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Prague July 17-20, 2014

Book of Abstracts

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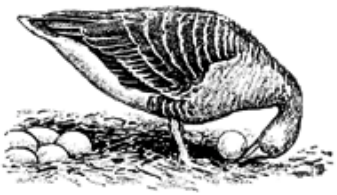

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Czech University of Life Sciences Prague, Faculty of Tropical AgriSciences, Department of Animal Sciences and Food Processing

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The European Conference on Behavioural Biology (ECBB) is organized every even year in a European country by the local Ethological Society in cooperation with the Committee of European Societies for Behavioural Biology (CESBB). The Czech and Slovak Ethological Society welcomes you to join VII ECBB held at the Czech University of Life Sciences Prague between July 17 and 20, 2014.

Let's come to enjoy this traditional meeting of top level behavioural science in one of the nicest cities in the world!

Jitka Bartošová

Chair of the Czech and Slovak Ethological Society and the Organizing committee

Czech University of Life Sciences Prague
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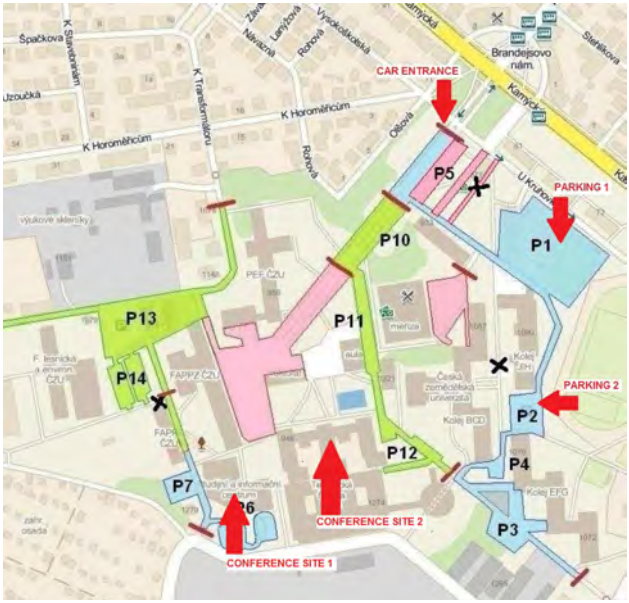

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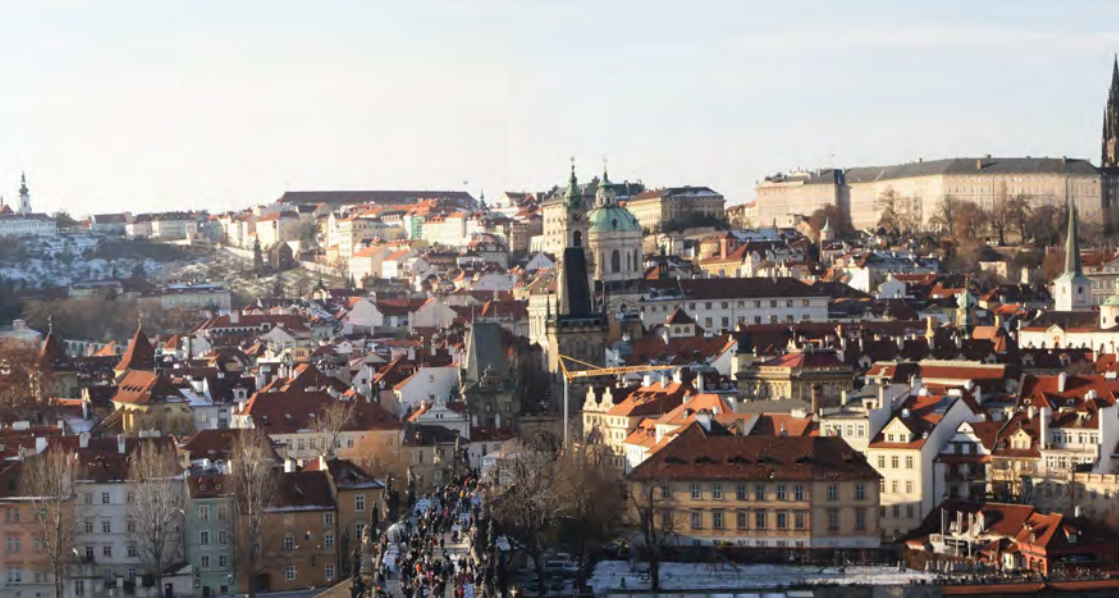

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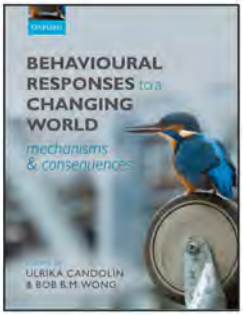

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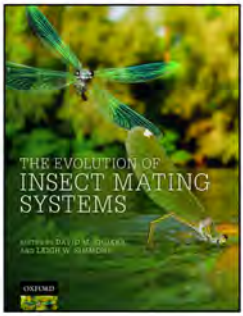

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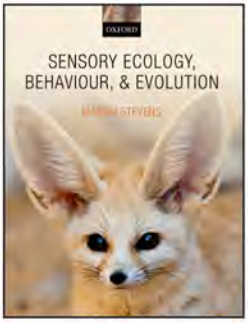

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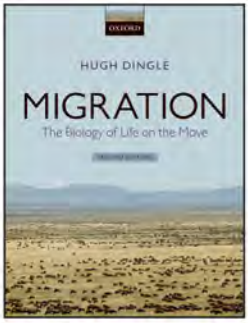

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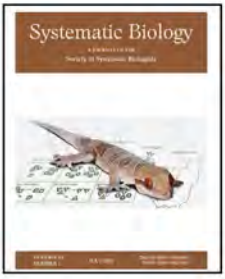

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Prof. Christine J. Nicol: The foundations of empathy – how chickens react to conspecific distress

Christine Nicol works as professor of Animal Welfare at the University of Bristol (UK). Her primary area of research is the application of animal behaviour to the improvement of animal welfare. Her scientific work on laying hens formed part of the evidence that was used by EU veterinary and scientific committees to bring about the 2012 EU ban on conventional 'battery' cages for laying hens and to develop alternative housing systems which have been embraced by industry. Christine Nicol expertise in the area of laying hen welfare has resulted in her participation in policy advisory groups and scientific panels in the UK, EU, USA, Australia, New Zealand and South Korea. The collaboration with epidemiologists has elucidated the causes and risk factors for debilitating welfare problems that occur on commercial farms, including feather pecking and cannibalism in hens, tailbiting and vulva-biting in sows, skeletal conditions and fractures in laying birds and leg health problems in broiler chickens. Alongside applied work, Nicol retain a fundamental interest in developing new methods of assessing welfare and applying these to highlight problem areas and to produce solutions. Her recent work has examined how animals' own choices can be used to validate practical indicators of welfare. Understanding the learning and cognitive abilities of domestic animals is essential to underpin valid welfare assessments. She has researched chicken navigation, selfcontrol, object permanence and social learning. Current work on empathic responses stems from her original 1996 paper on maternal sensitivity to perceived feeding errors in chicks. She has published 162 papers and supervised 25 PhD students. In 2012 Christine Nicol was awarded the UFAW medal for outstanding achievement in animal welfare science.

Prof. Tecumseh Fitch: Evolution of honest signalling

W. Tecumseh Fitch is Professor of Evolutionary Cognitive Biology at the University of Vienna. He studies the evolution of cognition and communication in animals and man, focusing on the evolution of speech, music and language. He is interested in all aspects of pattern recognition and vocal communication in vertebrates. In 2009 he moved to a permanent professorship in Vienna, where he co-founded the new Department of Cognitive Biology in the Faculty of Life Sciences. He is the recipient of an ERC Advanced Grant, and is a co-author of over 140 publications, one book, and one patent.

Prof. Dr. Hynek Burda: Improbable research in behavioural biology: Research that first makes people

laugh, and then makes them thinkSince 1994 Hynek Burda is the full professor and head of the Department of General Zoology of the University Duisburg-Essen in Essen, Germany. He is also the visiting professor at the Department of Zoology, Faculty of Biology of the University of South Bohemia in Ceske Budejovice (Budweis, since 2000) and at the Department of Game Management and Wildlife Biology, Faculty of Forestry and Wood Sciences of the Czech University of Life Sciences in Prague, Czech Republic (since 2010). His current research interests cover especially biology, behavioural ecology, taxonomy and evolution of subterranean mammals, particularly African mole-rats and sensory ecology (especially, but not only, hearing and magnetoreception) of vertebrates, particularly mammals. He is the author and coauthor of the Czech-Swahili dictionary, four widely recognized German university textbooks (General Zoology, Systematic Zoology, Evolution, and Human Biology) and on African mole-rats as well as editor of and contributor to several Conference Proceedings and books. Web of Science lists him as an author and coauthor of 133 peer-reviewed papers.

Prof. Alexandre Roulin: Interactions between young siblings: from rivalry to negotiation up to cooperation

Alexandre Roulin is professor at the University of Lausanne (Switzerland) since 2004. He is mainly interested in two topics namely the evolution, maintenance and adaptive function of variation in melanin-based coloration and family interactions with emphasis of parent-offspring conflict and sib-sib competition/cooperation. These studies require field as diverse as behavioral ecology, population dynamics and genetics as well as molecular genetics. Major results of his research include the role of pleiotropy in the melanocortin system to explain the adaptive function of melanin in vertebrates and the finding that young siblings can negotiate peacefully how parental resources are shared among the progeny. To tackle these scientific issues he works mainly with barn owls. Alexandre Roulin has published 158 papers and is the author of two book chapters.

Programme overview

Thursday, July 17th
16:00 – 18:00 Registration (Canteen)
18:00 – 20:00 Welcome drink

Friday, July 18th
08:00 – 18:00 Registration (SIC)
09:00 – 09:20 Opening ceremony (Congress hall)
09:20 – 10:20 Plenary lecture
10:20 – 10:50 Coffee break
10:50 – 12:30 Symposia/Sessions
12:30 – 14:00 Lunch
14:00 – 15:00 Plenary lecture
15:00 – 16:00 Posters (odd numbers) and Coffee break
16:00 – 18:00 Symposia/Sessions
18:30 AGM of Czech and Slovak Ethological Society (MII)

Saturday, July 19th
09:00 – 10:00 Plenary lecture
10:00 – 10:30 Coffee break
10:30 – 12:30 Symposia/Sessions
12:30 – 14:00 Lunch
13:00 – 14:00 ASAB AGM
14:00 – 14:40 Niko Tinbergen-Award - Erica van de Waal
14:40 – 15:40 Symposia/Sessions
15:40 – 16:40 Posters (even numbers) and Coffee break
16:40 – 18:00 Symposia/Sessions

Sunday, July 20th
09:00 – 10:00 Plenary lecture
10:00 – 10:30 Coffee break
10:30 – 12:10 Symposia/Sessions
12:10 – 12:30 Closing ceremony
12:30 Lunch

ABSTRACTS

Ordered by the last name of the first author

Plenary speakers

Improbable research in behavioural biology: research that first makes people laugh, and then makes them think

H. Burda

University Duisburg-Essen, Essen, Germany and Czech University of Life Sciences, Praha, Czech Rep.

Animal behaviour has ever been in the focus of interest of most people - and accordingly it is a grateful subject of books, TV series, films, reports in journals and newspapers, and - of course - in internet. Most journalists and their audience understand it (or believe that they understand it) much more than e.g. molecular biology, biochemistry, physiology, morphology, taxonomy or ecology. Studies on animals well known to publics are most covered. Since, however, the reports are usually very superficial and distorted people get often false impression of the actual content, goals and sense of (behavioural) science. The aspects and problems of popularization will be discussed, and examples will be presented of achievements in behavioural research which became very popular - has been at first considered funny or even futile and useles, eventually, however, made people think.

(plenary speaker)

The foundations of empathy - how chickens react to conspecific distress

C. Nicol, L. Paul, J. Edgar

University of Bristol

Animals may witness occasions when their conspecifics are distressed or in pain. The extent to which an observer animal is itself distressed by the experience of the conspecific will depend on its capacity for empathy, and will have consequences for its own wellbeing. Emotional transfer occurs when an observer detects arousal in a conspecific demonstrator, and when this detection leads to a matching arousal response in the observer. If the observer also experiences a sense of aversion when witnessing the distress of a conspecific then this is evidence of foundational emotional empathy. If the observer understands something of the predicament of the conspecific this is evidence of foundational cognitive empathy. We conducted a series of experiments where we separated broody hens from their chicks with a wire mesh partition. We then allowed the broody hens to witness their chicks receiving repeated air puffs for a period of a few minutes. The chicks reacted to the air puffs by increasing their rate of distress calling in the environment where air

puffs were received. In later experiments we found that chicks avoid places associated with air puff delivery, showing that air puffs are mildly aversive. The broody hens showed marked behavioural changes (reduced preening, increased standing, and increased maternal vocalisation rate) during the periods when their chicks received air puffs. We also equipped the hens with small externally-mounted monitors situated within a small harness to measure heart-rate, and we recorded the surface temperature of the hens' combs and eyes using infra-red thermography. When hens observed the mild distress of their chicks, there was a significant increase in their heart rate and a rapid reduction in core temperature detected at the eye, relative to a variety of control conditions such as the sound of the air puff on its own. These experiments provide strong evidence for emotional transfer between hens and their chicks. However, it is not yet clear whether hens find the mild distress of their chicks aversive, or simply salient. Results of conditioned place preference experiments conducted to investigate this aspect will be presented. In contrast to their response to chicks, hens do not match or respond to the arousal of other adult hens. The possibility that adult conspecifics are less averse to the air puff and therefore provide less of a demonstration of distress has been rejected, since we found that hens and chicks show equal avoidance of cues associated with air puffs. Instead we favour the proposal that social bonds mediate empathic responses. The interaction between hens and chicks is fine-tuned, with mutual influences exerted. Hens respond behaviourally when they expect their chicks may receive an air puff (even when the chicks consider themselves to be safe), and this provides some evidence for cognitive empathy. However, the hens' physiological responses are more pronounced when both the hen and the chicks expect that air puffs will be directed towards chicks. Using natural variation in the arousal responses of the mother hens, we have found that the stronger the hen's reaction, the more agitated chicks become. This suggests that a responsive mother stimulates action rather than having a calming (social buffering) effect. Directions of ongoing and ideas for future research in this area of work will be presented.

(plenary speaker)

Interactions between young siblings: from rivalry to negotiation up to cooperation

A. Roulin

University of Lausanne, Department of Ecology & Evolution

Until the sixties and seventies evolutionary biologists envisioned family interactions as harmonious with parents maximising the number of surviving offspring. However, after the development of the theories of kin selection and parent-offspring conflict, it became evident that family members might have conflicting interest concerning the allocation of parental resources and such conflicts may be particularly violent between siblings. Sibling competition refers to rivalry between siblings over access to limited parental

resources. The cause of sibling rivalry stems from offspring demanding more resources from their parents than parents are willing to supply. The limitation of resources leads to three forms of conflict between family members: siblings compete among each other to share resources, offspring are in conflict with their parents over how much parents should invest in providing resources, and in species with biparental care the mother and father are in conflict over how much effort each party should assume. The observation that even closely related individuals compete intensely for resources may seem counterintuitive at first sight. There is however a trade-off between behaving altruistically towards relatives to derive indirect genetic benefits and competing with them to obtain direct material benefits. This makes the study of sibling interactions challenging as such interactions range from cooperation to fierce competition. Here I will present a review of parent-offspring conflict and sibling competition and elaborate the concept of sibling cooperation based on data collected in the barn owl (*Tyto alba*).

(plenary speaker)

Symposia

Adaptive value of developmental plasticity

Long-lasting influences of the social environment adolescence on adult behaviour – a neglected period of developmental plasticity

N. von Engelhardt, H.-J. Bischof, T. Ruploh

University of Bielefeld, Germany

The effect of the early social environment on adult behaviour has primarily been studied by focusing on prenatal and early postnatal life when parents and siblings are known to have a strong influence on shaping development. It is more poorly understood how the interaction with conspecifics later in life modifies adult behaviour. During the transition to independence, individuals encounter new social environments. At the same time, their physiology, morphology and behaviour changes and can be affected by the social environment. We investigated how the adolescent social environment influences adult sexual and social behaviour of male zebra finches. Males reared in pairs courted more as adults and were more aggressive but grouped less with conspecifics than males reared in groups. Adolescence may be a critical period during which adult behaviour is shaped by the social environment since behavioural differences did not disappear in adulthood even after extensive social experience. Our findings strongly resemble effects in guinea pigs, indicating that the social environment during adolescence may have a similar function in different vertebrate species. We studied the functional consequences of the adolescent social environment under laboratory conditions by assessing reproductive performance when adolescent and adult environment were matched and mismatched. Comparing our findings with studies in other vertebrates, l will discuss the potential adaptive function of the social environment during adolescence and the evidence for potentially similar neuroendocrine mechanisms across vertebrates.

(keynote speaker)

Mechanisms and adaptive function of developmental plasticity

B. Taborsky

Behavioural Ecology, Institute of Ecology and Evolution, University of Bern, Switzerland

The environment experienced early in life can persistently affect behaviour and life history later in life. The resulting phenotypic differences are likely to impact on the Darwinian fitness of individuals and are thus subject to selection. While our understanding of

causal mechanisms of lasting developmental effects, both on the level of behaviour and brain mechanisms, is steadily increasing, their adaptive function is still often unknown. By testing the performance of individuals under experimental conditions that either match or do not match the anticipated conditions, it is possible to distinguish between non-adaptive and adaptive plasticity. In addition, it is important to establish whether a given plastic response can be adaptive in the natural habitat of a species, for example by demonstrating that the maternal or the early environment of an individual sufficiently well predicts later life conditions. In this talk I will present examples from vertebrate studies that have explicitly targeted the question of the adaptive values of developmental plasticity.

(keynote speaker)

Alterations of attachment behaviours, the HPA axis and the oxytocinergic system in lambs separated from their mother and reared with peers

S. Gaudin, E. Chaillou, F. Cornilleau, M. Meurisse, C. Moussu, M.A. Wicke, R. Nowak

Physiologie de la Reproduction et des Comportements, UMR7247 INRA/CNRS/Université de Tours, Nouzilly, France

Disturbance in the mother-infant attachment bond is known to have short and long term negative effects on social behaviour, physiology and neurobiology of animals. Yet, early mother separation is widespread in farm animal husbandry like in sheep: lambs are separated from their mother within hours following birth and are reared with peers. In this work, we evaluated the impact of peer-rearing on attachment behaviours, HPA-axis and central oxytocin, comparing two rearing conditions: mothered lambs (M) and lambs separated from the mother since birth and reared with a peer (P). Results show that over 21 days, cortisolemy in P did not differ from M, although P had higher levels than M on Day 1. At 21 days, attachment for the partner was assessed through a procedure similar to "the strange situation" used in children. Lambs developed a selective social bond for the peer but key features defining attachment were altered: proximity seeking was not more frequent with the familiar peer than with an unfamiliar lamb and the presence of the partner was not linked to more exploration. Central modifications in the paraventricular nucleus of the hypothalamus were also detected in P: they had less neurons containing CRF and more neurons containing oxytocin than M. These results are in accordance with neurobiological changes observed in rats submitted to chronic homotypic stress. An interpretation could be an increase of oxytocin production to cope with daily stress and desensitization of the HPA-axis in peer-reared lambs.

(poster 1)

Effects of seasonal manipulation on personality and stress response in young common voles

A. Herde[1], G. Gracceva[2,3], N. Bunzel[1], R. Palme[4], J. A. Eccard[1]

[1]*Animal Ecology, Institute for Biochemistry and Biology, University of Potsdam, Germany*
[2]*Behavioural Physiology, Institute of Behavioural Neurosciences, University of Groningen, The Netherlands*
[3]*Behavioural Biology, Institute of Behavioural Neurosciences University of Groningen, The Netherlands*
[4]*Institute for Medical Biochemistry, University of Veterinary Medicine, Vienna, Austria*

Animal personalities are by definition stable over time, but to what extent they may change during development in order to adjust to environmental change is unclear. Animals of temperate environments have evolved physiological and behavioural adaptations to cope with the cyclic seasonal changes. This may also result in changes in personality, defined as suites of behavioural and/or physiological traits that vary consistently amongst individuals. Winter, typically the adverse season challenging survival, may require individuals to have shy/cautious personality whereas during summer, energetically favorable to reproduction but with high competition, individuals may benefit from a bold/risk taking personality. In order to test the effects of seasonal changes in early life on behaviour (activity, exploration, and anxiety), body mass and stress response, we manipulated the photoperiod and quality of food to simulate the conditions of winter and summer. We used common voles (*Microtus arvalis*) as they display behavioural consistency over time and contexts and show typical seasonal life-histories. Summer-born voles allocated to winter and winter-born voles allocated to summer conditions at weaning behaved no longer consistent compared to voles that stayed in their season of birth. A detailed analysis on behavioural changes and the effects on body weight and stress response of the seasonal treatments will be discussed with regard to developmental plasticity of animal personalities.

