

ZOOLOGY 2011

18th Benelux Congress of Zoology

Utrecht, The Netherlands, 2-4 november 2011



EVOLUTION
BRAIN
COGNITION

**Scientific Programme
& abstracts**



Universiteit Utrecht



18th Benelux Congress of Zoology

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Programme at a Glance

Wednesday 2nd November	
REGISTRATION 19:00-20:00 <i>Maskeradezaal</i>	
20:00-21:30	Opening plenary lecture/Studium Generale: Clive Wynne - "Why your dog loves you so" <i>Aula</i>
21:30-22:30	Drinks reception <i>Maskeradezaal</i>

Thursday 3rd November	
REGISTRATION 08:30-17:00 <i>Main staircase</i>	
08:30-09:00	Coffee <i>Senaatszaal</i>
09:00-09:20	Opening remarks & welcoming address <i>Aula</i>
09:20-10:10	NVG symposium keynote lecture: Ted Morrow - "Two sexes, one genome" <i>Aula</i>
10:10-11:00	NVG symposium keynote lecture: Kate Lessells - "Sexual conflict over parental investment: behavioural mechanisms determine evolutionarily stable patterns of investment" <i>Aula</i>
11:00-11:30	Coffee <i>Senaatszaal</i>
11:30-12:30	Plenary lecture: Marian Joëls - "The adaptive value of stress for memory formation" <i>Aula</i>
12:30-13:30	Lunch <i>Maskeradezaal</i>
13:30-15:30	Session 1: Sexual conflict and behavioural traits: steps towards a mechanistic integration (NVG Symposium) <i>Aula</i>
	Session 2: Behavioural and Evolutionary Genetics; Applied Ecology <i>Belle van Zuylenzaal</i>
15:30-16:00	Coffee <i>Senaatszaal</i>
16:00-17:00	Distinguished Zoologist lecture: Barry Keverne - "Mammalian brain evolution" <i>Aula</i>
17:00-19:00	Poster session & drinks reception <i>Senaatszaal</i>
19:00-22:00	Congress dinner <i>Belle van Zuylenzaal</i>

Friday 4th November	
REGISTRATION 08:30-11:00 <i>Main staircase</i>	
08:30-09:00	Coffee <i>Senaatszaal</i>
09:00-10:40	Session 3: Behavioural Ecology <i>Aula</i>
	Session 4: Cognition 1 <i>Belle van Zuylenzaal</i>
	Session 5: Evolution <i>Kannunikenzaal</i>
10:40-11:00	Coffee <i>Senaatszaal</i>
11:00-12:00	Plenary lecture: Simon Fisher - "Molecular windows into speech and language" <i>Aula</i>
12:00-13:00	Lunch <i>Foyer</i>
13:00-14:00	Plenary lecture: Kevin Laland - "Animal social learning and the evolution of culture" <i>Aula</i>
14:00-15:00	Session 6: Jacques Kets Awards <i>Maskeradezaal</i>
	Session 7: Cognition 2 <i>Belle van Zuylenzaal</i>
	Session 8: Biological Rhythms <i>Kannunikenzaal</i>
15:00-15:30	Prizes & closing remarks <i>Kannunikenzaal</i>

Quiet space during the meeting - *Eijkmankamer*

Zoology 2011

18th Benelux Congress of Zoology

Wednesday 2nd - Friday 4th November 2011

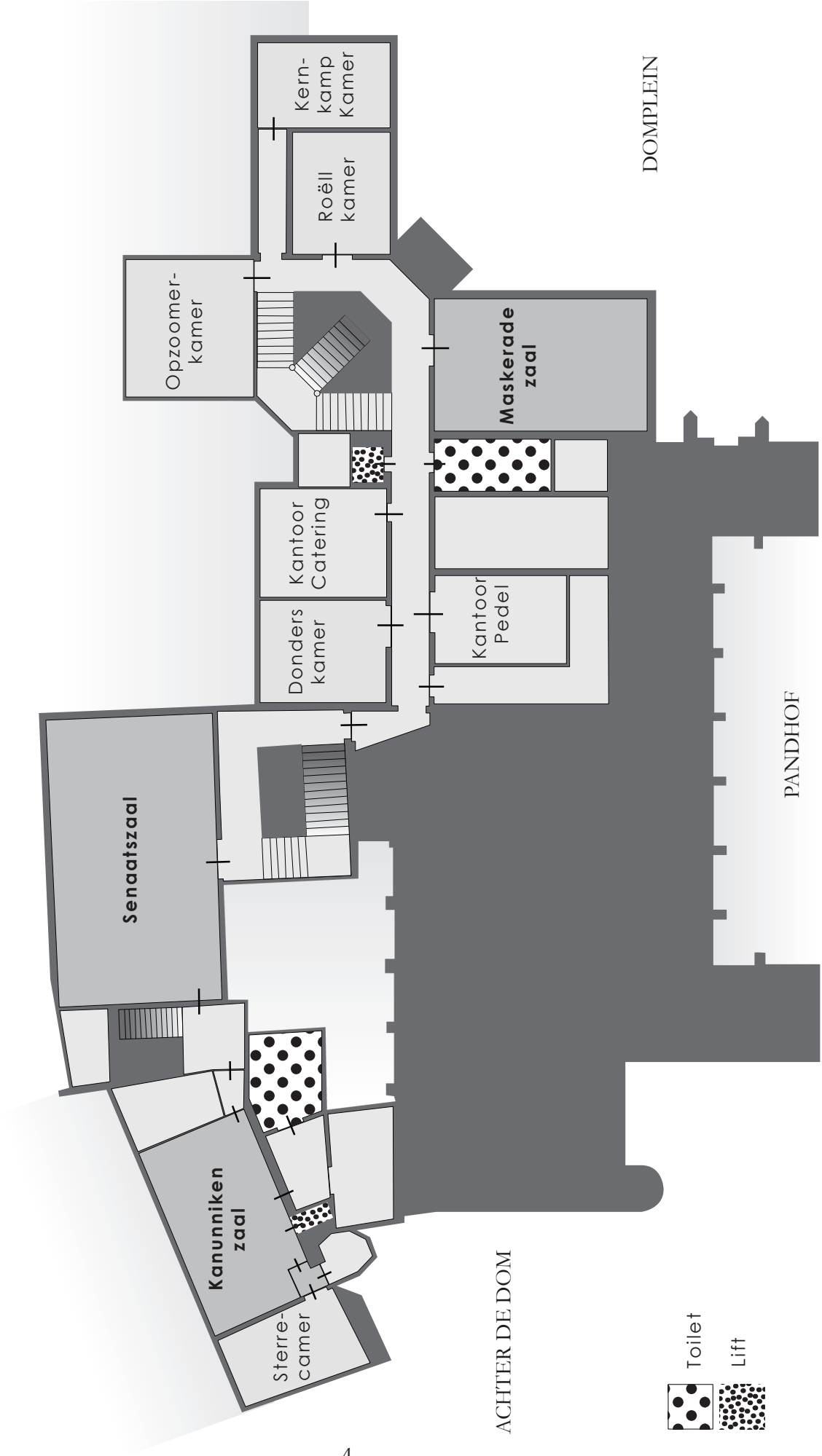
Utrecht, the Netherlands

Scientific Programme & Abstracts

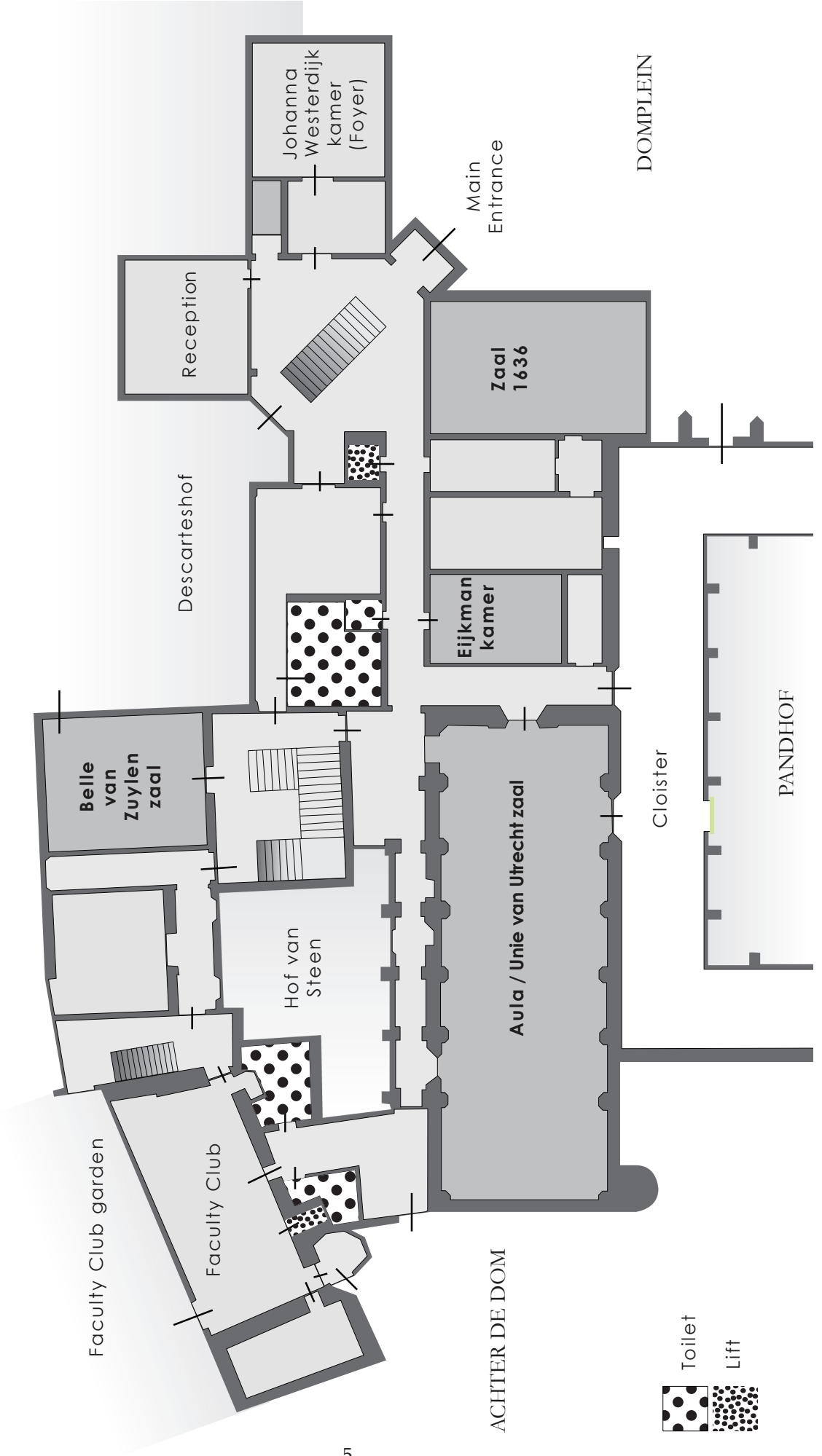
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UTRECHT, UNIVERSITY, ACADEMIEGEBOUW
1st Floor



UTRECHT UNIVERSITY, ACADEMIEGEBOUW
Ground Floor



Welcome

It is my great pleasure to welcome you to Zoology 2011 – or, more formally, the 18th Benelux Congress of Zoology –, hosted this year by the Royal Dutch Zoological Society (Koninklijke Nederlandse Dierkundige Vereniging, KNDV) and Utrecht University. The organising committee chose “Evolution – Brain – Cognition” as the theme for this year’s meeting. We feel that these are among the most prominent topics in modern zoology, with exciting recent developments as illustrated by the plenary lectures delivered by some of the most eminent zoologists. We believe we have assembled a high quality programme and look forward to stimulating presentations on a wide variety of topics which will emphasize the depth of zoological research in the Benelux region and beyond. In particular, the meeting is an excellent showcase for the work of young researchers and is a great opportunity for them to meet their scientific colleagues and peers from across the region.

