethology studies the genetic basis of behavioural changes due to domestication. Particular interest is paid to side-effects of increased selection for production on behaviour and welfare, and to conservation aspects of captivity-induced behavioural changes. The main areas of research are feeding and learning in relation to adaptation capacity, and social behaviour in the same perspective, using the fowl as a model species. For this purpose the behaviour of the red junglefowl (ancestor of all domestic chickens) and a selected White Leghorn strain is compared. Using molecular genetics technology, genomic regions of importance for the behavioural differences are identified, and candidate genes are selected. By utilising genetic crossing strategies, specific genetic strains can be created for further studies of the gene effects. In 2008, populations of two new genetic types of birds were set up for behaviour genetics studies. The first was a F8-generation of intercross between White Leghorn laying hens and red junglefowl, to be used for extensive mapping of Quantitative Trait Loci. The second was an outbred red junglefowl population, in which consecutive generations will be selected for low fearfulness, to study gene expression responses to early domestication.

Egg size and egg number is one of the traits that will be mapped in a new QTL-study.

Research in the Cardiovascular Development Lab is concerned with studying the genetic and physiological mechanisms of cardiac growth and adrenergic regulation in a fast-growing chicken strain prone to develop cardiac failure and hypertension. Because these processes are altered by prenatal stress, the ultimate goal of the studies is to manipulate the cardiovascular phenotype and potentially alleviate or delay the onset of dysfunction. In 2008 we also started a new line of research to identify the molecular components that regulate how adult birds supply heat and regulate egg temperature during natural incubation. The candidate molecules are a subfamily of transient receptor potential channels (TRP), the thermoTRPs and we have analyzed the existence and expression of TRPV1, V3, V4, M8 and A1 in the skin of the brood patch during natural incubation in red junglefowl and zebrafinches.

A broody red junglefowl hen naturally incubating a clutch of eggs in the outdoor aviary at Vreta Gymnasiet

HIGHLIGHTS. In March, Christina Lindqvist defended her doctoral thesis in ethology, with the title: “Domestication effects on foraging behaviour – consequences for adaptability in chickens”, with Björn Forkman from the University of Copenhagen as opponent. In November, Daniel Nätt presented his licentiate thesis, “Stress and the offspring – Adaptive transgenerational effects of unpredictability on behaviour and gene-expression in chickens (Gallus gallus)”, with Berry Spruijt from the University of Utrecht as opposition.

Thirteen articles were published by researchers in the division in 2008 in a wide range of topics, from acoustics to genetics. Only some will be mentioned. In collaboration with researchers from SLU and UU, Per Jensen showed that the allele causing the Yellow Skin (visible as yellow legs) in chickens is caused by one or more cis-acting and tissue-specific regulatory mutation(s) that inhibit expression of beta-carotene deoxygenase 2 in skin. Remarkably, this allele originates from the grey junglefowl, casting some doubts on the generally assumed monophyletic origin of domestic chickens (Eriksson et al. 2008. Identification of the Yellow Skin Gene Reveals a Hybrid Origin of the Domestic Chicken. PLoS Genetics 4, e1000010). In another paper, Jennie Håkansson and Per Jensen presented data from four successive generations of red junglefowl in captivity, showing that even in the absence of any
directed selection, animals change their anti-predator behaviour over time. This is of importance when attempting to conserve species by rearing them in captivity (Håkansson & Jensen 2008. A longitudinal study of antipredator behaviour in four successive generations of two populations of captive red junglefowl. Applied Animal Behaviour Science 114, 409-418.)

Matthias Laska and two of his students were able to demonstrate that mice have an excellent olfactory discrimination ability for structurally related aliphatic odorants and that certain molecular parameters such as carbon chain length or the type of functional group play an important role for odor quality coding (Laska et al. 2008 Olfactory discrimination of aliphatic odorants at 1ppm: too easy for CD-1 mice to show odor structure-activity relationships? J. Comp. Physiol. A 194, 971-980.).

In collaboration with colleagues at Kolmården Wild Animal Park, Matthias Laska showed that South African fur seals can successfully be trained to discriminate between objects on the basis of odor cues and that these marine mammals have surprisingly well-developed olfactory learning and memory capabilities (Laska et al. 2008. Successful acquisition of an olfactory discrimination paradigm by South African fur seals, *Arctocephalus pusillus*. Physiol. Behav. 93, 1033-1038).

Mats Amundin and colleagues from Lund University published a paper on the first version of ELVIS in the prestigious Journal of the Acoustical Society of America.

Finally, we want to mention the construction of a new aviary to hold a colony of zebrafinches that will be used in research projects on the physiology of bird incubation and also for teaching purposes.

In collaboration with colleagues at Kolmården Wild Animal Park, Matthias Laska showed that South African fur seals can successfully be trained to discriminate between objects on the basis of odor cues and that these marine mammals have surprisingly well-developed olfactory learning and memory capabilities (Laska et al. 2008. Successful acquisition of an olfactory discrimination paradigm by South African fur seals, *Arctocephalus pusillus*. Physiol. Behav. 93, 1033-1038).

**Testing the olfactory performance of mice behaviorally.**

**Detail of adult zebrafinches in the new aviary constructed in the greenhouse adjacent to the B-building at the University**

**COOPERATION.** The Applied Ethology Group is involved in a large cooperative project with researchers from UU, SLU, KTH and KI, aiming at studying different aspects of the functional genomics of fowl. In total about 15 PhD-students, 5 postdocs and 6 principal investigators are involved. This is conducted within the framework of the so called Center for Functional Genetics, where Per Jensen is vice chairman.

**From left to right: Anna Maitz, B.Sc. Rosa Mariela Rivas Bautista, Luna Kjeldmand, Prof. Matthias Laska, Dra. Laura Teresa Hernandez Salazar**

The Sensory and Behavioral Physiology Group has a long-standing collaboration with the Instituto de Neuro-Etologia of the Universidad Veracruzana in Xalapa, Mexico. Anna Maitz and Luna Kjeldmand, students of the International Master Programme in Applied Ethology performed the experimental part of their thesis work in Mexico and collected data on chemosensory performance of spider monkeys. The same group is also collaborating with the Department of Neuro-Etologia of the Universidad Veracruzana in Xalapa, Mexico. Anna Maitz and Luna Kjeldmand, students of the International Master Programme in Applied Ethology performed the experimental part of their thesis work in Mexico and collected data on chemosensory performance of spider monkeys.
of Neurobiology at Yale University in New Haven, Connecticut, where master student Erik Boman spent five months collecting data for his Master thesis on olfactory performance in Alzheimer Disease model mice.

Mats Amundin is collaborating with LU, Sea World San Diego, the US Navy, the Swedish Board of Fisheries, the Swedish Environmental Protection Agency, Aarhus University, the Finish Ministry of Environment, Danmarks Miljöundersögelser, Fjord & Baelt Center, Denmark, and Loughborough university, UK.

The CADE Lab is collaborating with researchers at the British Antarctic Survey studying egg incubation temperatures in macaroni penguins at Bird Island, South Georgia.

EXTERNAL ACTIVITIES. Members of the division have been heavily involved in external lecturing and committee advising. The group has been visible several times on national TV, radio and in several newspaper articles on various subjects relating to the research conducted. Per Jensen was invited speaker at conferences in Edinburgh and Århus.