(oral presentation)

Effects of food quality on growth, survival, immunity and immunity-related gene expression in the greater wax moth

S. Kecko[1], J. Vrublevska[1], T. Krama[1], R. Krams[1], I. Krams[1,2]

[1]*Daugavpils University, Latvia*
[2]*Tartu University, Estonia*

The resources available to an individual in any given environment are finite, and variation in life history traits reflect differential allocation of these resources to competing life functions. Nutritional quality of food is of particular importance in these life history decisions. In this study we tested tradeoffs among growth, immunity and survival in three groups of greater wax moth (*Galleria mellonella*) larvae fed on diets of high and

average nutritional quality. We found rapid growth and weak immunity (as measured by encapsulation response) in the larvae of the high-energy food group. The larvae grew slower on food of average nutritional quality. However, encapsulation response was stronger in this group. The larvae grew longer in the low-energy food group, and had the strongest encapsulation response. We observed the highest survival rates in larvae of the low-energy food group, while the highest mortality rates were observed in the high-energy food group. A significant negative correlation between body mass and the strength of encapsulation response was found only in the high-energy food group revealing significant competition between growth and immunity only at the highest rates of growth. We observed differences in expression of immunity-related genes. The results of this study help to establish relationships between types of food, its nutritional value and life history traits of *G. mellonella* larvae.

(oral presentation)

Resource-dependent temporal changes in anti-predator behaviour of common toad (*Bufo bufo*) tadpoles

A. Kurali, K. Pásztor, A. Hettyey, Z. Tóth

Lendület Evolutionary Ecology Research Group, Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Budapest, Hungary

Change in activity as a response to predators' presence is a well-known phenomenon in amphibian larvae. Less is known about how such plastic behavioural responses are mediated by food availability and larval development. Our aim was to detect these resource-dependent changes during the larval period in common toad (*Bufo bufo*) tadpoles. We raised tadpoles in the presence or absence of predator cues and exposed them to low or high food levels in a full factorial design and repeatedly observed individuals' activity during their ontogeny. We found a significant decrease in tadpoles' anti-predator behaviour, but the extent of changes differed among the treatment groups. Tadpoles raised in the presence of predator cues were less active than those raised without such cues and tadpoles' activity decreased more intensively with time in the predator-cue treatment groups than in the control groups. Food limitation increased tadpole activity in general, but the magnitude of this effect was lower in the presence of predator cues. Thus, tadpoles had the constraint of being more active in a food limited environment, but feeding activity was moderated by the potentially higher predation risk. Our results suggest that the presence of multiple environmental cues may lead to considerable life-history trade-offs during the larval period in common toads and contribute to better understand the limits of plastic anti-predator behavioural responses in amphibian larvae.

(poster 2)

Impacts of a glyphosate-based herbicide and predation threat on the behaviour of agile frog (*Rana dalmatina*) tadpoles

Z. Mikó, J. Ujszegi, Z. Gál, A. Hettyey

Lendület Evolutionary Ecology Research Group, Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Budapest, Hungary

The widespread application of pesticides emphasises the importance of understanding the impacts of these chemicals on natural communities. The most commonly applied broad-spectrum herbicide in the world is glyphosate, which is usually applied together with surfactants. At sublethal concentrations, glyphosate-based herbicides can cause temporal paralysis and can also affect antipredator responses of tadpoles. We exposed agile frog (*Rana dalmatina*) tadpoles to three concentrations (0, low and high) of a glyphosate-based herbicide, combined with three predator treatments (no predator, Aeshna cyanea or Lissotriton vulgaris) in a full factorial experiment. We surveyed activity, visibility and vertical position of tadpoles. Our results showed that the herbicide and the presence of predators decreased tadpole activity and visibility. Glyphosate had a significant effect on the vertical position of tadpoles: as glyphosate concentration increased, tadpoles descended to the bottom of the tanks. Vertical position of tadpoles was also negatively affected by the presence of predators. Our study suggests that glyphosate-based herbicides can influence tadpole behaviour and tadpoles give similar response to the pesticide as they give to predator-stress.

(poster 3)

The effects of the early social environment on shaping emotionality and stress reactivity in wild cavies

S. Sangenstedt, N. Sachser, S. Kaiser

University of Muenster, Germany

The social environment of an individual can have profound effects on its behavioural development, including the expression of emotionality, as well as on stress reactivity. Not only the current generation, but also the F1-generation can be influenced in its behavior, its physiology and in its reproductive success by the social environment the parental generation experiences. In several species, mothers can influence the development of their offspring during the prenatal and early postnatal period i.e. via behavior or hormones, which provides them with the opportunity to adjust the offspring's phenotype to fit future environmental conditions in an adaptive way. The present study aims to reveal differences in behavioral profiles and stress responsivity in male adolescent wild cavies whose

mothers lived either in a social stable (SE) or in a social unstable (UE) environment during pregnancy and lactation. It was shown before that male wild cavy offspring of mothers living in an unstable social environment display a behavioural infantilization with an increased and prolonged display of juvenile behavioural patterns. Our findings show that UE-sons stay less anxious over adolescence whilst SE-sons get more anxious over time. Further, a stability in emotionality traits and plasma testosterone concentrations in UE-sons is revealed whereas in SE-sons a stability in physical responses to stress is detected. It appears that UE-sons have a more flexible inner physiology, which is reprogrammed during adolescence, whilst they display a rather fixed behavioural profile over time. SE-sons, on the contrary, show a plastic behavioural profile, but a stable inner physiological reaction to stress.

(poster 4)

Shaping of biobehavioural profiles during adolescence: An adaptation to the prevailing environment?

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The social environment male guinea pigs experience during adolescence profoundly influences the development of their biobehavioural phenotypes. These socially shaped profiles are considered to represent adaptations to the respective environment the animals live in, with males stemming from high-density situations adopting a queuing strategy (QU) and males stemming from low-density situations adopting a resource defence strategy (RD). In order to test whether these different biobehavioural profiles indeed have an adaptive function, match-mismatch experiments are conducted in which endocrine status, social behaviour and reproductive success are assessed. In a first experiment, groups consisting of one QU, one RD and two females each were kept together for up to five weeks simulating a low-density contest situation. RD were hypothesised to perform better within this condition as it matches their prevailing environment. First results show that RD exhibit significantly higher cortisol and testosterone responses compared to QU, indicating RD to extensively mobilise energy reserves and, moreover, to dominate the competitive situation. Beyond that, development of body weights is significantly more affected in RD than in QU during the initial hours of confrontation, which is likely due to the high energy expenditure in RD. However, this difference disappears afterwards, thus arguing against long-term negative effects. Taken together, these findings indicate an advantage of RD over QU at least in terms of the underlying neuroendocrine mechanisms. This supports the assumption of an adaptive function of the shaping of biobehavioural profiles during adolescence, although insight from behavioural data and reproductive success is needed to further validate this.

(poster 5)

Affective states and the proximate control of behaviour

Affective states and proximate control of behaviour: a model and data on mood – emotion interactions

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I will introduce the idea that affective states provide the foundation of proximate behavioural control mechanisms. That is, I will review classical terms such as motivation, appetitive behaviour, and behavioural goal in the light of affective states. This will allow for a general emotion-based theory of behavioural control allowing for testable predictions. Intrinsic, proactive as well as extrinsic, reactive short-term affective states (emotions) may function to generate immediate behavioural goals, and also to provide feedback on whether or not a goal has been achieved. At the same time, long-term affective states (moods) resulting from cumulative experience of short-term emotions, may modulate reaction gradients and decision-thresholds in future situations. These affective states provide a common currency for prioritising behaviour and it is hypothesised, for example, that negative states take precedence over positive ones and high arousal states over low arousal ones. In a second part, I will show results from a current series of experiments with sheep discussing how we attempted to induce differential mood states by manipulating housing conditions (and how and why we failed) and how we classified the sheep's reactions to the presumed valence of physical, social, and thermal stimuli using as indicator variables their general behaviour, automated recording of ear movements and postures as well as non-invasive measurements of frontal cortical brain activity applying functional near-infrared spectroscopy.

(keynote speaker)

Affect, value, probability and decision-making

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A defining characteristic of affective states is that they are valenced (positive or negative; rewarding or punishing). This is reflected in operational behavioural definitions that render them accessible for scientific study in non-human animals, without needing to

know whether they are consciously experienced. Reinforcement-based definitions, which we will consider here, equate the tendency to (learn to) approach ('want') or avoid an outcome with its affective value – approached stimuli are usually rewarding (induce a positive state or 'liking'), whilst avoided stimuli are punishing. By assigning value to decision-outcomes, affective states clearly play a pivotal role in the proximate control of behaviour. There is considerable interest in the possibility that affective valuation provides a common currency for decision-making; how affective value is modulated by motivational state (incentive valuation); whether experience of affective value is required 'online' at the time of a decision or whether it can be stored in a non-affective form; and how habitual and goal-directed decision-making systems use and update affective information. However, there is much less research on the role of long-term affective states or 'moods' in decision-making. We propose that one role of such states is to act as Bayesian priors that reflect cumulative experience of reward and punishment across time, indicate the likelihood of future rewarding and damaging events, and thus guide decision-making, especially under ambiguity where correct decisions are critical for survival. If so, as well as providing short-term valuation of decision outcomes, affective states offer a mechanism for logging longer-term outcome probabilities that inform future decision-making.

(keynote speaker)

Developmental stress predicts 'optimistic' judgement biases in European starlings

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Developmental stress causes impairments in biological state, and in humans is associated with an increased risk of affective disorders such as anxiety and depression in adulthood. We have developed an animal model of developmental stress in which wild European starlings (*Sturnus vulgaris*) were cross fostered into broods in which they faced differential competition for food during the first two weeks after hatching. We have shown that birds that were bottom the weight hierarchy in a nest suffered impaired state, as measured by increased oxidative stress and increased telomere attrition during the manipulation. Here we test the hypothesis that these birds would show evidence of more negative affective state as adults. We used a judgement (i.e. cognitive) bias task in which the birds were initially required to learn the shade of cues associated with rewarding and punishing outcomes (palatable and toxic mealworms respectively). Birds were subsequently tested with novel shades intermediate between those learnt. We predicted that developmentally stressed birds would be more pessimistic in this task, avoiding ambiguous cues. Contrary to predictions, we found that birds with markers of poorer state (shorter telomeres) were more optimistic in the task, judging the ambiguous cues as more likely to yield a positive

outcome than the birds in a better state. This finding fits with previous results from the same birds suggesting that the developmentally stressed individuals display a 'hungry' phenotype, and will strategically choose to trade off the risk of ingesting toxins for the nutritional content of the toxic worms. These results highlight the difficulties of using judgement bias tasks with food reward to assess affective state in animals likely to differ in feeding motivation.

(oral presentation)

How to repeatedly test pigs' judgement bias using a spatial paradigm

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The cognitive bias approach to measuring valence of affective states in non-human animals might be used to measure both state and trait, i.e. treatment effects but also optimism/pessimism as an aspect of personality. The latter requires stability over time, i.e. repeated testing, which up to now was impossible in domestic pigs using a spatial judgement paradigm. Hence, our aim was to enable repeated testing of pigs by introducing a mild punishment and partial reinforcement. Subjects (n=15) underwent a 7 day-training, during which a goal box was presented in either the right or left corner (6 runs/day each) of an experimental arena. Subjects were rewarded (S+, 5ml of applesauce freely available) in the one and punished (S-, applesauce unavailable and rustling plastic bag waved over the head) in the other corner, one run/day/position being unreinforced. In the next 4 weeks, the goal box was additionally presented on three unreinforced, ambiguous, equidistant positions ('probes': nearS+, middle and nearS-; each twice/week, i.e. 8 test repetitions; 2 different positions/day on 3 days/week). Latency to open the goal box was measured and individual relative latency calculated for test days. Data were analysed using mixed effect models with day and position for S+ and S-, and test repetition and position for all positions on test days, both including repeated measurements, and post-hoc Tukey Kramer t-tests. Subjects learned to discriminate S+ and S- and showed graded responses to probes. They showed lower latencies during the first test week, with stable response levels in the following 6 repetitions. In conclusion, the modified paradigm for repeated testing for spatial judgement biases in domestic pigs will enable future studies on optimism/pessimism as personality traits.

(oral presentation)

Intranasally administered oxytocin decreases heart rate and increases heart rate variability in dogs

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In recent years an increasing number of studies have used intranasal oxytocin administration in order to explore its effects on human social cognition. This approach is based on the tacit assumption that intranasal administration of oxytocin enables direct access of the peptide to the central nervous system. In humans the effects of intranasal oxytocin on both behavioural and physiological levels are well-documented. The increasing interest in dog social cognition makes it timely to study the effect of intranasal oxytocin in this species as well. In order to validate the intranasal administration of oxytocin in dogs we examined whether, in addition to behavioural effects, it had parallel effects on physiological parameters such as heart rate and heart rate variability to those seen in humans. Ten adult pet dogs of different breeds participated in two test occasions receiving oxytocin and placebo nasal spray (in a counterbalanced order) followed by a 40-minutes waiting period and an ECG recording. A considerable individual variation could be observed in the effect of oxytocin on heart rate (HR) and heart rate variability (HRV). However, at the group level oxytocin significantly decreased HR ($t(9)=2.810$, $p=0.020$) and increased HRV ($t(9)=4.472$, $p=0.002$). These results are in line with the findings from human studies and thus indicate that intranasal administration of oxytocin might be a valid approach to study its effects on dog social cognition. Furthermore the individual variation in the effect of oxytocin on HR and HRV make it a good indicator of the physiological effect of oxytocin and thus could be used as a covariate in future behavioural studies.

(poster 6)

The role of pheromones and other semiochemical in animal behavior. The impact of sex pheromones masking to laboratory mouse mating.

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The aim of this study was to demonstrate the importance of olfactory communication in animals life and the consequences of the disorder by experiment, which shows that masked sex pheromones affect on the reproductive behavior of laboratory mice. The experience was conducted on 160 laboratory mice. Observations have shown significant

differences between the control group and the experimental groups, suggesting a masking effect or deterrent effect on male laboratory mice, as shown on the latency axis. Statistical research have only shown the importance of the smell of "mint", which demonstrate that different odors mask with different strength. To calculate the relationship between the measured parameters following statistical programs were used: IBM SPSS Statistics 20 and Statistica.

(poster 7)

The difference is droll – Towards a cognitive bias test in mice

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Cognitive bias refers to altered information processing resulting from an individual's emotional state. Comparable to anxious or depressed humans, animals in a putatively negative emotional state are more likely to judge an ambiguous stimulus as if it predicts a negative event, while animals in a putatively positive emotional state are more likely to judge the same stimulus as if it predicts a positive event. In the present study we aimed at establishing a cognitive bias test for mice. We validated that our set-up can indeed assess different expectations about the outcome related to an ambiguous stimulus: mice having learned to expect something positive within a maze showed a more positive judgment of an unfamiliar location than animals having learned to expect something negative. In a second step, the use of spatial location as discriminatory stimulus was confirmed by showing that the mice's interpretation of an ambiguous stimulus depended on its spatial location, with a position exactly midway between a positive and a negative reference point provoking the highest level of ambiguity. In a pilot study we analyzed cognitive bias in serotonin transporter (5-HTT) knockout mice, a well-established mouse model for the study of anxiety- and depression-related behavior. The anxiety- and depression-like phenotype of 5-HTT knockout mice manifested - comparable to human conditions - also in a trend for a negative distorted interpretation of ambiguous information, albeit this effect was not statistical significant. The results suggest that cognitive bias tests are useful to study emotional states in mice, which may not only increase the translational value of animal models in the study of human affective disorders, but which is also a central objective of animal welfare research.

(poster 8)

Dogs discriminate emotional expressions of human faces in pictures

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The question whether animals respond to the emotional expressions of others has become a focus of research in the last decade. To address this question, we presented a sample of 20 dogs with a two-choice task on a touch-screen computer, with photos of unfamiliar people from validated databases as stimuli. After pre-training with a simple discrimination task, the dogs learned to discriminate between stimulus pairs that presented half-faces of a person with an angry and a happy emotional expression. In a fully crossed design, an equal number of subjects was trained with either the upper or the lower half of the faces presented and with either the angry or the happy expression rewarded. Dogs that reached a pre-determined learning criterion were tested with four types of probe trials that were interspersed within sets of training trials: 1) the same half of the faces as in the training but of novel faces, 2) the other half of the faces used in training, 3) the other half of novel faces and 4) the left half of the faces used in training. The results of the dogs that passed the learning criterion show that learning was quicker if the happy stimulus, rather than the angry stimulus, was rewarded, which would be predicted if the dogs recognize the emotional expressions and an angry face is considered an aversive stimulus. Furthermore, at group level, these dogs performed significantly above chance level in all four probe conditions. The fact that the dogs transferred the training contingency to novel stimuli that shared with the training set only the emotional expression as a distinguishing feature between stimulus pairs suggests that dogs can differentiate between emotional expressions in human faces.

(oral presentation)

Caffeine modifies aggressive behaviour of workers of the red wood ant *Formica polyctena* during dyadic aggression tests with workers of *Formica rufibarbis*

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Caffeine, a common central nervous system stimulant, is known to influence physiology and behaviour of both invertebrates and vertebrates. In vertebrates (rodents and humans) caffeine administration was found to exert both stimulatory and inhibitory

effects on specific patterns of aggressive behaviour. The effects of caffeine administration on physiology and behaviour of social insects are still very little known. We investigated the effects of chronic oral caffeine treatment on behaviour of workers of the red wood ant Formica polyctena during dyadic aggression tests involving confrontations with allospecific ants (*Formica rufibarbis*). Intranidal workers of F. polyctena were fed 0 ppm, 7 ppm, 25 ppm, 100 ppm and 200 ppm caffeine (diluted in aqueous sugar solution) during 14 days prior to the tests. Aggression tests (40-45 dyads per group) took place in sets of two joined test tubes. Ant behaviour was video recorded and analyzed using the software BehaView. The highest dose of caffeine (200 ppm) significantly enhanced several patterns of overt aggressive behaviour (charges, dragging the opponent and fights), antennal contacts with the opponent and locomotory activity close to the opponent. Lower doses of caffeine also enhanced some features of overt aggressive behaviour of *F. polyctena* (100 ppm: rate of occurrence of fights; 25 ppm: rate of occurrence of biting, number of episodes and total duration of dragging; 7 ppm: total duration of dragging). However, the highest dose of caffeine (200 ppm) reduced the number of episodes and the total duration of open-mandible threats. These findings imply that chronic oral caffeine administration enhances overt aggression, but reduces ritualized aggression in workers of F. polyctena paired with allospecific ants (*F. rufibarbis*).

(poster 9)

Effects of food related enrichment on behaviour of broiler chickens

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Behavioural profile of meat-type chickens is characterized by a low proportion of active behaviours. Rapid growth and lack of exercise cause health problems in broiler chickens. Stimulation of foraging behaviour by various food items could make animals more active. The aim of this study was to investigate the effects of food related enrichments on activity levels and litter directed behaviour of young broilers. Broiler chickens (n=79) were divided into four groups based on food related enrichment scattered on litter (mealworms, whole wheat, saw dust – control 1, nothing – control 2). Treatments were applied daily during three weeks from hatching. We performed four 40-min observations (10 min before and 30 min after the treatment into 10-min intervals). Duration of physical activity (time spent on legs), litter directed behaviour (litter pecking and scratching)and leg stretching were analysed from videos. Mixed model ANOVA proved the significant effect of treatment on physical activity($F(3,36)=8.29$, $p<0.001$), as well as frequencies of litter pecking ($F(3,36)=55.37$, $p<0.001$) and litter scratching ($F(3,36)=35.39$, $p<0.001$). Post hoc comparisons showed significant increase of all these parameters in mealworm group as compared to other groups ($p<0.001$). However, effects were limited mostly to the first 10-

min interval after the onset of treatment. Post hoc comparison showed lower frequency of leg stretching in mealworm group in comparison with other groups ($F(3,36)=5.01$, $p<0.01$). Induction of foraging behaviour as a kind of exercise may have positive effect on incidence of broiler leg disorders. Mealworm as a highly palatable food had a strong motivational influence. However this effect was quite short-term. This work was funded by the APVV-0047-10 and VEGA 2/0196/14.

(poster 10)

Animal personality in comparative perspective

Social networks, social information and personality in wild baboons

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Sociality can have important fitness consequences for individuals and much research has been dedicated to understanding the costs and benefits of group living. The recent advent of social network analysis has allowed researchers to concurrently investigate direct and indirect associations between individuals and thus individuals' access to social information. Social information can play a critical role in the reproduction and survival of social animals, however little consideration has been given thus far to understanding individual differences in access to social information and the propensity for individuals to use social information. In this study, we investigate whether individual differences in social network position, task solving and social information use is related to personality in wild baboons Papio ursinus through the use of detailed social network observations over 4 years and two field experiments to assess social information use. In those cases in which personality predicted spatial associations in baboon networks, shy individuals were more likely to be found in close proximity to other shy individuals, whereas bold baboons had few strong associations with others. However, bold baboons were more likely to solve a novel foraging task, and were also more likely to use social information to solve a task. We suggest that personality constrains both an individual's access to social information because of the patterning of social relationships between task solvers and non-solvers and its use of social information, thus limiting the flow of information in the social group.