I would like to take this opportunity to thank my co-organisers for their hard work that made this conference possible: Thijs Zandbergen, Will Swaney, Sanne Moorman, Eddy van der Zee and Dominique Adriaens. We are extremely grateful to our main sponsors, the Dutch Organisation for Scientific Research (NWO), The Royal Netherlands Academy of Science (KNAW), The Royal Dutch Zoological Society (KNDV), The Helmholtz Institute, Neuroscience & Cognition Utrecht and Utrecht University, for their generous support.

We are grateful to Utrecht University, the largest and most highly ranked university in The Netherlands, for hosting the meeting. Utrecht University is celebrating its 375th anniversary this year, and it is marvellous that we can celebrate the achievements of modern zoology in such historic surroundings. The plenary lectures will be given in the University main hall or Aula, in 1579 the site of the ratification of the treaty of the Union of Utrecht, essentially the start of the Netherlands as a sovereign state.

Beyond its great University, the city of Utrecht also has a lot to offer visitors and we hope that you take this opportunity to explore the city and its historical centre during the meeting. Please consult your delegate bag for more information and should you have any questions, please do not hesitate to contact one of the conference committee members or ask at the conference registration desk for assistance.

On behalf of the organising committee I wish you a very stimulating and enjoyable conference,

Professor Johan J. Bolhuis, Chair, Scientific Organising Committee

Scientific Organising Committee

Professor Johan Bolhuis (Utrecht University) - Chair

Dr. Thijs Zandbergen (Utrecht University) - Secretary

Dr. Will Swaney (Utrecht University)

Sanne Moorman, MSc (Utrecht University)

Professor Eddy van der Zee (University of Groningen) - KNDV

Professor Dominique Adriaens (Ghent University) - RBZS

Meeting Information

The meeting is being hosted by Utrecht University and will take place in the Academiegebouw on the Domplein in the heart of Utrecht:

Academiegebouw, Domplein 29, 3512 JE Utrecht

Pre-conference registration, all scientific sessions, breaks, lunches and the conference dinner will all take place in several different rooms within the Academiegebouw – please consult the schedule and building layout to determine which room each session or event is in.

Route descriptions

The Academiegebouw is situated in the very centre of the city, next to the famous Dom Tower, which dominates the skyline of Utrecht. It is within walking distance of Utrecht Centraal train and bus station. Should you prefer to use public transportation from Utrecht Centraal, take bus No. 3 or 4 towards “Burg. Fockema Andrealaan” and get off at the “Neude” stop, or take bus No. 11 towards “De Uithof/WKZ” and get off at the “Janskerkhof” stop.

General information

Registration desk opening hours

Wednesday 2 nd November:	19:00 – 20:00
Thursday 3 rd November:	08:30 – 17:00
Friday 4 th November:	08:30-11:00

Registration

Registration grants delegates admission to all plenary talks, symposia, parallel sessions, poster sessions, coffee breaks, drinks receptions and a 50% discount on admission to the University Museum (Lange Nieuwstraat 106). Simply show your conference name badge at the museum for discounted admission of €3.75.

Badges

For security and registration reasons, please wear your name badge at all times to ensure admission to all sessions of the meetings.

Lunches & Conference Dinner

Lunches and the conference dinner are *not* included in the registration fee – if you have paid in advance for lunch or dinner, vouchers will be included with your badge.

Speakers

Speakers should bring their laptops or load their talks onto the presentation laptop during the coffee or lunch break prior to the session they are to present in.

Poster Presenters

The poster session will take place between 17.00-19.00 on Thursday 3rd November in the Senaatszaal, however posters should be installed between 8.30 and 9.00 on Thursday 2nd November to enable delegates to view posters at their leisure. Poster presenters should make sure they are present at their posters during the main poster session. *Posters should be removed by 12:00 on Friday* – any posters that remain after this time will be removed and may be discarded.

Lost and Found

Found items should be returned to the registration desk or at the reception of the Academiegebouw. Should you lose anything, please enquire at these locations.

Internet Access

Wireless internet is available throughout the Academiegebouw and the access code can be obtained at the registration desk or the Academiegebouw reception. The *Eijkmankamer* is reserved throughout the meeting as a quiet space should you need to work or check email etc. during the meeting.

Student Awards

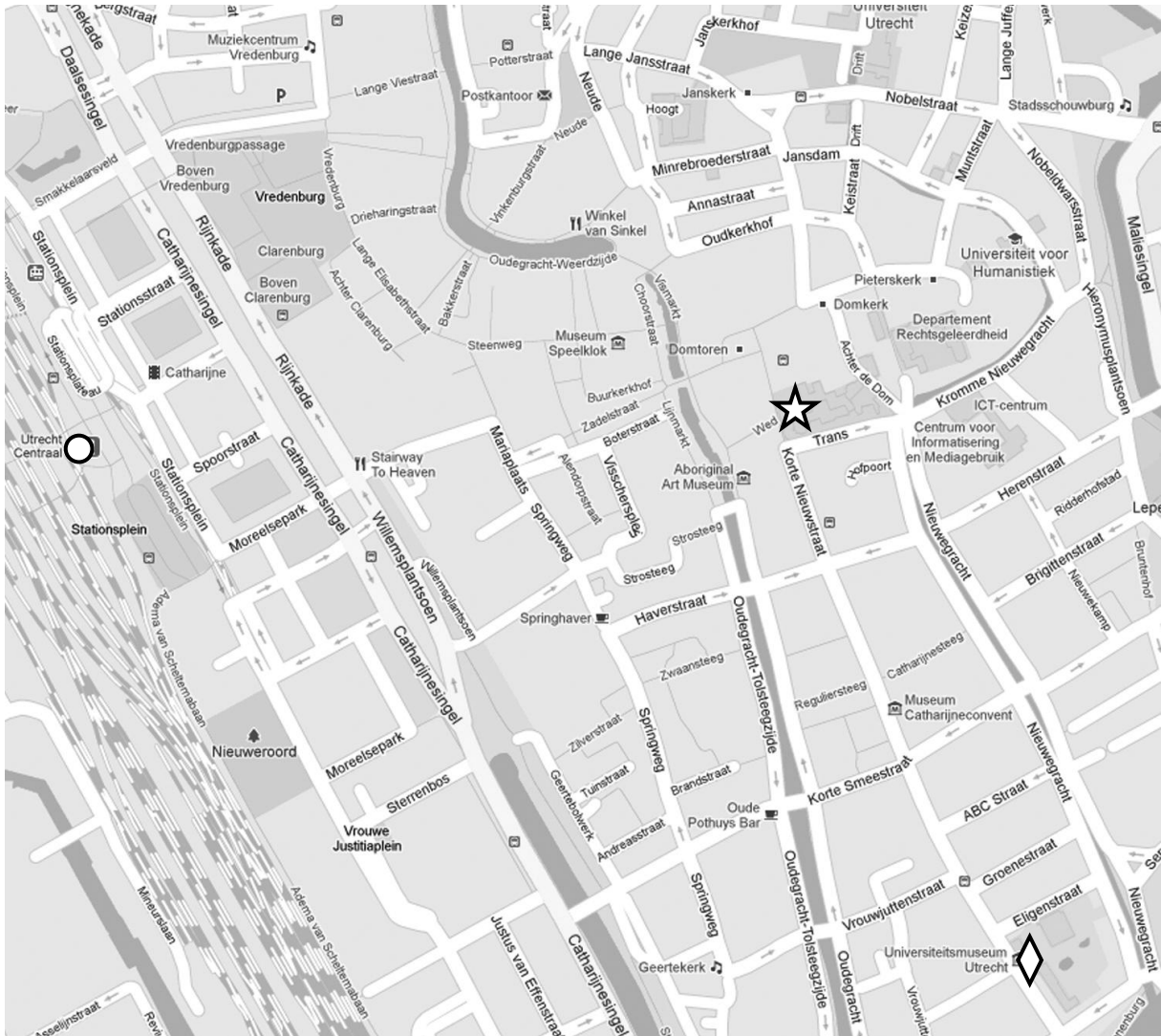
Awards for the best student poster and oral presentations will be made at the conclusion of the conference. There are four separate prizes to be awarded:

- Best Masters student oral presentation
- Best Masters student poster
- Best PhD student oral presentation
- Best PhD student poster

Jacques Kets Biology Award 2011

The 'Jacques Kets' Biology Award is a prize awarded by the Royal Zoological Society of Antwerp since 1953 to encourage interest in nature among young people. The prize is named after Jacques Kets, a naturalist and taxidermist from Antwerp who became director of the RZSA in 1843. Since 2004 the prize is awarded in conjunction with the Parc Pairi Daiza. The prize is awarded for the best Belgian Masters thesis in biology during the previous year, with one Walloon and one Flemish winner. The finalists will present talks on their work in Parallel Session 6 in the Maskeradezaal on Friday afternoon.

Map of Utrecht City Centre



Key:

- ★ Academiegebouw (Domplein 29)
- Utrecht Centraal Station
- ◇ University Museum (Lange Nieuwstraat 106)

Detailed Programme

Wednesday 2nd November

19:00-20:00 Registration - *Maskeradezaal*

Plenary lecture 1 - Aula Studium Generale

20:00-21:30 **Clive Wynne**, *University of Florida, Gainesville, USA*
'Why your dog loves you so. The origins of dogs' sensitivity to human beings'
Chaired by Johan Bolhuis

21:30-22:30 Drinks reception – *Maskeradezaal*

Thursday 3rd November

08:30-17:00 Registration – *Main Staircase*

08:30-09:00 Coffee – *Senaatszaal*

Opening Remarks & Welcoming Address - Aula

09:00-09:20 **Johan Bolhuis**, *Chair of Benelux Congress of Zoology 2011 organising committee*

Willem Hendrik Gispen, *University Professor and former Rector Magnificus, Utrecht University*

NVG symposium keynote lectures – Aula

'Sexual conflict and behavioural traits: steps towards a mechanistic integration'

Chaired by Joris Koene & Bram Kuijper

09:20-10:10 **Ted Morrow**, *Uppsala University, Uppsala, Sweden*
'Two sexes, one genome'

10:10-11:00 **Kate Lessells**, *NIOO-KNAW, Wageningen, Netherlands*
'Sexual conflict over parental investment: behavioural mechanisms determine evolutionarily stable patterns of investment'

11:00-11:30 Coffee - *Senaatszaal*

Plenary Lecture 2 - Aula

11:30-12:30 **Marian Joëls**, *Utrecht University & UMC Utrecht, Utrecht, Netherlands*
'The adaptive value of stress for memory formation'
Chaired by Eddy van der Zee

12:30-13:30 Lunch - *Maskeradezaal*

Parallel Session 1: NVG symposium – Aula

'Sexual conflict and behavioural traits: steps towards a mechanistic integration'

Chaired by Joris Koene & Bram Kuijper

13:30-13:50 The role of ornamentation in a mutually ornamented finch
E.P. van Rooij, N. Svedin, S.R. Pryke, S.C. Griffith

13:50-14:10 Elevated T-levels decrease promiscuity in female blue tits
B. de Jong, A.G.G. Groothuis, L. Lens, J. Komdeur

14:10-14:30 The evolution of asymmetric genitalia: the outcome of sexual conflict or mechanical efficiency?
M. Schilthuizen

14:30-14:50 Parental conflict versus cooperation in the evolution of genomic imprinting
W.T. Swaney, J.P. Curley, E.B. Keverne

14:50-15:10 Quantifying male reproductive success of a simultaneously hermaphroditic snail
Y. Nakadera, C. Blom, J.M. Koene

15:10-15:30 Sneaky monkeys: an audience effect of male rhesus macaques (*Macaca mulatta*) on sexual behaviour
A.M. Overduin - de Vries, J.J.M. Massen, B.M. Spruijt, E.H.M. Sterck

