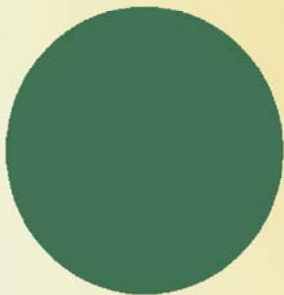


ZOOLOGICAL INSTITUTE
UNIVERSITY OF COPENHAGEN
PARK AREA

www.zi.ku.dk



SEMINAR DAY
WEDNESDAY 29TH JANUARY 2003

Zoological Institute, Park Area
Seminar Day, Wednesday 29th January 2003
Auditorium B

For Staff, PostDocs, PhD-students and MSc-students.
And for students interested in the ongoing research at the Zoological Institute, Park Area

The Zoological Institute of Copenhagen University has six departments in the Park Area, all of which are involved in cutting-edge biological research as well as undergraduate and graduate teaching.

This booklet provides a brief summary of the research interests and members of each department, as well as an introduction to the achievements of each group in 2002 and what is planned for 2003.

All the departments welcome new speciale students, particularly (but not exclusively) those who are interested in research covered by the major research interests of each group. Collaborative projects between the different departments or involving the August Krogh Institute, the Botanical Institute, or the Zoological Museum are encouraged. There are also many opportunities for experiencing research through shorter undergraduate projects (both Biologiske projektarbejder and Fagprojekter), which can often form the basis subsequent speciale projects.

This booklet is designed to provide some outline information that may be useful to those looking for research projects, as well as providing an overview of the state-of-the-art of research within each of the six departments. More extensive information is available on the Zoological Institute's Web site:

<http://www.zi.ku.dk>

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Department of Animal Behaviour

Research Approach

The department strives to make contributions of international quality to research in the field of animal behaviour and to its interfaces with other disciplines such as population ecology and evolutionary biology. Our research approach integrates questions about the mechanism, development, function and evolution of animal behaviour (as advocated by Niko Tinbergen, Nobel Laureate) and uses experimental, modelling and comparative methods to answer these questions. Our research is relevant to, and is currently being applied to animal conservation, husbandry and welfare.

Main research interests

Communication and stress/welfare behaviour are topics with clearly defined questions of current interest and also potential for long-term development because of the breadth of these topics and their many interfaces with other research disciplines.

The behaviour of signallers and receivers in communication networks (several individuals within communication range of each other), e.g. eavesdropping, environmental constraints on signal propagation, consequences of communication network for social organization and breeding strategies, the roles of communication behaviour in conservation (Peter McGregor, Torben Dabelsteen).

Behavioural adaptation responses to challenging events (e.g. captivity), associated neuroendocrine changes, and farm animal welfare (Leif Lau Jeppesen, Knud Erik Heller)

Externally funded research programmes

EU, Marie Curie postdoc (2001-2003)

SNF, Foreign postdoc (2001-2002)

SNF, Foreign postdoc (2002-2003)

EU, Marie Curie Training Site (2001-2004)

SNF, rammebevilling (2002-2003)

Centre for Sound Communication (CSC) (Danish National Research Foundation) (1999-2003)

Copenhagen Fur Centre (CFC), rammebevilling (2002-2004)

Staff developments in 2002

Leif Lau Jeppesen finished his term of office as Head of the Zoological Institute. There were no other changes to the permanent staff.

Temporary appointments: Denise Pope began her postdoc on fiddler crab communication, funded by SNF. Tom Peake's EU-Marie Curie postdoctoral fellowship ended in 2002. He continued as Amanuensis. Giuliano Matessi started a Marie Curie Individual post doc. fellowship on rock sparrow social behaviour. Vivi Pedersen started her postdoctoral fellowship on animal welfare, funded by CFC. Mogens Bildsøe and Thorsten Balsby had temporary CFC post doc positions.

news feature



Nosy neighbours

By snooping on one another's social lives, animals can work out how to behave when they meet in the future, John Whitfield listens in on the natural world's eavesdroppers.

Nosiness isn't nice. But in the past few years, behavioural biologists have shown the trait in a more positive and intriguing light. Animals from fish to songbirds, they have found, can achieve success by keeping watch on their neighbours' social lives. Such eavesdropping may also be woven into the fabric of human societies — and might even help to explain why people often behave charitably.

Prying animals reap significant rewards. They know when to pick a fight and when to back down; who to mate with, and who to cuckold. Not surprisingly, perhaps, researchers have also found that animals behave differently depending on who is watching or listening. Animal communication, experts are coming to realize, has evolved to fit into a social network, rather than being a collection of signals intended simply to impress a particular mate or rival.

Eavesdropping shows "how incredibly subtle animal strategies are," says evolutionary biologist Lee Dugatkin of the University of Louisville in Kentucky. This subtlety explains why it went unnoticed until recently — it's tricky to design experiments to tease out the effects on one animal of watching other animals interact. Peter McGregor, a behavioural ecologist at the University of Copenhagen in Denmark, suggests that researchers may also have neglected such experiments because they underestimated animals' cunning. "For most people, fish don't rate when it comes to cognitive abilities," he observes.

Yet McGregor's team has shown that Siamese fighting fish (*Betta splendens*), pictured above, possess considerable social nous. Males of this famously aggressive species defend their territories with displays of fin-swinging and gill-raking. But if this doesn't settle matters, things turn physical — sometimes fatally so.

Like human boxers, Siamese fighting fish study their opponents' previous bouts. Males pay more attention to their neighbours when they fight than at other times, McGregor and his colleagues found. And after viewing such contests, males approach the winners more warily than they do the losers, relying more on visual displays and less on biting.

Verbal abuse

Some researchers have questioned whether such experiments prove that bystanders scrutinize the interaction between opponents — they might be responding to the animals' inherent toughness or speediness. McGregor's team tackled this issue in great tits (*Parus major*) by using recordings of the birds' songs. To a male great tit, victory is a question of timing. A male threatens a rival by singing over his song, and shows deference by singing only in the gaps between the other's choruses. This allowed the researchers to use the same songs, regardless of any intrinsic property they might have, to denote attack or defence, belligerence or tact.

Setting up two loudspeakers outside a male's territory, the researchers played out

duets of differing structures and outcomes. They then moved either the winning or losing spooker into the bird's territory, and noted his reaction. Males sang less to losers², perhaps because they regard them as less of a threat, or perhaps because they are more ready to escalate contests with losers to visual displays or violence. A winner got the same cautious treatment as a stranger.

Playback experiments with nightingales (*Luscinia megarhynchos*) yield similar results — except that males intensely they sing towards winners, rather than giving losers the silent treatment². Again, it is hard to know whether the differences reflect a more, or less, aggressive response. "The interpretation can go into hand-swinging," McGregor admits. But in each case, it is clear that eavesdropping influences the animals' subsequent behaviour.

Watching a fight also changes physiology. Cichlid fish (*Oreochromis mossambicus*) that see a contest experience a rush of testosterone, perhaps priming them to fight³. Dugatkin believes that the next challenge is to integrate behavioural and physiological data on eavesdropping. "There are very few studies looking at the physiology and behaviour of one system," he says. "I think that synthesis is going to happen soon."

Males are not the only

Nosiness alters physiology, says Lee Dugatkin.

242 © 2002 Nature Publishing Group NATLRE/VOL 419/15 SEPTEMBER 2002 www.nature.com/feature

Page 1 of Nature's news feature on communication networks. In which our fighting fish proved more photogenic than we did ...

Academic highlights 2002

Four PhDs were awarded to four nationalities (Danish, French, English & Portuguese).

The work on communication networks was featured in a news feature in *Nature*, and it also received international media attention, twice in *Nature Science Update: Perch affects bird's pitch* (about environmental constraints) 28 Dec. 01; *Careless whispers cost chicks* (about eavesdropping) 03 May 02.

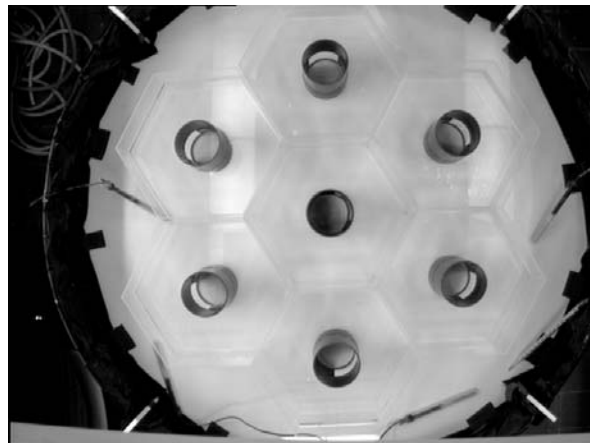
With respect to teaching, NIK (Naturvidenskabeligt IT Kompetencecenter) funded our "kuvøse-projekt" on use of multimedia in teaching. For instance, we introduced the use of palmtops in some of the practical classes in Behavioural Biology (A-modul) and made a new course website. Biologisk Studienævn funded video recordings of experiments on social behaviour in mice flocks. The recordings will be used for practical classes in a completely new first year course in behavioural biology.

Developments expected in 2003

The successful experimental research involving field and laboratory studies of communication behaviour will be continued. In a novel extension of our work with eavesdropping we have developed an innovative model system ("fishworld") for studying communication network activities in the laboratory, see picture. The artificial multi-territorial system allows full control of information flow and continuous monitoring of a complete set of social and communicative events. Our work on network behaviour will be expanded to include endocrine aspects, for instance in collaboration with ISPA, Portugal (Ricardo Matos), and simulation modelling approaches (Andrew Terry).

Our emphasis on integrating behaviour research with applied aspects continues into 2003. Within conservation, existing collaborations (e.g. Bird Life Int., RSPB, Danish Ministry of Environment) will be maintained and new collaborations will begin (IUCN, Combined Univ. Cornwall). The results of previous research on how the welfare of mink may be improved will be tested in large-scale experiments on farm mink, see picture.

Innovations in teaching will include a completely new first year course in behavioural biology (1/3 of the new course in Population Biology). The practical classes will make extensive use of multimedia techniques and use live animals only for displays/demonstrations.



"fishworld"



Ball playing mink faring well

Permanent scientific staff: Torben Dabelsteen, Knud Erik Heller, Leif Lau Jeppesen, Peter McGregor.
For a full staff list see: <http://www.zi.ku.dk/animbehav/index.html>

PhD theses completed in 2002

Thorsten J.S. Balsby – Vocal communication in the whitethroat *Sylvia communis* – supervisor: Torben Dabelsteen. Defence 18 January 2002.
Claire Latruffe – Signal value and communication significance of variation in song – the example of the corn bunting *Miliaria calandra* – supervisor: Peter McGregor. Defence 29 April 2002.