(keynote speaker)

Using data reduction to understand animal personality

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The covariation or structure of personality traits is a species-typical characteristic shaped by evolution and/or a species' ecology. Personality structure can also reveal the functions of personality traits in a given species. Data reduction, either via principal components

analysis or factor analysis, is a powerful means by which to determine the 'latent variables' underlying personality dimensions. That being said, many researchers in animal personality hesitate to use principal components analysis or factor analysis or err in the use of these methods. In this talk I hope to begin to change this state of affairs. I will thus first provide a brief overview of these methods and place them within the context of ethological research. Then, using a published example from a study of Barbary macaques, I will highlight decisions that researchers need to make when conducting such analyses, and will point out tools and techniques that can help them make the best decisions. Next, drawing on the same study, I will turn to practical matters, including how to interpret results, how to compute variables from these results, and when and how one can compare results across species or populations. Finally, I will dispel the long-standing belief that very large sample sizes are needed for these analyses.

(keynote speaker)

Behavioral consistency and personality in pit-building antlion larvae under varying environmental axes

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Over the last decade there has been a growing interest among behavioral ecologists in exploring animal personalities. A pre-condition for defining personality is evidence for consistent behavior. Whereas studies of animal personality on active foragers are very common, personality of trap-building predators is generally understudied. We investigated for the first time the existence of personalities in pit-building antlion larvae in the context of foraging (pit construction) and habitat selection (relocation distance and direction) over time and under three environmental axes: climatic conditions, sand depth and soil type. Consistency was much stronger for pit construction and relocation distance than for movement directionality. We suggest that movement directionality is of less importance to trap-building predators while relocating their traps, than for active predators chasing after prey. Pit construction and relocation distances were positively correlated between varying levels of sand depth and soil type, but not between climatic conditions. Substrate might induce faster decision making in these sand-dwelling insects, or could be perceived by such insects as a more drastic alteration in their habitat. We show that different individuals within the population indeed possess different personalities. We suggest that personality should be examined at two levels: the amount of energy expenditure (distances) and the pattern of energy expenditure (directionality). Finally, our study illustrates how varying environmental conditions can result in varying levels of behavioral plasticity, while largely preserving animal personalities.

(oral presentation)

Willingness to explore a novel food is genetically transmitted in free-ranging Japanese macaques

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The presence of consistent behavioral, affective, and cognitive differences in animals, often termed personality or temperament, has attracted the attention of researchers who study captive and wild populations of various taxa. Using long-term data, microsatellite analysis and novel-object and novel-food tests, an approach applied in wild mammal and bird populations, but one rarely used to study nonhuman primates, we tested whether (1) wild Japanese macaques display consistent differences in their behavioral reactions upon encountering a novel object and a novel food, (2) environmental factors, age, sex and social rank influence these reactions and (3) these differences have a genetic basis. Individual monkeys were consistent in their reaction to repeated novel food tests. Monkeys slow to approach and interact with the novel food manipulated and tasted the novel food less intently and were also slow to approach and interact with the novel object. High ranking individuals explored the novel object less intently than medium and low ranking individuals. Closely-related individuals (that were not maternal kin) were more similar in the degree to which they manipulated and tasted novel foods than genetically distantly-related individuals. Our study therefore highlights the genetic transmission of a personality trait related to exploration in wild nonhuman primates and suggests that social transmission from the mother did not play a major role in this trait.

(oral presentation)

Individual variation and behavioural interactions in an obligate mutualism

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The partnership between non-burrowing gobiid fishes and alpheid shrimps is one of the most remarkable interspecific mutualisms known. The near-blind shrimp rely on tactile and chemical cues from their goby partners to warn them of predators. In return, the shrimp construct and maintain the burrows which provide shelter for the gobies. Although aspects of this relationship have been well-studied, less is known about behaviour at the individual level, and in particular the interactions and interdependence of the two species'

behavioural patterns. We conducted field observations of the obligate mutualist goby, *Ctenogobiops feroculus*, and it's common shrimp partner, *Alpheus djeddensis*, at One Tree Island on the Great Barrier Reef. Twenty-eight partnerships were filmed for 30 minutes around midday on 3 separate days. We found that individual gobies displayed consistent variation in the frequency and duration of vigilance behaviour and foraging bouts. Moreover, the vigilance behaviour of the goby directly correlated with the behaviour of their shrimp partners; shrimp with a more vigilant partner ventured out far less often and were less active. Bold behaviour in the gobies in response to a disturbance was also correlated with boldness in the shrimp. By quantifying the interactions between the two species, we have gained greater insight into the behavioural mechanisms underlying this fascinating mutualism.

(oral presentation)

The ontogeny of personality-related traits in northern bald ibises (*Geronticus eremita*)

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Recent studies suggest that personality is not just determined genetically and physiologically, but is shaped during ontogeny, and influenced by environmental factors. Laboratory studies often lack the environmental heterogeneity that affects personality development in the wild. Still, studies of the development of personality in unrestrained animals are scarce. We studied the development of behavioural traits associated with personality in a free-ranging semi-tame colony of Northern Bald Ibises (*Geronticus eremita*). We tested exploration, boldness, aggression, and sociability in parent- and hand-raised chicks (n=19 and n=9, respectively) repeatedly, at 3, 5, and 7 weeks post hatching. Furthermore, we investigated the development of hormonal profiles to assess hypothalamic-pituitary-adrenal-axis (HPA-axis) reactivity. Behavioural and hormonal parameters showed little consistency over time. Principal Component Analyses revealed clustering of exploration- and boldness-related parameters as well as a relation between HPA-axis reactivity and social behaviours at all stages of development. Further, parent- and hand-raised individuals differed in several behavioural parameters as well as in hormonal parameters. This hints at a considerable developmental plasticity of personality development. The behavioural differences between parent- and hand-raised individuals further indicate an effect of the social environment on personality development. In sum, our findings support the idea that personality is shaped through ontogeny, integrating physiology and experience. Financially supported by the Ethologische Gesellschaft e.V.

(poster 11)

Behavioral and hormonal responses to light intensity of guanacos (*Lama guanicoe*) in captivity

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The guanaco, wild ungulate, belongs to Camelidae family. Some ungulates showed cortisol circadian rhythm with high cortisol concentrations at beginning of day and lower when light declines. Stress response was described to decrease by night and to increase during the day. This study assesses the relationship between behavioral patterns and serum cortisol concentrations in response to changes in light intensity in captive guanacos. The study was conducted in a Mediterranean environment (33°38'28"S,70°34'27"W). The experimental group was formed by 17healthy adult females, captive-bred, non-pregnant and non-lactating. Animals were immobilized with a chute and deprivation of vision, ensuring animal welfare. An ethogram was performed and blood samples were collected every 2hours for 24hours. Day sampling was performed under natural light and at night under red light. Cortisol was measured by ELISA test. Statistical analysis considered ANOVA, principal components and correlations. Two factors were chosen: reactive group(RG) with 26% of variance and proactive group(PG) with 14% of the variance. RG(n=9) was positively associated with screaming, spitting, urinating, reject and negatively to jumping, and PG(n=8), was positively associated with jumping and negatively with kicking. Serum cortisol concentration was 155.96nmol/L (RG) and 368.45nmol/L (PG)($p<0.05$). Differences between day and night concentrations were not observed in RG and PG groups ($p>0.05$). Our results related to lower levels of cortisol in RG than PG, would indicate a greater control and management of adverse factors. The lack of cortisol circadian pattern observed in RG and PG groups could be related to factors like animal immobilization. Noninvasive sampling would be recommended in further research.

(poster 12)

Personality and female behaviour under risk of infanticide in the bank vole (*Myodes glareolus*)

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Animal personality describes the phenomenon that individuals behave systematically different from each other, these differences are consistent over time and/or across situations. Personality can have an effect on different life-history traits like reproductive

success. The aim of our study was to determine if personality affects the behaviour and decision making of female bank voles (*Myodes glareolus*) under a potential infanticidal situation. Vole females can conceive again immediately post-partum, so that they can be concurrently pregnant and lactating. Experimental evidence suggests that females can recognize the sire of the offspring from their current litter, and that they prefer the sire off their offspring over unfamiliar males. Bank vole males, if not the sire of a litter, are potentially infanticidal and therefore a possible threat for the female's investment in the current litter. Thus for a lactating female, the presence of the sire of her current litter should pose less threat than the presence of an unknown male. Given the bank voles reproductive system, when presented with a possible mating partner, a lactating female has to trade-off current reproduction by providing maternal care, for future reproduction by actively seeking for a mate. We investigate if this trade-off is associated with personality measurements. In a first step, we design suitable behavioural tests to describe the personality structure of the bank vole including measures of exploration, boldness and activity. In the second step, tested female individuals were subsequently set out into large outdoor enclosures where they were presented with the presence of a male individual. We followed their behaviour with automated radiotelemetry and RFID-systems. First results will be presented.

(oral presentation)

Factors influencing personality in wild bonobos

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Personality refers to individual differences consistent across time and situations. It is widespread among animal species, but animal personality has gained the attention of scientists only recently. Most studies have focused on certain personality traits, but to understand the evolution of personality structure, we need to examine personality dimensions in multiple species using a common set of traits. Little research has been conducted on personality in wild populations of nonhuman primates. For our study we examined factors influencing personality in 16 wild bonobos (*Pan paniscus*) in Wamba, Democratic Republic of the Congo by behavioral observation and questionnaire ratings about personalities. Using factor analysis, we extracted five personality dimensions from a 54-item questionnaire, and three dimensions of behavioral tendencies. We found correlations between some dimensions derived from the two different methods that validate the rating method in wild-living bonobos and can lead us to understand the functions of the dimensions. The association that we found between sex and some personality traits provides insights into the evolution of the social system of bonobos.

(oral presentation)

Behavioural type, behavioural variation and individual characteristics in reproductive male Carpetan rock lizards (*Iberolacerta cyreni*)

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The most important goal in 'personality studies' is to determine the evolutionary and developmental mechanisms underlying consistent individual behavioural differences. However, estimating individual quality or 'true' fitness is hard and thus, linking behaviour to individual quality is not always straightforward. Here, we explored if activity and risk-taking were consistent and linked to various – potentially fitness-linked – individual traits in wild-caught adult male Carpetan rock lizards (*Iberolacerta cyreni*) during the reproductive season. We focussed on two components of behavioural variation: individual mean behaviour (behavioural type) and individual behavioural variation based on five or six repeated behavioural assessments. The lizards were consistent both within and across behaviours, displaying activity and risk-taking personalities, and an activity–risk-taking behavioural syndrome. More active lizards had brighter colouration. Risk-takers had relatively larger legs and more femoral pores. When analysing complex behavioural type (combining activity and risk-taking), we found that generally bolder (i.e. more active and risk-taking) lizards had relatively larger legs, more femoral pores but less lateral blue spots. We also found that lizards expressing risk-taking with high consistency were in better body condition than their inconsistent conspecifics. Our results show that male Carpetan rock lizards behave consistently at different levels, and both their behavioural types and their consistency of expressing the behavioural types covary with several potentially quality-indicator traits. Possible evolutionary implications of such links are discussed.

(oral presentation)

Personality and social relationships

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Long term positive social relationships are especially important for primates who live in stable social groups and previous work has shown that having strong stable social ties is positively related to female reproductive success. In this study we addressed the role

of personality in social relationships in a semi-free ranging group of Barbary macaques. The personality profiles of 26 semi-free ranging individuals were previously assessed using a questionnaire, which yielded four dimensions: Friendliness, Activity/Excitability, Confidence, and Opportunism. Behavioral data on social interactions, including grooming, rates of approaches, and time spent in contact, of the same individuals were collected via observations. The goals of this study were to use social network analysis to illustrate the validity of ratings and to examine the association between each individual's personality and their position in the social group. We thus tested whether there were relationships between personality dimensions and social interactions as assessed by behavioral observations. Our results will help to further evaluate the importance of social relationships for group members and the connection between an individual's personality and its position in the social network.

(oral presentation)

Association of novel oxytocin receptor gene polymorphisms with sociality and activity of Siberian husky dogs

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In humans oxytocin plays an important role in various complex social behaviours, such as social support, pair-bonding, trust, cooperation, envy. The oxytocin system is also involved in several neurological disorders. Our recent results prove that polymorphisms of the oxytocin receptor gene (OXTR) are related to complex social behaviors in herding dog breeds, German Shepherd and Border Collie. Here we investigated the effect of three, novel single nucleotide polymorphisms of OXTR gene on human directed social behaviors and activity of a non-herding dog, the Siberian Husky. Dogs' behavior traits were assessed in a test series consisting of three episodes: Spontaneous activity, Greeting by an unfamiliar woman and DNA sample collection. Additionally, dog owners completed a questionnaire assessing activity-impulsivity and inattention. We found significant associations between OXTR gene polymorphisms and both the activity level and the social behaviour toward humans of Siberian Huskies. The results are in harmony with findings on other animal models and on humans. Funded by HAS 01 031, Bolyai Foundation, OTKA K84036.

(oral presentation)

Interspecies differences in behavior of cotton-top tamarin (*Saguinus oedipus*) and red-handed tamarin (*Saguinus midas*)

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Studies of personality in nonhuman primates have recieved considerable attention. Studies of platyrrhine primates, however, are rare and thus restrict interspecies comparisons. The main aim of this study was to compare behavior of cotton-top tamarins (*Saguinus oedipus*) and red-handed tamarins (*Saguinus midas*). Behavior of 42 individuals in 10 groups was recorded from July 2011 to May 2012 in 9 zoological gardens in the Czech Republic and in Slovakia. Relationships among wide range of behaviors were evaluated separately for each species and species-specific personality models were revealed. PCA identified 2 dimensions (Activity, Confidence) for the cotton-top tamarins and 3 dimensions (Social activity, Nervousness, Assertiviness) for red-handed tamarins. Relationship between personality traits and other characteristics of individulas (age, sex, breeding status) were examined.

(poster 13)

Response to changes in the environment in common ravens and carrion crows: influence of development and social context

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Exploration may be particularly important for young animals, as it provides them with opportunities to learn about and exploit their physical and social surroundings. We investigated the exploration behaviour of two closely related, generalist corvid species during development and across social context. We tested 9 common ravens and 10 carrion crows, which were hand-reared under the same conditions, and housed in species groups at Haidlhof Research Station, Austria. Subjects were repeatedly presented with novel inanimate items, whilst alone and with a sibling conspecific, during three life stages: fledging, juvenile and sub-adult (1.5 years old). Whilst alone, they were also presented with novel and familiar animate items (people), during two life stages: fledging and juvenile (8 months old). We expected age differences and a facilitating influence of social context on exploration behaviour. However, we did not expect to find significant species differences, as the species' have similar life histories. Both species interacted most with novel objects and food at the juvenile stage, which may relate to developmental steps,

such as independence. They also interacted less with the structure as sub-adults, which may reflect an increase in neophobia. The birds interacted with inanimate items more frequently, though took longer to interact, when a conspecific was present. Additionally, we found some species differences, with the most striking difference being the crows' lack of interaction with the novel, though not familiar, person. We discuss these findings by relating to differences in the two species' ecology and behaviour, such as habitat use and caching proficiency.

(oral presentation)

The role of state-behavior feedback loops in explaining adaptive personality differences

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In recent years it has become widely accepted that individuals within single populations often exhibit consistent differences in behavior across contexts and over time (called 'animal personality'). However, it is much less evident how behavioral consistency can be explained from an adaptive viewpoint. We propose an evolutionary explanation for personality-related differences based on state-behavior feedback dynamics. The feedback mechanism between state and behavior exists because the state of an individual affects optimal behavior, which in turn might affect its state. Positive feedback loops between state and behavior have been proposed as an adaptive explanation for personality but the idea has so far not been tested empirically. We propose here that positive feedback loops between sampling (information acquisition) and body condition can explain why individuals differ in sampling behavior. We present descriptive data on the occurrence of between- and within- individual variation in sampling, and how this variation is affected by ecological factors such as high predation risk, using wild passerine birds (great tits) as a model species.

(poster 14)

Artificial environments and the study of 'adaptive' personalities

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Animal personality research is blooming in various disciplines of evolutionary biology, such as evolutionary ecology, behavioural physiology, and quantitative genetics. Empiricists increasingly study personality using a widely adopted two-step approach that is efficient but, in our view, often inappropriate for addressing most questions at hand. As a typical first step, wild individuals are captured, and their behavioural phenotype assayed repeatedly under standardized laboratory conditions. As a second step, 'typed' individuals are tracked (either in the laboratory or following release into the wild) to assess personality-related links with ecological or evolutionary processes. By doing so, researchers assume that behavioural types measured in the laboratory match those expressed in the wild. This is a rather bold assumption because extremely novel environments, such as the laboratory, can elicit the expression of variation that is neither expressed nor correlated with variation expressed in the wild. Here, we thoroughly detail the nature of our concern, and propose strategies to both investigate and alleviate this hypothetical caveat in the study of adaptive personalities.

(oral presentation)

Survival costs of personality in marine isopod *Idotea balthica*

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Animal personality describes the idea that animals show consistent between-individual variation in behavioral patterns over time and between situations. These kinds of consistent behavioral traits have been found for example in aggressiveness, boldness, and activity but their ecological and evolutionary consequences are still obscure. However, differences in personality can be associated with differences in life history; e.g. survival of individuals. Here, we present a study where we studied whether activity can be considered as a personality trait in marine crustacean Idotea balthica and what its relation to survival is. The study was done by first studying the consistency of activity and afterwards its connection to survival with and without predator experimentally in laboratory conditions. We found that activity fulfilled the presumptions of personality as individuals had consistent between-individual differences over time and across situations. In situations where predator was not present less active isopods survived better than

active ones in both sexes. However, in the presence of predator the survival of isopods was sex-specific as the active males survived better than less active ones but activity did not affected the survival of females. Our results demonstrate that personality exists in I. balthica, and that evolution of personality in I. balthica is likely to be a trade-off between benefits and costs as the activity of individual is costly but simultaneously, it may increase for example mating success by increasing the number of encounters of possible partners.

(oral presentation)

Similarity of personality positively affects the onset of reproduction: a study in a monogamous rodent

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Animal personality is defined as individual differences in behaviour that are consistent across time or contexts. Personality has been frequently shown to have fitness consequences and it is thought to be subject to evolutionary processes. Different hypothesis have been developed to explain why personality variation is maintained within populations. Here, we considered one of the possible mechanisms which is that certain combinations of personality types within breeding pairs could be fitness increasing. We investigated the association between personality combinations within nulliparous pairs and their onset of reproduction. The study was conducted on the monogamous mound building mouse (*Mus spicilegus*), which has a reproductive life of around 4 months. An early onset of reproduction is fitness relevant, as a delayed reproduction potentially limits the number of breeding occasions and lowers the chance that offspring will start reproducing during the same season. Before pairing, we performed elevated plus maze tests revealing consistent individual differences in the animals' anxiety-related behavioural responses, indicating the existence of personality types. We found that within-pair similarity in anxiety scores affected the chance/timing of reproduction: pairs with similar anxiety levels had a higher probability to start reproducing earlier, independently of the anxiety levels of both partners of the pair. The observed advantage of such positive assortative pairing with respect to anxiety/emotionality and onset of reproduction could contribute to maintain the variability of this personality trait in the population.

(oral presentation)

Survival costs of fast exploration during juvenile life in the European rabbit

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Animal personality is considered to be subject to natural selection, and measuring its fitness consequences is an important step in the study of the evolution of this phenomenon. The costs and benefits of certain personality traits are frequently considered to be non-constant across different life history stages. However, almost no studies have investigated so far the survival consequences of personality during juvenile life. We investigated survival costs of exploratory behaviour in juvenile European rabbits (*Oryctolagus cuniculus*). Early exploratory behaviour was assessed in two annual cohorts. This was done either by quantifying the time course of exploration of the area around the burrow shortly after emergence above ground, or by conducting open field tests shortly before emergence. In both years, the study revealed consistent results: more exploratory individuals had a lower chance of survival, assumingly due to their higher risk of predation. We also found indications for a higher probability of survival in females than in males. And individuals born to larger litters, which typically had lower body masses around emergence above ground tended to have a lower chance of survival than animals born to smaller litters. Furthermore, more exploratory animals had larger home ranges and were more aggressive and less sociable towards conspecifics as subadults, indicating consistencies in behaviour across time and context. In conclusion, the results provide evidence for survival costs of exploratory boldness during juvenile life, whereas this personality trait which might be considered to be advantageous during adulthood. This finding could contribute to our knowledge on life history trade-offs leading to the maintenance of personality variation within populations.

(poster 15)

Interacting phenotypes and the maintenance of between-individual behavioural variation in field crickets

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Aggressiveness is one of the key behaviours in the study of animal personality. However, despite this trait being a product of an interaction between two individuals by definition, the effect of social partners on the focal individual's behaviour is typically fully neglected.

This is a problem since such 'interacting phenotypes' are simultaneously representing both environments and evolving traits. Social interactions thus play a key role in maintaining behavioural variation and therefore must be considered when studying socially-expressed behavioural traits. Here we investigate the extent to which phenotypic variance in behavioural phenotypes is attributable to the focal and opponent identity in aggressive interactions displayed by wild-caught field crickets *Gryllus campestris*. We repeatedly assay aggressiveness of adult males in staged fights, where all individuals within a group encounter each other in dyads multiple times. Such design allows us to partition phenotypic variance into focal and opponent effects. By applying quantitative genetics models to behavioural ecology we gain insight on the mechanisms behind the maintenance of between individual variation and are able to make predictions on how social environments affect the evolution of behavioural phenotypes.