Parallel Session 2: Behavioural and Evolutionary Genetics; Applied Ecology - Belle van Zuylenzaal

Chaired by Franky Bossuyt; Kurt Jordaens

13:30-13:50 Chemical Characterisation of the courtship water of Palmate newts (*Lissotriton helveticus*, Salamandridae)
D. Treer, I. Van Bocxlaer, W. Vandeborgh, S. Janssenswillen, P. Proost, G. Baggerman, F. Bossuyt

13:50-14:10	Digit ratio, and variation in the androgen receptor, serotonin transporter, and dopamine D4 receptor genes in African foragers: the Hadza <i>L. Butovskaya, A. Vasiliev, E. Lazebny, N. Burkova, M. Kulikov, A. Mabulla, V. Shibalev, P. Ryskov</i>
14:10-14:30	Origin and genomic organization of a sex pheromone in aquatic newts (Salamandridae) <i>S. Janssenswillen, D. Treer, K. Roelants, F. Bossuyt</i>
14:30-14:50	Early Radiation and Functional Diversification of Tetrapod Alpha Keratins <i>W. Vandebergh, K. Roelants, F. Bossuyt</i>
14:50-15:10	EAG Response of <i>Helicoverpa armigera</i> Hubn and its predator <i>Chrysoperla carnea</i> Steph. to volatiles of different varieties of cotton and sunflower <i>A. Pandey</i>
15:10-15:30	Species identification of forensically important flies using DNA barcoding <i>A.M. Jordaens, G. Sonet, R. Richet, E. Dupont, Y. Braet, S. Desmyter</i>
15:30-16:00	Coffee - <i>Senaatszaal</i>
<i>Plenary Lecture 3 - Aula Distinguished Zoologist Lecture</i>	
16:00-17:00	Barry Keverne , <i>University of Cambridge, Cambridge, UK</i> 'Mammalian brain evolution' <i>Chaired by Will Swaney</i>
17:00-19:00	Poster session & drinks reception - <i>Senaatszaal</i>
19:00-22:00	Congress dinner - <i>Belle van Zuylenzaal</i>

Friday 4th November

08:30-09:00 Coffee – Senaatszaal

Parallel Session 3: Behavioural Ecology – Aula

Chaired by Marie José Duchateau

- 09:00-09:20 Incubation effort and decreases in late-life reproduction in female Seychelles warblers (*Acrocephalus sechellensis*)
M. Hammers, D.S. Richardson, T. Burke, J. Komdeur
- 09:20-09:40 Effects of nest site characteristics on breeding success of the great reed warbler (*Acrocephalus arundinaceus*) in Iran
S. Amininasab, J. Komdeur
- 09:40-10:00 Some causes of the variable shape of flocks of birds
C.K. Hemelrijk, H. Hildenbrandt
- 10:00-10:20 Fertilization without amplexus in Indian Nightfrogs (Anura, Nyctibatrachidae)
B. Willaert, I. Van Bocxlaer, S. Matthijs, S.D. Biju, V. Giri, R. Panjekar, F. Bossuyt
- 10:20-10:40 Male hind leg waving is involved in chemical communication during courtship in the African Dwarf Clawed Frog
S. Matthijs, B. Willaert, F. Bossuyt

Parallel Session 4: Cognition 1 – Belle van Zuylenzaal

Chaired by Johan Bolhuis

- 09:00-09:20 Local orientation and foraging: changes in decision making can eliminate evolutionary trade-offs
J. van der Post
- 09:20-09:40 Maternal care shapes social learning propensities in adult rats
C.M. Lindeyer, M. J. Meaney, S. M. Reader
- 09:40-10:00 Do bats recognize their predators?
T. Driessens, B.M. Siemers
- 10:00-10:20 Learning the value of social information
S. M. Reader, G.M. Kohn, M.J. Spierings
- 10:20-10:40 Species Differences in How Corvids Respond to Pilfering: Implications for Social Cognition
E.E. van der Vaart, R. Verbrugge, C.K. Hemelrijk

Parallel Session 5: Evolution - Kannuikenzaal

Chaired by Menno Schilthuizen

- 09:00-09:20 Stasis, change and reversal of premaxilla morphology in haplochromine cichlids
J. C. van Rijssel, F. Witte
- 09:20-09:40 Evolved changes in guppy shoaling and stress responses
I. Trezza, W.T. Swaney, S.M. Reader
- 09:40-10:00 Phenotypic plasticity favors the evolution of heritable nongenetic effects
A.L.W. Kuijper, R.A. Johnstone
- 10:00-10:20 News from down under to the West: Comparative thermal biology of lizards of the *Liolaemus goetschi* group from Patagonia, Argentina.
D.L. Moreno Azócar, M.F. Bonino, F.B. Cruz, M.G. Perotti, C.S. Abdala, B. Vanhooydonck
- 10:20-10:40 The coexistence of two congeneric lemur species: niche separation and competition as underlying mechanisms
I.I. de Winter, P.C. Wright, W.F. Hooft

10:40-11:00 Coffee - Senaatszaal

Plenary Lecture 4 - Aula

- 11:00-12:00 **Simon Fisher**, Max Planck Institute for Psycholinguistics, Nijmegen, Netherlands & University of Oxford, UK
'Molecular windows into speech and language'
Chaired by Martin Everaert

12:00-13:00 Lunch - Foyer

Plenary Lecture 5 - Aula

- 13:00-14:00 **Kevin Laland**, University of St Andrews, St Andrews, UK
'Animal social learning and the evolution of culture'
Chaired by Simon Reader

Parallel Session 6: >Uei Yg? Yg'5k UfXg- Maskeradezaal

Chaired by Zjef Pereboom

- 14:00-15:00 Jacques Kets Award Presentations

Parallel Session 7: Cognition 2 – Belle van Zuylenzaal

Chaired by Liesbeth Sterck

- 14:00-14:20 Tolerant food sharing in despotic bonobos
E. de Groot, J. Stevens
- 14:20-14:40 Asymmetries of the parietal operculum in common chimpanzee
and handedness
E. Gilissen, D. Hopkins
- 14:40-15:00 Pro-sociality in despotic macaques: the effect of kinship,
friendship and dominance
E.H.M. Sterck, J.J.M. Massen

Parallel Session 8: Biological Rhythms - Kannuikenzaal

Chaired by Eddy van der Zee

- 14:00-14:20 Circadian clocks: evolution to increasing complexity and
robustness
K.A. Gargar
- 14:20-14:40 The brain at low temperature: effects of hibernation on brain and
behaviour in Syrian hamsters.
A.S. Boerema, T. Koopmans, A.M. Strijkstra, E.A. van der Zee
- 14:40-15:00 Circadian clocks and events to memorize: time-place association
E.A. van der Zee, C. Mulder, M.P. Gerkema
- 15:00-15:30 Prizes & closing remarks – *Kannunikenzaal*

Plenary Lecture Abstracts

Studium Generale Lecture

Why your dog loves you so: the origins of dogs' sensitivity to human beings

Clive Wynne

Department of Psychology, University of Florida, Gainesville, USA

Nearly half of all households harbor a dog and few people who do not have a dog of their own pass a day without seeing many of these animals. Dogs are ubiquitous, but I shall argue that many commonly-held beliefs about dogs are mistaken. Humans did not intentionally create dogs from wolves. Dogs are not even descended from big gray wolves. Dogs do not have special cognitive skills to aid in their understanding of people, rather they use the same mental abilities as are found in other canids. The difference between dogs and wolves lies in a small difference in developmental timing. A small difference with a big impact. Dogs are wolves that refused to grow up. And it is their perpetual childishness that makes them so appealing to us.

The adaptive value of stress for memory formation

Marian Joëls

Utrecht University & Rudolf Magnus Institute, UMC Utrecht, Utrecht, Netherlands

Exposure to potentially threatening situations leads to activation of two systems which causes enhanced release of catecholamines like noradrenaline and corticosteroid hormones respectively. Both hormones reach the brain. Receptors for these stress hormones are enriched in limbic brain structures, like the hippocampus and amygdala, which are important for (emotional) memory formation. Studies in rodents as well as human subjects have shown that stress improves memory for the events during which stress hormones are released. However, this improvement is only seen when the hormones are present at the same time and at the same synapses as those involved in the processing of stress-related information. By contrast, enhanced hormone levels which are out of sync with stress exposure impair memory formation. Recent experiments have revealed some of the cellular mechanisms underlying these principles. The effect of stress hormones on memory formation is highly adaptive, enabling organisms to remember important life events.

Distinguished Zoologist Lecture

Mammalian brain evolution

Barry Keverne

Sub-Department of Animal Behaviour, University of Cambridge, Cambridge, UK

Viviparity has played a major role in mammalian evolution particularly in the context of maternalism, which has required radical changes in the functional evolution of the brain. Viviparity requires the action and interaction of two genomes in one individual and has resulted in a tissue type unique to mammals, namely the trophoblast which forms the placenta. The foetal placenta exerts considerable influence on the maternal brain, determining neuroendocrine function and behaviour. Hormones secreted by the placenta act on the maternal brain to suppress maternal sexual behaviour and fertility, increase maternal food intake in anticipation of subsequent foetal demands and promote the synthesis of oxytocin in anticipation of its requirements for parturition, maternal behaviour and milk letdown. In short, the foetal genome determines its own destiny via its placenta. The question arises as to how the adult maternal brain has evolved to optimise such interactive responding with the developing foetal genome. Maternal imprinting of key regulator genes provides a unique epigenetic transcriptional regulatory mechanism that results in alleles being monoallelically expressed according to parent-of-origin. Among vertebrates, genomic imprinting is restricted to viviparous mammals and has been thought to play a significant role in the evolution of the brain and placenta. In this talk I will explore the role of genomic imprinting in brain evolution and its key role in synchronising gene expression in brain and placenta at critical developmental times. I will show how the outcome of such genetic developmental co-adaptation positively shapes the next generation's mothering capabilities.

Molecular windows into speech and language

Simon Fisher

Max Planck Institute for Psycholinguistics, Nijmegen & Wellcome Trust Centre for Human Genetics, University of Oxford, UK

Genes involved in speech and language disorders offer novel perspectives on the evolution of human traits. People with mutations of the FOXP2 gene have problems mastering sequences of mouth movements needed for fluent speech, accompanied by expressive and receptive language impairments. FOXP2 is an evolutionarily ancient gene which switches on and off other genes in brain circuits of diverse vertebrates. Researchers are studying it in a wide range of systems, from neuronal models, mutant mice and songbirds, to humans themselves. Intriguingly, dysfunction of this gene impairs neural plasticity and motor-skill learning in mice, and impedes vocal imitation during song learning in zebra finches. Analyses of molecular evolution in primates indicate that FOXP2 protein sequence underwent accelerated change on the human lineage after splitting from the chimpanzee. Nevertheless, FOXP2 should not be viewed as the mythical 'gene for language' but as one piece of a complex puzzle. Overall, my talk will demonstrate how our multidisciplinary investigations of genes like FOXP2 are helping build the first bridges between genes, brains and speech and language.

Animal Social Learning and the Evolution of Culture

Kevin Laland

School of Biology, University of St Andrews, St Andrews, UK

Both demographically and ecologically, humans are a remarkably successful species. This success is generally attributed to our capacity for culture. But how did our species' extraordinary cultural capabilities evolve from its roots in animal social learning and tradition? In this seminar I will provide a provisional answer. After characterizing contemporary research into animal social learning, I will focus in on a case study of stickleback learning that illustrates the strategic nature of animal copying. I will go on to describe the findings of an international competition (the 'social learning strategies tournament') that I organized to investigate the best way to learn. I will suggest that the tournament sheds light on why copying is widespread in nature, and why humans happen to be so good at it. Finally, I will end by describing some other theoretical and experimental projects suggesting feedback mechanisms that may have been instrumental to the evolution of culture.