Ricardo Matos – Social influences on signalling: audience effects and communication networks – supervisor: Peter McGregor. Defence 6 August 2002.
Andrew Terry – Bioacoustics in conservation: new approaches using vocal individuality – supervisor: Peter McGregor. Defence 28 May 2002

MSc theses completed in 2002

Safi K. Darden – Vocal Identity in the Swift Fox (*Vulpes velox*) – Perspectives for Conservation – supervisor: Torben Dabelsteen. Examination 11 February.
Linda S. Mathiasen – (Lundbeck) Validation of the conditioned emotional response model – supervisor: Knud Erik Heller. Examination 17 June.
Hans Henrik Petersen (Danish Pest Infestation Laboratory) – Vurdering af prædationsrisikoen hos den afrikanske multimammate mus *Mastomys natalensis* – supervisors: Leif Lau Jeppesen & D. Herwig Leirs. Examination May 2002.

Galina Plesner – Acoustic communication in dolphins – supervisor: Peter McGregor. Examination 12 April.
Kenneth Nielsen – Bevaring af Europas store rovdyr – supervisor: Knud Erik Heller. Examination 8 February
Ann Sofie Aarøe – Sangaktivitet og investering i yngelpleje hos musvitten *Parus major* – supervisor: Torben Dabelsteen. Examination 11 December.

Ongoing PhD projects in 2002

Carlos Pacheco – Reintroduction of purple gallinule: vocal behaviour and conservation – supervisor: Peter McGregor.

Angelika Poesel (CSC) – Information transfer among blue tits *Parus caeruleus* during the dawn chorus and diurnal singing interactions – supervisor: Torben Dabelsteen.

Ongoing MSc projects in 2002

Janne D. Andersen – Developmental modes for schizophrenia – supervisor: Knud Erik Heller.
Anne Line Brink – Alternativ fodring af minkhvalpe før 8-ugers alder – supervisor: Leif Lau Jeppesen.
Sandra H. Blumenrath – Sound communication and degradation in the great tit *Parus major* – supervisor: Torben Dabelsteen.
Henrik Dam – Animal models of post traumatic stress disorder (PTSD) – supervisor: Knud Erik Heller.
Tonny Freimanis – Stereotypier hos rødmus – supervisor: Knud Erik Heller.
Naomi Hagelberg – Individidentifikation af poteaftryk – supervisor: Knud Erik Heller.
Mette M. Ibsen-From – Social behaviour in Canids – supervisor: Torben Dabelsteen.
Kåre Jakobsen – Homerange hos katte – supervisor: Knud Erik Heller.
Tanja T. Jørgensen – Adfærdsmæssig effekt af kastration og sterilisering hos hunde – supervisor: Leif Lau Jeppesen.

Per Mogensen – Courtship calls in the corncrake *Crex crex* – conservation perspectives – supervisors: Torben Dabelsteen and Tom Peake.
Aiko S. Nielsen – Kombineret effekt af plads, skjul og tidlig erfaring hos sølvvræve – supervisor: Leif Lau Jeppesen.
Sandra S. Nielsen – Visual mimicry in insects – supervisor: Peter McGregor
Maj-Britt Schwaner – Undersøgelse af arveligheden af prepulse inhibition i rotter – supervisor: Knud Erik Heller.
Lise Steffensen – Drikkevand og adfærd i dieperioden hos minkhvalpe – supervisor: Leif Lau Jeppesen.
Mette Søndergaard – Effekt af malkerobotter på adfærd/velfærd hos malkekæmper – supervisor: Leif Lau Jeppesen.
Gry M. Therkildsen – Quiet singing in blackbirds *Turdus merula* – supervisor: Torben Dabelsteen.
Rikke Vienberg – A comparison of the hooting structure in Tawny Owl (*Strix Aluco*) males and their male offspring – supervisor: Torben Dabelsteen.

Publications in refereed journals and peer-reviewed book chapters

- Balsby, T.J.S. & Dabelsteen, T. (2002) Female behaviour affects male courtship in whitethroats (*Sylvia communis*). An interactive experiment using visual and acoustic stimuli. *Animal Behaviour* 63, 251-257.
- Balsby, T.J.S. & Dabelsteen, T. (2002) Do males perceive differences in song repertoire size in whitethroats *Sylvia communis*? *Bioacoustics* 13, 93-94
- Dabelsteen, T. & Mathevon, N. (2002) Why do songbirds sing intensively at dawn? A test of the acoustic transmission hypothesis. *Acta Ethologica* 4, 65-72.
- Dabelsteen, T. & Mathevon, N. (2002) Diurnal variation in transmission caused degradation of blackcap song: implications for communication network activities. *Bioacoustics* 13, 87.
- Damm, B.T., Bildsøe, M., Vestergaard, K.S., Ladevig, J. & Gilbert, C. (2002) The effects of confinement on periparturient behaviour and circulatory prolactin, prostaglandinF2 and oxytocin in preparturient gilts with access to a variety of nest materials. *Applied Animal Behaviour Science* 76, 135-156.
- Foerster, K., Poesel, A., Kunc, H. & Kempenaers, B. (2002) The natural plasma testosterone profile of male blue tits during the breeding season and its relation with song output. *Journal of Avian Biology* 33, 269-275.
- Forstmeier, W & Balsby, T. J. S. (2002) Why mated dusky warblers sing so much: Territory guarding and male quality announcement. *Behaviour* 139, 89-112.
- Holland, J., Dabelsteen, T., Pedersen, S.B. & Paris, A.L. (2001) Potential ranging cues contained within the energetic pauses of transmitted wren song. *Bioacoustics* 12, 3-20.
- Holm, L., Jensen, M. B. & Jeppesen, L.L. (2002) Calves' motivation for access to two different types of social contact measured by operant conditioning. *Applied Animal Behaviour Science* 79: 175-194.
- Matessi, G., Dabelsteen, T. & Pilastro, A. (2001). Subspecies song discrimination in a Mediterranean population of the reed bunting *Emberiza s. Intermedia*. *Italian Journal of Zoology* 68, 311-314.
- Matessi, G., Griggio, M. & Pilastro, A. (2002) The geographical distribution of populations of the large-billed reed bunting matches that of its main winter food. *Biological Journal of the Linnean Society* 75, 21-26.
- Matos, R.J. & McGregor, P.K. (2002) The effect of the sex of an audience on male-male displays of Siamese fighting fish (*Betta splendens*). *Behaviour* 139, 1211-1221.
- Otter, K.A., Stewart, I.K., McGregor, P.K., Terry, A.M.R., Dabelsteen, T. & Burke, T. (2001) Extra-pair Paternity among Great Tits (*Parus major*) following Manipulations of Male Signals. *Avian Biology* 32, 338-344.
- Rasmussen, R. & Dabelsteen, T. (2002) Song repertoires and repertoire sharing in a local group of blackbirds. *Bioacoustics* 13, 63-76.
- Peake T.M., Terry, A.M.R., McGregor, P.K. & Dabelsteen, T. (2002) Do great tits assess rivals by combining direct experience with information gathered by eavesdropping? *Proceedings of the Royal Society of London, Series B* 269, 1925-1929.
- Pedersen, V., Moeller, H., N. and Jeppesen, L. L., (2002) Behavioural and physiological effects of post-weaning handling and access to shelters in farmed blue foxes (*Alopex lagopus*). *Applied Animal Behaviour Science* 77, 139-155
- Terry, A.M.R. & McGregor, P.K. (2002) Census and monitoring based on individually identifiable vocalisations: the role of neural networks. *Animal Conservation* 5, 103-111.

Publications in non-refereed journals

- Jeppesen, L.L., Pedersen, V. & Simonsen, T. (2002) Stereotypier, Velfærd, Politik og Produktion. Faglig Årsberetning 2001, Pelsdyrerhvervets Forsøgs- og rådgivningsvirksomhed, 21-27.
- Jeppesen, L.L. (2002) Bevar minkens gode velfærd. *Dansk Pelsdyravl* 6, 5-6.
- Jeppesen, L.L. (2002) Hvad er dyrevelfærd egentlig? *Dansk Pelsdyravl* 10, 4-5

Department of Cell Biology

Research Interests

The research interests of the Department of Cell Biology are the molecular neurobiology and molecular endocrinology of invertebrates. As model animals we use several species from two invertebrate groups, cnidarians and insects.

Cnidarians are particularly interesting because they are one of the earliest offshoots of metazoan evolution, and because they are the lowest animal group that has a nervous system. They are also interesting models for developmental biologists because they have a simple body plan, and an amazingly high regeneration capacity. For our own neurobiological studies, we use various cnidarians, such as *Hydra magnipapillata*, the hydromedusa *Polyorchis penicillatus*, and the sea anemones *Anthopleura elegantissima*, and *Calliactis parasitica* (see picture). In these animals we investigate the structure and function of



Three sea anemones (*Calliactis parasitica*) attached to a snail shell inhabited by a hermit crab. © Peter Nahke, Hamburg

neuropeptides, neuropeptide biosynthesis, and neuropeptide receptors.

Insects are the largest group of invertebrates. They are ecologically and economically extremely important, because 70% of all flowering plants depend on insects for their pollination, and insects can be severe pests, destroying about 30% of our potential annual harvest. Furthermore, insects can be vectors for serious diseases such as malaria, yellow fever, sleeping sickness, and bilharzia. Despite the importance of insects, however, their molecular endocrinology is still not well understood. Our Department contributes considerably to this research field by the cloning and characterizing of neuropeptide receptors and identifying their cognate ligands (the neuropeptides). We use the fruit fly *Drosophila melanogaster* as one of our main research models because it is well characterized and its genome has been sequenced. Our current research goal is to identify all neuropeptide receptors (about 40–45) that are expected to be found in the *Drosophila* Genome Project database (www.flybase.org). For comparative reasons we are also interested in the malaria mosquito *Anopheles gambiae*, whose genome has recently been sequenced and published (October, 2002).

While *Drosophila melanogaster* is an extremely useful animal for finding insect neurohormone receptors, these flies are too small to do appropriate physiology. For these reasons we are cloning and characterizing the most important receptors originally found in *Drosophila* from larger insects, such as the silkworm *Bombyx mori* (Lepidoptera) and the locust *Locusta migratoria* (Orthoptera).

External financial support

Our research in 2002 was financially supported by Lundbeck Foundation, Novo Nordisk Foundation, Carlsberg Foundation, Danish Natural Science Research Agency (SNF), and the Biotek II programme of the Danish Research Agency.

Staff in 2002

Cornelis (Cok) Grimmelikhuijzen, professor

Frank Hauser, associate professor, since May 2002

Georg Nørgaard Hansen, associate professor

Michael Williamson, laboratory technician

Alice Kristensen, laboratory technician (80%)

Charlotte Brodersen, laboratory assistant (50%)

Karen Meilvang, departmental secretary

Birgitte Paulsen, secretary to Cornelis Grimmelikhuijzen (15%), since July 2002

Achievements in 2002

We found (using a technique called two-colour double-labelling *in situ* hybridization) that *Hydra* has at least seven neurochemically different populations of neurons. Some neurons express one preprohormone (which, however, is processed into four or more different neuropeptides), other neurons show coexpression of preprohormone genes. This shows that primitive nerve cells use "cocktails" of neuropeptides for their signalling.