(oral presentation)

Do individual differences in behaviour relate to cognitive abilities of Eurasian harvest mice (*Micromys minutus*)?

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Cognitive abilities have been studied in several animal species including non-model vertebrates. Thereby, previous studies have rather focused on specific cognitive abilities of these different species than on intra-specific variability of cognitive styles within populations. However, recent theories assume that there exist constant individual cognitive types and that there is a relation between these cognitive types and animal personalities (known as correlated individual behaviours throughout time and different situations). To address the question whether correlations between individual personality types and cognition occur in our study species, we tested male and female Eurasian Harvest Mice (*Micromys minutus*) using different personality and cognitive tests. Preliminary results indicate repeatable individual behaviour in boldness, activity pattern and the recognition of novelty (Y Maze). Our results show that harvest mice may behave constantly in different situations and throughout time, which would confirm the existence of animal personalities in this species. Based on the assumption that more active and bolder individuals are less attentive and less flexible towards visual cues, we hypothesize that less active and shyer animals show better cognitive abilities in recognition of novelty than more active and bolder individuals.

(poster 16)

Colour traits refer to behavioural profiles in the convict cichlid (*Amatitlania nigrofasciata*)

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Individual behavioural differences, consistent over time and across situations, between members of the same species are frequently related to differences in reproductive success, susceptibility to disease and quality of life. During mate choice, individuals could, therefore, use partner behavioural profiles to choose suitable mates. Estimate partner profile supposes to use multiple traits. However, multiple cues suggest high cognitive performance and to encounter the potential partner in a variety of situations. Because colour morphs can be associated with life history strategies, differently coloured individuals may display different behavioural profiles. Colouration could, therefore, be used as a single signal by conspecifics in mate-choice decisions. We investigated the relationship between personality and colour characteristics in the monogamous, biparental convict cichlid *Amatitlania nigrofaciata*. The species has the prisoner's garb-like appearance with individual variations in intensity of the grey and black patterns. In addition, females have gold flecks on the abdomen. For each individual, we quantified its behavioural profile using measures of boldness, exploration, aggressiveness, obstinacy and maintenance. All personality traits, except obstinacy and maintenance, were found to be repeatable within individuals and relationships between some of them enabled us to define a behavioural syndrome. A PCA was thus performed on the traits, to reduce individual personality to two dimensions: aggressiveness and emotional reactivity. We found a positive correlation between emotional reactivity and paleness or orange body area in females. Our results support the hypothesis that colour traits are related to personality and therefore could be a valuable cue in mate choice.

(poster 17)

Hormonal levels reveal personality in marmosets?

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Personality traits describe a correlated suite of behavioural traits, consistent across time and/or contexts. They are often causally linked to physiological traits that may provide a proximate and mechanistic explanation to the evolutionary maintenance of the variation in these behavioural correlations. Surprisingly however, this notion received little interest

among non-human primate studies so far. Therefore, in the present study we combined behavioural and physiological parameters to study consistent inter-individual differences in common marmosets (*Callithrix jacchus*). We assayed salivary cortisol levels and their relation to the personality trait aggressiveness of individually separated marmosets (n = 15) in two blocks of specifically designed behavioural tests. In the Mirror Test, a mirror was placed into the testing compartment of the experimental enclosure; in the Video Test, the mirror was replaced by a computer screen on which an image of an unfamiliar but same sex individual was presented. Saliva samples were taken before, immediately after and 10 minutes after the tests, while all the behavioural responses during the tests were recorded with a video camera. In both tests, we predicted that seeing an "unfamiliar conspecific" would evoke a (primarily) aggressive response in this highly territorial species, yet that this response may vary consistently across individuals. Whether inter-individual differences in hormonal levels are linked to the personality trait aggressiveness, i.e. more aggressive individuals show higher levels of salivary cortisol after seeing an unfamilar conspecific than less aggressive individuals will be discussed.

(oral presentation)

"Laugh together, cry together" Emotional contagion between the owner and the dog - a questionnaire study

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Empathy is an essential component of human social life. An element of empathy, emotional contagion has been already demonstrated in several non-human animal species, but research on dogs is limited. Our aim was to develop a questionnaire for measuring the reactivity of dogs to the emotions of owners. Owners (N = 162) were asked to rate their level of agreement on 1-5 Likert scale with statements like „My dog is frightened when I am afraid of something." After a Principal Component Analysis seven questions loaded high on a factor labeled as Emotional Contagion. Internal consistency of the scale was good (Cronbach's alpha> 0.7). The scale positively correlated with the empathy level of owners (Pearson $r=0.19$, $p<0.05$) as expected based on personality trait correlations between owners and dogs (Turcsán et al., 2012, AABS, 140:154–160). Moreover, owners who scored their dogs high on the Emotional Contagion scale rated pictures of dogs as nicer, and they considered that due to their dogs someone loves them. Our questionnaire seems to be an appropriate mean for assessing emotional contagion between the owner and dog, but for further validation we aims at comparing the scale scores with the results of a behavioral test battery. Funded by HAS 01 031, Bolyai Foundation, OTKA K84036.

(poster 18)

Personality and growth in young common northern boa

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Personality in animals receives much attention in last decades. Recently, it was hypothesized (Biro & Stamps 2008) that consistent individual differences in behaviour could be a result of such differences in energy metabolism. This study investigates the relationship between behavioural traits and growth rates in common northern boa (*Boa constrictor imperator*). Specifically, we assessed multivariate relationships among growth parameters assessed under standard conditions and multiple behavioural traits. We recorded behaviour and growth of thirty juveniles from birth to two years of age. The animals were measured as newborns and at the age of one and two years. The food intake was kept proportional to body mass of the individuals. The body weight of the snake and its prey was recorded prior each feeding event. Aggressive behaviour towards an experimenter during manipulation as well as latency of the first attack on the prey was recorded. Moreover, we performed tests for exploratory behaviour, activity and reactions to novel prey. The weight gain during growth (growth efficiency) and a weight loss during a short fasting period were used as measures reflecting parameters of energy metabolism. The newborns exhibited only little variation in their body size, but they reached highly variable body masses and lengths at the age of two years. Examined behavioural traits showed significant consistency in time, situation and individual; the main variation we interpret as "bold-shy" axis of the personality. Surprisingly, behavioural traits only weakly correlated with the growth parameters. Possible explanation of this finding is that in passive, energy saving animals like boid snakes, the main energy expenditures can be hidden in "inactive" digestion and thermoregulation.

(poster 19)

Integrating mechanistic and functional approaches to understand personality variation in Barbary macaques (*Macaca sylvanus*)

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Within personality research, there has been a recent shift away from understanding individual outcomes for personality types to understanding the evolutionary ecology of personality. Two predominant approaches within this field currently exist: the mechanistic approach examines how proximate factors are correlated with the expression of personality-related behaviours; the functional approach examines how personality-related behaviours

affect an individual's interaction with its social and ecological environment and thus affect its fitness. This study aims to integrate these two approaches in order to advance our understanding of how personality variation arises and is maintained within populations, using wild Barbary macaques as the model species. Established methodologies (observer questionnaires and behavioural coding from observational data) will be used to quantify personality traits and dimensions in Barbary macaques. Each trait will then be examined mechanistically through its association with cortisol reactivity, and functionally, through its association with mating (frequency of copulations), reproductive (infant survival to one year) and social success (degree of social integration). Here, initial results from this study will be presented, highlighting how personality and cortisol reactivity variation are reflected in social networks of proximity, grooming, feeding and aggression.

(oral presentation)

Environmental contribution to the emergence of behavioural consistency

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Behavioural consistency has sparked a high interest recently in evolutionary behavioural ecology. Behavioural consistency limits individual behavioural plasticity and thus warrants evolutionary explanation. While several explanations, like frequency dependent selection, link to life-history strategies or temporally and spatially varying selective forces, have been put forward as mechanisms leading to genetic adaptations resulting in the emergence of behavioural consistency. However, less attention was paid to the direct environmental effects potentially affecting (or even causing) behavioural consistency. Here, we present results from a factorial common garden experiment ran on Rana dalmatina tadpoles with predation (presence/absence of predatory cues) and social (reared alone/with conspecifics) treatments, where we repeatedly assessed activity and risk-taking. The treatments had various effects on the strength of animal personality (consistency in single behaviours) and behavioural syndrome (consistency across functionally different behaviours), and on behavioural type (individual mean behaviour) and behavioural precision (within individual behavioural variation in a constant environment) too. We discuss our results in the light of what is known about the evolution of behavioural consistency and emphasize the importance of individual experience in the emergence of this widely observed phenomenon.

(oral presentation)

Sex-specific associations between nest defense, exploration and breathing rate in breeding pied flycatchers

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Behavioral syndromes – suites of correlated behaviors within a population – constrain animals to a limited range of behavioral choices and set a limit to the available variation in behavioral phenotype of a population. Behavioral syndromes are especially important during stressful situations, potentially limiting the ability to cope with stress appropriately. In this field study, we investigated associations between neophobia (latency to enter nest in the presence of a novel object), nest defense (response to a model predator), and breathing rate in response to handling in breeding pied flycatchers (*Ficedula hypoleuca*). We did not find any significant difference in anti-predator responses between males and females, which indicates low sexual conflict over parental care in the pied flycatcher. However, females were found to be more neophobic than males, while males and females did not differ in their breathing rates. Further, our study demonstrated a strong positive correlation between nest defense behavior and neophobia in male, but not in female pied flycatchers. Males that defended their nest more had lower breathing rate and higher latency to resume nestling feeding after encountering a predator decoy than males that mobbed less intensely. We found only weak evidence that nest partners might affect each others' behavior in these contexts.

(oral presentation)

Use of human odor fall-out in human identification line-ups

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In previous study (Vyplelová et al.,2014) was proven that one of the abilities of specially trained police canines is to identify human odor fall - out collected from hand situated 5 cm above sterile cotton square called ARATEX®. Aim of this following study was to find the shortest time needed for collection of human odor fall – out which the dogs are able to detect. Next aim was to prove if there is significant difference between successful comparison of scents collected from males and females. In our research 6 specially trained police canines (German Shepherds) was used. The dogs were supposed to match odor fall-out of 12 individual humans – 6 males and 6 females. Scents were collected on

cotton squares that were stored in glass jars with twist off lids and marked with codes. Before the scent collection was all tested person asked to wash their hands and let them dry naturally without contact with any objects. Then human odor fall – out was collected – times were previously determined. To find the differences between successful matching of scents collected from males and females was used Wilcoxon signed-rank test in program Statistica 9.0 (2009). Significant differences were not found. Shortest time needed for collection of human odor fall – out, which the dogs were able to detect was 2 minutes. Two dogs were able to match samples collected for 2 minutes, otherwise two different dogs were able to collect samples whit odor fall - out collected for 3.5 minutes.

(poster 20)

Personality assessment in squirrel monkeys (*Saimiri sciureus* **and** *Saimiri boliviensis***)**

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Personality assessments in nonhuman primates have mostly been focused on apes and Old World monkeys. Assessment of personality in New World monkeys should benefit both an evolutionary understanding of personality across taxa, and may be useful to address species-specific needs in individual differences within captivity. We extended the study of personality in New World monkeys to two species of squirrel monkey: Saimiri boliviensis (n=40) and S. sciureus (n = 62). We also obtained ratings of their well-being. Personality was assessed via the Hominoid Personality Questionnaire (HPQ), which has been used to assess several other species of nonhuman primates, including brown capuchin monkeys (*Sapajus apella*), a New World monkey species. Parallel analysis and principal components analysis revealed four components for each species. Boliviensis components were labelled Timidness, Assertiveness, Agreeableness and Openness (reversed). Sciureus components were labelled Openness-Assertiveness, Timidness, Agreeableness, and Independent-Assertiveness. The four well-being items formed one component in both species, and were negatively correlated with scores on Timidness ($r = -0.67$, $p < .001$) and positively correlated with scores on Openness ($r = -0.50$, $p < .01$) in boliviensis ($n = 35$). For sciureus, there was also a negative correlation with Timidness ($r = -0.48$), and a positive correlation with Independent-Assertiveness ($r = 0.45$), however these findings were not significant ($n = 11$). We present these preliminary findings within a comparative framework, and discuss what interspecific differences might determine differences in component structure.

(oral presentation)

Birds, brains, and behaviour

Role of the striatal vocal region in adult songbirds

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Birdsong is a learned vocalization. In order to learn and produce songs, songbirds have a system of brain vocal nuclei. Vocal nucleus within the striatum (basal ganglia) called lateral Area X (LArea X) is necessary for vocal learning but does not have a strong effect on song in the adult songbird zebra finch. Nevertheless, it shows high activation during singing that is differentially induced when the male sings alone song called undirected or when he sings toward a female during courtship song called directed. Therefore we tested the hypothesis that LArea X affects the song even in adult zebra finches. We used bilateral neurotoxic (axon sparing), electrolytic (axon damaging), and sham (control) lesions of LArea X and recorded both undirected and directed songs before and up to 6 months after the surgery. We found that the lesioned birds first decreased the song motif tempo after surgery but after 2 weeks it increased and stayed increased up to 6 months. Further, while in control birds song linearity and stereotypy correlated positively before and after the surgery, the correlation was either lost or changed in the lesioned birds. Last but not least, the biggest effect on song was seen in birds that repeated the last syllable in the song motif prior to surgery. These birds started to stutter on this syllable after surgery and the stuttering was worse when the male directed songs to a female. In conclusion, these results show that basal ganglia plays a role even in adults and it controls song tempo, sequencing and switching from one motor segment to the next. The research was supported by NIH Fogarty International Research Collaboration Award R03TW007615 and VEGA 2/0177/14 grant.

(keynote speaker)

One species, two songs? Response to song in physically and acoustically varied environments

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Scatter-hoarding birds have become a text-book example of adaptive brain specialization. Hiding food in many thousands of locations protects the birds from catastrophic loss of their food reserves, but also faces them with the challenge of retrieving these items later. One potential solution to this problem is to have an adaptively specialized spatial memory system. Indeed, the hippocampal formation (HF), which is involved in spatial memory, is larger in scatter-hoarding birds than in their non-hoarding relatives, suggesting such an adaptive specialization. However, the nature of this adaptive specialization is not well understood. Can they remember more locations than non-hoarders? Can they retain the information for longer? Is the spatial information more precise? The answer to these questions may be different for different species, as some bury their food (e.g. jays), while others hide it in crevices in their natural foraging niches (e.g. titmice). Titmice don't just use memory to retrieve their food, but also to decide where to hide new items. This allows them to avoid generating spatial clumps, further reducing the odds of catastrophic loss. They move through their home range and hoard or retrieve food nearby to where they are at any point in time. Therefore, rather than having to freely recall the locations, they could be cued by the view of the hoarding site itself. Using a technique inspired by recognition memory research in humans, we explore whether coal tits (*Periparus ater*) use free and/or cued recall when retrieving memories of previously hoarded food items. Understanding how they retrieve their memories will allow us to better investigate how selection has acted on their memory systems in the future.

(keynote speaker)

Do female zebra finches distinguish lesion-induced changes in song?

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Zebra finch (*Taeniopygia guttata*) belongs to songbirds producing learned vocal behavior. There is an important sensitive period in juvenile males when they hear and memorize tutor's song. Although the females do not sing they also undergo similar period for song acquisition at approximately the same age as males. Generally, song in oscine birds plays a crucial role in a mate choice. Female zebra finches show strong preference for the song

of their father or their mate in comparison to the song of an unfamiliar male. They also prefer super-normal length or high-amplitude songs. In previous studies we found that bilateral neurotoxic lesions in brain region Area X, important for vocal learning, leads to changes in song of adult male zebra finches. The song tempo increased and males repeating last syllables of song motif before surgery started to stutter on these syllables after the lesion. In link with the above mentioned findings we were interested if females can recognize the changed song and/or if they have some preference depending on the songs of their fathers. We used sexually naive female zebra finches that were isolated from parents at 94-102 days post hatch. Up to this age, there were exposed to fathers' songs with or without repetitions. After separation they were housed together in one cage. The experimental song preference cage was placed in sound attenuating box with loudspeakers on both sides. The female was placed into the center of the cage, left to habituate for 30 min and then the speakers played 30 min loop of males' songs recorded before and after surgery. During each session there were played 5 songs repeated 4 times in random order from each speaker alternatively. The data analysis are in progress. The research was supported by VEGA 2/0177/14 grant.

(poster 21)

Key players in the social network establishment of a captive group of rooks

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Birth, death or disappearance of individuals is frequent in animal social groups. These modifications of the group composition can have important consequences on the social structure. Moreover in mammals, many studies have highlighted the importance of some specific individuals also called key players for the cohesion of social groups and the set-up of new relationships. The loss of these key players could lead to social bond disruptions and/or social group fragmentation. In social corvids like rooks, the reproductive pair is the core unit of the social structure, but they live all year long in colony where they can interact with individuals outside the pair. Thus, like in mammals, introduction or disappearance of key individuals should also affect the social organization of the group. In this study, we first introduced new members to an existing captive colony of birds (5 new birds in a group of 9) and investigated the role of each individual in the establishment of a stable social network. We recorded affiliative and aggressive interactions, and considered the network as structured and cohesive once the frequency of affiliations becomes relatively higher than the frequency of aggressions. We also investigated the potential for key players in the building network. Secondly, we analyzed the consequences of the loss of one female on the undergoing process. This female was performing the majority of the inter-subgroup interactions and associations. The impact of her lost on the network cohesion and social patterns underlying group building will be discussed.

(poster 22)

Good mothers, smart offspring: prenatal conditions affect brain development and learning in a precocial bird

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The ability to respond to environmental change and novelty has been suggested to be a main driver in the evolution of enlarged brains and its associated enhanced cognitive performance. Indeed, comparative analyses in birds and primates revealed that species with a relatively large brain have increased innovative abilities and are more likely to survive and successfully establish themselves in novel environments. Within species, however, the evolutionary processes that shape individual variation in brain size and cognition remain poorly understood. In many taxa, a within-family resemblance in problem-solving abilities is observed. However, it is largely unclear if this within-family resemblance is due genetic or non-genetic effects. Using repeated Japanese quail (*Coturnix japonica*) selection lines for high and low maternal egg investment, we demonstrate that prenatal conditions have a pronounced effect on brain development. Furthermore, we observed an intriguing sexual dimorphism in both absolute and relative brain size. We relate these differences with the animal's performance in a range of learning and innovation tests to assess if prenatal maternal investment affects cognitive performance and if larger brains are indeed associated with higher cognitive abilities. Together, this study provides novel insights into the role of prenatal conditions in creating variation in brain development and cognitive capacity within a species.

(oral presentation)

Sexual selection on male acrobatics: female choice for neuromuscular skills

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Sexual selection was proposed by Charles Darwin to explain the origin of traits that seemed to contradict his theory of evolution by natural selection. He found it difficult to explain how the large tail of a peacock could evolve when it had obvious survival costs such as increasing the male's vulnerability to predation and reducing the efficiency of his flight. Sexual selection theory posited that the peacock's tail would evolve if the fitness benefits provided by the tail outweighed its costs. Sexual selection is now a main branch of biological investigation, attracting empirical and theoretical biologists alike.

A particularly spectacular category of behavioural ornamentations that evolved under sexual selection pressure are the elaborate courtship displays performed by males of many species, ranging from spiders to humans. Despite their presence in most animal taxa, we know very little about the physiological and anatomical mechanisms underlying the evolution of elaborate courtship behaviours. A few species have been studied to estimate the energy requirements of courtship or the hormonal activation of relatively simple courtship behaviours. However, our knowledge about neuromuscular specializations that support elaborate displays is limited to a few model species. In this talk, we will review our work on the physiological control of the elaborate courtship of a tropical bird, the male Golden-collared manakin, which has been the focus of our research for nearly 20 years. We propose that in some species, females select males based on their neuromuscular capabilities and acquired skills and that elaborate courtship displays evolve to signal these traits.

(oral presentation)

Differences in olfactory species recognition in the females of two Australian songbird species

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Although birds have recently been shown to possess olfactory abilities and to use chemical cues in social communication, limited effort has been made to demonstrate the use of odorants in mate recognition and mate choice. Even less is known regarding the use of odorants in species recognition. The ability to recognize conspecifics should be more pronounced in social species. This study investigates the importance of olfactory cues in species recognition in females of two estrildid finch species with different levels of sociality. Combining odor preference tests with chemical analyses, we investigated whether female zebra finches and diamond firetails are able to distinguish between the species based on volatile traits and whether individuals exhibit species-specific differences in body odorants. Zebra finches are more social than diamond firetails but both species have an overlapping distribution area. In an experimental Y-maze paradigm, we tested whether individuals can use the differences in their species odor fingerprints to distinguish conspecifics from heterospecifics. We found that zebra finches displayed a significant preference for the odor of conspecifics over that of heterospecifics, whereas diamond firetails did not reveal a preference. Using gas chromatography and mass spectrometry, we demonstrated that body odorants of the two species were significantly different in relative composition. This finding demonstrates the potential importance of

olfactory cues in species recognition, at least in social species. Even these two closely related species display remarkable differences in their responsiveness to similar chemical cues, which might be caused by species-specific differences in ecology, physiology, or evolution.