NVG Symposium: 'Sexual conflict and behavioural traits: steps towards a mechanistic integration'

Two sexes, one genome

Ted Morrow

Department of Animal Ecology, Evolutionary Biology Centre, Uppsala University, Uppsala, Sweden

Males and females of many species are thought to experience unique selection pressures throughout their reproductive lives. As a consequence, the genetic code from which the phenotype arises may be doomed to failure since no single solution will satisfy the requirements of selection, which may differ between the sexes. An important issue for evolutionary biologists therefore is to determine the identity and nature of genetic loci that evolve under this form of sexually antagonistic selection. Here I will describe a series of experiments that were designed to examine sex-specific effects on gene expression in the fruit-fly with the aim of identifying sexually antagonistic loci and learning more about how sexual conflict influences the genome and the whole organism.

NVG Symposium: 'Sexual conflict and behavioural traits: steps towards a mechanistic integration'

Sexual conflict over parental investment: behavioural mechanisms determine evolutionarily stable patterns of investment

Kate Lessells

NIOO-KNAW, Wageningen, Netherlands

Despite sexual conflict over parental investment being a universally expected consequence of sexual reproduction, we still have an incomplete understanding of how this conflict is resolved when both parents care for the offspring. Unlike sexual conflict over mating, there is little evidence for mechanisms which actively manipulate a mate's investment. Instead, models have assumed that an individual's investment is under its own control and evolves to be the best response to its partner's effort. The earliest model (Houston & Davies 1985) assumes that parents each make investment in a single bout without knowing their mate's investment (a sealed bid). However, when both parents care for their young they usually make repeated bouts of investment in the offspring, and are expected to negotiate behaviourally over the level of care that each makes. I will present two recent models (Lessells & McNamara; Johnstone et al.) which make different assumptions about the behavioural mechanisms underlying negotiation. The models reveal that the resolution of sexual conflict over parental investment depends critically on the behavioural mechanism by which the conflict is resolved, and hence underline the need for more information on what behavioural mechanisms are actually used.

Oral Presentation Abstracts

Session 1-1: NVG Symposium

The role of ornamentation in a mutually ornamented finch

E.P. van Rooij, N. Svedin, S.R. Pryke, S.C. Griffith

Macquarie University, Sydney, Australia

Sexual selection studies have generally focused on dimorphic species where only one sex is ornamented. However, only very rarely similar questions about ornaments in species where both sexes are ornamented have been addressed. The socially monogamous long-tailed finch (*Poephila acuticauda*) is a sexually 'slightly dimorphic' passerine in which both sexes possess multiple ornaments to a similar extent: two long graduated pintail feathers, a black throat patch and an orange-yellow coloured bill. Here we present the results of work investigating the variation in ornamentation, within and between the two sexes. We also assessed the way ornamentation affects mutual mate choice for social mates and extra-pair mates in a free-living population and whether the expression of ornamentation is linked to quality in both males and females. We also present results from analysis of wild birds in captivity in which we have investigated mutual mate choice based on different (manipulated) bill colours. Our findings suggest that the expression of ornamentation does not influence mate choice of social as well as extra-pair mates in the free-living population and we find no evidence that the expression of ornamentation is linked to quality. We also found a low level of infidelity compared to other short-lived passerines. Combined these results suggest these ornaments might not currently be under sexual selection. However, we did find a preference for mates with similar bill colour when providing choice between different colours, which possibly plays a role in species recognition.

Session 1-2: NVG Symposium

Elevated T-levels decrease promiscuity in female blue tits

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It is well known that testosterone (T) in males positively affects current reproduction by stimulating courtship and territorial defence as well as the number of extra-pair offspring (EPO) they sire. In many species females show similar seasonal fluctuation in T-production during the breeding season as males, but female T-levels are much lower and the fitness consequences of this hormone in females is unclear. Previous experimental studies have shown that elevated T-levels in females negatively influence female attractiveness and female-specific courtship behavior. However, little is known how T influences female extra-pair copulations and hence the number of EPO's. In this study we manipulated T-levels in free-living female blue tits (*Cyanistes caeruleus*) within the physiological range for only a short period, coinciding with the natural elevation of T, prior to egg laying. In others we blocked the androgen receptors and a third group was sham-treated. We found that females with elevated T-levels had fewer EPO's compared to females of the other treatment groups. For females an increase in EPO's (and thus lower T-levels) is beneficial, as a previous study on blue tits demonstrated higher survival of EPO young compared to within-pair young. Our results suggest that elevated T-levels differentially affect fitness in males and females. We will discuss this finding in the light of possible selection pressures on T-production in both sexes, such as sexual antagonistic selection.

Session 1-3: NVG Symposium

The evolution of asymmetric genitalia: the outcome of sexual conflict or mechanical efficiency?

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Asymmetric male and female genitalia have evolved independently a surprising number of times in otherwise externally symmetric groups of animals. This pattern begs further description and explanation in terms of driving mechanisms, particularly given the role that symmetry is thought to play in sexual selection. In this presentation I outline a research program that focuses on using taxonomic data for evaluating the macro-evolutionary patterns and experimental approaches for understanding the driving mechanisms of this curious, pervasive, and yet understudied phenomenon.

Session 1-4: NVG Symposium

Parental conflict versus cooperation in the evolution of genomic imprinting

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A unique form of gene expression known as 'genomic imprinting' occurs in mammals. 'Imprinted genes' dispense with diploidy and are expressed in haploid fashion according to parent-of-origin, with the other parental allele silenced. Thus paternally expressed genes are expressed only from father-derived alleles, and maternally-expressed genes from mother-derived alleles. This maternal- and paternal-specific haploid expression predominantly affects regulatory genes which are heavily expressed in the embryo and placenta. As the placenta is a genetically half-paternal structure within the mother which mediates nutrient delivery to the embryo and regulates maternal physiology and behaviour during pregnancy, it is a site for potential parental conflict over maternal investment in offspring. The dominant theory explaining the evolution of genomic imprinting posits that it arose out of this parental conflict in mammals and predicts that paternally-expressed genes should mediate increased investment in offspring and maternally-expressed genes should counteract this. Thus parent-of-origin expression of imprinted genes would potentially allow the two parental genomes to influence maternal investment in opposite directions. While early research into imprinted genes supported this, more recent work indicating important effects of imprinted genes in the adult brain suggests that their effects are more widespread. Our own studies of paternally expressed genes suggest that instead of conflict, coadaptation between mother, offspring and father may have played a key role in the evolution of imprinting and that some imprinted genes have evolved to regulate reproduction in adults to mutual adaptive benefit.

Session 1-5: NVG Symposium

Quantifying male reproductive success of a simultaneously hermaphroditic snail

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In contrast to the historical expectation, recent theoretical studies have indicated that simultaneously hermaphroditic animals also experience sexual selection, just like separate sexed species. The empirical study of sexual selection processes in hermaphrodites is fascinating and required for a full understanding of the evolution of this mode of reproduction. However, due to the fact that these animals are male and female at the same time, examining the proposed predictions and assumptions is a challenge. In particular, many simultaneously hermaphroditic taxa fertilize internally, can store and digest sperm and can self-fertilize their eggs, making precise measurement of their reproductive success difficult. Here, we present research that quantitatively measures male reproductive success of the great pond snail, *Lymnaea stagnalis*. We examined how long they use sperm from a mating partner (allosperm) using a microsatellite marker. Previous work indicated that these snails store and use allosperm for about three months, but in that study the author used albino mutants (as genetic marker) and the mating history of the animals was unclear. Our results reveal that most individuals stop to use allosperm well before three months after they received sperm only once. In addition, the timing of this decline in outcrossing shows large variation between pairs. Therefore, we explore several factors (e.g., body size and mating duration) to explain the variation in this timing. We will discuss how these findings will form a good basis for further research into sexual selection in this simultaneous hermaphrodite.

Session 1-6: NVG Symposium

Sneaky monkeys: an audience effect of male rhesus macaques (*Macaca mulatta*) on sexual behavior

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Males and females have different sexual interests and subsequently may show conflicting sexual strategies. While dominant males try to monopolize females, promiscuity benefits females and subordinate males. One way to escape monopolization by dominant males is to copulate in their absence. We tested this inhibitory effect of males on the sexual behavior of their group members in captive group-living rhesus macaques. Indeed, copulations between females and non-alpha males almost exclusively took place when the alpha-male was out of sight. Furthermore, the inhibiting effect was not unique for the alpha male. An upcoming non-alpha male also inhibited copulations of its group members, and three other non-alpha males inhibited female copulation solicitations. Females adjusted their behavior to the presence of bystander males, as they initiated and accepted initiations more often in absence than in presence of bystander males. Although not significant, in males a similar pattern was found. The observed reduction in mating behavior in presence of bystander males is in accordance with an 'audience effect', in which the behavior is modulated in relation to the presence or absence of third parties. This audience effect may serve as an important mechanism to reduce (aggressive) interruptions of subordinate male copulations. This audience effect is of special importance for subordinate males in species with promiscuous females, incomplete alpha male monopolisation and high levels of male aggression.

Session 2-1: Behavioural and Evolutionary Genetics

Chemical Characterisation of the courtship water of Palmate newts (Lissotriton helveticus, Salamandridae)

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After hibernation on land, European newts (Salamandridae, Amphibia) return to the water for courtship and breeding. Males develop several sexual characteristics such as a bright coloration and an extended crest on back and tail. The tail is used for fanning (underwater waving) and is predicted to direct pheromones from the male cloaca to the nose of the female in a complex courtship behaviour. Although this behaviour has been known for decades, the molecules expressed during waving and their exact function have never been demonstrated. We studied the courtship of palmate newts (*Lissotriton helveticus*) in an integrative approach, combining ethological tests, transcriptomics and proteomics. First, we tested the ability of complete courtship water (water in which males just fanned their tail) to attract females and obtained a positive behavioural assay. To further characterise the molecules responsible for this attraction, we then isolated peptides and proteins from the courtship water and used precursor cDNA information to fully characterise them. Our analyses identified multiple peptides and proteins up to 200 amino acids, showing that newt courtship water contains more than a single pheromone, and likely holds multiple kinds of chemical information.

Session 2-2: Behavioural and Evolutionary Genetics

Digit ratio, and variation in the androgen receptor, serotonin transporter, and dopamine D4 receptor genes in African foragers: the Hadza

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The role of genes in the expression of masculinity in humans has been focus of recent behavioral genetic studies. This is the first study on the variation digit ratios, (the ratio between the second and the fourth digits, 2D:4D), and polymorphisms of the AR, DRD4E3, and 5-HTTLPR genes in simple hunter-gatherers, namely the Hadza of Tanzania. We found no influence of AR gene on the right hand 2D:4D ratio and the directional asymmetry in 2D:4D (DR-L) and a weak positive correlation between the number of CAG repeats and left hand 2D:4D. The multiple regression analyses with digit ratios and directional asymmetry as dependent variables and the three gene candidates (AR, DRD4E3 and 5-HTTLPR) as independent variable revealed the following: men with lower number of CAG repeats had significantly lower left hand 2D:4D; men with higher numbers of 48-bp init copies in exon 3 of a VNTR polymorphism in DRD4 gene had significantly lower digit ratios on both hands; no effect of the 5-HTTLPR gene on either digit ratios or directional asymmetry. It is noteworthy that these results were obtained for a human population that is still practicing a foraging and has been subjected to a high selective pressure due to harsh environment and practically no access to modern medical care.

Session 2-3: Behavioural and Evolutionary Genetics

Origin and genomic organization of a sex pheromone in aquatic newts (Salamandridae)

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Males of aquatic salamandrid newts often use tail-fanning behaviour to direct cloacal pheromones towards receptive females, but few of these molecules have been characterized. The Asian *Cynops pyrrhogaster* is known to emit a pheromone called sodefrin, a decapeptide that is cleaved from the larger Sodefrin Precursor Factor (SPF). Behavioural tests have demonstrated that sodefrin has the ability to attract and excite gravid females. To understand the evolution of SPF and pinpoint the origin of sodefrin, we sequenced cloacal mRNA (transcribed DNA) from males and females in five salamandrid genera with aquatic courtship. We found a substantial difference in number of transcripts between the sexes, and recovered up to seventeen different SPF transcripts per species. Integration of genome and transcriptome analyses indicate that this SPF transcript diversity is formed by a combination of gene/exon duplications and alternative splicing. Phylogenetic analyses further indicate that sodefrin evolved from SPF by a frameshift mutation within the lineage of Asian newts, i.e. long after the origin of the tail fanning behavior. We hypothesize that other salamandrid newts are using the same behaviour to deliver different pheromones that are likely derived from similar SPF precursors.