For insects we have made considerable progress with the identification of various neurohormone receptors:

The insect adipokinetic hormones (AKHs) are a large family (more than 35 members) of peptide hormones that are involved in the mobilization of sugar and lipids from the insect fat body during energy-requiring activities, such as flight and locomotion. In 2002 we identified the first insect AKH receptors from *Drosophila melanogaster* and *Bombyx mori*. These results (which were published in PNAS) represent a breakthrough for insect endocrinology, because it will lead to the cloning of all AKH receptors from all model insects used in AKH research and, therefore, to a better understanding of AKH heterogeneity and actions. Because insect AKHs are structurally closely related to the red-pigment-concentrating-hormone (RPCH) from crustaceans (AKH injected into crustaceans induces pigment concentration in chromatophores – RPCH injected into insects induces lipid mobilization), it will now also be possible to clone the crustacean RPCH receptors.

We cloned a second *Drosophila* receptor that was closely related to the first *Drosophila* AKH receptor, both with respect to amino acid sequence and gene structure. We expressed this receptor in Chinese hamster ovary (CHO) cells and used these cells (i.e., changes in their second messenger concentrations) as a bioassay to identify the neuropeptide. We expected that this ligand would be a *Drosophila* AKH, but it turned out to be *Drosophila* corazonin. Corazonin increases heart beat in some insects, but its function in *Drosophila* is unknown. These results are intriguing, because not only are the *Drosophila* AKH and corazonin receptors structurally and evolutionarily related, but so are their preprohormones, which suggests a co-evolution of ligands and receptors. The results also suggest that earlier in insect evolution, there was only one receptor/ligand couple that was responsible for both fat mobilization and heart beat during flight or other activities, and that, during evolution, gene duplications and specializations occurred. The *Drosophila* corazonin receptor is the first insect corazonin receptor to be identified. This will enable insect researchers to identify corazonin receptors from all other insects of interest. We have illustrated these possibilities by the identification of a potential corazonin receptor in the genomic database from the malaria mosquito *Anopheles gambiae*.

FMRFamide (Phe-Met-Arg-Phe-amide) and FMRFamide-related (i.e., N-terminally extended) neuropeptides are extremely widespread and abundant in invertebrates and have numerous important functions. In 2002 we



Caterpillars of the silk moth, *Bombyx mori* ©mjv.com

identified the first *Drosophila* FMRFamide receptor, which binds with high affinity to several endogenous *Drosophila* FMRFamides. Our paper on these results, which was published in PNAS, was the first report on the molecular identification of an invertebrate FMRFamide receptor. The sequence of the *Drosophila* FMRFamide receptor might provide the basis for the cloning of many other invertebrate FMRFamide receptors. We have illustrated this possibility by identifying a potential FMRFamide receptor in the *Anopheles* Genome Project database. This putative FMRFamide receptor in *Anopheles* is a new and potentially important drug target that might help us to combat malaria. FMRFamides are especially abundant in nematodes (*Caenorhabditis elegans* has 22 different FMRFamide prohormone genes!). The possible discovery of an FMRFamide receptor in nematodes will supply us with an essential drug target to fight parasitic nematodes, such as *Brugia malayi* that causes elephantiasis, which is the second leading cause of permanent disability worldwide (130 million people infected; 1.1 billion people, 20% of the world's population, are at risk of infection). All these examples illustrate that our work might also result in useful societal benefits.

Insects and other arthropods have an external skeleton (cuticle) that they need to exchange during growth or metamorphosis. This shedding of the old cuticle is called moulting or ecdysis. Because of the very large number of insects living on earth, moulting is one of the most commonly performed behaviours on our planet. Moulting is initiated and regulated by a hormonal peptide, ecdysis-triggering-hormone (ETH). In 2002 we cloned and identified the first two *Drosophila* ETH receptors. Our results can, again, be the basis for the cloning of the ETH receptors from all other insects or arthropods. We have shown that this possibility is realistic by the identification of two potential ETH receptors in *Anopheles*.

In addition to the above-mentioned receptors, we have now also identified several *Drosophila* cap receptors (which are involved in insect renal function), one crustacean cardioactive peptide (CCAP) receptor (involved in insect ecdysis) and several others.

Developments expected in 2003

We are well on our way to clone and characterize practically all (about 40-45) neuropeptide receptors from *Drosophila*. We expect that these results from our *Drosophila* receptor project will give us a totally new view on the endocrinology of insects. Furthermore, we might be able to group these receptors together (structurally, evolutionarily, functionally) and find unexpected functional relationships.

Permanent scientific staff: Cornelis Grimmelikhuijzen, Frank Hauser, Georg Nørgaard Hansen
For a full staff list see: http://www.zi.ku.dk/cellbiology/fac_staff_student.htm

PhD thesis completed in 2002

Camilla Lenz – Cloning and functional expression of neuropeptide receptors and their ligands in *Drosophila melanogaster* and *Bombyx mori* – supervisor: Cornelis Grimmelikhuijzen. Defence 15 July 2002.

MSc theses completed in 2002

Nikolaj P.E. Saxild – Molecular cloning and expression of a putative somatostatin receptor – supervisor: Cornelis Grimmelikhuijzen. Examination 4 June.

Lisbeth Bohn – Molecular cloning and expression of a third Leu-rich-containing G protein-coupled receptor from *Drosophila melanogaster* – supervisor: Cornelis Grimmelikhuijzen. Examination 12 August.

Karsten B. Jensen – Kloning og sekvensering af et nyt prohormon kodende for et formodt nyt

neuropeptid, en KVamid, i *Hydra magnipapillata* – supervisor: Cornelis Grimmelikhuijzen. Examination 20 December.

Sidrah Quereshi – Development of adeno-associated viral vector for *in vivo* gene delivery into the central nervous system – supervisors: Cornelis Grimmelikhuijzen and Frank Hauser. Examination 10 September.

Ongoing PhD project in 2002

Giuseppe Cazzamali – *Drosophila* Genome Project
– supervisor: Cornelis Grimmelikhuijzen.

Ongoing MSc projects in 2002

Thomas Secher – *Bombyx* allostatin receptors –
supervisor: Cornelis Grimmelikhuijzen.

Johanne Neiendam – NCAM in mammalian brain –
supervisor: Cornelis Grimmelikhuijzen.

Sadia Marza – NCAM in mammalian brain –
supervisor: Cornelis Grimmelikhuijzen.

Anders Dastrup – Prohormone processing in *Hydra*
– supervisor: Cornelis Grimmelikhuijzen.

Carina Rosenkilde – *Drosophila* orphan receptors –
supervisors: Cornelis Grimmelikhuijzen and
Frank Hauser.

Camilla Pretzmann – circadian rhythms in
mammals – supervisor: Cornelis
Grimmelikhuijzen

Anette Iversen – *Drosophila* ETH and capa
receptors – supervisors: Cornelis
Grimmelikhuijzen and Frank Hauser

Lene Arler – *Drosophila* capa receptors –
supervisors: Cornelis Grimmelikhuijzen and
Frank Hauser

Sune Kobberup – *Drosophila* gastrin/CCK receptors
– supervisors: Frank Hauser and Cornelis
Grimmelikhuijzen

Kristoffer Egerod – *Drosophila* FMRFamide
receptors – supervisors: Frank Hauser and
Cornelis Grimmelikhuijzen

Eólfur Reynisson – *Drosophila* orphan receptors –
supervisors: Cornelis Grimmelikhuijzen and
Frank Hauser

Stine Frederiksen – *Drosophila* orphan receptors –
supervisors: Frank Hauser and Cornelis
Grimmelikhuijzen

Rikke Mortensen – circadian rhythms in mammals –
supervisor: Cornelis Grimmelikhuijzen

Nikolaj Tindbæk – neurohormone receptors in
mammals – supervisor: Cornelis
Grimmelikhuijzen

Susanne Schöller – FMRFamide receptors in
Anopheles gambiae – supervisors: Frank Hauser
and Cornelis Grimmelikhuijzen

Marina Rybaltov – *Drosophila* orphan receptors –
supervisors: Frank Hauser and Cornelis
Grimmelikhuijzen

Lars Jørgensen – *Drosophila* orphan receptors –
supervisors: Frank Hauser and Cornelis
Grimmelikhuijzen

Publications in 2002

Cazzamali, G. & Grimmelikhuijzen, C.J.P. (2002)
Molecular cloning and functional expression
of the first insect FMRFamide receptor.
*Proceedings of National Academy of Sciences
of the USA* 99, 12073-12078.

Cazzamali, G., Saxild, N.P.E. & Grimmelikhuijzen,
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Department of Evolutionary Biology

Research profile

Our main research areas are the study of the molecular evolution of cellular processes and organismal complexity, and evolutionary processes at the intra- and interspecific levels. The increase in the availability of DNA-data and the understanding of molecular genetics offers the opportunity to explore general mechanisms fundamental to molecular evolution, and to study the interrelationship between inheritance, phenotype and genotype. At higher levels and based on DNA-data, we study population genetic processes within species, the generation of species diversity, interactions among species, evolution of regional faunas and diversification at higher taxonomic levels.



Oryx and Kudu in Etosha National Park. Just two of the African artiodactyls whose population genetics and speciation are studied in the department.

Main research interests

Molecular processes

Molecular processes can facilitate extreme diversity of gene products without changes in the underlying DNA (alternative splicing is an example). Regulatory networks of non-coding RNAs (ncRNA) are likely to be important for cellular functions and thus for phenotypic evolution.

Main projects

- Alternative splicing in evolution. (Peter Arctander)
- Evolution of regulating non-protein-coding RNAs. (Peter Arctander)

Evolutionary processes at the intra- and inter-specific levels

We focus on population genetic processes of a general nature, such as the phylogeny of major animal groups and problems related to the evolution of regional faunas (e.g. Large African herbivores such as antelopes, gazelles, buffalos, elephants, hippos, pigs and zebras).

Main projects

- Evolution of population structure and speciation among African Artiodactyls. (Hans R. Siegismund, Peter Arctander)
- African elephants and zebras. (Hans R. Siegismund, Peter Arctander)
- Conservation genetics (Hans R. Siegismund)
- Genetic variation within the honey bee, *Apis mellifera* (Bo Vest Pedersen)
- Phylogenetic studies of European bumblebees (Bo Vest Pedersen)

Research Projects of Post-docs

Jakob Damgaard - Use of molecular genetic markers for resolving Neopteran insect phylogenetic relationships with special emphasis on aquatic and semiaquatic bugs (Heteroptera: Nepomorpha & Gerromorpha)

Henrik Glenner – Arthropod phylogeny with special emphasis on crustaceans

Peter Gravlund – Early cattle in Denmark – its origin and relations to the aurochs (*Bos primigenius*) investigated using ancient DNA.

Daniel Jeffares – a) Transcript evolution in *Caenorhabditis* nematodes. b) 2. Description of the Mei2-like Protein Family. c) 2. Evolution of Sam/Frodo Retrotransposons in *Caenorhabditis* nematodes.