(poster 23)

Delay of gratification in Goffin Cockatoos (*Cacatua goffini*)

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The ability to inhibit the impulse to consume an immediate food item over an extended period of time is rare in non-human animals. So far, only some primates, dogs and, within birds, only corvids have been shown to be able to fully inhibit the consumption of a desirable food item in anticipation for a delayed gain for longer than a minute in an exchange task. As corvids are cachers and were already known to be able to temporarily discard food items, it was unclear whether similar performances on delayed exchange tasks in birds were limited to other food hoarding species. We tested 14 Goffin's cockatoos (*Cacatua goffini*): subjects were able to delay the consumption of an immediately accessible food reward but waited longer (up to 80s) for qualitative than for quantitative gains.

(poster 24)

Regeneration of striatal vocal area in songbirds: in a view of MRI and immunohistochemistry

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Songbird nucleus Area X of striatum (LArea X) is responsible for vocal learning. It has been found that this nucleus in adult songbird zebra finch (*Taeniopygia guttata*) regenerates

after excitotoxic damage and this regeneration is accompanied with changes in song. However, this was found using classical method where the bird's song was recorded for several months and at the end the bird was sacrificed to determine lesion location and efficiency. Therefore, in order to link the changes in song with the regeneration process in the same individual, it would be beneficial to use a technique enabling continuous examination of the lesion size such as the magnetic resonance imaging (MRI). Since MRI has a relatively low resolution for such a small nucleus as LArea X, in this study we validated the lesion size measured using MRI. We created bilateral lesions of LArea X, scanned all individuals before operation, one day, one month, and three months after operation, and measured the lesion sizes from the MRI images. Some of the birds were sacrificed at the same time points and the lesion size was measured from immunohistochemically (IHC) stained brain sections. We found that there was no statistical difference between lesion sizes measured by MRI and IHC. One day after the surgery, the sizes of undamaged region were 4±2,0% (MRI) and 12±7% (IHC) of its size before the surgery. One month after surgery, LArea X was regenerated up to 70±1,9% (MRI) and 73±2,4 (IHC), and three months after surgery the sizes were up to 80±1,4% (MRI) and 84±1,2 (IHC). In conclusion, we confirmed the suitability of MRI for continual observation of lesion development in small songbirds. The research was supported by VEGA 2/0177/14 grant.

(poster 25)

First investigation of the cerebral network implicated in food neophobia in young chicken *Gallus gallus domesticus*

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Food neophobia - the transient rejection to eat a new source of food - is an adaptive behavior that allows individuals to deal with potentially dangerous sources of food and unpredictable environment. Described in many mammalian and avian wild species, this behavior is a massive issue when dealing with farm animals in term of animal welfare. Indeed, during food transition, young chickens exhibit a high food neophobia with rejection that can last several days. This behavior is associated with the emission of distress vocalizations and redirected behaviours such as intensive pecking of the floor and the cage. We propose to investigate for the first time the neurobiological basis of this phenomena in chickens of 1 week old. Our study focuses on two brain structures,

the amygdala implicated in emotions and the nucleus accumbens that plays a central role in the reward circuit. Understanding the neuronal bases of food neophobia will help to develop new tools so as to suppress/reduce this behaviour in farm birds, thus considerably increasing animal welfare.

(poster 26)

Should I stay or should I go? Social dynamics in a wild raven population, *Corvus corax*

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Common ravens are renowned for their highly sophisticated social skills such as establishing qualitatively diverse relationships to conspecifics, remembering those relationships over several years, supporting each other in conflicts, teaming up to rise in rank and cooperating to overcome the defense of food resources by conspecifics. Applying those skills, however, seems to be connected to conspecifics` characteristics such as age, sex, kinship or familiarity at varying degrees. In captivity, where most studies are conducted, birds are kept permanently together in one social group until reaching maturity. In the wild, however, raven social groups exhibit strong fission-fusion dynamics with individuals joining or leaving groups for variable amounts of time, from few days to several months or even years. In this study we focused on these fission-fusion dynamics and analyzed association data of individually marked wild ravens (n=42) that were recorded over an observational period of two years in the Northern Austrian Alps and that were known of being alive within the entire period. We investigated i) similarities and changes in the groups` social structure over the entire period, ii) sub-grouping, i.e. preferred associations with regard to the birds` individual characteristics (sex, age, rank) and with regard to kinship relations, and iii) presence/absence dynamics over time. Our findings corroborate the picture derived from studies of social interactions and are discussed in respect to the evolution of socio-cognitive skills.

(oral presentation)

Ontogeny of non-vocal signals in birds – First insights from ravens (*Corvus corax*)

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Displays in birds are known to be species-specific stereotyped motor patterns, which can vary in their complexity. Tinbergen (1952) proposed that they derived during the course of evolution from behavior patterns resulting from interactions of distinct tendencies such as attacking and fleeing. Lorenz (1937) defined them as Fixed Action Patterns, which are innate and distinctive. Based on this work, visual signals were generally seen as ritualized and highly fixed communicative means. However, Gwinner (1964) suggested that members of the corvid family, ravens (*Corvus corax*) use some of their non-vocal signals as flexible behavioral strategies. To examine this claim systematically, we investigated the ontogeny of communicative signaling in ravens with a special focus on non-vocal signaling and flexibility of signal use. We examined the following questions: (a) Which kind of non-vocal signals are used by ravens? (b) Does their production and usage change during ontogeny? To carry out this study, six hand raised ravens were observed during their first year of life. We videotaped interactions with other group members (min 30 per bird per month) during this time period and coded them based on already established parameters used in the primate gesture literature (e.g. Pika and Liebal 2012). Preliminary results indicate that in addition to displays, ravens use communicative gestures as flexible, intentional strategies, which differ in relation to meaning and function.

(poster 27)

Element string segmentation by Zebra finches

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When learning their song, songbirds like zebra finches do not always copy complete songs, but they combine chunks of several songs. The elements within these copied chunks usually have higher transitional probabilities and shorter pauses between them than elements between chunks, indicating that transitional probabilities and pauses might play an important role in the segmentation process. Interestingly, similar cues are used by human infants when they are segmenting speech input into words. This ability is thought to be one of the precursors of language learning. In this study we examine how the perception of strings of song elements in zebra finches is affected by transitional

probabilities and pauses between elements. Zebra finches were trained to discriminate between two strings of zebra finch song elements. These strings consisted of triplets that could be segmented based on transitional probabilities only (group 1) or on both transitional probabilities and pauses (group 2). When they had discriminated these strings, they were trained on chunks of three elements from these strings that formed either a familiar triplet or combined elements from different triplets. In this second training phase, their performance on the chunks shows how strongly they associate a chunk with the string it came from. Preliminary results show that zebra finches have more difficulties learning strings without pauses, compared to strings in which the chunks were segmented by pauses. The results also suggest that zebra finches learn the chunks from a continuous stream both when there are transitional cues and pauses available, as well as when there are only transitional cues present. This suggest that the segmentation abilities of zebra finches rely on both transitional and pause cues.

(oral presentation)

Phylogenetic comparative analyses on the oxidative stress in birds

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Why do we grow old and die is a fundamental question in biology. Oxidative stress is thought to play a pivotal role in the ageing process. Studies comparing the possible association between oxidative physiology and organismal performance across a wide range of species might help understand the evolutionary bases of the redox state. Yet, phylogenetic comparisons based on several wild-living species are very scarce, and therefore we cannot generalise. We sampled 88 European bird species during their breeding period and assayed multiple components of the oxidative physiology system using the following markers: oxidative challenge by reactive oxygen species (level of hydrogen peroxide), defence by the non-enzymatic antioxidant system (total antioxidant status, uric acid and glutathione concentration) and degree of peroxidative damage to membrane lipids (malondialdehyde concentration by HPLC). Using phylogenetic comparative analyses to control for independence of species due to descent from common ancestors, we report preliminary results about the covariation between redox state markers, as well as their relationship with life-history traits (body size, lifespan) and energetically costly phenotypic traits (brain size and flight behaviour). We discuss the implications of our results for avian biology based on evolutionary theories of ageing.

(poster 28)

Cooperative behaviour among non-kin

Evolutionary routes to non-kin cooperative breeding in birds

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Cooperatively breeding animals live in social groups in which some individuals help to raise the offspring of others, often at the expense of their own reproduction. Kin selection – when individuals increase their inclusive fitness by aiding genetic relatives – is a powerful explanation for the evolution of cooperative breeding, particularly since most groups consist of family members. However, recent molecular studies have revealed that many cooperative groups also contain unrelated immigrants, and the processes responsible for the formation and maintenance of non-kin coalitions are receiving increasing attention. Here I provide the first systematic review of group structure for all 212 species of cooperatively breeding birds for which data are available. Although the majority of species (56%) nest in nuclear family groups, cooperative breeding by unrelated individuals is more common than previously recognized. Twenty-six percent nest in mixed groups of relatives and non-relatives, and 18% nest primarily with non-relatives. Obligate cooperative breeders are far more likely to breed with non-kin than are facultative cooperators, indicating that when constraints on independent breeding are sufficiently severe, the direct benefits of group membership can substitute for potential kin-selected benefits. I review three patterns of dispersal that give rise to social groups with low genetic relatedness, and I discuss the selective pressures that favor the formation of such groups. Although kin selection has undoubtedly been crucial to the origin of most avian social systems, direct benefits have subsequently come to play a predominant role in some societies, allowing cooperation to persist despite low genetic relatedness.

(keynote speaker)

The significance of information in reciprocal cooperation

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If reciprocity is to generate evolutionarily stable cooperation, investment in helping others at one's own expense should increase the likelihood to obtain fitness benefits in return that compensate for the costs of initial investment. Evolution of such exchange of

services is hampered by the inherent potential that cheating pays. At the proximate level, reciprocity involves the consideration of information about the likelihood to obtain fitness benefits in return of a helpful act. Such information results from previous experience of an individual and may involve different degrees of complexity. Several theoretical models have shown that even a simple rule making use of little information, such as "help anyone if helped by someone" (generalized reciprocity) can generate stable levels of cooperation under a wide range of conditions. Here I shall demonstrate with examples from several vertebrate species that cooperative behaviour among unrelated individuals can be based on the reciprocal exchange of same or different commodities. The major ingredients of this mechanism are the costs to the donor and the benefits to the recipient, and the outside options to the involved parties. An important component of the decision to help a social partner based on the expectation to receive help back in return is the time between the partners' reciprocal exchange; a delay of information transfer between cooperating partners has equivalent effects to increasing the costs of cooperation. Hence, the most likely form of reciprocal cooperation in animals is coaction, or exchange with very little time delay between successive actions of social partners.

(keynote speaker)

The motivation of dogs to rescue people

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The aim of training a Search and Rescue Dog (SARD) is to make the dog search intensely and to indicate the direction of the human scent. Therefore, SARD training typically involves the finding of victims and the coping with obstacles. The training is repeated using new settings at different places to enable dogs to adjust to real disaster situations. The training to find victims involves a hide-and-seek procedure between humans and dogs. The trainer determines the alleged victim's position and makes them hide there before the dog starts to search the person after a signal is given. Habituation to obstacles includes training to walk over rubble or on a ladder, to pass a gap, to get over a moving plate, etc. Most dogs seem very motivated to cope with these challenges. The aim of this study was to understand the motivation of dogs to learn these procedures during the training. To this end, the behaviour of dogs during, before and after the training was video-recorded and analysed with regard to features that might indicate motivation, including the movement and position of the tail, vocalizations (e.g., whining and barking), evasion, and time of attention towards the owner or dog handler. Our results suggest that SARD training resembles behavioural enrichment for the involved subjects.

(poster 29)

Food sharing and tolerance in dogs (*Canis familiaris*) and wolves (*Canis lupus*)

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Tolerance and food sharing have been linked to cooperation e.g. more tolerant primate species are more likely to succeed in cooperative tasks than less tolerant ones. Wolves and dogs are potentially interesting in this context since wolves are known to cooperatively hunt and share prey whereas feeding of domestic dogs is mainly controlled by humans, which may have led to a loss of food tolerance capacity in the latter. This is contrary to some domestication hypotheses which argue that dogs have been selected for reduced aggression, suggesting increased tolerance. Here we compared identically- raised and kept wolves and dogs, in a food-sharing context to shed light on the effect of domestication on intraspecific tolerance. Experiment 1 presented dyads with either a bone or a bowl of meat and investigated the effects of dominance and species on tolerance. Experiment 2 tested whether males were more tolerant of females when they are in heat (food-for-sex hypothesis) and examined effects of the affiliative relationship on tolerance. Here either one central bowl of meat or two separated bowls were presented. Results of experiment 1 showed that differences between dogs and wolves were mediated by dominance rank. Although dominance did not affect aggression in wolves, there was more aggression in dominant than low-ranking dogs. Additionally, wolves co-fed for longer than dogs. Results of experiment 2 are in the process of analysis and will be presented. The current results suggest that wolves are more tolerant than dogs towards subordinate conspecifics, which may be due to their dependency on cooperation and food sharing. In contrast, dogs seem to have a steeper dominance hierarchy, preventing them from challenging dominant partners.

(poster 30)

Norway rats reciprocate according to perceived quality of received help

V. Dolivo, M. Taborsky

University of Bern, Switzerland

Direct reciprocity according to the criterion “help someone who has helped you before” reflects cooperation based on the principle of postponed benefits. In Homo sapiens, it is well established that the predominant factor influencing the motivation to reciprocate is an individual’s perceived benefit resulting from received help. Previous experiments have demonstrated that also Norway rats, Rattus norvegicus, cooperate using direct

reciprocity in an iterated prisoner's dilemma, helping preferentially cooperators instead of defectors. It is yet unclear which criteria rats use to assess the value of a cooperator. In an experiment involving two cooperators providing test rats with "appreciated bananas" or "less appreciated carrots", we found that rats distinguish between different cooperators depending on the quality of their help. Tested individuals reciprocated more often with cooperators that previously provided them with more appreciated food. The delay before reciprocating was also adjusted to the partner's perceived helping quality. When cooperating with two conspecific partners expending the same effort, rats apparently rely on obtained benefit to adjust their level of help.

(oral presentation)

Evolution of social behaviour in the primitively eusocial wasp *Ropalidia marginata***: do we need to look beyond kin selection?**

R. Gadagkar

Indian Institute of Science, Bangalore

Ropalidia marginata is a primitively eusocial wasp widely distributed in peninsular India. Although solitary females found a small proportion of nests, the vast majority of new nests are founded by small groups of female wasps. In such multiple foundress nests, a single dominant female functions as the queen and lays eggs while the rest function as sterile workers and care for the queen's brood. Being a typical 'feminine monarchy' in the haplodiploid insect order Hymenoptera, our attempts to understand the forces that have moulded the evolution of social behavior and altruism in this species have naturally employed inclusive fitness and kin selection theories as guiding frameworks. Although inclusive fitness theory has been quite successful in explaining the high propensity of the wasps to found nests in groups, several features of its social organization suggest that forces other than kin selection may also have played a significant role in the evolution of this species. These features include, lowering of genetic relatedness due to polyandry and serial polygyny, nest foundation by unrelated individuals, acceptance of young non nest-mates, a combination of well-developed nest-mate recognition and lack of intra-colony kin recognition, a combination of meek and docile queens and a decentralized self-organized work force, long reproductive queues with cryptic heir designates and conflict-free queen succession, and in general, extreme intra-colony cooperation and inter-colony conflict. In this talk I will describe these features and discuss whether we should add multilevel selection to our toolkit in demystifying the evolution of social behavior and altruism in *Ropaldia marginata*.

(oral presentation)

Norway rats use olfactory cues to cooperate reciprocally in an iterated prisoner's dilemma game

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University of Bern, Switzerland

A mechanism responsible for cooperative behaviour among unrelated animals is reciprocity, where individuals help others contingent on previous interactions. Norway rats (*Rattus norvegicus*) live in large social groups where they interact repeatedly with related and unrelated individuals. Female Norway rats have been shown to cooperate reciprocally using direct, indirect and generalized reciprocity, but the cues they use to evaluate their partners' behavior are yet unknown. We studied the importance of olfactory information for reciprocal cooperation of rats in an iterated prisoner's dilemma paradigm. In a two player food exchange task, focal rats experienced either cooperative or non-cooperative partners in presence or absence of smell in a full factorial design. In the test phase, individuals could provide help for the partner with which they had interacted before. Our results show that the rats' propensity to cooperate depends on previous social experience only if olfactory information is available. Our results suggest that chemical cues play an important role in the transmission of infor¬mation in cooperative interactions among rats, even beyond individual recognition.

(oral presentation)

Polygamy, conflict and cooperation in cooperatively breeding cichlids

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Comparative evidence suggests that monogamous mating may facilitate the evolution of cooperative breeding. This seems plausible when considering that monogamy typically causes high and stable relatedness among group members. Nevertheless, cooperative breeding occurs in a wide range of mating systems. Intraspecific variation in polygamy levels of cooperative breeders allows to unravel the relative importance of mating patterns for cooperation among group members. More polygamous breeders are expected to experience higher turnover rates than monogamous conspecifics due to greater inter- and intrasexual conflict. This will reduce relatedness in groups of polygamous breeders, which should affect cooperation. Here we re-port long-term field data from the facultatively polygynous, cooperatively breeding cichlid Neolamprologus pulcher. We show that polygynous breeders benefit from a higher reproductive output. More polygynous males face higher levels of intrasexual competition, whereas females appear to pay no costs

for male polygyny. However, monogamous pairs appear to last longer. Thus, polygamy is apparently beneficial for male breeders, but it lowers within-group relatedness by higher breeder turnover. Cooperation hence yields lower inclusive fitness bene-fits for subordinates in polygynous groups, which may in fact increase their helping propensity, as in this species relatedness has been shown to reduce altruistic behaviour.

(oral presentation)

Mechanisms of reciprocity in breeding birds

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Reciprocal altruism is a form of mutual co-operation, in which one individual helps another and receives assistance itself in return some time later. Our previous results demonstrated that reciprocity with a tit-for-tat enforcement strategy can occur among breeding pied flycatchers (*Ficedula hypoleuca*) to repulse a predator. However, the sources of variation in cooperative behaviour and the mechanisms motivating individuals to cooperate are still far from being well understood. Our recent results show that reciprocity among non-kin may dependent on the personality type of social partners, their capacity for empathy and habitat quality. We found that consistent individual differences in response against novel objects, anti-predator behaviour and personality are related, and that these responses are important predictors of nest failure in breeding great tits (*Parus major*). We also found that propensity to cooperate positively correlated with the availability of food resources. These results suggest the importance of individual's condition, and we show that cooperation in animals must be viewed in a complex economic context.

(oral presentation)

Evolutionary dynamics of empathy and emotional contagion

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Empathy, emotional contagion and other-perception action mechanisms (PAMs) are characterized by the activation of similar circuitries (aka "shared representations") when an individual perform or observes a given action, a phenomenon also called mirroring

or neural resonance. These mechanisms play a fundamental role both in prosocial behavior and in understanding others' actions/intentions (mindreading). We show that for an observer, simulating an actor's behavior might provide fitness benefits in terms of mindreading, leading to the evolution of PAMs. The simulated "shared representations" facilitate the performance of the corresponding actions, occasionally leading to coordination events, a phenomenon usually defined as emotional contagion. We show in an evolutionary dynamics framework and by using computational simulations that PAMs are advantageous in complex environments, even when coordination is costly and evolutionary tradeoffs hinder its full inhibition. Only secondarily, positive assortment like kin or group selection might coopt these cognitive processes for cooperation. This further explains the evolution of the empathic gradient suggested by de Waal, and the correlation between assortment and emotional contagion. Hence, we propose a first theoretical model combining bottom-up and top-down processes to explain the evolution of emotional contagion and empathy-mediated cooperation.

(oral presentation)

Effect of social system on allosuckling and adoption in zebra species

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Nursing of non-filial offspring (allonursing) is very attractive topic in behavioral biology. Although this behaviour can be very costly for the female, it occurs in a variety of species, including ungulates. The three living zebra species differ in their ecology and social system. Mountain zebra *Equus zebra* and Grevy's zebra *Equus grevyi* live in arid environments, while plains zebra *Equus quagga* inhabit savannahs in the wild. Mountain and plains zebra mares form long-term stable herds associated with a social hierarchy, whereas Grevy's zebra mares form herds with loose associations of short duration. In this study, we investigated the occurrence of allosuckling in three zebra species at the Dvůr Králové Zoo, Czech Republic, during 1626 h of observation. We recorded no successful allosuckling bouts and only 1 and 22 attempts to allosuckle by foals of mountain and plains zebra, respectively, whereas we observed 117 attempts and 13 successful allosuckling bouts by Grevy's zebra foals. Moreover, more than half of all observed Grevy's zebra foals succeeded in allosuckling at least once. When rejecting an allosuckling attempt, Grevy's zebra mares were less aggressive than mountain and plains zebra mares. Grevy's zebra mares allowed occasional short allosuckling by a non-filial foal not as mountain and plains zebra mares. The higher tolerance towards non-filial offspring, including the occurrence of allosuckling in Grevy's zebra, could be caused by the different social systems of zebra species.