Session 2-4: Behavioural and Evolutionary Genetics

Early Radiation and Functional Diversification of Tetrapod Alpha Keratins

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The conquest of land was arguably one of the most fundamental ecological transitions in vertebrates, and entailed significant changes in skin structure and appendages to cope with the new environment. In extant tetrapods, the rigidity of the integument is largely created by type I and type II keratins, which are structural proteins essential in forming a strong cytoplasmic network. It is expected that such proteins have undergone fundamental changes in both stem and crown tetrapods. Here we integrate genomic, phylogenetic and expression data in a comprehensive study on the early evolution and functional diversification of tetrapod keratins. Our analyses reveal that all type I and II tetrapod keratins evolved from only two genes that were present in the ancestor of extant vertebrates. Subsequently, the water-to-land transition in the stem-lineage of tetrapods was associated with a major radiation and functional diversification of keratin genes. These duplications acquired functions that serve rigidity in integumental hard structures and were the prime for subsequent independent keratin diversification in tetrapod lineages.

Session 2-5: Applied Ecology

EAG Response of Helicoverpa armigera Hubn and its predator Chrysoperla carnea Steph. to volatiles of different varieties of cotton and sunflower

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Electroantennogram (EAG) response of male and female adults pest *Helicoverpa armigera* Hubn. And predator *Chrysoperla carnea* was recorded for leaf and bolls extract of different varieties of cotton and sunflower. Among the sexes female showed more response than males. Among the varieties AK-235 and Adonicum recorded higher EAG response but least response was recorded in the variety Ak-227. in case of *C.carnea* the varieties tested Goarani-6, Indore-1, Badnawar and Andrews showed better response than other. Boll varieties extracts like K-6 recorded more response. Among the sunflower varieties KBSH-1 recorded more response. Least response was noted in the variety KBHH-1. in case of *C.carnea* males showed higher response than females. Sungen-85 variety showed more response. The EAG response was higher in hexanol, alpha pinene and caryophyllene in case of *C.carnea*, while *H.armigera* showed higher response to hexanol, pentanol and Caryophyllene oxide. Over all, hydrocarbons form a major part of the compound present in the hexane extract of sun flower leaves followed by terpenes. In case of hexane extracts of cottonbolls, terpenes, isoterpenes, cymene and caryophyllene were found in traces, while alpha and beta-pinene, myrcene, comphene, limonene, octane and terpinene were found as major chemicals.

Session 2-6: Applied Ecology

Species identification of forensically important flies using DNA barcoding

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Accurate identification of an insect specimen is usually a crucial first step in a forensic entomological analysis because closely related carrion species may differ substantially in growth rate and diapause response. However, species-diagnostic anatomical characters are often difficult to use since 1) they are not known for most immature stages, 2) existing keys may be incomplete and difficult to use for nonspecialists and 3) the available material could be strongly degraded or fragmented. A DNA-based identification tool may largely overcome these problems. Here, we first give an overview of the current status of the use of DNA barcoding of the cytochrome c oxidase subunit I (COI) gene for the identification of forensically important West European *Sarcophaga* species. We show that 1) the length of the barcode fragment (entire COI, barcode region, mini-barcode) does not substantially change the identification success in this group, 2) DNA barcoding reveals cryptic diversity and 3) DNA barcoding may even serve as a tool to recognize introduced species. A forensic entomological investigation can thus strongly benefit from a DNA-based species identification.

Session 3-1: Behavioural Ecology

Incubation effort and decreases in late-life reproduction in female Seychelles warblers (*Acrocephalus sechellensis*)

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Knowing how and why individual fitness components change with age in many iteroparous species is essential to understanding the evolution of life histories. Several studies show that reproductive output in females declines after having reached older ages, but the underlying causes for such a decline are poorly understood. A change in maternal effects, such as reduced incubation effort in female birds, may be one of the main causes of declines in late-life reproductive output. Using an exceptional long-term dataset of individuals from a natural, closed, and predator-free population of the Seychelles warbler (*Acrocephalus sechellensis*), we show that female reproductive output decreases at old age. Two possible explanations for this late-life reduction in reproductive success are lower hatching success and higher egg predation due to lowered incubation effort of older females, or higher hatchling mortality due to lowered food provisioning. In the Seychelles warbler, few hatchlings die of starvation, but egg loss during the incubation stage is important and explains a large proportion of the reproductive success. Importantly, female Seychelles warblers usually produce only a single egg, so that the loss of the egg means failure of the entire breeding attempt. Consequently, we investigated to what extent late-life declines in reproductive output can be explained by changes in incubation effort in old females. This is one of the first studies that investigated why old females reproduce less well and helps understanding senescence in wild animal populations.

Session 3-2: Behavioural Ecology

Effects of nest site characteristics on breeding success of the great reed warbler (*Acrocephalus arundinaceus*) in Iran

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We investigate for the first time the breeding biology of the great reed warbler (*Acrocephalus arundinaceus*) in Iran. The study was conducted in the Zarrinkola artificial wetlands (328 ha) in Mazandaran province, Iran. Breeding density was 0.86 breeding pairs per ha in the studied area. Nest site characteristics studied include: nest size, nest height from water level, water depth around the nest, and distance to the nearest neighbouring nest. The average breeding success (probability of fledging young by breeding pairs per season) was 71% (n = 30). Firstly, we predict that larger nests provide more suitable spaces for eggs and nestlings. Great reed warblers make nests above the water level within high-density reeds. We expect that higher nests have higher success because of lower chance of flooding. Secondly, we predict that the greater the distance to the nearest nest is, the lower the competition for food between neighbouring breeding pairs, and the higher the final breeding success. However, the breeding success in the studied area was not associated with nest size, nest height, nest depth nor nearest neighbouring nest. Breeding success decreased significantly with laying date. Early laying date indicated greater breeding success. Breeding success increased significantly with clutch size. Breeding density, nest site characteristics, clutch size and breeding success in Iran indicated significant difference with similar parameters in European populations, which will be discussed. Results of this research will have important implications when ranking the nest site characteristics for breeding habitat management in this and other species.

Session 3-3: Behavioural Ecology

Some causes of the variable shape of flocks of birds

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The constant variation of the shape of huge flocks of starlings (*Sturnus vulgaris*) when they circle above their sleeping site at dawn has amazed observers for ages. Similar variation of shape occurs in the flocks of other species of birds, more so than in fish schools (fish schools are usually oblong). The causes of this variability, however, are mostly unknown up till the present time. We investigate these causes with the help of a computer model that generates a travelling group by self-organisation. In the present paper, we use a model, called StarDisplay, the flocking patterns of which resemble both qualitatively and quantitatively those of real birds (in particular starlings). In this model, individuals coordinate with neighbours through attraction, alignment and avoidance of collision (just as in models of fish schools). This model is supplemented with a few specifics of starling behaviour, namely 1) simplified aerodynamics of their flying movement, 2) a low and constant number of interaction-partners and 3) preferential movement above a 'sleeping area'.

As to shape, we measure the relative proportions of the flock and the longest dimension in respect of its movement. We show that variation of flock shape is due to at least four causes, namely a) the aerodynamics of flying, b) the large size of the flock, c) low number of interacting partners, and d) heterogeneity of the environment. We explain how this comes about and thus construct hypotheses that can be tested empirically.

Session 3-4: Behavioural Ecology

Fertilization without amplexus in Indian Nightfrogs (Anura, Nyctibatrachidae)

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Although anurans exhibit major variation in reproductive behaviour, a form of amplexus, i.e. the male grasping the female, is nearly always present. This behaviour is important in synchronizing egg deposition with fertilization, since the latter is performed externally in nearly all frogs. However, studies in *N. humayuni* and *N. petraeus*, two nyctibatrachid frogs endemic to the Western Ghats of India, have shown that these species have no amplexus in the strict sense. Instead, the grasping is absent, or replaced by a short and loose contact between male and female that is aborted before the eggs are deposited. To pinpoint the moment of fertilization in this unusual anuran behaviour, we studied in detail the reproductive behaviour of *Nyctibatrachus humayuni*. Surprisingly, our study indicates that eggs are fertilized a few seconds after oviposition, even though the male is not present at that moment. This strongly suggests that male semen release takes place on the back of the female before the male dismounts the female and the eggs are deposited. The female remains motionless after deposition, allowing the sperm to reach and fertilize the eggs. This behaviour is similar to observations in the Madagascan frog genus *Mantidactylus*. Because both genera have independently evolved femoral glands, whose biological function is still unknown, we hypothesize that this structure is involved in courtship behaviour without amplexus.

Session 3-5: Behavioural Ecology

Male hind leg waving is involved in chemical communication during courtship in the African Dwarf Clawed Frog

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In contrast to other vertebrate classes, few pheromones have been identified and characterized in amphibians. One of the species in which chemical communication has already been demonstrated is the fully aquatic African Dwarf Clawed Frog *Hymenochirus boettgeri* (Anura, Pipidae). Males of this species have a subdermal breeding gland behind each front leg, which substantially enlarges when they are sexually active and calling. It has been shown in a Y-maze experiment that females are attracted to males with breeding glands, but not to males where the breeding glands are surgically removed. However, other potential functions during courtship remain unknown and the molecules involved are still unidentified. To better understand the function of the breeding gland, we studied and filmed in detail the courtship behaviour of *Hymenochirus boettgeri*. We observed that during courtship, males often wave their hind legs to the female before engaging in amplexus. This waving transfers water from around the breeding glands, and therefore any water-soluble chemical produced by them, directly towards the female's nose. Chemical analysis of water taken from the male's direct proximity during this behaviour confirms the presence of water-soluble molecules. Our study thus indicates the presence of short-distance chemical communication during courtship in natural conditions. We are currently using an integrative approach combining a cDNA library of the breeding gland, chemical analysis of water, and more fine-tuned behavioural assays to further characterize the key molecules in this waving behaviour.

Session 4-1: Cognition 1

Local orientation and foraging: changes in decision making can eliminate evolutionary trade-offs.

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Animals differ in how they sense and process information obtained from the environment. An important part of this information processing is used to find food. In terms of foraging, local decision making determines how successful individuals are at finding food on longer timescales. Using an artificial-world model, we studied different kinds of decision making to understand how local information processing affects larger scale behavioral patterns and their evolution. We compared a restricted decision making (less memory) to extended decision making (more memory). We then compared the evolution of decision making and behavioral actions (moving and scanning for food) in patchy and uniform environments. Our results show that with restricted decision making individuals face a trade-off in the patchy environment: they try to stay in patches by not moving forward too far, but to do so they sacrifice how fast they travel between patches. With extended decision making this trade-off completely disappears because decision making allows moving forward to be avoided in patches. Instead moving forward can be used exclusively for faster travelling between patches and for selecting bigger patches. This kind of information processing is not possible with restricted decision making. Our results show how changes in local decision making can significantly alter what evolutionary forces are faced and can eliminate evolutionary trade-offs.