Annette Bruun Jensen – Beekeeping and Apis biodiversity in Europe

Regin Rønn – Bacterial diversity in soil – effect of protozoan grazing

Staff

Peter Arctander, Professor

Bo Vest Pedersen,

Associate Professor

Hans R. Siegismund,

Associate Professor

Bent Christensen, Professor

emeritus

New development in 2003

In January 2003 the Carlsberg Foundation granted 5 years of support for the project “Molecular Diversity and Evolution”. The grant includes a total of 10 post doc years, 2 PhD stipends and running costs amounting to more than 8 million kroner.



A comb with Black or Læsø Bees, *Apis mellifera mellifera*. The Queen is marked with a blue dot. This subspecies is the focus of genetic studies aimed at conserving European bee biodiversity.

The project has two major components:

1. Evolution of processes responsible for gene product diversity. Focus will initially be on alternative splicing in evolution.
2. Evolution of regulatory networks based on non-coding RNA. The overall perspective for these studies is the molecular evolution of organismal complexity. The aim is to better understand the relation between phenotypic evolutionary change and the evolution of basic molecular processes. Methodologically, the project will combine bioinformatics and molecular experimentation including the use of expression microarrays, and will use nematodes as model organisms.

The project is in close collaboration with the Bioinformatics Centre, KU, the Department of Statistics and Operational Analysis, KU, and John Mattick’s group at the Institute for Molecular Biosciences at the University of Queensland, Australia.

Permanent scientific staff: Peter Arctander, Bo Vest Pedersen, Hans Siegismund

For a full staff list see: http://www.zi.ku.dk/evolbiology/index_new.htm

PhD thesis completed in 2002

Ann-Charlotte Heiberg – Population effects of anti-coagulant rodenticide resistance in Norway rats (*Rattus norvegicus*) – supervisor: Hans Siegismund. Defence 29 May 2002

MSc theses completed in 2002

Jan Lundsted – Analysis of the minisatellite DYF155S1 (MSY1) in a forensic perspective – supervisor: Peter Arctander. Examination 3 December

Mika Zagrobely – Survey of a family of non-LTR retrotransposons in *Caenorhabditis elegans* and *Caenorhabditis briggsae* – supervisor: Peter Arctander. Examination 20 December

Ongoing PhD projects in 2002

Anders Hansen – Damage formation in ancient DNA – supervisor: Peter Arctander

Lise Hansen – Interplay between reproductive system and genetic population structure – supervisor: Hans Siegismund

Thomas Hansen – Genetic and phenological variation in stress-dependent sex allocation patterns and selfing rate in *Silene nutans* – supervisor: Hans Siegismund

Tobias Mourier – Evolutionary implications of reverse transcription – supervisor: Peter Arctander

Charles Masembe – Phylogeography of African bovids – supervisor: Hans Siegismund

Vincent Muwanika – Phylogeny of African pigs and the population structure of the common warthog (*Phacochoerus africanus*) in Africa – supervisor: Hans Siegismund

John B. Okello – Population genetics of the African savannah elephant – supervisor: Hans Siegismund

Louise Buchholt Pedersen – Phylogeny, pollination, reproductive biology, and historical ecology in Zingiberales – supervisor: Hans Siegismund

Charles Twesigye – Molecular diversity of the *Tilapia* fish – supervisor: Hans Siegismund

Eske Willerslev – DNA survival and diversity in fossil remains – supervisor: Peter Arctander

Ongoing MSc projects in 2002

Naja Steen Andersen – Genetic differentiation in Danish and European populations of *Beta vulgaris* – supervisor: Hans Siegismund

Jonas Binladen – Phylogenetic position of the woollen rhinoceros – supervisor: Bo Vest Pedersen

Ditte Guldager Christensen – Population genetic studies of the water frog, *Rana esculenta*, in Denmark – supervisors: Bo Vest Pedersen and Koos Boomsma

Martin Bay Hebsgaard – The evolution of water bugs, Nepomorpha (Hemiptera: Heteroptera), with a new hypothesis on the evolution of respiratory behaviour – supervisor: Bo Vest Pedersen

Bodil Kværnø – Molecular phylogeography of *Dryas* – supervisor: Hans Siegismund

Eline Lorenzen – Status of the blackfaced impala – is it threatened by hybridisation? – supervisor: Hans Siegismund

Søren Mørck – Detection of alternative splicing in *Caenorhabditis elegans* – supervisor: Peter Arctander

Rikke deNeergaard – Population genetic studies of Uganda Kob and White-eared Kob – supervisor: Hans Siegismund

Jesper Stenderup – Evolutionary biology of Branchiopods – Supervisor: Henrik Glenner

Olivier Falk-Rønne – Importance of multi-copy genes for phylogenetic studies – supervisor: Bo Vest Pedersen

International Publications

Christensen, B., Pedersen, B. V. & Hvilsom, M. M. (2002) Persisting clone pool differences in sexual/asexual *Buchholzia appendiculata* (Enchytraeidae, Oligochaeta) as revealed by genetic markers. *Pedobiologia* 46: 90-99.

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- Ekelund, F., Frederiksen, H.B. & Rønn, R. (2002) Population dynamics of active and total ciliate populations in arable soil amended with wheat. *Applied and Environmental Microbiology* 68, 1096-1101.
- Glenner, H. & Høeg, J.T. (2002) The Evolution of Rhizocephala. In: *Modern Approaches to the Study of Crustacea*. E. Dscobar-Briones & F. Alvarez (Eds). pp 301-310.
- Gravlund, P. (2002) Molecular phylogeny of Tornier's cat snake (*Crotaphopeltis tornieri*), endemic to East African mountain forests: biogeography, vicariance events and problematic species boundaries. *Journal of Systematic and Evolutionary Research* 40, 46-56.
- Jepsen, B.I., Siegismund, H.R. & Fredholm, M. (2002) Population genetics of the native caribou (*Rangifer tarandus groenlandicus*) and the semi-domestic reindeer (*Rangifer tarandus tarandus*) in Southwestern Greenland: evidence of introgression. *Conservation Genetics* 3, 401-409.
- Møller, P. R., Jordan, A. D., Gravlund, P. & Steffensen, J. F. (2002) Phylogenetic position of the cryopelagic codfish genus *Arctogadus* Drjagin, 1932 based on partial mitochondrial cytochrome b sequences. *Polar Biology* 25, 342-349.
- Nielsen, L.R., Philipp, M. & Siegismund, H.R. (2002) Selective advantage of ray florets in two endemic Galápagos species, *Scalesia affinis* and *S. pedunculata* (Asteraceae). *Evolutionary Ecology* 16, 139-153.
- Nyakaana S., Arctander, P. & Siegismund, H.R. (2002) Population structure of the African savannah elephant inferred from mitochondrial control region sequences and nuclear microsatellite loci. *Heredity* 89, 90-98.
- Pedersen, B.V. (2002) European Bumblebees (Hymenoptera: Bombini) – phylogenetic relationships inferred from DNA sequences. *Insect Systematics and Evolution* 33, 361-386.
- Pitra, C., Hansen, A.J., Lieckfeldt, D. & Arctander, P. (2002) An exceptional case of historical outbreeding in African sable antelope populations. *Molecular Ecology* 11, 1197-1208.
- Rønn, R., Gavito, M., Larsen, J., Jakobsen, I., Frederiksen, H. & Christensen, S. (2002) Response of free-living soil protozoa and microorganisms to elevated atmospheric CO₂ and presence of mycorrhiza. *Soil Biology and Biochemistry* 34, 923-932.
- Rønn, R., McCaig, A.E., Griffiths, B.S. & Prosser, J.I. (2002) Impact of protozoan grazing on bacterial community structure in soil microcosms. *Applied and Environmental Microbiology* 68, 6094-6105.
- Tautz, D., Arctander, P., Minelli, A., Thomas, R.H. & Vogler, A.P. (2002) DNA points the way ahead in taxonomy. *Nature* 418, 479
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- Willerslev, E., Mourier, T., Hansen, A. J., Christensen, B., Barens, I. & Saltzberg, S. L. (2002) Contamination in the draft of the human genome masquerades as lateral gene transfer. *DNA sequence* 13, 75-76.

Popular articles

- Ekelund, F. & Rønn, R. (2002) Hvorfor forsvinder bakterier oftest, når vi tilsætter dem til jord? Miljøforskning. *Nyhedsbrev for Det Strategiske iljøforskningsprogram* 53, 33-34.
- Siegismund, H. R. (2002) Hvad er en art? *Fugle i Felten* 8, 24-27.

Department of Population Ecology

Research Profile

The department's ambition is to make fundamental research contributions to the field of animal population ecology, including its interfaces with animal behaviour, population genetics and evolutionary biology. Our research programmes aim to elucidate processes that determine the dynamics of populations and the degree of adaptation of individuals within these populations. We integrate theory and experimental techniques from behavioural ecology, population dynamics and evolutionary biology, with a balanced emphasis on invertebrate and vertebrate model organisms. Outside the realm of fundamental science, our research is relevant for conservation biology, for understanding the consequences of climate change and for the biological control of arthropod pests.

Major research interests

The ecological and evolutionary study of conflict and cooperation in insect societies and the interactions of these societies with competitors, mutualists and parasites (Koos Boomsma and Jes Søren Pedersen, with contributions from David Nash and Bo Vest Pedersen)

Spatio-temporal interactions in tritrophic systems, metapopulation dynamics and biological control (Gösta Nachman)

Integrated pattern- and process-orientated studies of the effects of climate on life history variation and the spatio-temporal dynamics of northern populations and communities (Mads C. Forchhammer, APE – the Arctic Population Ecology group).

Externally funded research programmes

Evolutionary Stability of Symbiotic Interactions involving Social Insects (SNF) (2000-2002)

Centre for Social Evolution and Symbiosis (SNF)(2002-2005)

Evolution of Hypersocial Systems (SNF-STENO)(2001-2004)

Scaling the interface between climate and ecology (SNF)(2000-2002)

Scandinavian-North European Network of Terrestrial Field Bases
"SCANNET" (EU/Danish Polar Centre)(2002-2003)

Research-Training Network "Integrated Studies of the Economy of Insect Societies", "INSECTS" (EU)(2001-2004)

Research-Network "*Maculinea* Butterflies of the Habitats Directive and European Red List as Indicators and Tools for Habitat Conservation and Management", "MacMan" (EU)(2002-2005)

Research Network "Beekeeping and *Apis* Biodiversity in Europe", "BABE" (EU)(2001-2004)

Staff developments in 2002

Associate Professors Hans Dreisig and Jørn Andreassen retired. Mads C. Forchhammer was appointed as associate professor and David Nash's AC-TAP position was made permanent as of 1 January 2003.



© Nette Levermann
A walrus calf surrounded by adults on Sandøen, Young Sound, NE Greenland. Nette Levermann is studying foraging ecology and population dynamics of this species as part of the Arctic Population Ecology group.