(oral presentation)

To flock or not to flock: foraging by wintering rooks (*Corvus frugilegus*)

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The rook (*Corvus frugilegus*) at its winter quarters often forages gregariously and it is hypothesised that this is an adaptation to adverse environment. It might be therefore predicted, that in harsh weather conditions, when the energy requirements are the highest, rooks have a stronger tendency to cluster together, comparing to periods of mild weather. I test this prediction using the data about the number of rooks foraging within the downtown of Wroclaw (SE Poland). It appeared the distribution of individuals in space was correlated to the ambient temperature and was more clumped in relatively cold days. I propose that forming groups decreases the risk from predation and improves foraging performance, because individuals can use public information to locate rich food patches.

(poster 31)

Protective nesting association between two associated passerines: an experiment using artificial and natural nests

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Nest predation is a major factor limiting reproductive success in birds. Predation has played a central role in the evolution of nesting strategies and nest defence can be critically important in breeding success. The pressure of predators may significantly affects the distribution pattern of nesting birds. Some individuals may reduce the risk of predation by nesting near other species with an aggressive nest defence. In the present study I tested the predator protection hypothesis using experimental (artificial nests) and observational (real nests) approaches on two ecologically similar passerine birds – the Barred Warbler *Sylvia nisoria* and the Red–backed Shrike *Lanius collurio*. The main predators of natural and artificial nests were birds, and to a lesser extent, also mammals. According to the predictions of the predator protection hypothesis the experiment confirmed the existence of a protective umbrella around the Red–backed Shrike and Barred Warbler nests, since the artificial nests located in territories inhabited by both species survived best, while those situated outside such territories fared worst. This study has shown that Barred Warblers and Red–backed Shrikes nesting in close proximity to one another achieve higher reproductive success. Both species were able to effectively defend their breeding sites against predators and benefit from this association. This type of interspecific positive interaction can be classified as facultative mutualism.

(poster 32)

Negotiation and appeasement can be more effective drivers of sociality than kin selection

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Cooperation is the main driver in the establishment of animal societies. Kin selection theory has been the main theoretical framework to understand the evolution of social behaviours. However, recent evidence has accumulated on the prevalence of non-kin interactions in animal societies. The mix of kin and non-kin interactions opens the question of the role of different selective forces in shaping social systems. Here we use a theoretical model, using the "pay-to-stay" framework, to incorporate negotiation between a dominant and a subordinate. We show that this negotiation allows the evolution of higher levels of help than kin selection forces. The negotiation under responsive strategies allows dominant individuals to secure help from dominants even though the enforcement mechanism is rarely realized. Subordinates are selected to appease dominants with help to avoid the enforcement. High relatedness between the dominant and the subordinate in our model is an obstacle for evolution to achieve higher helping levels.

(oral presentation)

Tolerance predicts raven cooperation in the loose string paradigm

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Cooperative behaviour is a highly important trait among different social species. Most studies on cooperation focus on its evolution, indicating a possible influence on both the development of human culture as well as on a variety of higher cognitive skills. However, cooperation experiments were mainly carried out on humans and non-human primates. There are indications that corvid species might share with primates the same cognitive abilities that allow them to coordinate their actions with others. However, experimental evidence is mostly lacking. We tested 9 captive ravens (*Corvus corax*) in a loose string paradigm to study whether they are able to synchronize their actions and cooperate, while in parallel testing whether they understand the need of a partner in this paradigm. We tested the ravens in a group setting, in all possible dyads and alone. Our results indicate that ravens can be successful in synchronizing their actions in order to cooperatively gain a reward. However, they don't seem to understand the importance of a partner in

the loose string paradigm, since they keep pulling the string also when they are alone. Furthermore, our results suggest that both in a group and in a dyadic setup tolerance predicts cooperative success. Interestingly, tolerance was the only predictor in the group setting, whereas in the dyadic set-up cooperation was also affected by kinship and the sex-combination of the dyad. This suggest that when given the choice, ravens choose to cooperate with individuals with whom they have high levels of tolerance, yet that when forced within a certain dyad, other factors also play a role in generating successful cooperation. We will present our data in light of their methodological contexts as well as their evolutionary implications.

(oral presentation)

Determination of cognitive skills in birds and other animals

'Raven politics' – understanding and use of third-party relations

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Life in groups structured by social relationships is cognitively challenging. It requires individuals to recognize and remember group members and, possibly, to learn about relationships between them. While some primates have been experimentally shown to understand third-party relationships, little is known about this capacity from other animals. Adopting the playback design used in primates, we here tested captive ravens for their ability to differentiate between simulated dominance interactions that either confirmed or violated the current rank hierarchy of members in their own social group and, critically, also of ravens in a neighboring group with whom they never had any physical interactions. Birds responded with increased stress and activity patterns to playbacks that were incongruent to the dominance hierarchy of their own group and a decrease in vocalization and attention patterns when the incongruent playbacks concerned the neighboring group. These findings indicate that ravens are capable of deducing third-party relations not only via physical interaction with some of the subjects (own group) but also by mere observation (neighboring group). We discuss these skills in respect to challenges imposed by the high degrees of fission-fusion dynamics shown by ravens under field conditions and recent observations on wild ravens selectively interfering in agonistic and affiliative interactions of conspecifics.

(keynote speaker)

Small brains, great minds: cellular scaling rules for bird brains

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Many birds, particularly corvids and parrots, are known to express complex cognitive skills comparable to those observed in primates. In order to examine how these similarities

are reflected at the cellular level we counted, using the isotropic fractionator method, neurons and nonneuronal cells in brains of passerine birds, parrots and representatives of some other bird orders. We show that, in passerines and parrots, neuronal numbers scale almost isometrically with telencephalic size, i.e., the average neuron size shows little increase and neuronal density decreases minimally as brains get larger. Neuronal densities in the passerine telencephalon exceed those observed in the primate cerebral cortex by a factor of 3-6. As a result, the number of telencephalic neurons in corvids and large parrots equals those observed in the cerebral cortex of monkeys. The cerebellum features similar scaling rules. However, because the relative size of the cerebellum is smaller than in mammalian brains, cerebellar neurons make a much smaller proportion of total brain neurons than in mammals. In contrast to the little variation in neuronal densities in telencephalon and cerebellum, the density of neurons rapidly decreases with increasing structure size in the optic tectum. For all examined brain structures, the densities of nonneuronal cells remain constant regardless of structure size, a finding congruent with data from mammals. Our findings strongly suggest that high neuronal numbers and hence high brain's computational capacity underpin the behavioural and cognitive complexity reported in passerine birds and parrots.

(keynote speaker)

Social transmission of tool use and tool manufacture in Goffin Cockatoos (*Cacatua goffini*)

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Tool use can be inherited or acquired as individual innovation or though social learning. The mechanisms of social acquisition of tool use in non-tool using birds are yet largely uncharted. We showed twelve Goffin cockatoos (*Cacatua goffini*) either demonstrations of tool use by a skilled innovator, or 'ghost' controls where either the tool or the food was moved magnetically. Subjects observing demonstrations by a conspecific showed a more enhanced tool-related performance than the ghost controls, with all three males in this group (but not the three females) acquiring tool-using competence. Furthermore, two of these males accomplished tool-manufacture in later transfer tasks. Since the tool handling techniques of successful observers differed substantially from those of the original demonstrator, goal emulation is the most plausible mechanism for the transmission.

(oral presentation)

The importance of key features, colour and size in predator recognition – cage experiments with great tits

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The mechanism of predator categorization has not been understood well yet. For categorization, animals could use the key features of the stimuli (beak, eyes, and claws) or they have a general concept how the predator should look like (colour, size). We examined how key features, coloration pattern and predator size influence categorization by a prey under laboratory conditions. We tested the reaction of great tit (*Parus major*) to the wooden and plush dummies of sparrowhawk (*Accipiter nisus*) with various modifications of its key features, colour and size. The dummy of unmodified sparrowhawk caused intensive stress behaviour (warning calls, knee-bending and raised feathers on head); any modification lowered the fear response (more feeding) and in some cases also increased the interest in the presented dummy (approaching and surveying it). The results of the experiments showed that some key features are more important than other (eye>beak>body); colour is more important for predator recognition than the presence of key features and the importance of coloration may be conditioned by the stimulus size. This implies that predator recognition is based on more complex set of stimulus qualities and not only simple presence or absence of key features. Nevertheless, there is a significant variability in dummies recognition and categorization by individual birds, which could be caused by different characteristics of tested tits, such as personality or experience.

(poster 33)

Personality affects performance in an innovation task in guinea pigs

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Innovativeness is generally useful to adjust flexibly to changes in the environment or novel situations. While on the between species level ecological as well as evolutionary drivers for animal innovation are quite well studied, on the within species level variation in this cognitive trait is less well understood. In this study we investigated whether different personalities in guinea pigs might favor differences in individual levels of innovativeness. We tested 24 guinea pigs for boldness, aggressiveness and sociopositive behaviour and in three novel foraging tasks of increasing difficulty. While boldness and aggressiveness

were not linked to performance in the innovation tasks, those individuals that repeatedly solved the foraging tasks showed lower levels of sociopositive behaviour than their less innovative conspecifics. Given that guinea pigs are highly social, group living animals, more social individuals might rely more on the abilities of conspecifics during foraging while more solitary individuals rely more on their own abilities to discover novel food sources.

(poster 34)

Relationships between emotionality trait and spatial learning strategy in Japanese quail

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Previous investigations pointed out a critical role of stress in facilitating the switch between different memory systems and cognitive strategies. In the present study we tested whether a trait for emotionality can modify the use and selection of different strategies for solving a spatial learning task. To that end, lines of Japanese quail divergently selected for a typical fear response, the duration of tonic immobility, were used. Previous investigations demonstrated that the selection program modified the general underlying emotionality of the birds rather than exerting only effect on tonic immobility. First, lines of quail were trained in a spatial reference memory task where birds had to learn the position of a cup that contained a food reward among 8 identical cups placed in the test arena. Data obtained by the end of training (distance moved to reach the target cup) and during the probe test (time spent in the zone surrounding the target cup) revealed that birds with a high emotionality acquired a more accurate representation of the location of the target cup. Second, quail from both lines were similarly trained for locating a target cup. Nevertheless, to find the food reward animals could either learn the position of the target cup ("spatial strategy") or learn that the rewarded cup was of different colours than other cups ("cue-based strategy"). Results showed that animals with a high emotionality preferentially used a spatial strategy whereas birds with a low emotionality preferentially used a cue-based strategy. These findings thus indicate that high emotionality facilitates spatial memory performances and promotes the selection of a complex spatial strategy. This effect is associated with a higher hippocampal neurogenesis.

(oral presentation)

Does it pay to be flexible? Life history consequences of reversal learning abilities in wild Great tits (*Parus major*)

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Flexibility, the ability to adjust behaviour when environmental conditions change, often appears like an adaptive trait that should be favoured by natural selection. Indeed, using proxies of behavioural flexibility, such has residual brain size and innovation propensity, comparative studies support a positive relationship between flexibility and invasion success in birds and mammals. However, the fitness consequences of direct measurement of cognitive flexibility remain unknown. Reversal learning tasks, in which subjects need to adjust their behaviour to shifts in reward contingencies based on stimulus dimension, is a well established and standard method to measure cognitive flexibility in comparative psychology. Here we used fully automatized and portable operant boxes to record performances of free-ranging Great tits in a colour reversal learning task and subsequently followed-up their reproductive success. Forty-four individuals successfully performed the task. We were able to monitor reproductive success of 14 of these birds. Unexpectedly, we found a strong negative link between reproductive success (number of fledglings) and individual differences in cognitive flexibility, measured by the number of trials required to reach 90% accuracy in the reversal learning task. These results hold when controlling for differences in total time required to perform the task, suggesting that motivation or accessibility to the devices do not drive this effect. Moreover, reversal learning performance cannot be explained by individual differences in personality, dominance or group size. Our results support the idea that under certain environmental circumstances, that remain to be determined, cognitive flexibility may be non-adaptive.

(oral presentation)

Sociality and communicative complexity in Malagasy primates

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The social complexity hypothesis predicts that animals engaging in many and varied social interactions should evolve more diverse signals. However, signal diversity may also be a result of the signalling environment or selection to avoid heterospecific matings. The relative importance of these factors on the evolution of signal diversity in primates is

still poorly understood. Lemurs are an excellent model to study the influence of sociality and ecology on the evolution of signal diversity because they are organized into solitary-, pair-living and group living species, occur in different habitats with different compositions of heterospecific congeners. In addition lemurs produce a variety of signals in the three main sensory modalities: acoustic, visual and olfactory communication. Repertoire sizes of vocal and acoustic signals were available for 25 species and visual signal repertoire size was available for 13 species. Phylogenetic lest-squares regressions revealed that communicative diversity correlates with group size but not ecological factors in all three communicative channels, suggesting that sociality is a prerequisite for the evolution of signal diversity in lemurs.

(oral presentation)

The visual perception of avian predators by three-spined sticklebacks (*Gasterosteus aculeatus*)

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The quantification of anti-predator responses is an important tool in animal behaviour research and is often used in the quantification of animal personalities and in the study of parasite-manipulated host behaviour. The three-spined stickleback (*Gasterosteus aculeatus*) has gained great popularity as a model in the investigation of inter-individual and inter-population differences in behaviour, and is a major model in the study of adaptive parasitic manipulation. However, although many studies have investigated the effects of parasites on antipredator responses, there is little known about which visual cues are used to detect and identify predators, or how they shape subsequent behaviour in this species. The current study is therefore the first to separate the various individual visual cues (i.e. object shape, movement, contrast and size) that are potentially involved in the perception of avian predators in the stickleback, and to investigate them independently. Here we present the results and a framework for future studies examining anti-predator behaviour and behavioural change in parasitized animals.

(oral presentation)

Social learning in nest building zebra finches

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Recent research from our laboratory suggests that decisions made by birds when nest building may be more flexible and experience dependent than is typically thought: male zebra finches learn to prefer a certain colour nest material after they have successfully reared a brood in a nest built with that colour. Moreover, with repeated nest-building experiences male zebra finches learn about the structural efficacy of the material used to build their nest: they prefer one material to a second when the second material requires the male to use twice as many pieces to construct his nest. These studies begin to elucidate the role of individual learning in nest building by birds. To date, however, there has been no investigation (with the exception of nest-site choice) into the role of social learning in nest building. In the current experiment we tested whether zebra finches learn about nest material from conspecifics. Pair-bonded zebra finches (the observers) that were naive with respect to nest building were first assessed for their pre-existing preference for nest building material of one colour or another, after which they observed a second pair (the demonstrators) build a partial nest using the observers' least-preferred colour. To assess whether the social demonstration of nest building with the observers least-preferred colour altered the observers' preference of nest material, we gave the observers a second preference test. In this second preference test we found that some of the observers did, indeed, switch their nest material preference. These data are the first to suggest that naive birds may use social information to choose the material with which they build their nest.

(oral presentation)

Variation in nest composition in blackbirds

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In order to decrease the exposure of their eggs and developing young to predators and climatic extremes, many birds build nests. We know a lot about the reproductive success of many of these nest builders but we know surprisingly little as to the contribution to their reproductive success made by the structure of the nest itself. While there are a few data showing that some aspects of nest structure (e.g. building a dome on a cup nest) may have evolved as an anti-predator response we do not know whether avian nest builders builds their nests in response to local climatic conditions. We, therefore examined

the effects of longitude, temperature and local weather conditions on the nest size, composition and reproductive success of nests of the common blackbird (*Turdus merula*) taken from across the UK. We found that there was considerable variation in the size of nests and in materials used. We also found some weak evidence that the structure varied depending on the local wind conditions but little evidence that other local environmental factors contributed to the observed variation. Perhaps surprisingly, the variation in nest morphology and composition did not seem to impact on nest success. It is not clear, then, whether the variation in nest structure is learned either individually or socially or due to availability of materials.

(oral presentation)

The effect of mothering on judgement bias in Japanese quail

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Behavioral development of animals is strongly influenced by early postnatal conditions. Behavior of mother affects offspring's development with long-term consequences on their social and emotional behavior. In contrast to mammals, in birds the influence of mothers on the socioemotional development of their offspring received little attention. Here, we used a spatial judgement task, in which Japanese quail females were trained to expect food reward in one location and punishment in another, to determine whether artificially raised quail and quail raised by adoptive mother respond differently to ambiguous stimuli of intermediate spatial location. 12 mothered and 12 maternally deprived birds were trained to differentiate positive (dish with mealworms) and negative (empty dish; aversive sound) location in 11 daily sessions each containing presentation of 2 positive and 2 negative stimuli in random order. Mixed model ANOVA proved a significant trial effect ($F(21,378)=3.02$, $p<0.001$) and location effect ($F(1,18)=587.98$, $p<0.001$), but no significant difference in approach times between the treatments (maternal vs. non-maternal). Starting from day 5 (trial 9), the quails discriminated successfully between the rewarded and the unrewarded locations. After the training period hens were subjected to 2 tests in which 3 ambiguous locations, intermediate between the rewarded and the unrewarded locations, were introduced. In the 1st ambiguous stimuli test there were a significant location ($F(4,72)=14.23$, $p<0.001$) and treatment effects ($F(1,18)=5.64$, $p<0.05$), with shorter approach latencies in mothered quail. However, in the 2nd ambiguous stimuli test significant location ($F(4,72)=19.75$, $p<0.001$) but no treatment effect were found. Supported by APVV-0047-10 and VEGA 2/0196/14.

(poster 35)

Social learning in horses

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Social learning is said to meet the demands of complex environments in which individuals compete over resources and co-operate to share resources. Horses (*Equus caballus*) were thought to lack social learning skills because they feed on homogenously distributed resources with few reasons for conflict. However, the horse's social environment is complex, which raises the possibility that its capacity for social transfer of feeding behaviour has been underestimated. We conducted a social learning experiment using 30 socially kept horses of different ages. Five horses, one from each group, were chosen as demonstrators, and the remaining 25 horses were designated observers. Observers from each group were allowed to watch their group demonstrator opening a feeding apparatus. We found that young, low ranking, and more exploratory horses learned by observing older members of their own group, and the older the horse, the more slowly it appeared to learn. Social learning may be an adaptive specialisation to the social environment. Older animals may avoid the potential costs of acquiring complex and potentially disadvantageous feeding behaviours from younger group members. We argue that horses show social learning in the context of their social ecology, and that research procedures must take such contexts into account. Misconceptions about the horse's sociality may have hampered earlier studies.

(oral presentation)

Brain functional asymmetry of domestic cat (*Felis catus*) on example of auditory lateralization

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The aim of this research was to find out if cats evince a brain functional asymmetry in auditory lateralization. We had to check if they react differently while they are hearing various acoustic stimuli. Sounds used were: calling „kitty kitty" (polish: „kici kici"), thunder, barking, meowing of upset cat and meowing of isolated cat. We selected randomly fifteen cats. The experiment took place in home of each cat. We used a wooden pad, cat's bowl, speakers (positioned on both sides of the bowl, in the same distance from it), laptop and a camera. After setting apparatus up, we were filling the bowl, which was on a pad, with cat

food. When a cat started eating, we started playing sounds. After each sound, we waited a few moments for animal reaction and its return to a bowl. The camera recorded cat's reaction and time. According to the assumption, the auditory asymmetry was observed, but only in the case of storm and barking sounds. Cats turn left significantly more often in response to those sounds. The results indicate that the right hemisphere is activated during emotional stimuli processing. Moreover, those sounds are causing longer time of latency between the perception and getting back to the bowl with cat food.

(poster 36)

Tool use and physical cognition in the greater vasa parrot

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Despite being widespread throughout the animal kingdom, the use of tools by nonhuman animals remains a relatively rare occurrence. We present new data on spontaneous tool using behaviour in a group of captive vasa parrots (*Coracopsis vasa*), a species previously unknown to use tools. A follow-up experiment was conducted to further explore the cognitive abilities underlying this species' tool use, in particular to determine whether they attend to the structural properties of the objects they interact with. Birds were presented with sets of novel objects that differed either visually (e.g. red rope vs. blue rope) or visually and structurally (e.g. red rope vs. yellow rope with wire inside) and individual time spent interacting with objects was recorded. When encountering structurally novel objects, subjects spent a greater proportion of time engaged in behaviours that allowed them to experience the structural properties of the object (e.g. biting or picking up). These preliminary results suggest that vasa parrots attend to the structural affordances of objects and alter their behaviour to further explore these properties. This research aims to shed light on some of the cognitive underpinnings of tool use in these birds and ultimately identify the greater vasa parrot as a species of interest for further studies of physical cognition.

(poster 37)

Comparing cognitive performance in qualitative spatial task: Are pigeon smarter than tits?