Session 4-2: Cognition 1

Maternal care shapes social learning propensities in adult rats

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Many vertebrates rely extensively on social information, but the value of information produced by other individuals will vary across contexts and habitats. Social learning may thus be optimized by the use of developmental or current cues to determine its likely value. Here, we show that a developmental cue, early maternal care, can shape social learning propensities in adult rodents. Female rats (*Rattus norvegicus*) consistently differ in the intensity with which they lick and groom (LG) their pups, allowing them to be categorized as high, low, or mid-LG mothers. These maternal care differences influence offspring development and neural architecture when adult. To investigate how differential maternal care and oxytocin influence social learning when adult we conducted a food preference learning test. The 100-day old male offspring of high and low-LG mothers were given the opportunity to learn food preferences for novel diets from mid-LG same sex conspecifics that had previously eaten these diets ('demonstrators'). We predicted high-LG offspring, because of decreased stress sensitivity, would show stronger social food preference learning than low-LG offspring, and that oxytocin would enhance social learning. In line with our predictions, high-LG offspring socially learned food preferences, but low-LG offspring did not. We administered oxytocin to subjects, but there were no detectable effects on social learning propensities. These data suggest that social learning propensities may be relatively stable throughout life, and potentially part of a suite of traits 'adaptively programmed' by early developmental experiences.

Session 4-3: Cognition 1

Do bats recognize their predators?

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Recognizing predators is vital for survival, therefore many animals are capable of assessing cues signalling the presence of predators. For the large and ecologically important group of bats, consistent knowledge about predator recognition is still lacking. In this study, we tested whether individual bats are able to recognize predators by visual, auditory or olfactory cues. Stuffed predator dummies and territorial calls of avian species known to prey on bats were presented in a flight room to wild Schreiber's bats (*Miniopterus schreibersii*) and to captive greater mouse-eared bats (*Myotis myotis*). In addition, wild mouse-eared bats were exposed to natural and synthetic olfactory cues of mustelids and fox, both potential day-roost predators, in y-maze experiments. Within all experiments, we scored for a variety of anti-predator responses, but in none of the cases the bats' behaviour was affected by the presented predator stimuli. Bats thus seem not to rely on vision, echolocation, hearing or olfaction for recognizing predators, although these sensory modalities are of key importance to them. We suggest that the lack of predator recognition abilities in individual bats is mainly due to the low predation pressure on bats, which likely is linked to their nocturnality and roosting habits.

Learning the value of social information

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Theorists have suggested that animals will employ learning strategies (biases) to maximise the utility of social information, information produced by the behaviour of other animals. For example, individuals may preferentially learn from successful conspecifics, or favour social information only under particular circumstances. The origins of social learning strategies remain controversial. In two experiments, we demonstrate that guppies *Poecilia reticulata*, small tropical fish, learn the value of social cues. In Experiment 1, subjects observed two trained fish ('demonstrators') foraging while we manipulated perceived foraging success, creating 'successful' and 'unsuccessful' demonstrators. After 24 training sessions over 12 days, subjects observed the two demonstrators feeding in a novel arena. Large but not small subjects preferred the foraging patch that the successful demonstrator had previously visited. Thus guppies remembered and preferentially learned from the successful individual, resulting in 'directed' social learning. In Experiment 2, subjects observed a single group of demonstrators. Depending on the prevailing context cues (bright white versus dim green light), the demonstrators either led them to or away from a food reward. After 84 training sessions over 21 days, subjects were individually exposed to demonstrators in the two contexts. Subjects followed demonstrators in the context where demonstrators had previously led them to food, but avoided demonstrators in the opposite context. Associative learning provides a parsimonious explanation for these acquired preferences. Based on our findings, we argue that social learning strategies, such as 'copy-successful-individuals', need not require adaptively-specialized cognitive mechanisms, and may thus be widespread across the animal kingdom.

Species Differences in How Corvids Respond to Pilfering: Implications for Social Cognition

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The social cognition of corvids has recently been the subject of much scientific attention. According to some, these birds might be capable of ‘theory of mind’, that is, reasoning about the mental states of others. This idea springs from experimental work on caching. When corvids hide food underground, they seem to take into account the perspectives and intentions of potential thieves. There are species differences in how they do this: When tested in similar setups, Western scrub jays appeared to selectively re-cache the items that others had seen them bury, while Clark’s nutcrackers appeared to cache progressively less in response to seeing their items get stolen. We investigate the cognition underlying this, as well as the extent of the species difference, with a computational model. The model consists of a kind of ‘virtual bird’, validated in previous work. Its behavior depends on a set of basic assumptions for corvid cognition, and a well-established model of human memory. By exposing this ‘virtual bird’ to simulated versions of the real experiments, we show that the differences between both species can be captured with only minimal adaptation of the virtual bird’s underlying rules. We also show that both the re-caching of scrub jays and the decreased caching of nutcrackers might not be related to social concerns at all. Our ‘virtual bird’ has no memory of whether it has seen another bird pilfer or not, but still acts as the real birds did, simply by reacting to finding its own caches missing.

Stasis, change and reversal of premaxilla morphology in haplochromine cichlids

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Lake Victoria’s cichlids have drawn the attention of many evolutionary biologists all over the world. The dramatic ecological changes in the lake during the past three decades provide a unique opportunity to study environmental effects on cichlid morphology. Due to some of these environmental changes, like decreased water clarity and a change in the composition of prey species, zooplanktivorous cichlids included more macro-invertebrates and small fish in their diet in the 1990s than in the 1970s. Through geometric morphometric analyses at three year intervals, this study shows how several haplochromine species adapted their premaxilla (upper jaw) to their changed diet. The number of teeth increased while the ascending arm of the premaxilla decreased in the 1990s. Both changes are in agreement with a more biting-like feeding style which seems necessary for the faster and larger prey such as shrimps, insects and fish. Remarkably, for some zooplanktivorous species, premaxilla morphology reversed in the 2000s to the form of the late 1970s. This reversal corresponds with the current diet of the zooplanktivores which includes again more zooplankton and less macro-invertebrates. These fascinating changes occurred within a decade and the possible contribution of both phenotypic plasticity and natural selection are discussed.

Session 5-2: Evolution

Evolved changes in guppy shoaling and stress responses.

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The guppy (*Poecilia reticulata*) has been widely used to examine behavioural adaptation to predation because it exhibits great polymorphism among geographically isolated populations. The expression of shoaling and anti-predator behaviour is modulated by the surrounding predation pressure, with genes and environment playing an interacting role in this process. Here, we compared shoaling and anti-predator behaviour of the laboratory-reared generation (F1) of a domestic population, never exposed to predators in their recent evolutionary past, with a feral population, introduced to Burgers' Zoo as domestic guppies 20 years ago and subject to high predation levels since then. We have previously studied the first generation and found that these strains have marked behavioural differences. Our current findings show that F1 generation feral guppies shoal more than domestic guppies. However, these increased shoaling responses are only observed after exposure to a mild stressor (25 min of isolation) and this stress-induced shoaling phenotype is similar in both the FO and F1 generations. A significant interaction effect shows that shoaling behaviour is sensitive to prior stress in the feral females, but not in the domestic females. Predator inspection behaviour did not significantly differ between feral and domestic guppies in either the FO or F1 generation, but isolation exposure reduced predator inspection. These data provide evidence for genetic adaptation of shoaling and stress responses in response to predation pressure in feral guppies.

Session 5-3: Evolution

Phenotypic plasticity favors the evolution of heritable nongenetic effects

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There is currently a growing interest in the evolutionary consequences of nongenetic inheritance, where phenotypic variation does not correspond to variation in DNA sequences, but to variation in DNA methylation, maternal effects or the cultural transmission of behaviour. The ecological conditions that favor these nongenetic inheritance systems over genetic inheritance remain poorly understood. Using a formal model, we assess when selection favors the evolution of heritable nongenetic effects, as opposed to alternatives such as genetic inheritance or bet-hedging. We show that such heritable nongenetic effects prevail when environmental fluctuations are relatively infrequent and different environments are encountered at similar rates. Interestingly, heritable nongenetic effects can evolve in a much wider range of conditions when individuals exhibit a certain degree of phenotypic plasticity, - for example when individuals are allowed to learn features about their current environment. This is because such plastic organisms that can adjust their phenotype to the current environment provide a more reliable source of environmental information to their offspring than non-plastic individuals. We challenge the conventional view that plasticity and nongenetic inheritance are alternative, mutually exclusive means to achieve adaptation. However, we also show that direct transmission of environmental information to offspring, which is not mediated by the parental phenotype, diminishes the scope for heritable nongenetic effects.

News from down under to the West: Comparative thermal biology of lizards of the Liolaemus goetschi group from Patagonia, Argentina.

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Thermal biology is a key aspect for an ectotherm's physiology and behavior. Although thermal biology is a well studied subject in reptiles, some evolutionary aspects are still controversial. For example it is unclear whether thermal variables coevolved in some groups of reptiles. Lizards from the *Liolaemus goetschi* group occur along a wide latitudinal range (28S-48S, 2300Km) across the cold and variable Patagonian environments. Their known phylogenetic relationships, variation in their ecological attributes and wide distribution makes this group a good study case to examine the evolution of their thermal biology. Here, we study thermal variables of 13 species belonging to the *Liolaemus goetschi* group, in order to answer three questions. First, did the thermal characteristics of the animals, such as critical temperatures and thermal preferences, co-evolve? Second, are these traits modelled by the environment or are they the result of phylogenetic constraints? Third, does the thermal features evolved at a greater phylogenetic scale in *Liolaemus*? We answer these questions by using phylogenetically based analyses as well as conventional statistics. We collected data from our focal species and used the species information about thermal biology of *Liolaemus* lizards available in the literature. Our results show that lizards from the *L. goetschi* group vary in some aspects of their thermal biology and some traits have co-evolved, but thermal biology seems to be independent of the environment and modelled by phylogeny. Some of these trends are also valid in a broader phylogenetic scale, but we found some mixed effects of environment and phylogeny.

Session 5-5: Evolution

The coexistence of two congeneric lemur species: niche separation and competition as underlying mechanisms

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The coexistence of closely related species is still a much debated subject in community ecology. Our research goal is to investigate niche differences and dominance patterns of the two congeneric species *Eulemur rufifrons* and *Eulemur rubriventer*, that live sympatrically in Ranomafana National Park, in order to explain their coexistence. Five-minute focal animal samples were recorded instantaneously, combined with all occurrences of feeding and direct interactions between inter- and intraspecific groups. We found significant differences along all three niche axes we investigated; 1) in resource utilization of feeding trees, 2) in spatial preferences, as *E. rufifrons* used the exposed and visible locations more than *E. rubriventer* and 3) in their temporal activity pattern, both at different parts of the day, in their cathemeral behaviour and in general, as *E. rufifrons* was more active during the day than *E. rubriventer*. *E. rufifrons* turned out to be dominant over *E. rubriventer* in most of the observed interactions, but the competition strength of each species can vary between seasons. We suggest that the combination of the subtle differences along their main niche axes, combined with the different competition strengths throughout the year and the heterogeneity of the environment, probably limits the intensity of competition between species and forms the basis of the explanation for the coexistence of these two closely related lemur species.

Session 7-1: Cognition 2

Tolerant food sharing in despotic bonobos

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Food sharing can be defined as the common use of monopolizable food items in which a food owner tolerates an approacher without food, to consume a part of his food. The study of food sharing in apes can provide a perspective on the evolution of altruism in humans.

We investigated food sharing and grooming in a captive group of bonobos at Planckendael Wild Animal Park (Belgium) and examined which of the existing hypotheses accounted for the observed patterns. The first author observed the group (6 adults and 2 juveniles) for a total of 295 hours in August and September 2010. We used a test paradigm to induce food sharing that consisted of 3 conditions: (1) Baseline with standard feeding regime and no intention to induce food sharing (2) Providing food in monopolizable paper bags (3) Providing monopolizable bundles of willow braches, in addition to the normal feeding regime.

The results showed that the dominance hierarchy was linear and strict, but the food transfers and the reactions of the food owners to approachers were mainly tolerant, in contrast with previous research. This finding argues against the harassment hypothesis. Food was not exchanged reciprocally, but was interchanged for grooming, as predicted by the biological market theory. However, food sharing and the interchange of food were strongly influenced by kinship. This strong influence might be due to the small sample size.