New temporary appointments in 2002 were: 1. Inga Zeisset and Ian Wynne as postdocs on the MacMan programme, 2. Kellie Palmer and Annette Bruun Jensen (as Kellie's replacement) on the BABE pro-

gramme (shared with Evolutionary Biology), 3. Sylvia Cremer as postdoc on the INSECTS network, 4. Michael Poulsen as PhD student, 5. Toke Høye as research assistant on the ScanNet programme, 6. Two postdoc positions available in the Centre for Social Evolution and Symbiosis were offered to Duur Aanen and Boris Baer. EU-Marie Curie postdoctoral fellowships of Duur Aanen, Boris Baer and Bill Hughes ended in 2002.

Academic highlights of 2002

Three new research programmes started in 2002, continuing work that had been developed at the department in the past few years (ScanNet, MacMan and the Centre for Social Evolution and Symbiosis). SCANNET is a multidisciplinary collaboration of northern field stations for monitoring e.g. species performance and phenology. MacMan is a European-wide conservation program for *Maculinea* large blue butterflies, which for us involves genetic studies of gene flow between populations and post-glacial colonisation routes. The Centre for Social Evolution and Symbiosis focuses on the issues mentioned in the first of the departmental research interests above.

With regard to teaching, the department offered for the first time an introductory course in GIS (Mikkel Bølstad and Gösta Nachman) and organised (with NORFA support) a PhD course in Individual Based Modelling (Gösta Nachman). The Department was also actively involved in the foundation of the PhD school ISOBIS (International School of Biodiversity Sciences). Koos Boomsma became a board member of ISOBIS.

Three publications by department members received considerable interest from the public media in 2002: 1. A paper by Jes Søe Pedersen (PNAS) on a 6000 km long colony of invasive Argentine ants. 2. A paper by Duur Aanen and Koos Boomsma (PNAS) on the phylogeny of fungus-growing termites and their symbionts. 3. A paper by Erik Post and Mads C. Forchhammer (Nature) on the effect of large scale climate fluctuations on muskox and reindeer populations in, respectively, east and west Greenland.

Developments expected for 2003

The Department will continue to cover terrestrial population ecology in the broadest possible way, i.e. including the interfaces with evolutionary biology (adaptation and co-evolution), population genetics (population subdivision/fragmentation, hybridization and phylogeography) and behaviour (mating systems). The Centre for Social Evolution and Symbiosis and the various EU-funded programs on social insects will exploit this entire range of activities. In the core area of population ecology, we will further expand our research profile in Arctic population ecology (APE), helped by a PhD fellowship funded by the Danish Polar Centre (applicants are currently being evaluated). Various aspects of conservation biology will also increase in importance, with existing and new spearheads in climate change ecology and the study of invasive species. Field programs on Læsø (*Maculinea* butterflies and their host ants, black honey bees) will be pursued at an even larger scale than last year.

Innovation in teaching will include a completely new zoological curriculum for the (2nd part) “Terrestrial Ecology” course in spring (starting with new courses in “Biodiversity” and “Conservation” in the second half of the new Bachelor curriculum), and the start of new first year courses in Population Biology and Statistics in the first autumn semester of the new curriculum.

Permanent scientific staff: Jacobus J. Boomsma, Mads Forchhammer, Gösta Nachman

For a full staff list see: http://www.zi.ku.dk/popecol/fac_staff_student.htm



A queen of the leafcutting ant *Atta colombica*, covered in minor worker ants. Recent work by Mischa Dijkstra has shown that they lay special trophic eggs on which the queen feeds.

PhD theses completed in 2002

Thomas Damm Als (Institute of Biological Sciences, University of Aarhus) – Evolutionary and Ecological Interactions between *Maculinea* Parasites and their *Myrmica* Ant Hosts – supervisors: Dave Parker and Koos Boomsma. Defence 12 March 2002.

Steven van Borm (Zoological Institute, University of Leuven, Belgium) – Microsymbionts and Intracolony Genetic Diversity in Ants – supervisors: Johan Billen and Koos Boomsma. Defence 27 May 2002.

Thomas B. G. Berg (DMU) – The Collared Lemming (*Dicrostonyx groenlandicus*) in Greenland: Population Dynamics and Habitat Selection in Relation to Food Quality – supervisors: Mads C. Forchhammer and Koos Boomsma. Defence 21 February 2003.

MSc theses completed in 2002

Mikkel Bølstad – Consequences of Residency for Habitat Use by Tawny Owls, *Strix aluco* – supervisor: Gösta Nachman. Examination 8 February.

Bjarke Feenstra (Centre for Skov og Landskab) – Modelling Individual Tree Mortality for Unthinned Oak Stands in Denmark – supervisors: Vivian Kvist Johannsen, Bo Marin Bibby (KVL), Marianne Philipp and Gösta Nachman. Examination 21 February.

Charlotte M. Moshøj – Foraging Behaviour, Predation and Diet of the European Lynx (*Lynx lynx*) in Sweden – supervisor: Mads C. Forchhammer. Examination 18 July.

Morten Bøyesen – Life History Variation and Adaptation in the Greenlandic Seed Bug *Nysius groenlandicus* – supervisor: Koos Boomsma. Examination 23 August.

Mette Borglykke (DMU) – Diet of the Beaver (*Castor fiber*) in Klosterheden State Forest, Denmark – supervisors: Mads C. Forchhammer and Aksel B. Madsen. Examination 22 October.

Stine Clemmensen – Comparative Life Histories of Lynx, Gray Wolf and Coyote – supervisor: Mads C. Forchhammer. Examination 14 November.

Ongoing PhD projects in 2002

Aqqaq Rosing Asvid – The Hunt of Ringed Seals and Harp Seals Around Greenland in Relation to Changes in Climate, Ice Cover, Oceanographic Conditions, and Ecosystem Context – supervisors: Mads C. Forchhammer and Koos Boomsma.

Michiel B. Dijkstra – Worker Policing in Fungus-Growing Ants – supervisor: Koos Boomsma.

Mette Hammershøj (DMU) – Population Dynamics and Inter/intracolonial Interactions of an Introduced Top Predator, the Mink – supervisors: Aksel B. Madsen and Mads C. Forchhammer.

Jane Uhd Jepsen (DMU) – An Individual Based Model for Roedeer – supervisors: Chris Topping and Gösta Nachman.

Flemming Merkel (GN) – Population Dynamical Studies of Eider Ducks in Greenland – supervisors: Gösta Nachman and Mads C. Forchhammer

Josephine Nyman (Forskerakademiet) – Physical Condition of Female Reindeer in Relation to the Foraging Condition in South Greenland – supervisor: Mads C. Forchhammer.

Michael Poulsen – Reproductive Conflict in Mutualistic Interactions Involving *Acromyrmex* Leaf-Cutting Ants – supervisor: Koos Boomsma.

Niels Martin Schmidt (KVL, KU) – Climate, Agriculture and Density Dependent Dynamics of Vertebrates Within and Across Trophic Levels in Contrasting Ecosystems – supervisor: Mads C. Forchhammer.

Ongoing MSc projects in 2002

Ditte Guldager Christiansen – Population Genetic Studies of the Water Frog, *Rana esculenta*, in Denmark – supervisors: Koos Boomsma and Bo Vest Pedersen.

Kasi Ben Desfor – Infidelity and Kinship in the Tawny Owl (*Strix aluco*) Population in Gribskov: a Parental Analysis Using DNA Microsatellite Analysis – supervisor: Koos Boomsma and Peter Sunde.

- Tim Engelkes** (SOKRATES, University of Amsterdam) – Social and Genetic Population Structure of the Invasive Garden Ant, *Lasius neglectus* – supervisors: Jes Søe Pedersen and Koos Boomsma.
- Ditte Hendrichsen** (DMU) – Predator-Prey Interactions in Relation to Long Term Variations in Biotic and Abiotic Factors – supervisors: Mads C. Forchhammer and Chris Topping.
- Trine-Lee Wincenz Jensen** (DMU) – Health and Reproduction in Rural and Urban Fox, *Vulpes vulpes*, Populations – supervisors: Aksel B. Madsen and Koos Boomsma.
- Lene Jung Kjær** – Assessing the Effects of Changes in Land Use on the Population Dynamics of Roedeer (*Capreolus capreolus*) by Applying an Individual Based Model to an Historical Landscape – supervisor: Gösta Nachman.
- Marie Nykjær Larsen** – Intra- and Interspecific Competition Between the Grain Beetle *Sitophilus zeamais* and the Grain Moth *Sitotroga cerealella* – supervisor: Gösta Nachman.
- Nette Levermann** (GN) – Walrus' (*Odobenus rosmarus*) Foraging Ecology and Population Dynamics in Relation to Climate Change – supervisors: Mads C. Forchhammer and Erik Born.
- Bjarne Lyberth** (GN) – Environmental Constraints on Body Condition and Cohort Variation Across Muskox Populations – supervisors: Arild Landa and Mads C. Forchhammer.
- Helene Nygaard** (DMU) – Duckling Survival in the Common Eider, *Somateria Mollissima*, on Christiansø, Denmark and in Upernavik, Greenland in Relation to Predation – supervisor: Mads C. Forchhammer.
- Katrine Raundrup** – Feeding Ecology of Muskoxen (*Ovibos moschatus*) in Relation to Parasite Burden – supervisor: Mads C. Forchhammer.
- Rolf Rødven** (University of Tromsø) – Density, Climate, Age and Life-History in a Herd of Female Reindeer in Finnmark – supervisors: Nick Tyler and Mads C. Forchhammer.
- Mette Vang** – Mortality of Lambs in Halså/Surnadal, Møre og Romsdal – supervisor: Gösta Nachman.