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Pigeons and great tits were previously tested as the subjects of various quantitative cognitive tasks based on discrimination learning via operant conditioning method, aversion learning or problem solving tasks. Here we present the results of comparative qualitative tests of cognitive performance in birds with different ecology. The performances of the domestic pigeons (granivorous) and the great tits (mainly insectivorous) were compared in spatial task based on abstract visual stimuli presented on a touch screen equipped with transparent wall containing four holes in the corners. The task was tested in two variants: the first one was based on association of shape stimuli with specific position (one of four holes), the second required the use of map-like stimuli denoting the specific hole. Both variants consisted of three phases with increasing difficulty: 1) shape or map-like stimuli were presented behind the correct hole, 2) the stimuli were shifted into the central position of the screen, and 3) the stimuli were further reduced in size and randomly shifted towards the four positions of the holes (never close to the correct one). Out of 12 trained tits and 14 trained pigeons, three tits and three pigeons finally succeeded in stage 2, but both species failed to succeed in stage 3. The only exceptions were two pigeons which passed to the stage 3: one with the map-like stimuli and the other one with the shape stimuli. The results might indicate that there are higher individual differences in performance in each phase of spatial cognitive task than differences between map-like vs. shape stimuli in both species. Although spatial memory of pigeons and great tits showed similar pattern, the tits completely failed when solving the most difficult stage of the task.

(oral presentation)

Personality influences individual cognitive abilities: overview of a series of experiments on horses

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A series of seven independent studies conducted on horses investigated whether the

interindividual variability observed in performances and processes involved during learning could be linked to differences in personality/temperament. For each study, the animals underwent a series of behavioural tests to assess five independent dimensions of their personality (fearfulness, gregariousness, locomotive activity, sensory sensitivity, reactivity to humans) followed by tests on instrumental learning. In all the studies, the dimension of fear was systematically correlated with learning performance. However, the way it was correlated depended on the stressfulness of the learning condition. Thus, if the subject was under stress at the time of learning, but this stress was unrelated to the learning situation itself (i.e. the horse was stressed prior to learning), fearful individuals were always disadvantaged. Nevertheless, being fearful was not always detrimental. When no additional stress factors were involved, fearful individuals showed improved memory performance regarding work, suggesting an enhanced state of alertness. Fearful subjects also performed better when the stress was induced by the task itself (e.g. using negative reinforcement). Regarding the processes involved, fearful individuals proved to be systematically more resistant to extinction and developed preferentially automatic actions at the expense of more cognitive strategies (as suggested by their responses in contingency degradation paradigm), suggesting less behavioural flexibility. The four other dimensions were also found to influence cognitive abilities, but this influence is weaker and more specific to the learning task.

(poster 38)

Food sharing and socio-positive behaviors as indicators of social bonding origin in young cockatiels (*Nymphicus hollandicus*)

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Food-sharing occurs largely in birds, especially during courtship and parental care. This behavior has been the subject of much attention because of its apparent altruistic nature and its possible impact on the evolution of complex cognition in human and non-human primates. One of the functions of food-sharing may be to build and strengthen bonds between kin and non-kin individuals. Birds such as psittacids and corvids usually form pair-bonds for life so choosing a reliable partner as a mate is crucial. It has been shown in previous studies with young jackdaws (*Corvus monedula*) that food–sharing strongly correlates with other socio-positive behaviors, peaks in the 2-month period post-fledging and decreases by the time that individuals form exclusive relations with one affiliative partner. In this research, we extend the von Bayern et al (2007) study using this time a group of immature cockatiels (*Nymphicus hollandicus*) including 5 siblings and 5 non-apparented birds in order to determine if we could replicate these findings and better

explain the function of food sharing and its consequences in affiliative partners choices. This will also allow a comparison of food-sharing in corvids and psittacids, the two most cognitive-advanced bird families. Our first results show that cockatiels frequently share temporary available food but, contrary to jackdaws, there is no begging, no sollicitation postures nor food-offer display, and that cockatiels are more encline to share food with siblings than with other conspecifics. Food-sharing seems also to correlate positively with socio-positive behaviors such as allopreening and seeking proximity, but also with dominance status. Less dominant birds avoid contacts and also food sharing with conspecifics.

(poster 39)

Interspecies prosociality determines the ability of African grey parrots to imitate human speech

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The ability of grey parrots (*Psittacus erithacus*) to acquire labels from the human speech and use it in specific meaningful ways (Pepperberg 1999, The Alex Studies, HUP), demonstrates their high cognitive and communicative skills, which have been explained by the social brain hypothesis predicting higher cognition in species with complex sociality. However, "language" skills differ profoundly between individuals and laboratories. We explored the hypothesis that label production of the grey parrots depends on characteristics of their extraspecific (human) social group and on the quality of the parrot-human bond, using owners of pet grey parrots as respondents for a questionnaire study. We collected data from 27 pet owners (3 men, age 22-72, mean 41). Their parrots (age 0.5-11 yrs) imitated 0-259 words. We found a linear increase of imitated labels with age (Tau=.33, p=.029). Among many tested predictors of parrots "language skills", the strongest were the desire to form an emotional bond with the bird and gain a new friend which have had motivated the purchase of the bird (partial Tau .78 and .93, p=.023 and .001, respectively). Label production was also higher in parrots whose owners had been interested in this species and had not expected problems or danger connected with physical contact before purchase (.75 and -.76, p=.032 and .028, respectively). Finally, owners scoring higher on Agreeableness and Extraversion had better "speaking" parrots (.70 and .66, p=.055 and .072, respectively). In our previous study, higher Agreeableness and Extraversion of student trainers equally lead to a higher label production in our laboratory kept parrots. Our study confirms the long suspected proposition that interspecific social bond is a key factor in interspecies communication.

(oral presentation)

Sex differences in reversal learning in guppies

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Behavioural flexibility allows individuals to modify their behaviour in response to environmental changes. Research in primates, rodents and domestic chicks suggests greater behavioural flexibility in females than in males, a difference that appears to be related to androgens. We investigated sex differences in behavioural flexibility in fish by comparing male and female guppies (*Poecilia reticulata*) in a reversal learning task. When trained on a colour discrimination, both males and females learned rapidly the task. However, once the reward contingency was reversed, females were more effective in inhibiting previously learned response, reaching learning criterion twice as fast as males. When inversion of contingency was repeated, males gradually reduced the number of errors in successive reversals and the two sexes had a similar performance after four reversals. Our results suggest that, as in the other vertebrates studied so far, female guppies possess a greater behavioural flexibility than male guppies.

(poster 40)

Object permanence in two species of tits: Is the mental representation required?

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Object permanence (OP) is a cognitive ability that enables animals to mentally represent the existence and the location of hidden objects. In humans, OP develops in six stages, in which the understanding of relationships between objects in space and time changes. Current research shows that primates, some carnivores, and several species of birds also acquire various degrees of this ability depending on their social life and foraging strategies. Our aim is to test two species of the Paridae family, food-storing coal tit (*Periparus ater,* N=19) and non-storing great tit (*Parus major*, N=8) to find out, which stage they can achieve and whether there is a difference between these species in relation to their caching ability. We want to compare the performance of wild-caught (7) and hand-reared (12) coal tits and examine possible role of neophobia in the OP test. We adapted Uzgiris-Hunt´s Scale 1 tasks for tits, thus most of the visible object displacements were realized by pulling a string. Preliminary results suggest no difference between hand-reared coal and great tits in searching for partially hidden objects (task 3), but most of the wild-caught

coal tits failed this task probably because of the neophobia. Furthermore, coal tits showed better performance than great tits in task 4 (fully hidden object). Most of the coal tits but only one great tit continued to the task 5 (two hiding places). Our results suggest that tits can solve the problems with simple hidden objects, although the success rate is variable. They can probably achieve the stage 4 (representing fully hidden objects), but most of them can´t solve task 5 and task 6 (three screens used), responding to the stage 5.

(poster 41)

Technical problem-solving, tool-use and insight in Common Ravens (*Corvus corax*) and Carrion Crows (*Corvus corone*)

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Technical problem-solving and innovative tool-use are often regarded as indicators of advanced intelligence because they suggest insight and causal reasoning abilities. We investigated if Common Ravens and Carrion Crows, two species that do not habitually use tools in the wild, innovatively use stone tools in a technical problem-solving task. It was also tested how different kinds of pre-experience with the functional properties of the apparatus affected the birds' performance. The experiment further addressed whether understanding of causality in the physical domain is a specific adaptation of tool-using species.
Firstly, we tested if the birds spontaneously drop stones through a tube into a transparent box to collapse a platform to get a reward. Secondly, the unsuccessful birds got the chance to explore the functional properties of the box. They could collapse the platform either by directly pushing it down with their beak from above or by pulling it down with a string from below. Thirdly, the birds were again tested with the stones. We could show that 4 out of 8 crows and 1 out of 10 ravens used stone tools, without having ever applied tools in experiments before. The remaining crows used both the pushing and the pulling experience to make a transfer to using the stones, implying that they have an understanding about the mechanism of the box. In contrast, none of the remaining ravens solved any further tasks. Successful birds also made a transfer to using sticks for collapsing the platform. The results indicate that ravens and crows can spontaneously use tools and have some understanding about the causalities of the task. This throws a new light on technical problem-solving abilities and tool-using capacities of bird species that do not use tools in the wild.

(oral presentation)

Dogs solve the support problem based on perceptual cues

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Early data suggested that dogs perform comparably poorly in physical cognition tasks. A recent study (Range et al. 2011, Anim. Cogn. 14: 575ff) challenged this view and suggested that dogs can spontaneously solve the "On/Off" task, a two-choice task in which a reward is placed out of reach on an accessible board and a second reward is placed next to another, parallel board. Here, we build on this work and explore which strategies dogs use to solve the support problem. We first replicated the "On/Off" condition of the previous study and then presented dogs that had reached a predefined learning criterion with three transfer tasks, the conditions "Contact" (the inaccessible reward is touching the second board but is not supported by it), "Perceptual Containment" (the inaccessible reward is surrounded but not supported by the second board) and "Gap" (the inaccessible reward is placed on a discontinuous board). Contrary to the findings of Range et al., our sample of 37 Border Collies did not perform above chance level in their first test session of the "On/Off" condition. From the third session onwards, however, group-level performance was above chance level, and thirteen subjects passed the learning criterion within a maximum of six sessions (60 trials). They, as a group, subsequently also performed above chance level in the "Contact" condition. In the "Perceptual Containment" condition, group performance initially dropped back to chance level before increasing again significantly across trials, whereas in the "Gap" condition, group performance remained below chance level throughout. These data suggest that dogs attend to visual cues when learning to solve the support problem, and do so without acquiring a full understanding of its causal underpinnings.

(poster 42)

Emotion recognition in laboratory beagles: an eye-tracking study

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Recent studies have shown that dogs are able to discriminate human facial expressions, in particular smiling and blank faces (Nagasawa et al. 2011, Anim. Cogn. 14: 525ff). However, it remains unclear whether dogs recognize emotions in human facial expressions, and

if so, whether this ability is acquired through experience or a result of selection during domestication. Here, we investigated whether dogs with limited exposure to humans respond differently to human faces showing different emotional expressions. For this purpose, we tested eight laboratory beagles that lived in packs with only occasional contact with dog keepers. These dogs were presented repeatedly with photographs of familiar and unfamiliar human emotional faces. In five sessions, neutral, happy, sad and angry faces were projected in life size onto a screen, with four repetitions per stimulus in each session. We used the eye tracking system Eyelink1000 (SR Research), to determine the dogs' face processing patterns. In addition, we recorded behavioural and physiological responses of the dogs to the stimuli (e.g. body posture and heart rate variability). Analysis of the physiological and behavioural data is still pending. For the eye tracking data, generalized linear mixed models revealed no significant effects of familiarity and emotion on fixation counts or durations and the probability of looking at particular regions of interest (e.g. eye, mouth or forehead, all $p > 0.2$). However, for the last variable, there were significant session effects. These data suggest that these laboratory dogs might not process human emotional facial expressions differently. A comparison with pet dogs will reveal whether this effect is due to their limited experience with humans.

(poster 43)

No training, just evolution: spontaneous response to structural changes in duets by Common ravens (*Corvus corax*)

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Comparative animal communication research is one of the main methods employed to understand the evolution of language. Equivalents to semantics of speech have been studied in many non-human animals, usually using playback experiments in ecologically relevant situations (e.g. referential alarm calls). Such studies do not require training and already indicate for what a cognitive capacity might have evolved. In contrast, non-human syntax has mainly been investigated with operant go-no-go tasks without any connection to a species' ecology. In order to test syntactic capacities with methods of behavioural ecology, a setup is needed, in which animals are sensitive to changes in the structure of otherwise unchanged elements. We addressed this issue in Common ravens. Adults of this species form breeding pairs and produce duets for territory defence. Pairs with a higher synchrony in their calling behaviour have a higher reproductive success; hence the duet structure may convey ecologically relevant information for rivals. In this study we habituated captive, territorial raven pairs to playbacks of duets of unknown conspecifics and subsequently tested them with duets of different structures. Ravens spent more time looking towards the loudspeaker if the duets followed a new rule; yet they did not respond to ungrammatical extensions. Males looked longer than females, but neither sex

differed in their agitation between tests and controls. The spontaneous discrimination confirms that ravens pay attention to the structure of duets. The sex difference further suggests that the composition of duets indeed carries ecological relevance. As with syntax in language, the reassembly of a finite set of elements appeared to convey additional information without a drastic contextual change.

(oral presentation)

The larger shall be on the right side. Domestic chicks are better at identifying larger sets when these are located to the right side

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Humans orient numbers from left (small values) to right (large values). This peculiarity may develop early in life as a predisposition to relate number to space is in place before the acquisition of language (deHevia et al., 2008). Bird species also exhibit a disposition to map numerical magnitudes from left to right (Rugani et al. 2007, 2011). In animal models the leftward bias at locating objects or numerical positions could depend on a more general bias in the allocation of attention under the control of the right hemisphere. Here we report evidence for an advantage at processing larger numerosities when these are presented in the right hemispace, not explained as by product of a selective left-sided attentional bias. Newborn domestic chicks were imprinted on a set of identical objects and on day 4 underwent a free-choice test in which two sets composed of different numerousness (e.g., 5 vs.10 objects) were hidden behind two different screens, one on the left and the other on the right side with respect to the subject. The position of the larger set was randomized between trials. We know that chicks are motivated to rejoin the higher number of social companions, displaying a significant preference to inspect the screen occluding the larger set, regardless of its left-right position (Rugani et al., 2009, 2013). Results show that chicks, when rejoining the set with the higher number of social companions, performed better when this was located to their right side. These data suggest that a disposition to map the numerical magnitude from left to right may originate from a pre-linguistic precursor.

(poster 44)

How you shouldn't try to teach match-to-sample to a raven (*Corvus corax*).

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The matching-to-sample (MTS) and non-matching-to-sample (NMTS) tasks are used to study conditional discrimination and concept manipulation in human and non-human species, especially birds. We know that most of the bird species tested so far show no manipulation of the concept of similar or different to solve these tasks and respond to them with simple associative learning. Nevertheless, corvids have been shown to successfully complete these tasks and therefore we can expect ravens to understand the general rules of going for similar or different. Although common ravens are known for their intelligence, and maybe because of it, they're also easily bored and extremely hard to keep motivated. Therefore we chose to use complex objects besides the usual food reward, to keep them focused and keen to participate. Surprisingly, our subjects did not manage to reach a significant rate of correct answers, and even though they showed no sign of learning, we found a difference of results depending on the test they were doing, and they appear to develop object preferences during the experiment. This natural tendency to go for NMTS and their growing penchant to go preferentially to certain objects shows that the physical access to them appears more rewarding by itself than the food rewarded for the correct choice. Future studies should take this into account when planning their design and, for example, use the objects as rewards by giving the birds the opportunity to manipulate them and play with them. These unexpected results show underestimated difficulties in understanding the priorities of ravens. Additional studies that build upon these promising findings may give insight in the understanding of motivational structures of ravens.

(poster 45)

Experimental assessment of social interaction in two species of the genus Teratoscincus (Gekkota)

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We tested the social interaction in two species of geckos of the genus *Teratoscincus*, specifically *Teratoscincus scincus* and *Teratoscincus keyserlingii* (further referred to as Ts and Tk). Both species are monomorphic, long-lived and probably territorial. Therefore, we predicted that they are monogamous or slightly polygynous lizards and adults tolerate offspring within their home range for a determinate period of time. Thus, they provide indirect form of parental care. We attempted to clarify this phenomenon by using

several sub-experiments in the lab, which were focused on agonistic behavior (within sex interactions, simulation of predator) and the behavior of adults towards immature geckos in their home terrariums. We found that adults of both species and sex exhibit a higher level of agonistic behavior, which may be related to territoriality and monogamous social system. Females are more tolerant to each other, males not. Apparently more females can live together in the territory of one male. The difference between species is in the choice of defensive strategy (Tk: attack, p=0.01; Ts: escaped, p=0.0002). We used two categories of immature geckos–juveniles and subadults in the second part of experiment. Other species of gecko, Eublepharis macularius were tested as a control. If adults were interested of stimulus, they have earlier noticed conspecifics immature geckos (p=0.002). Nevertheless, they are tolerant to other immature geckos in their territory. We observed marking of terrarium and second individual in both experiments. This behavior also indicates that they are territorial lizards. Thus, discrimination between familiar and unfamiliar conspecifics is important for these desert geckos. The findings suggest that our prediction could be correct.

(poster 46)

Predator recognition by red-backed shrikes – importance of predator colour, size and presence of key features

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Red-backed shrikes (*Lanius colurio*) show vigorous behaviour during the nest defence; therefore, their ability to recognize novel artificial stimuli as predators can be easily measured. Very different behaviour in presence of a sparrowhawk (*Accipiter nisus,* common predator of adults) and kestrel (*Falco tinnunculus*, scarce predator of shrikes) suggest the ability of shrikes to 1) adjust their behaviour to the actual peril and 2) use details in colouration of the predator for the recognition. Similarly, low mobbing towards bigger corvid species, contrasting to vigorous mobbing towards smaller corvids, suggests the size of the predator to play important role in recognition as well. The importance of both these parameters together with the identity of some typical features of a raptor (beak, eye, claws) in predator recognition was tested by means of presenting textile dummies at shrikes' nests. Firstly, the applicability of dummies made from textile was justified (it was not in case of plastic dummies). The higher importance of the typical (key) features of a raptor was shown to be higher than the colouration of the body. All dummies equipped with pigeon key features were treated as a pigeon by shrikes. Dummies equipped with raptor key features were recognized as a predator only in case their body colouration was not altered substantially. Additionally, the effect of the body size was shown to be significant as well, artificially enlarged jays (*Garrulus glandarius*) were attacked less, and carrion crows (*Corvus corone*) with reduced body size were attacked more than their naturally sized counterparts.

(oral presentation)

What's so special about dog's responsiveness to human beings?

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Much research in recent decades on the peculiar responsiveness of dogs to human beings has focused on the possibility that dogs evolved special skills in reading human behavior during the period of domestication – the "domestication hypothesis." I shall review evidence for this hypothesis and find it wanting. I consider experiments on wolves and dogs responding to human gestures indicating the location of food, and experiments in which wolves and dogs respond to indicators of human visual attention. The behavior of both wolves and dogs towards people in these tasks can be explained by the same basic behavioral principles that account for the behavior of other species: social imprinting and conditioning to human actions that predict desirable consequences. To understand what makes dogs dogs we need to look to their behavioral development and hypersociality.

(oral presentation)

Brain functional asymmetry of domestic dog (*Canis familiaris*) on example of motor lateralization

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Motor lateralization is defined as a preference to use one side of the body in tasks requiring motor function. According to many authors, this type of lateralization probably applies to all vertebrates, as well as many species of invertebrates. Hemispheric asymmetry at the level of behavior has been demonstrated also in dogs. Our research aimed to verify whether dogs evince motor lateralization in the performance of more complex tasks, and whether there are gender differences. The aim of our research was also to check whether there is a relationship between the strength of paw's lateralization and the time of completing the task. We tested 26 dogs, 11 males and 15 females with problem boxes, specially constructed for this purpose. The results provided evidence of the existence of motor lateralization in dogs in a task requiring complex activity. What is more, there are differences in its intensity at the individual level. Gender differences were also revealed in this regard. We did not find relation between degree of lateralization and the time of completing the task by a dog, so this result opens the way for further exploration.

(poster 47)

Environmental influences on avian vocal behaviour

Environmental and genetic control of song learning in songbirds

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Environmental factors influence physiology and behaviour of an individual to a varying degree depending at which life history stage they are experienced. For example, birds are able to integrate different environmental cues in order to time reproductive behaviour. Therefore, it is vital to determine the extent to which behavioural plasticity is attributable to genetic variation or environmental conditions. We first found evidence in domesticated canaries that the social environment as represented by either the quality of a tutors' song or the duration of tutor availability has the potential to influence the song output in the offspring to a varying degree. Second, our experiments in zebra finches showed that both song and the underlying neuroanatomy have low levels of heritability whereas the interaction of genotype-by-environment was important for brain development which could be a mechanism to maintain additive genetic variation. These results demonstrate the significant importance of environmental conditions for song learning and brain development in songbirds.

(keynote speaker)

One species, two songs? Response to song in physically and acoustically varied environments

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Avian acoustic communication is crucial to territory defence and mate attraction in many species. Over the last 10 years signals of a growing number of avian, and other, species have been shown to have different characteristics in noisy urban areas compared with quieter rural areas. However, less is known about how differences affect signalling efficiency: how are signals interpreted by receivers? Here we present findings on how males and females respond to song from different acoustic environments. We also present data on the transmission of song in these environments and the extent to which degradation is associated with response, emphasising the importance of differentiating

between physical and acoustic features of environments. Implications for conservation planning and key future questions will be discussed.