Session 7-2: Cognition 2

Asymmetries of the parietal operculum in common chimpanzee and handedness

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A left larger than right Planum Temporale (PT) is a neuroanatomical asymmetry common to both human and chimpanzee. A similar asymmetry was observed on the human Parietal Operculum (PO) and the convergence of PT and PO asymmetries is strongly associated with right-handedness in humans. We here assessed whether this combination also exists in common chimpanzees (*Pan troglodytes*). Magnetic resonance scans were obtained in 83 captive subjects. PT was quantified following procedures previously employed and PO was defined as the maximal linear distance between the end point of the sylvian fissure and the central sulcus. Handedness was assessed using two tasks that were designed to simulate termite fishing of wild chimpanzees and to elicit bimanual coordination without tool use. Chimpanzees showed population-level leftward asymmetries for both PT and PO. As in humans, these leftward asymmetries were not correlated. Handedness for tool use but not for non-tool-use motor actions mediated the expression of asymmetries in PT and PO, with right-handed apes showing more pronounced leftward asymmetry. Consistent PT and PO asymmetry combinations were observed in chimpanzees. Proportions of individuals showing these combinations were comparable in humans and chimpanzees but handedness effects on these combinations were not similar in the two species.

Session 7-3: Cognition 2

Pro-sociality in despotic macaques: the effect of kinship, friendship and dominance

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Actively granting food to a companion is called pro-social behavior and is considered to be part of altruism. Recent findings show that some non-human primates behave pro-socially. However, pro-social behavior is not expected in despotic species, since the steep dominance hierarchy will preclude pro-sociality. We tested pro-social behavior with a one and a two partner set-up in captive long-tailed macaques. We show that some despotic long-tailed macaques do grant others access to food and show pro-social behavior. They are pro-social to kin, but not to friends. This suggests that mechanisms of benefitting kin and non-kin are different. Their dominance hierarchy determines pro-social behavior in an unexpected way: high-ranking individuals grant, while low-ranking individuals withhold their partner access to food. Thus, dominants do not rule through 'fear above love', but through 'be feared when needed and loved when possible'.

Session 8-1: Biological Rhythms

Circadian clocks: evolution to increasing complexity and robustness

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Almost every species possess the ability to entrain to the daily alternation of light and darkness. The circadian clock system is one of the few biological systems which has been understood down to its genetic components, although a complete biochemical network remains to be constructed. In this presentation, recent studies on the circadian clocks of cyanobacteria will be reviewed and comparison with that of mammals will be made. In the unicellular cyanobacteria, the circadian clock seems to be primarily based on posttranslational modifications involving only three proteins. In mammals, the current knowledge is that circadian rhythmicity in behavior and physiology is orchestrated mainly by a ~10,000-neuron brain tissue called the suprachiasmatic nucleus. The neuronal cellular clockwork requires transcription-translation feedback processes which is possibly coupled with posttranslational modifications. Several characteristics of circadian clocks common among different species will be highlighted. Such commonality can be a basis for working with simpler mathematical models that exhibit most of these common properties. Then, the presentation will try to illustrate such simplification procedure using a recent mathematical model of the cell-autonomous mammalian circadian clock. In this way, we hope to derive both top-down and bottom-up approaches on how complexity in nature could be studied; that is, by modifying and linking existing mechanisms in order to produce a more complex (can do more things) and possibly more robust system (can withstand more environmental fluctuations).

Session 8-2: Biological Rhythms

The brain at low temperature: effects of hibernation on brain and behaviour in Syrian hamsters.

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In hibernation animals lower their metabolism to save energy. As a consequence hibernating animals also cool down and enter a state of torpor. One could expect that hibernators maintain a low metabolic rate throughout the hibernation season to maximize energy savings. This however is rarely the case. Deep hibernators intersperse long (multiple days) torpid periods, with short (~12 - 24 hours) euthermic periods. In these 'periodic arousals' hibernators spend >80% of the total amount of energy used in the entire hibernation season. Because of the high energetic costs associated with periodic euthermia, many biological functions have been attributed to these periodic arousals, but a general function has not been unequivocally established. In European ground squirrels hibernation is associated with dynamic changes at the cellular level in the brain, such as neuronal connectivity dynamics and reversible Alzheimer like phosphorylation of the neuronal skeleton, coinciding with a loss of spatial memory. In contrast, in some other hibernators, such as Alpine marmots and bats, memory is not influenced by hibernation. In this paper we compare brain and behavioural consequences of hibernation in Syrian hamsters and European ground squirrels. We show that there are differences in patterns of neuronal connectivity in their torpid brains and that although Alzheimer like tau phosphorylation occurs in both species, spatial memory is not affected by hibernation in Syrian hamsters.

Circadian clocks and events to memorize: time-place association

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In time-place association (TPA) animals connect the location of a stimulus with time of day. Since long we know that daily rhythms are connected with learning aspects, already in 1926 Beling showed the concept of time memory in honey bees. A good 50 years later Biebach and co-workers demonstrated circadian TPA in birds. They made plausible that TPA can optimize resource localization and exploitation in a circadian changing environment. In mammals utilization of an internal clock for TPA has long remained ambiguous. We designed a novel paradigm that reflects the natural situation in which foraging mice have to evaluate risks connected with feeding locations, depending on the time of day (Van der Zee et al., *Curr Biol.*18:844-848). Using this functional paradigm, we demonstrated the circadian nature of TPA in mice for the first time. This opened the possibility to investigate the role of clock components in TPA. Results showed that circadian TPA is CRY, but not PER clock gene dependent. Following this line we can use the TPA paradigm to explore the involvement of the suprachiasmatic nuclei, the circadian master clock, and potential peripheral clock systems like the hippocampus in the integration of the circadian system with memory formation, on a functional behavioral and physiological and anatomical level. Further perspectives of functional TPA studies encompass the impact of aging in memory processes, as illustrated by first results of the deteriorating effects of aging.

Poster Presentation Abstracts

Resolution power of SNPs vs. SSRs markers for parentage and traceability purposes in sole (Solea solea L.)

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High marine fishing pressure during the last decennia has increased the importance of aquaculture for human food production. Resolving common problems during rearing of aquatic organisms is therefore given high priority in aquaculture research. Sole (*Solea solea* L.) is a species of great potential for commercial breeding, although numerous problems still need to be addressed. Although genetics and genomics have gained importance in aquaculture research, only few such tools are available for sole. The aim of this study is the assessment of novel SNP markers to improve sole aquaculture. More specifically the power of SNP markers vs. SSRs as genetic tool during selective breeding and for traceability applications. I first compared the power of SNPs vs. SSRs to perform parentage analyses; a crucial analytic tool to ensure the persistence of genetic variation in broodstocks, avoid inbreeding depression and construct linkage maps. We performed parentage analysis based on categorical allocation and showed that 21 highly polymorphic SNPs provided the same accuracy as 4 SSRs (1/5 ratio). When parental genotypes were excluded, the number of SNPs required to resolve the complete family structure tripled. In a second part, I evaluated the use of SNPs to detect aquaculture escapees in natural populations which ultimately will lead to a panel of SNPs for forensic applications. To this end, we simulated an escape event and analyzed the data with a specific method tailored for SNPs (SNPPIT). We found that 50 highly polymorphic SNPs were sufficient to assign most escapees to their original aquaculture facility.

Evaluation of long-term functional deficits following transient cerebral ischemia in two mouse strains.

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Nowadays, no suitable animal model exists to assess long-term disabilities after cerebral ischemia. The aim of this study was to compare long-term behavioral and histological differences between two common mouse strains (129S2/SvPasCr1 and C57BL6H) after 30 minutes of middle cerebral artery occlusion (MCAo). Sensorimotor assessments were conducted at one and at three weeks post-surgery using accelerated Rotarod and open-field locomotion. Long-term behavioral testing began four weeks after MCAo using operant conditioning in a progressive fixed-ratio (FR) schedule. Experiments ended with volumetric determination of the infarcted area using NeuN immunostaining. Although no effect of ischemia was detected in 129S2 mice using these tests, in C57 mice, results showed obvious short-term motor and locomotor deficits. Furthermore, subtle but persistent disturbances of endurance and executive functioning were recorded by the progressive schedule tests but not highlighted by sensorimotor tests. Ischemic lesion extended to the dorsolateral part of the striatum in both strains and recurrent cortical damages were also observed in C57 mice. All those results are in accordance with inherent morphological and behavioral features of each strain. Since the motor cortex is spared by 30 minutes MCAo, functional disabilities could be related to striatal damages. In conclusion, C57BL/6H mouse strain, by offering an acceptable survival rate and enough sensitivity to MCAo, seems to be a mouse strain suitable to evaluate long-term deficits and possible functional recovery after cerebral ischemia.

DNA barcoding of European and African Accipiter (Accipitridae: Falconiformes)

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We obtained full (647bp) or mini (291bp) DNA barcodes of 140, mostly African and European, specimens of 25 *Accipiter* (Aves: Accipitridae) species. Kimura-two-parameter (K2P) distances were calculated between barcodes to calculate thresholds of intra- and interspecific species boundaries. Thresholds were comparable, or higher, to that of previous studies and ranged from 2.8% to 3.0% (best compromise threshold based on cumulative intra- and interspecific K2P distances) and from 3.9% to 5.3% (10 times average intraspecific K2P distance). Identification success was determined using the best match and best close match criteria and ranged between 84% (mini barcodes) and 90% (full barcodes). Incorrectly or ambiguously identified specimens belonged to three species pairs that shared at least one haplotype: viz. *A. nisus* - *A. rufiventris*, *A. gularis* - *A. virgatus* and *A. cooperii* - *A. gundlachi*. All 19 other species could be identified unambiguously using the full DNA barcodes.

True injection of male accessory gland products via a love dart in a hermaphroditic land snail

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Sexual conflict shapes the evolution of many behaviours and processes involved in reproduction. Nearly all evidence supporting this comes from species where the sexes are separated. However, a substantial proportion of animals and most plants are hermaphroditic and theoretical work predicts that sexual conflict plays an important role even when the sexes are joined within one individual. This seems to have resulted in bizarre mating systems, sophisticated sperm packaging and complex reproductive morphologies. By far the best-known example of such an extreme strategy is the shooting of so-called love-darts in land snails. Such darts are forcefully stabbed through the partner's skin and the substance carried on the dart has been shown to enhance paternity. All known love darts carry the active substance on their outside and enter this into the partner's blood by stabbing, in some cases repeatedly. Here, we show that species of the snail genus *Everettia* possess a dart that serves as a real injection needle. Their dart is round in cross-section, contains numerous channels, and has perforations along the side of the dart. Histology and electron microscopy show that these holes connect to the channels inside the dart and run all the way up to the elaborate mucus glands that are attached to the dart sac. This strongly suggests that the gland product is directly injected into the partner's blood. Clearly, it remains to be demonstrated how this dart is actually used during mating and whether it indeed enhance sperm storage and/or paternity.

Guppies remember shoal locations in a spatial memory task

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The ability to learn and remember the location of conspecifics potentially provides anti-predator, foraging and mating benefits to grouping animals. Here, we investigated whether the guppy (*Poecilia reticulata*) – a well-studied model organism for behavioural ecology – remembers the location of a conspecific shoal in a simple maze setup. Previous work on poecilids has revealed that males prefer to shoal with female groups to increase their mating chances, while females choose same-sex shoals to minimize sexual harassment by males. Thus shoal location memory might depend on the sex of the individual and of the shoal. To address these questions, single male and female guppies were introduced to a test tank for 5 min with an all-male or all-female shoal at one end and an empty container at the other. The subjects were then returned to their starting point, held behind opaque barriers for 5 min, and allowed to choose between the two hidden outer compartments, which now contained no conspecifics. Subjects spent significantly more time in the compartment that had previously housed the shoal, results consistent with them learning and remembering this location. We discuss the influence of the sex of subjects and the shoal on shoal location memory. Our results indicate that guppies readily learn the location of conspecifics in their environment.