Publications in refereed journals and peer-reviewed book chapters

- Aanen, D.K., P. Eggleton, C. Rouland-Lefèvre, T. Guldberg-Frøsløv, S. Rosendahl & J.J. Boomsma (2002) The evolution of fungus-growing termites and their mutualists. *Proceedings of the National Academy of Sciences of the U.S.A.* 99, 14887-14892.
- Als, T.D., D.R. Nash, & J.J. Boomsma (2002) Geographical variation in host-ant specificity of the parasitic butterfly *Maculinea alcon* in Denmark. *Ecological Entomology* 27, 403-414.
- Anderson, C., J.J. Boomsma & J.J. Bartholdi III (2002) Task partitioning in insect societies: bucket brigades. *Insectes Sociaux* 49, 171-180.
- Boomsma, J.J. & G. Nachman (2002) Analysis of sex ratios in social insects. In: Hardy, I.C.W. (ed.) *Sex ratios: concepts and research methods*, p. 93-111. Cambridge University Press, Cambridge UK.
- Bot, A.N.M., D. Ortius-Lechner, K. Finster, R. Maile & J.J. Boomsma (2002) Variable sensitivity of fungi and bacteria to compounds produced by the metapleural glands of leaf-cutting ants. *Insectes Sociaux* 49, 363-370.
- Bønløkke-Pedersen, J., J. Drachmann, J. Frydenberg & J.J. Boomsma (2002) Rare extra-pair fertilizations in the semi-colonially breeding linnet *Carduelis cannabina*. *Journal of Avian Biology* 33, 203-206.
- Forchhammer, M.C., E. Post & N.C. Stenseth (2002) North Atlantic Oscillation timing of long- and short-distance migration. *Journal of Animal Ecology* 71, 1002-1014.
- Forchhammer, M.C., E. Post, N.C. Stenseth & D.M. Boertmann (2002) Long-term responses in arctic ungulate dynamics to changes in climatic and trophic processes. *Population Ecology* 44, 113-120.
- Fox, A.D., J.O. Hilmarsson, O. Einarsson, A.J. Walsh, H. Boyd & J.N. Kristiansen (2002) Staging site fidelity of Greenland White-fronted Geese *Anser albifrons flavirostris* in Iceland. *Bird Study* 49.
- Giraud, T., J.S. Pedersen & L. Keller (2002) Evolution of supercolonies: the Argentine ants of southern Europe. *Proceedings of the National Academy of Sciences of the U.S.A.* 99, 6075-6079.
- Hels, T. & G. Nachman (2002) Simulating viability of a spadefoot toad (*Pelobates fuscus*) metapopulation in a landscape fragmented by a road. *Ecography* 25, 730-744.
- Hughes, W.O.H., J. Eilenberg & J.J. Boomsma (2002) Trade-offs in group living: transmission and disease resistance in leaf-cutting ants. *Proceedings of the Royal Society of London series B* 269, 1811-1819.
- Kristiansen, J.N. & N.S. Jarrett (2002) Interspecific competition between Greenland White-fronted Geese *Anser albifrons flavirostris* and Canada Geese *Branta canadensis interior* moulting in West Greenland: Mechanisms and consequences. *Ardea* 90, 1-13.
- Lindström, J., T. Coulson, L. Kruuk, M.C. Forchhammer, D. Coltman & T. Clutton-Brock (2002) Sex ratio variation in Soay sheep. *Behavioral Ecology and Sociobiology* 53, 25-30.

- Moilanen A., L. Sundström & J.S. Pedersen (2002) *MATESOFT: a program for genetic analysis of mating systems*. Version 1b "Silver". Incl. documentation 46 pp.
- Nachman, G. & R. Zemek (2002) Interactions in a tritrophic acarine predator-prey metapopulation system III: Effects of *Tetranychus urticae* (Acari: Tetranychidae) on host plant condition. *Experimental and Applied Acarology* 26, 27-42.
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- Post, E. & M.C. Forchhammer (2002) Synchronization of animal population dynamics by large-scale climate. *Nature* 420, 168-171.
- Poulsen, M., A.N.M. Bot, C.R. Currie & J.J. Boomsma (2002) Mutualistic bacteria and a possible trade-off between alternative defence mechanisms in *Acromyrmex* leaf-cutting ants. *Insectes Sociaux* 49, 15-19.
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- Schultz, T.R., S.A. Solomon, U.G. Mueller, P. Villesen, J.J. Boomsma, R.M.M. Adams & B. Norden (2002) Cryptic speciation in the fungus-growing ant *Cyphomyrmex longiscapus* Weber and *Cyphomyrmex muelleri* Schultz and Solomon, new species (Formicidae, Attini). *Insectes Sociaux* 49, 331-343.
- Sunde, P. (2002) Starvation mortality and body condition of Goshawks *Accipiter gentilis* along a latitudinal gradient in Norway. *Ibis* 144, 301-310.
- Van Borm, S. & J.J. Boomsma (2002) Group-specific polymerase chain reaction amplification of SSU rRNA-encoding gene fragments from 12 microbial taxa. *Molecular Ecology Notes* 2, 356-359.
- Van Borm, S., J. Billen & J.J. Boomsma (2002) The diversity of microorganisms associated with *Acromyrmex* leaf-cutting ants. *BioMed Central Evolutionary Biology* 2002 2, 9.
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- Van der Hammen, T., J.S. Pedersen & J.J. Boomsma (2002) Convergent development of low relatedness supercolonies in *Myrmica* ants. *Heredity* 89, 83-89.
- Villesen, P., P.J. Gertsch & J.J. Boomsma (2002) Microsatellite primers for fungus-growing ants. *Molecular Ecology Notes* 2, 320-322.
- Villesen, P., T. Murakami, T.R. Schultz & J.J. Boomsma (2002) Unravelling the transition between single and multiple mating in attine ants. *Proceedings of the Royal Society of London, series B* 269, 1541-1548.

Publications in non-refereed journals (excluding abstracts, including popular articles)

- Boomsma, J.J. (2002) First Annual Report of the EU-IHP Research-Training Network "Integrated Studies of the Economy of Insect Societies", "INSECTS", 24 pp.
- Forchhammer, M.C. (2002) Analyser og modeller i relation til forandringer i klimaet. In Meltofte, H. (ed) *Sne, is og 35 graders kulde – Hvad er effekterne af klimaændringer i Nordøstgrønland?* DMU: Tema-rapport 41, pp. 15-24.
- Forchhammer, M.C. & T.B.G. Berg (2002) Moskusokserne i Zackenbergdalen påvirkes af snemængde og plantevækst. In Meltofte, H. (ed) *Sne, is og 35 graders kulde – Hvad er effekterne af klimaændringer i Nordøstgrønland?* DMU: Tema-rapport 41, pp. 67-72.
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- Nachman, G. (2002) Biology needs IT. *Dina News*, 3.
- Olesen, C.R., T. Asferg & M.C. Forchhammer (2002) Rådyret i Danmark. *DMU: Tema rapport* 39.

Department of Terrestrial Ecology

Research profile

Our aim is to be at the forefront of studies of nutrient turnover and the dynamics of the populations responsible for these processes in terrestrial ecosystems. We are at the cutting edge of studies of the most prominent unicellular eukaryotes (the protozoa) and study these in conjunction with soil-dwelling nematodes. The two groups of organisms allow us to analyse nutrient dynamics over a range of spatial scales, covering different soil microenvironments, as well as the rhizosphere where strong interactions even occur with aboveground organisms via the living plant. Our research is highly relevant to the applied fields of crop production and ecotoxicology.

Major research interests

Linking aboveground terrestrial ecology and soil biology via the living plant. This has proven to be an attractive research field giving clues to mechanisms behind ecosystem functioning (Søren Christensen).

Protozoa in the soil environment. Molecular, microscopic and physiological examination to reveal if specific soil protozoa exist as opposed to marine forms (Flemming Ekelund).

Biology of dung invertebrates. Particularly beetles and earthworms, with a main focus on feeding mechanisms and ecotoxicology (Peter Holter).

External funding 2002

Spy-nat-force (Gap dynamics in unmanaged forests) (SJVF 1999-2003).

START grant for writing EU application (SNF 2001-2002).

Fire in Tropical Ecosystems (Council for development research, RUF 1999-2003)

Biological Processes in Contaminated Soil (SMP 1998-2003).

NATO-grant for invitation of Professor S A Karpov (Univ. St. Petersburg) (SNF 2002).

Research support (SNF 2001-2003).

Thematic network Conservation of soil diversity under global change (CONSIDER) (EU 2002-2006).

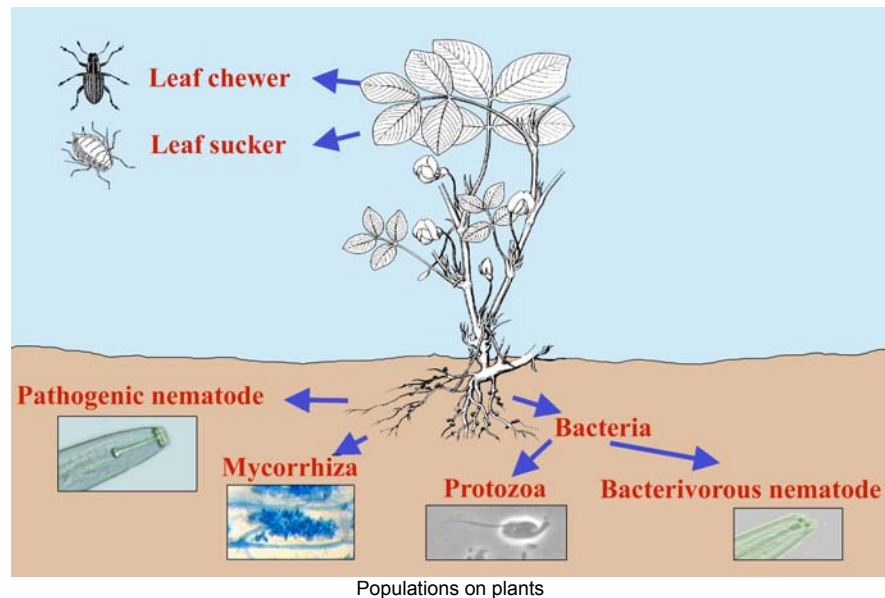
Travel grants (Carlsberg 2002).

Staff development 2002

Flemming Ekelund was appointed as associate professor.

Major achievements in 2002

We have made major progress in developing an experimental set-up for the study of interactions between aboveground herbivores and soil processes at the quantitative level, combined with population dynamics belowground. The molecular work on soil protozoa has shown that the soil contains numerous fragments of DNA derived from organisms that cannot be cultured. In contrast to common belief, physiological and structural examination of selected dung beetles has conclusively shown that the mouth apparatus is not used for grinding food.



The thematic network “Conservation of soil organism diversity under global change” (CONSIDER) started in 2002. The group is coordinated from this laboratory and has members from The University of Lund (S), Institut voor Oecologisch Onderzoek (NL), Universität Darmstadt (D), University of Reading (UK), University of Helsinki (FIN), Estación Experimental del Zaidín (ES) Agronomie et Environnement ENSIA (F), University Jyväskylä (FIN), and University of London (UK).

The 7-day PhD course “Dynamics of Organic Matter in Soils”, with our group as main organizer, took place for the fourth time (previous courses in 1993, 1996, and 1999). 18 PhD students from Scandinavian universities (KU, OU, AU, DTU, RUC, University of Lund, Aas (N), KVL) participated, together with representatives from the public sector institutions DMU, GEUS, Danish

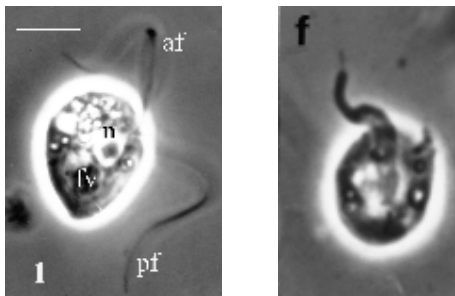


The common dung beetle *Aphodius rufipes*

Research Service for Crops and Soils, and “Hedeselskabet”. This time teachers were from KU (Geography, Molecular Biology, Botany, Zoology) supplemented by external teachers from The Agricultural University (KVL), Natural History Museum (Molslaboratoriet), Danish Research Service for Crops and Soils, Universities of Lund and York, and Laboratoire d’Ecologie, Ecole normale Supérieure, Paris.

Expected developments in 2003

Our work on soil protozoa has been consolidated by the appointment of Flemming Ekelund as assistant professor. We plan to quantify the hidden diversity we have found among soil protozoa to estimate its ecological importance. The investigations of aboveground – belowground interactions will continue this year, and will involve Dr Bryan Griffiths, Scottish Crop Research Institute, Dundee, who plans to spend two research visits with us in 2003. The investigations on dung beetle feeding will continue in an effort to determine whether these organisms should be regarded as mainly or exclusively microbivores.



Two protozoa that are examples of organisms that we have found in soil samples, which turned out to be new to science and where we took part in the species description

The series of workshops and bilateral exchange visits funded by the thematic network CONSIDER will expand our work on aboveground-belowground interactions and soil microfauna, and will encourage pan-European collaborations in this area.

Within basic level teaching we plan major improvements in “systems ecology” teaching, with the

inclusion of computer presentations on the small but important organisms that are not suited for laboratory demonstrations at the basic level.

Permanent scientific staff: Søren Christensen, Flemming Ekelund, Peter Holter
For a full staff list see: http://www.zi.ku.dk/terrecol/fac_staff_student.htm

PhD thesis completed in 2002

Annette Pedersen – The effect of fire on the decomposer microbiota in cultivated tropical savannah soil – supervisor: Søren Christensen. Defence due March 2003

MSc theses completed in 2002

Maria Sommer Holtze – Culturable bacteria and protozoa in mercury contaminated soil – supervisor: Flemming Ekelund. Examination 7 February.

Peter Nørlem Ellingsøe – Influence of sample size on the analysis of community structure of soil bacteria – supervisor: Søren Christensen. Examination 19 February.

Rikke Kirkeløkke Christensen – Interactions among three biological control agents used for biological control of insect pests in greenhouses – supervisor: Peter Holter. Examination 12 June.

Gitte Frilund – Growth conditions for fungi in agricultural soil; two types of interactions – supervisor: Søren Christensen. Examination 20 June.

Lena Stenseng – Biological control of houseflies by the parasitoid *Urolepsis rufipes* – supervisor: Peter Holter. Examination 26 June.

Karen Stevnbak Andersen – The effect of microbial control organisms on protozoa and *Pseudomonas* in soil – supervisor: Søren Christensen. Examination 8 August.

Irene West Nielsen – Prey mediated long-term effects of a protease inhibitor on the omnivorous carabid *Harpalus affinis* – supervisor: Peter Holter. Examination 14 November.

Martin Vedel – Food choice of enchytraeid worms, and the importance of food quality for reproduction of *Enchytraeus crypticus* – supervisor: Flemming Ekelund. Examination 13 December.

Ongoing PhD projects in 2002

Lisa B. Nielsen – Interactions within the decomposer community during recolonisation of gaps in natural forests – supervisor: Søren Christensen.

Tina S. Svendsen – Population biology of earthworms; effects of veterinary drugs? – supervisor: Peter Holter.

Ongoing MSc projects

Marcia Techau – Interactive effects of nutrient stress and herbivory on pea plants; - and can plants be healed? – supervisor: Søren Christensen.

Christa Stæger – The flagellate *Phalansterium solitarium* and its placement in the phylogenetic tree – supervisor: Flemming Ekelund.

Trine Koch – Physiological adaptations of protozoa with similar morphology but originating from contrasting environments – supervisor: Flemming Ekelund.

Mette Vestergård – Effect of soil nutrient status and foliar herbivory for nematodes in the rhizosphere – supervisor: Søren Christensen.

Bettina Markussen – Seasonal migration of female roe deer (*Capreolus capreolus* L.) – a field study from Central Sweden – supervisor: Peter Holter.

Charlotte Nielsen – Biological control of flies in stables; interactions with parasitoid wasps and pathogenic fungi – supervisor: Peter Holter.

Refereed publications 2002

Bjørnlund L., Vestergård M., Johansson S., Nyborg M., Steffensen L., & Christensen S. (2002) Nematode community of natural and managed beech forests – a pilot survey. *Pedobiologia* 46, 53-62.

Brinch U.C., Ekelund F., Jacobsen C.S. (2002) A proposal for a protocol that minimizes side effects of organic solvents used to spike soil samples for experimental purposes. *Applied and Environmental Microbiology* 68, 1808-1816.

Ekelund, F. (2002) Estimation of protozoan diversity in soil. *European Journal of Protistology* 37, 361-362.

Ekelund, F. (2002) A study of the soil flagellate *Phalansterium solitarium* Sandon 1924 with preliminary data on its ultrastructure. *Protistology* 2, 152-158.

Ekelund, F. (2002) Tolerance of soil flagellates to increased NaCl levels. *Journal of Eukaryotic Microbiology* 49, 324-328.

- Ekelund, F., Frederiksen, H.B. & Rønn, R. (2002) Population dynamics of active and total ciliate populations in arable soil amended with wheat. *Applied and Environmental Microbiology* 68, 1096-1101.
- Holter, P., Scholtz, C. H. & Wardhaugh, K. G. (2002) Dung feeding in adult scarabaeines (tunnellers and endocoprids): even large dung beetles eat small particles. *Ecological Entomology* 27, 169-176.
- Kraglund, H.O. & Ekelund, F. (2002) Infestation of natural populations of earthworm cocoons by rhabditid and cephalobid nematodes. *Pedobiologia* 46, 125-135.
- Müller, A.K., Westergaard, K., Christensen, S. & Sørensen, S.J. (2002) The diversity and function of soil microbial communities exposed to different disturbances. *Microbial Ecology* 44, 49-58.
- Rønn, R., Gavito, M., Jakobsen, I., Frederiksen, H. & Christensen, S. (2002) Response of free-living soil protozoa to elevated atmospheric CO₂ and presence of mycorrhiza. *Soil Biology and Biochemistry* 34, 923-932.
- Svendsen, T. S. & Baker, G. H. (2002) Survival and growth of *Aporrectodea longa* (Lumbricidae) fed on sheep and cow dung with and without moxidectin residues. – *Australian Journal of Agricultural Research* 53, 447-451.
- Svendsen, T. S., Sommer, C., Holter, P. & Grønvold, J. (2002) Survival and growth of *Lumbricus terrestris* (Lumbricidae) fed on dung from cattle given sustained-release boluses of ivermectin or fenbendazole. *European Journal of Soil Biology* 38, 319-322.
- Sverdrup, L.E., Ekelund, F., Krogh, P.H., Nielsen, T., & Johnsen, K. (2002) Soil microbial toxicity of eight polycyclic aromatic compounds: effects on nitrification, the genetic diversity of bacteria and the total number of protozoans. *Environmental Toxicology and Chemistry* 21, 1644-1650.

Department of Zoomorphology

Research Profile

The research of the department revolves around the integrated organism and a comparative zoological approach. We wish to understand the morphology of the organism as it relates to function, ecology and phylogeny. We therefore strive to always compare results with animals from both close and more distantly related groups, allowing us to understand how the morphological traits and the functions they serve have evolved. The research has close links to evolutionary ecology (reproductive strategies), physiology, and phylogeny. Our study objects are taxa rather than single species and at present include Crustacea, Bivalves, and Amphibia. Our work is fundamental science, but has strong links to applied issues, such as marine fouling, biocontrol and environmental chemistry and toxicology.

Major research interests

The evolution of complex reproductive systems. The research is focused on cirripede Crustacea (“barnacles”) and bivalves. Both are groups of sessile marine organisms and have systems encompassing separate sexes, hermaphrodites and systems incorporating minute dwarf males. We strive to understand how these systems operate and have evolved (Åse Jespersen and Jørgen Lützen on Bivalves, Jens T. Høeg in Cirripedia). In related research we also study the effect of hormone-like compounds in the environment on the reproductive organs of fish.

Crustacean sensory organs. This research combines transmission and scanning electron microscopy, digital video analysis of live animals and electrophysiological recordings to allow an integrated understanding of sensory biology. We study an array of decapod Crustacea and the specialized cypris larva of the Cirripedia, which initiates the sessile phase and is the main focus of antifouling studies of man made objects (Jens T. Høeg and Anders Garm).

The amphibian kidney. Again combining both morphological and physiological methods, we study the function and evolution of the amphibian kidney, including the little known, but phylogenetically important group, Gymnophiona (Nadja Møbjerg and Åse Jespersen).



Geotyphlops: A gymnophionian amphibian

Externally funded research

Evolutionary Zoomorphology (SNF, 2001-2003).

The amphibian kidney: A comparative morphological and physiological study (SNF 2002).

The amphibian kidney: A comparative morphological and physiological study (Carlsberg 2003).

Phylogeny of the Crustacea; from the stem towards an advanced branch (SNF 2000-2002).

The taxonomy, biogeography and phylogeny of parasitic barnacles: an integrated study of a highly specialized taxon (Carlsberg 2001-2002).

Sexual systems and metamorphosis in Cirripede Crustacea: Model systems for the evolution of complex life histories (SNF 2003-2005).

Biology and morphology of “Y” larvae: A hundred year old enigma. (Carlsberg 2003-2004).

Copenhagen Biosystematics Centre (EU Framework 5 Major Research Infrastructure Centre).

Unravelling the Evolutionary Radiation of the Thecostracan (Crustacea: Maxillopoda) Barnacles Using Molecular and Morphological Evidence (NSF, USA 2003-2006).

Carlsberg Foundation Grant for technician (2003)

Staffing

The permanent scientific staff comprises two associate professors (J.T. Høeg, head of department, and Å. Jespersen). One new associate professor is under appointment. J. Lützen retired in 2002 but remains as an emeritus partner in funded programs. Assistant professor Nadja Møbjerg received a new postdoc and remains as a staff member through 2003. The department has no permanent technical staff (but see below).

Academic highlights in 2002

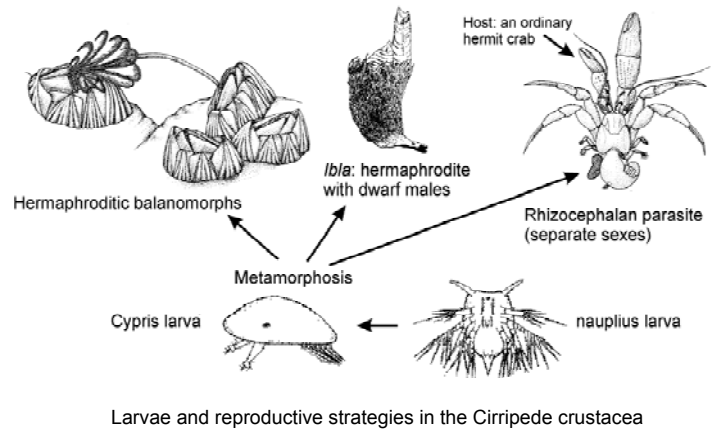
In the field of crustacean larval development, J. T. Høeg initiated a collaboration with the Zoological Museum and the University of Vienna. The emphasis is on branchiopod Crustacea in vernal ponds, and this has now resulted in an MSc thesis, a symposium poster, and two submitted publications.

Nadja Møbjerg and Åse Jespersen have expanded their studies on the amphibian kidney, combining experimental and comparative approaches based on both morphology and physiology, collaborating with The Natural History Museum, London and the August Krogh Institute. Similarly, A. Garm and J.T. Høeg also initiated collaborative studies on crustacean sensory setae with the August Krogh Institute.