Ipsilateral bias revealed by an operant-based task following middle cerebral artery occlusion in mice

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Functional deteriorations in rodent stroke models could be precisely assessed using operant conditioning. Behavioral flexibility (i.e., the capacity to adapt behavior in changing environments) is a cognitive ability that can be affected by lesions extending to the striatal territories, similar to the ones resulting from middle cerebral artery occlusion (MCAo). Thus, we evaluated behavioral flexibility in mice after MCAo in a task requesting that the animals frequently change the orientation of their instrumental responses.

Adult C57Bl/6H mice were subjected to 30 minutes of right middle cerebral artery occlusion or sham surgery. Twenty-one days later, they went through several tests assessing sensorimotor capacities, and behavioral flexibility was evaluated in operant-based learning task where mice had to switch between two levers, alternatively associated with a food outcome. Lesion locations were eventually determined through immunohistostaining (NeuN).

Sensorimotor testing did not point any gross disorder 21 days after MCAo. In the operant-based task, no flexibility deficit could be identified. However, a detailed analysis revealed that mice in the MCAo group tend to respond toward the lever located in their ipsilesional field. No such bias appeared in sham controls. Histological analysis showed that ischemic lesions extended to the whole right striatum and to a part of the right motor cortex.

This study suggests that basic sensorimotor tests are not always sufficient to model long-lasting deficit after stroke, whereas an operant-based task is able to reveal subtle disturbances, in this case, a bias toward the affected side.

Sexual conflict and cost of copulation in a simultaneous hermaphrodite

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Sexual conflict between male and female interests can increase the cost of mating interactions. This conflict is particularly evident in simultaneous hermaphrodites, often resulting in long and complex copulation processes. Long copulations are assumed to be costly events in terms of increased risk predation and energy expenditure. In spite of the potential of these factors to explain mate choice and duration of copulation, for most simultaneous hermaphrodites copulation costs have never been quantified. In order to address this question, we measured metabolic rates in the earthworm *Eisenia andrei* (Oligochaeta, Lumbricidae). We used an infrared gas analyser to quantify differences in CO₂ production between pairs of separated earthworms and pairs of earthworms that were allowed to copulate. Preliminary results showed that recently mated earthworms are metabolically more active than unmated ones. We expect this metabolic activity to be high during copulation as well, resulting in a significant demand of energy that probably constitutes an overlooked allocation of resources during the mating process.

Biological studies including life history study of Tetranychopsis horridus (Canesterini& Fanzago) (Acari: Tetranychidae) under laboratory conditions

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Tetranychopsis horridus (Canesterini& Fanzago) (Acari: Tetranychidae) is a mite of inadequately known biology that lives on hazelnut crops in Ardabil province, Iran. The mites are spread randomly on the leaves, and they prefer the upper surface of the leaves to lay their eggs, especially on the midrib of the leaves. We studied the biology of *T. horridus* under controlled conditions (15C, 60% RH and a photoperiod of 16L: 8D hours). Duration of each life stages, longevity, reproduction rate, the intrinsic rate of natural increase (r_m), net reproductive rate (RO), mean generation time (T), doubling time (DT) and finite rate of increase (?) of *T. horridus* on the hazelnut plants were calculated. Differences in fertility life table parameters of this mite on host plant analyzed by means of pseudo-values, which were produced by jackknife re-sampling. The averages of adult longevity, Pre-oviposition, oviposition and post- oviposition period of *T. horridus* were 20.2, 4.5, 11.2 and 4.9 days, respectively. The mean developmental time was 65.8 days. Values of r_m (intrinsic rate of increase) and Finite rates of increase (?) were 0.019 individuals day⁻¹ and 1.02 day respectively. The population doubling time (DT) and mean generation time (Tc) showed 34.8 and 62.5 days, respectively. Data on these points is still needed to obtain an extensive picture of the factors that is determined the dynamics of *T. horridus* populations. The results of this study offers direction for future study on estimating the performance of other species of mites.

Pointing behaviour, insight and natural selection.

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It is generally assumed that a reaction on pointing behaviour is an indication of insight into the intention of the pointer. Reactions to pointing behaviours are described in primates and dogs. However, reactions to pointing behaviour are also found in species that are less related to us.

For instance: The male common shelduck reacts to pointing to a rival by the female. The female stickleback reacts to pointing to the nest entrance by the male. The honeybee reacts to pointing to a food source by a hive mate. It is questionable whether in all these cases the reaction on pointing indicates an insight in the intention of the pointer.

A mother hen points towards food to teach her chicks what is edible. Artificially bred chicks react on a finger pointing towards food. Such chicks have experience with neither food nor finger. Probably the finger acts as a model of the bill of a mother. In such cases it is unlikely that insight is involved. This suggests that also no insight is involved when chicks react at the pointing behaviour of their mother. Probably these behaviours are the result of natural selection, in a similar way as that sexual interactive behaviours are the result of natural selection.

It seems difficult to establish criteria to decide in which cases insight is present and in which cases not.

Van Rooijen, J. (2010) Do dogs and bees possess a 'theory of mind'? *Animal Behaviour*, 79, 2, e7-e8. doi:10.1016/j.anbehav.2009.11.016

Vasopressin and oxytocin receptor genes in bonobos (*Pan paniscus*)

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Many studies have linked polymorphisms in receptor genes of the neuropeptides vasopressin and oxytocin to differences in social behaviour and personality traits, both within and between species. Here we focus on the VNTR in the promotor region of the vasopressin receptor gene (*avpr1a*) named 'RS3' and on a SNP 'rs53576' in the third intron of the oxytocin receptor gene (*OTR*). Hammock and Young (2005) found that humans and bonobos share a very similar RS3 polymorphism, that is completely missing in chimpanzees, speculating that the differences between chimpanzees and bonobos in RS3 may be related to differences in social behaviour. However this study was based on genetic information in only one bonobo and five chimpanzees. A later study on a large samples of chimpanzees has shown that some chimpanzees do have the RS3 polymorphism. For bonobos, no further studies on RS3 have been published. Also no studies have been published about the presence of rs53576 in bonobos, but it has been proposed that oxytocin may play an important role in this species. Our current aim is to study intraspecific differences in RS3 and *OTR* in 16 wild-born bonobos. We identified polymorphisms through PCR, electrophoresis and sequencing. We found that RS3 was present in all 16 bonobos, but that there is a lot of variation in length for this polymorphism. Furthermore, bonobos seem to have the same rs53576-polymorphism as found in humans. The next step is to link this variation in polymorphisms to behaviour through observational and experimental data.

A computational model of suction inflow and opercular outflow of water during prey capture in fish

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By performing a sudden expansion of the mouth cavity while approaching a prey, suction feeders generate a flow of water that draws the prey into the mouth. Especially for flow patterns inside the mouth cavity and related dynamics (e.g. the forces, muscle power requirements and energetics for expanding the buccopharyngeal cavity) our current knowledge is largely based on modelling studies. Unfortunately, the existing models did not include the outflow of water through the opercular and branchiostegal valves, which occurs relatively early in the feeding act (i.e. near the time of maximal mouth opening). Here, I present a new computational fluid dynamics (CFD) modelling approach that allows for simulating flows during the complete suction sequence. The model is rotationally symmetric with cross-sectional radii of the head corresponding to the geometric means as measured on the actual fish (high-speed video for external movements, X-ray pictures for internal buccopharyngeal shape). A narrow slit connects the buccopharyngeal cavity with the external water throughout the simulation, but backflow is prevented by increasing the viscosity of the fluid in the opercular region during the early instants of buccal expansion. The model was programmed in ANSYS Fluent 12.1 using this software's deforming mesh functionality. The model was validated by comparing the CFD output to the measured velocity of the prey and the timing of valve opening. The model will allow us to explore the functional morphology and behavior of unidirectional water flow generation in aquatic vertebrates in considerably more detail than was previously possible.

Observations on migration and burrowing activity of Chinese mitten crabs (*Eriocheir sinensis*) in the river Scheldt

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The Chinese mitten crab (*Eriocheir sinensis*) is an invasive species introduced in Europe in the beginning of the 20th century, most probably by ballast water. After a rapid colonization of inland waters, their population decreased following major water pollution after WW2. Recently, the Chinese mitten crab is becoming more abundant again, presumably by taking advantage of the improved water quality. The impact of this exotic species on the ecosystem is unknown but could be substantial because of their increasing numbers observed in the river Scheldt.

The present explorative study collected baseline data on the abundance and migration of the Chinese mitten crab in the Scheldt estuary and some associated marsh creeks. The crabs were captured with fyke nets at a number of fixed locations. The upstream migration of juveniles in the estuary showed a peak in the period February-April. Stomach contents analyses indicated that the diet of the Chinese mitten crabs in the brackish part of the estuary consisted mainly of crustaceans, while more upstream the crabs had consumed more plants.

Specific research was carried out on the occurrence of the burrows by juvenile crabs in the creeks. The density of burrows was highest in the freshwater tidal zone of the estuary. Chinese mitten crabs preferred steep, east-oriented river banks and constructed their burrows close to the water line. Given their low densities in the marsh creeks, the impact of burrowing activity on creek stability is probably limited.

Melanin-based colour as a potential indicator of male quality in *Zootoca vivipara*

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Implicated in such diverse functions as thermoregulation, species recognition, protection and social signalling, colours affect animal biology in many ways. Non-structural coloration in animals arises from pigments, molecules that typically serve multiple functions in the body. If the pigments constitute a rare resource, they need to be allocated among these functions. For instance, carotenoids are important in antioxidant and immune defences and there is ample evidence that individuals allocating large amounts of carotenoids to sexual coloration are advertising their superior quality. Like carotenoids, melanin and its precursors are also involved in many bodily functions, including skin coloration, but also immunity, nociception, stress response, energy expenditure and food intake. Unlike carotenoids, which animals must obtain from their diet, melanin is generally synthesised de novo. Whether the allocation of melanin, like carotenoids, is widely used as a signal in intraspecific communication remains poorly studied. In this study, we quantified the ventral melanin-based colouration in individuals of a lacertid lizard, *Zootoca vivipara*. We related variation in colour patterning to variation in the delayed cutaneous hypersensitivity response and to parasite load. Our results show a clear sexual dimorphism in melanin-based colouration in this lizard, and higher immune responses in darker males. However no correlation was found between the proportion of black colouration and the parasite load. These findings suggest that the melanin-based colour may signal the immune response in *Z. vivipara*.

Effects of crayfish on the establishment of macrophytes in a shallow peat lake

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Macrophytes are the most important components of wetland ecosystems; they provide food and habitat for animals, increase nutrient retention and reduce resuspension of the water column. Therefore, the decline of submerged macrophytes has profound consequences for ecosystem processes in shallow lakes. Restoration measures to reduce phosphorus loading have been implemented in the Loosdrecht peat lake system; however a direct return of submerged macrophytes was not apparent. Invasive herbivores intruding aquatic systems may amplify negative effects for macrophyte abundance. The red swamp crayfish *Procambarus clarkii* has invaded many water bodies throughout the world, giving rise to breeding populations that now threaten freshwater ecosystems. In this case study we tested the strength of top-down effects, including indirect effects by an omnivorous crayfish on establishment of macrophytes in two shallow ponds. One pond was characterized by a high iron concentration due to application, while the second pond had the original phosphate concentrations from the main lake. We hypothesize that *P. clarkii* exerts a strong negative impact on submerged macrophyte abundance and that macrophytes are important in crayfish diet. By means of enclosure and exclosure experiments we tested the effect of crayfish on 3 submerged macrophyte species; *Chara globularis*, *Elodea nuttallii* and *Myriophyllum spicatum*. A food web study based on stable isotope analysis was done to evaluate the contribution of macrophytes to the general diet of crayfish. We found that crayfish have an evident negative effect on submerged macrophyte abundance, although mainly by their sloppy feeding behaviour and the consequential increase in water turbidity.

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