Jens Høeg entered the EU SOCRATES program and served as a teacher at the Humboldt University in Berlin.

Nadja Møbjerg participated in a "Science Learning" investigation hosted by the CND ('Science Learning') centre at the Faculty of Science

J.T. Høeg participated in the DR2 science program *Viden Om* as a specialist on crustacean evolution, and hosted the subsequent e-mail conference.



Expected developments in 2003

The most important development is the imminent appointment of a new staff member (lektor), which will bring the permanent scientific staff up to three. The new lektor is expected to introduce new biochemical and molecular methods into the research profile and to promote existing intra- and extra-mural co-operation. Furthermore, the department will hire a laboratory assistant funded by a one-year grant from the Carlsberg Foundation to assist the already funded research programs.

The research into reproductive biology of bivalves and fish will continue with several national and international partners. Our project on fish reproduction is highlighted by present fears that hormone-like compounds are responsible for decreased sperm viability in humans. The project on the amphibian kidney will expand due to a new postdoc grant to Nadja Møbjerg from the Carlsberg Foundation. This research will continue to be closely linked to partners at the August Krogh Institute. Similarly, Anders Garm will develop an electrophysiological set-up jointly with the August Krogh Institute to study sensory setae in shore crabs (*Carcinus maenas*) and hermit crabs (*Pagurus bernhardus*).

J.T. Høeg will launch three new, related research programs. A three year SNF funded project will focus on the reproductive biology of the Cirripedia as model systems for the evolution of complex life cycles; another project will use molecular and morphological characters to analyze the phylogeny of the Cirripedia; this may eventually be integrated with research based around a new parallel processing computer cluster for phylogenetic analysis that will start operation in 2003, a joint venture between the Zoological and Botanical Institutes and the Zoological Museum. A third project concerns the morphology of the enigmatic Y-larvae (Crustacea Facetotecta); these are pelagic larvae known world-wide from the plankton and clearly related to the Cirripedia, but their adults remain entirely unknown. New developments are also expected in the field of marine fouling in relation to the work with cirripede larvae.

A new transmission electron microscope with digital image storage is currently being installed at the Botanical Institute as part of the instrument consortium set up with the Department of Zoomorphology and the Zoological Museum. The department can now offer up-to-date equipment for digital image storage and processing for both electron and light microscopy as well as digital video.

With respect to teaching, the zoomorphology department's contribution to the new B.Sc. Biology curriculum will expand considerably and is expected to commence in September. This may regrettably mean a short hiatus in offering the advanced "fagmodul" in Zoomorphology.

Permanent scientific staff: Jens Høeg, Åse Jespersen

For a full staff list see: http://www.zi.ku.dk/zoomorphology/fac_staff_student.htm

MSc theses completed in 2002

- K. Frøkjær-Jensen** – Reproduktionsstrategier hos ovovivipare Bivalvia – supervisors: J. Lützen and Å. Jespersen. Examination 19 February.
- Mette Bang** – Histologisk undersøgelse af det hunlige kønsapparat hos *Neptunea antiqua* (Gastropoda: Buccinidae) som udviser TBT-induceret imposex – supervisor: J. Lützen. Examination 18 February.
- Mikkel Gejr Larsen** – Vækst hos den koloniale søpung *Bothryllus schlosseri* – supervisor: J. Lützen. Examination 25 March.
- Mikkel Blomsterberg** – Larval morphology and juvenile growth in pedunculated Cirripedia – supervisor: J.T. Høeg & Henrik Glenner (Department of Evolution). Examination 31 May.
- Anders Galatius** – Skeletal udvikling, vækst og directional asymmetri af forlemmerne hos marsvin (*Phocoena phocoena*) – supervisors: Å. Jespersen and Carl Kinze (Zoological Museum). Examination 13 December.

Ongoing PhD project in 2002

- Anders L. Garm** (KU PhD grant). Morphology, function and neurophysiology of crustacean sensory setae – supervisor: Jens T. Høeg.

Ongoing MSc projects in 2002

- Ole Sten Møller** – Larval development in large branchiopod Crustacea – supervisor: J. T. Høeg and J. Olesen (ZMUC).
- Susan Holdt** – Field and laboratory investigation on settlement in cirripede cyprids of the genus *Balanus* – supervisor: J.T. Høeg (co advisors Danish Hydraulic Institute).
- Christian Baron** – Science studies and the place of history in Evolution – supervisors: Claus Emmeche (Niels Bohr Institute) and Jens Høeg.

Publications in refereed journals and peer reviewed book chapters

- Høeg, J.T. & Kolbasov, G.A. (2002) Lattice organs in y-cyprids of the Facetotecta and their significance in the phylogeny of the Crustacea Thecostraca. *Acta zoologica (Stockholm)* 83, 67-79.
- Glenner, H. & Høeg, J.T. (2002) A scenario for the evolution of the Rhizocephala. In Alvarez F; Escobar-Briones E (Eds.). *Modern approaches to the study of Crustacea*, Kluwer Academic/Plenum Publishers, New York: pp. 301-310.
- Jespersen, Å., Lützen, J. & Morton, B. (2002) Ultrastructure of seminal receptacles and dimorphic sperm in two commensal bivalves, *Barrimysia siphonosomae* and *Pseudopythina ochetostoma* (superfamily Galeommatoidea) from Hong Kong. *Zoomorphology* 121, 159-172
- Lagersson, N. & Høeg, J.T. (2002) Settlement behavior and antennular biomechanics and in cypris larvae of *Balanus amphitrite* (Crustacea: Thecostraca: Cirripedia). *Marine Biology* 141, 513-526.
- Lützen, J. (2002) Internal structure and nucleus formation in *Sacculina polygena* (Crustacea: Cirripedia: Rhizocephala: Sacculinidae). *Crustacean Research* 31, 39-46.
- Møbjerg, N., Larsen, E.H. & Novak, I. (2002) K⁺ transport in the mesonephric collecting duct system of the toad, *Bufo bufo*. Microelectrode recordings from isolated and perfused tubules. *Journal of Experimental Biology* 205, 897-904.
- Pérez-Losada, M., Høeg, J.T., Kolbasov, G.A. & Crandall, K.A. (2002) Reanalysis of the relationships among the Cirripedia and the Ascothoracida and the phylogenetic position of the Facetotecta (Maxillopoda: Thecostraca) using 18S rDNA sequences. *Journal of Crustacean Biology* 22, 661-669.
- Rybakov, A.V., Korn, O.M., Høeg, J.T. & Walossek, D. (2002) Larval development in *Peltogasterella* studied by scanning electron microscopy (Crustacea: Cirripedia: Rhizocephala). *Zoologischer Anzeiger* 241, 199-221.
- Rybakov, A.V. & Høeg, J.T. (2002) The ultrastructure of retinacula in the Rhizocephala (Crustacea: Cirripedia) and their systematic significance. *Zoologischer Anzeiger* 241: 95-103.
- Willumsen, N.J., Amstrup, J., Møbjerg, N., Jespersen, Å., Kristensen, P. & Larsen, E.H. (2002) Mitochondria-Rich cells as experimental model in studies of epithelial chloride channels. *Biochimica et Biophysica Acta* 1566, 28-43.

Popular accounts

- Møbjerg, N. (2002) Nefridier regulerer dyrs vand- og saltbalance. *Dansk Naturhistorisk Forening Årsskrift* 12 – 2001/2002: 22-28.
- Møller, O.S. (2002) På krebsdyrjagt på Baha California – en krebsdyrmands odysse. *Dansk Naturhistorisk Forenings Årsskrift* 12, 2001/2002

Zoological Institute, Park Area
Seminar Day, Wednesday 29th January 2003
Auditorium B

For Staff, PostDocs, PhD-students and MSc-students.
And for students interested in the ongoing research at the Zoological Institute, Park Area

09.15 – 10.15 Terrestrial Ecology (Chairman Søren Christensen)

- 1 - **Charlotte Nielsen:** *Interactions between two entomopathogenic fungi, stable and houseflies, and a parasitoid.*
- 2 - **Marcia Techau:** *Aboveground-belowground interactions on pea plants depend on phosphorous.*
- 3 - **Mette Vestergaard:** *Nitrogen, phosphorous and aphid effects on soil organisms in the rhizosphere of barley.*
- 4 - **Søren Christensen:** *Interaction between ectomycorrhiza and protozoa on pine roots.*

10.15 – 10.30 coffee break

10.30 – 11.30 Animal behaviour (Chairman Torben Dabelsteen)

- 1 - **Angelika Poesel & Torben Dabelsteen:** *Moving threats – territorial responses of male blue tits to simulated intrusions.*
- 2 - **Giuliano Matessi:** *Male rock sparrows intercept and use rival courtship calls to adjust paternity protection behaviours.*
- 3 - **Denise Pope & Peter McGregor:** *Fiddler crab males use information in signals directed at females.*
- 4 - **Tom Peake:** *Eavesdropping and networks in fighting fish.*

11.30 – 12.30 Evolutionary Biology (Chairman Bo Vest Pedersen)

- 1 - **Daniel Jeffares:** *Alternative splicing and the evolution of transcriptome.*
- 2 - **Tobias Mourier:** *Eukaryotic intron loss.*
- 3 - **Eske Willerslev:** *Diverse plant and mammalian DNA obtained directly from Pleistocene frozen ground cores.*
- 4 - **Jesper Stenderup:** *Molecular phylogeny of branchiopods.*

12.30 – 13.20 Lunch, sandwiches will be served outside auditorium B

13.20 – 14.20 Cell Biology (Chairman Cok Grimmelikhuijzen)

- 1 - **Michael Williamson:** *A new preprohormone in Hydra and its localisation in nerve cells.*
- 2 - **Frank Hauser:** *Bioassays for G protein-coupled receptors.*
- 3 - **Annette Iversen:** *Identification of the first insect ecdysis triggering hormone receptors.*
- 4 - **Giuseppe Cazzamali:** *Identification of the first insect receptors for adipokinetic hormone, corazonin, and crustacean cardioactive peptide*

14.20 – 15.20 Population Ecology (Chairman Koos Boomsma)

- 1 - **Bill Hughes:** *Sex, size & parasites: benefits of polyandry for leaf-cutting ants.*
- 2 - **Ditte Guldager Christiansen:** *Hybrid waterfrogs in Denmark.*
- 3 - **Ditte Hendrichsen:** *Computer modelling of population changes in space and time.*
- 4 - **Aqqalu Rosing-Asvid:** *Ringed seals, Polar bears and climatic change.*

15.20 – 15.45 Coffee break

15.45 – 16.45 Zoomorphology (Chairman Jens T. Høeg)

- 1 - **Åse Jespersen:** *Reproductive biology and sperm structure in viviparous bivalves.*
- 2 - **Nadja Møbjerg:** *An introduction to excretory organs in the animal kingdom.*
- 3 - **Anders Garm:** *Electro-physiological recordings from crustacean sensory setae.*
- 4 - **Christian Baron:** *Science studies and the place of history in evolution.*

16.45 End of meeting