(keynote speaker)

Mosaic of Yellowhammer dialects: what influences the distribution of dialects in the landscape?

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Intraspecific geographic variation in bird vocalization has often the form of dialects, with sharp boundaries between populations of individuals sharing particular song form. Research of distribution and origin of dialects may improve our understanding of processes such as cultural evolution, dispersal patterns, gene flow and emergence of reproductive barriers, and adaptation to habitats. We focus on dialect variation of the Yellowhammer (*Emberiza citrinella*), a common European songbird species with a simple song and easily recognizable dialects. Thanks to a successful citizen science project Dialects of Czech Yellowhammers, we obtained detailed data about distribution of dialects across the Czech Republic; this is complex and mosaic-like as in several other European regions so far studied in detail. However, factors responsible for this geographic distribution still remain unknown. Distinction between local and foreign dialect allows recognition of local and alien males, and thus might influence male territorial behaviour or female choice. Alternatively, social interactions might play minor role, and the dialect distribution may primarily result from fragmentation of suitable environments in the present-day landscape or in the recent past. To test some of these hypotheses, we collect Yellowhammer song recordings and information about habitat distribution at transects across dialect boundaries in the Czech Republic, and test responses of territorial males to their own and foreign dialects by playback experiments. Detailed data collected within the project Dialects of Czech Yelowhammers are used for selection of suitable field sites and preparing playback recordings. In the poster, we introduce preliminary results from the first season of this research.

(poster 48)

Spreading of information in a network of interacting neighbours

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Dispersed individuals can coordinate the onset of life history events, like reproduction or migration, on a large (population) spatial scale. However, the mechanism of this synchronisation has not yet been identified. In many species signals produced by one individual stimulate signalling activity of its immediate neighbours. I propose that such local focuses of signalling could transform into waves propagating in space. This hypothesis predicts that signalling self-organizes into bursts, because neighbours tend to enter activity and refractory periods together. Temporal characteristics of such pulses should be more similar in locations close in space than in distant ones. Finally, denser populations should produce relatively more complex wave patterns, since the number of propagating waves is proportional to the number of individuals. These predictions were tested in an analysis of time series of numbers of territorial songs in chaffinches, *Fringilla coelebs*, and the results supported the hypothesis. Time series of singing activity had memory of their past states: they were autoregressive processes with reddened spectra. The degree of similarity in two synchronously sampled time series, measured as a Euclidean distance between their spectra, decreased with the increasing physical distance of sampling spots and the number of signalling males. It is concluded that networks of interacting neighbours may integrate populations synchronising life cycles of dispersed individuals.

(oral presentation)

Female maternal investment in response to attractive male songs under urban noise conditions in domestic canaries *Serinus canaria*

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In passerines male song stimulates female reproduction and females are known to adjust their maternal investment according to song quality. Female domestic canaries prefer male songs with a wide frequency bandwidth and a high-repetition syllable rate emitted at low frequencies (1-5 kHz) and increase their maternal investment in eggs when stimulated with these highly attractive songs. We previously found that low frequency urban noise decreases female sexual responsiveness for low frequency songs through auditory

masking. We predicted that urban noise exposure will equally affect female maternal investment. Using a cross-over design we broadcast low frequency songs to females either in an overlapping noise condition or in an alternating one. Females decreased both their sexual responsiveness and their clutch size in the overlapping noise condition relative to the alternative noise treatment. No differences were found concerning egg size or egg composition (yolk and albumen mass, testosterone concentration). Our results are in line with previous results from the field indicating that urban noise decreases reproductive success and suggest that this could be achieved through auditory masking, highlighting one possible proximal mechanism leading to the reduction of clutch size.

(oral presentation)

Factors affecting begging calls in Tengmalm's owl (*Aegolius funereus*) fledglings during post-fledging dependence period: scramble competition or honest signalling of need?

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Begging behaviour of nestlings has been intensively studied for several decades as a key component of parent-offspring conflict. There are essentially two main theories to account for intensity of food solicitation among offspring: that intensity of begging is related to some form of scramble competition between nest mates or that it offers honest signalling of need to parents. The vast majority of studies which have addressed begging behaviour have been based on observations of, and experiments on, nestlings and have not considered begging behaviour, during the post-fledging period. Begging vocalizations in this post-fledging phase of dependence have rarely been studied, despite the importance of vocalizations as a communication method between offspring and parents, particularly for nocturnal species. We radiotracked 39 fledglings of the Tengmalm's owl (*Aegolius funereus*) in two years with different availability of prey: 2010 (n = 29 fledglings) and 2011 (n = 10 fledglings) and made 1320 nightly localizations in which we recorded presence or absence of begging calls. Within years, the most important measures related to the probability of vocalization were body condition at fledging, time of night, number of surviving siblings, age and weather conditions. Begging intensity increased with age in both years; however, in the year with low prey availability fledglings vocalized significantly more often. The main factor causing these differences between years was probably the different availability of prey, affecting breeding success, post-fledging behaviour, and thus also both short- and long-term needs of offspring. We believe that our results suggest honest signalling of their fledgling's need.

(poster 49)

Flight initiation distance and habituation to humans in urban and rural house sparrows

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Wild animals living in anthropogenic habitats need to adapt to the risks and stress caused by proximity to humans. In our research we studied how house sparrows (*Passer domesticus*) from differently urbanized habitats tolerate human disturbance. On the one hand, we measured flight initiation distance from humans in 15 wild populations of sparrows from differently urbanized habitats. On the other hand, we captured individuals from these populations and observed how fast they habituated to repeated human disturbance, i.e. how the time spent behind a shelter decreased following repeated approaches by a human. We found that, as expected, birds from more urbanized habitats have shorter flight initiation distance. In captivity, there was no difference in the time spent behind the shelter between urban and rural birds during the first observation; and while both urban and rural sparrows showed habituation, it was faster in urban birds. Our results support the idea that urban animals are more tolerant towards humans than their rural conspecifics. Behavioral flexibility and/or higher stress tolerance can help animals to cope with anthropogenic environment and exploit urban habitats.

(oral presentation)

Maternal effects and behaviour in birds

Non-genetic inheritance in birds: transmission of behaviour from mother to offspring

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Individual phenotypic variability, first considered as background noise, now appears to play a fundamental role in evolutionary processes and adaptation of species to their environment. The individual's phenotype is the result of both its own genetic factors and environmental influences. Recent evidence points that environmental influences could imply non-genetic inheritance processes, defined as the transmission to offspring of components of the parental phenotype or environment involving factors other than DNA sequences. In mammals and birds, many studies have focused on the role of maternal effects on this non-genetic inheritance. Indeed, we know that mammalian mothers can influence the general development of their offspring both before and after birth. So, for example, prenatal maternal stress or maternal deprivation during early postnatal life affect many young primates' and rodents' behavioural traits including emotive and social behaviour, cognitive abilities, sexual and maternal behaviour In addition, maternal effects have recently been evidenced in avian species thus opening new possibilities to develop our knowledge of non-genetic inheritance mechanisms. Here, we propose to review the literature on prenatal and postnatal maternal effects on bird behavioral development and to detail recent research that opens new perspectives concerning mechanisms involved in non-genetic inheritance.

(keynote speaker)

Good mums, bad mums: what maintains variation in maternal investment in wild bird populations?

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Maternally-derived hormones are important mediators of prenatal maternal effects in animals. Although many experimental studies have demonstrated their potency in shaping offspring phenotypes, we still know remarkably little about their adaptive value, and the mechanism that contribute to the maintenance of variation in maternal hormone

transfer in the wild. I will present a series of studies based on long-term population monitoring, experimental manipulations and comparative analyses in which I addressed these questions in different bird systems. Our results show that natural selection acts in surprising ways on maternal yolk hormone deposition, and that (physiological) constraints limit the mother's ability to allocate egg resources optimally. Furthermore, I explore what role sex-specific selection plays in determining which sex is more sensitive to maternal yolk hormones across species. Together, these studies provide novel insights into the evolution and evolutionary consequences of hormone-mediated maternal effects in birds.

(keynote speaker)

Effects of exogenously and genetically manipulated yolk testosterone content on early behavior of Japanese quail

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Avian mothers may modify the behavioural phenotype of their offspring and facilitate its adaptation to post-hatching environment through deposition of different amounts of yolk hormones in their eggs. In the present study, we analysed behavioural differences between high (HET) and low (LET) egg testosterone (T) lines of Japanese and the effects of genotype-maternal T interaction on behaviour of the LET and HET quail exposed to experimentally increased yolk T levels. Prior to the incubation, eggs of both lines were injected either with T (50 ng per 20 µl of olive oil) or olive oil. Behaviour of chicks hatched from these eggs was quantified in an open–field, tonic immobility and runway tests during the second week of age. We did not find differences between chicks of the LET line and HET line in both the open–field and tonic immobility tests and experimentally increased yolk T did not affect behavioural measures in these tests. In the runway test, HET quail showed shorter latency to enter the close area and spent more time in this area close to their social group mates as compared with LET quail indicating enhanced social motivation. Conversely, an exposure to exogenously increased yolk T levels decreased sociability of HET chicks, while no effects were recorded in the LET line. Our results demonstrated that selection for high yolk T levels in Japanese quail positively influenced socially motivated behaviour of chicks during the early postnatal period. Moreover, we found that T mediated maternal effects on behaviour may differ regarding the individual genotype. This study was supported by the grants APVV 0047-10, VEGA 2/0196/14 and VEGA 1/0686/12.

(poster 50)

Transgenerational effects of the social environment on endocrine profiles and behaviour in Japanese quail (*Coturnix c. japonica*)

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The social environment is known to influence an individual's behaviour and physiology. In birds, independant studies have shown that social density affects both circulating hormones in breeding females and hormone deposition to the yolk. Yolk hormones influence the development of the offspring and represent an important pathway through which maternal effects are established, potentially preparing the offspring for the environment it is born in. In this project we combined the above aspects to further explore in which way the social environment influences hormone mediated maternal effects and offspring phenotype across several generations of Japanese quail (*Coturnix c. japonica*). The experiment followed four generations to test the scope of grand-/maternal effects and investigate whether the offspring was adjusted to the maternal environment. The two treatment groups in the parental generation consisted of one female and one male (pair treatment) or three females and one male (group treatment) housed together. The F1 offspring generation was housed under social conditions that either matched or differed from the maternal treatment, while birds in the F2 and F3 generation were all kept in groups. In each generation we performed behavioural (e.g., emergence test, tonic immobility) and physiological (e.g., stress protocol, yolk hormones, fecundity) tests to correlate endocrine and behavioural profiles between mothers and daughters. Here we would like to present our first results on the effects of differing social experiences and whether mothers indeed prepare their offspring for the future environment.

(oral presentation)

Effects of exogenously and genetically manipulated yolk testosterone content on immune system of Japanese quail

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Maternal testosterone (T) can modify a wide scale of phenotypic characteristics of offspring. These phenotypic changes should help offspring to prepare for environmental conditions experienced by the female during egg formation. Effects of maternal T on the immune system of offspring are still unclear. Direct administration of exogenous androgens

into the egg yolk represents the most common experimental approach used in this field. In our laboratory, we created a unique model of Japanese quail selected for high (HET) and low (LET) egg testosterone content and these lines enable us to study effects of acutely changed levels of T in eggs with clearly defined maternal T concentrations determined by genetic background. In order to analyse effects of an acute maternal T increase on the immune system in the LET and HET lines we injected either 50 ng of T or only olive oil into eggs of both lines. In offspring hatched from these eggs we tested cell-mediated immunity after subcutaneous phytohemagglutinine (PHA) administration as well as acute phase response and antibody production after intraperitoneal lipopolysaccharide (LPS) injection in order to test various parts of immune defences. The genetic selection alone did not influence any observed parameter of the immune response. However, we found significant effect of an interaction between genetic line and T treatment. Egg T treatment increased He/Ly ratio in response to LPS in the LET line, while it has no effect in the HET line. Furthermore, exogenous testosterone injection decreased weight of bursa of Fabricius. Our results imply that the acute raise of maternal T can manifest differently in offspring with different genetic background defining maternal T deposition. Study was supported by APVV 0047-10 and VEGA 1/0686/12.

(poster 51)

Maternal behavior of native tabunny Kazakh horse

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In all mammals between mother and cub usually exists a close relationship. The great interest represents maternal behavior of the Kazakh mares. We made observation (timing) in herds of farm called “Kulandy” on Aral-Caspian lowland, of the behavior of mares during the prenatal period, at childbirth and after it. Timing was performed in bright moonlit nights of spring period (April-May months of 1995, 1998, 2003, 2006 and 2012). There is a direct relationship between the duration of the first portions of colostrum consumption (in the first 1-3 days) and survival of newborns (0,778 ± 0,064). To number of the main signs of selection choice on the maternal instincts, including expressiveness of a maternal instinct, we entered: the duration of licking mother of foal right after birth, the total duration of sucking udder (including unsuccessful attempts) by foal on the third day, milkiness of mares, and live weight of a foal on the 65th day after birth. Positive correlation occurred between all four features characterizing the maternal instincts and productive qualities of the animal, contributing to the growth of the young. Feature of a maternal instinct to the foal, expressed in licking duration, has positive correlation with growth of the live weight (0,534±0,130) that finally promotes survival of young growth (0,650±0,159). The highest correlation concerning behavioral signs is noted between a maternal instinct of a licking and behavior of a foal expressed in the general duration of

sucking an udder (0,627±0,012). Established the high degree of dependence of mare's milkiness with live weight of a foal, (0,711±0,141), which is quite logical.

(poster 52)

Genetic and experimentally-driven variability of yolk testosterone levels in Japanese quail

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Maternal testosterone (T) in the egg is attributed to modify phenotypic development of an avian embryo and promote its adaptation to posthatching environment. Yolk T concentrations can vary according to both genetic and environmental variations but it is not known whether there is an interaction between the genetic and environmental component that can result in differential maternal effects. To examine this interaction we used two lines of Japanese quail divergently selected for high (the HET line) and low (the LET line) egg T content. First, we analysed an endogenous capacity of females from both lines to adjust yolk T deposition in response to changes of external factors by a manipulation of their social and physical environment. Second, we directly injected exogenous T into the eggs of both lines and investigated effects of experimentally increased yolk T levels on growth, immunological measurements and behaviour of quail until the age of 4 weeks. We found that changes in social environment influenced deposition of yolk T into the egg and an extent of this yolk T variation is line-dependent. Moreover an exposure to experimentally increased yolk T levels influenced growth and some aspects of immune response and behaviour of quail although these effects did not parallel line differences in these traits. Thus, our data indicate that consequences of environmentally driven plasticity of yolk T deposition on offspring phenotype can be differentially manifested in the context of genetically determined yolk T concentrations. Supported by grants APVV 0047-10 and VEGA 1/0686/12.

(oral presentation)

Sexual dimorphism in egg and hatchling size in Northern Lapwing (*Vanellus vanellus*)

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In sexually size dimorphic birds with polygynous breeding system, where the fitness return from male and female offspring differs, female may advantage offspring of the more beneficial sex according to the sex allocation theory. Females may affect performance of sons and daughters by differential allocation of resources to the eggs depending on their sex. Egg size is considered a reliable predictor of maternal investition in egg and consequently in Chick size at hatching. Larger chicks have an advantage over conspecifics especially because they should have higher amount of nutrients available. Here, we analyzed egg size variability in relation to embryo sex and sex specific size dimorphism in Northern lapwing (*Vanellus vanellus*) hatchlings. In lapwings males are the larger sex and are expected to have higher nutritional requirements for maintenance and growth. We predict males' chicks to be heavier/larger at the time of hatching and we suggest them to hatch from larger eggs. We will present results biased on two years (2013, 2014) study of South Bohemian population of Northern Lapwing.

(poster 53)

Social effects of parental care: chicks' expectation is influenced by provisioning experiences

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Males and females can often increase their reproductive success differently and this leads to the evolution of distinctive sex roles. Parental care, both as a consequence of and a further drive behind this difference, is a key sex role component. We experimentally investigated whether parental sex roles experienced within the family affect the chicks' provisioning expectations in the biparental zebra finch (*Taeniopygia guttata*). In a split-family design, half of the chicks were allowed to be provisioned by only their mother, and the other half provisioned only by their father. Families were split from day 8 of the oldest chick until independence, whereas in control broods both parents continued to

care for the offspring. Visual and acoustic contact between half-broods and parents were preserved during the course of uniparental care. Shortly after fledging, when chicks were mobile but still dependent on parental provisioning, they were offered the choice to interact with either of their parents. Chicks spent more time and begged for food longer and more frequently from the same parent they received food from during the nestling phase. We conclude that parental expectations of zebra finch chicks are influenced by previous social interactions with their parents. In a follow-up study, we will ask whether these early-life social experiences have long-lasting effects on adult parental behaviour, so that social learning of parental sex roles takes place.

(oral presentation)

Human disturbance effects on nesting seabirds, the storm petrel

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Anthropogenic effects are stress factors with strong impact on breeding activity in animals. Human disturbance leads to a physiological stress-response by increasing glucocorticoids. Stress-responses are essential for survival as they inhibit all ongoing secondary processes, in order to focus resources on functions essential for immediate survival. However, if stress lasts too long, it might become chronic and can have severe consequences. Here, we have investigated the effects and consequences of anthropogenic disturbance in a breeding storm petrel population - a species important as bio indicator. These ground nesting birds are highly vulnerable to predation and some colonies breed in coastal caves which receive large number of tourists. Considering that storm petrels have only a single brood per year, the risk and the costs of interrupting breeding activity is very high. Therefore, there should be a critical trade-off between survival and reproductive success. One could expect that it is crucial to complete breeding activity and consequently it would be necessary to reduce the stress-response and habituate to human activity. Experiments were conducted by comparing 2 populations within the same cave, one disturbed by humans, the other not: First, a classical stress-response following the classical Wingfield protocol and second, a "population stress-response" due to human disturbance. Third, we tested whether these populations got really habituated using an ACTH-and DEX-challenge-test (Cyr & Romero 2009). Our results suggest that storm petrels habituate to human disturbance e.g. boat traffic and visits to the colony. But also shows that tourism does change the breeding physiogy in storm petrels, which might have long-term effects.

(poster 54)

The importance of male age on the breeding success of small tree finches

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Because of the high costs related to reproduction, females seek reliable indicators of male quality when choosing their mate. Plumage characteristics can be such an indicator in birds, giving information about health, nutritional stage and in several species also the age. Age can also be seen as indirect indictor for male experience. In Darwin's small tree finches (*Camarhynchus parvulus*), male head coloration becomes progressively darker with age and can be reliably used to tell the age of a male individual. A previous study by Kleindorfer (2007) showed that females of this species prefer older males and have a higher breeding success when paired with older males. In this study, we compared several parameters of breeding success between younger and older males over the course of two breeding seasons, both in the first brood and in two consecutive broods within the same season. Analysis showed no significant differences between the two age groups in terms of clutch size, brood size or number of fledglings. However, in 2012 but not in 2014, the chance of successfully raising at least one chick increased with male age. A possible explanation lies in the different weather conditions of the two years: 2012 was characterised by periods of intense rain and a high percentage nests were abandoned; 2014 was a very dry year and nest abandonment was rare. Older males tended to abandon nests more frequently than younger males, suggesting that they were better in assessing when the environmental conditions do not favour successful rearing of the brood. An alternative explanation is that older males are better at compensating for increased environmental stress.

(poster 55)

Long-term consequences of prenatal exposure to testosterone and carotenoids for behaviour and immune function in Japanese quail (*Coturnix japonica*)

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Avian eggs vary in the amount of maternally-deposited hormones depending on the environmental or social conditions experienced by the mother during reproduction. Exposure to high concentrations of yolk androgens during embryo development typically leads to an enhanced growth rate and a higher competitiveness. However, such benefits may go hand in hand with costs for the offspring, for example in the form of higher oxidative stress or a weaker immune system. To mitigate such negative effects of exposure

to high yolk androgen concentrations, mothers might adjust the deposition of other egg components, in particular antioxidants and immunostimmulants. Here we experimentally tested the interactive effects between yolk androgens and yolk carotenoids on offspring behaviour, immune function and oxidative stress in Japanese quail (*Coturnix japonica*). We experimentally elevated yolk testosterone and / or yolk carotenoid concentrations by injecting either only testosterone, only carotenoids, both combined or only oil. Half of the chicks were then immune challenged with an injection of diphtheria-tetanus vaccine, whereas the other half served as a non-immune-challenged control. All chicks performed in an open-field and a novel-object test, they were tested for tonic immobility and we measured their breath rate. We also measured the oxidative and immunological status of the birds. The results of our study will provide novel insights into the interactive effects between two major maternally-transmitted compounds in avian eggs on offspring physiology and behaviour.

(poster 56)

Power of memory: from neurobiology and comparative studies to neurocognitive diagnostics

Memory and cognitive control in animal models of brain disorders

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Spatial navigation is perhaps the most popular behavioral model in study of relation of brain to behavior. It requires multiple processes such as recognition of places and positions, cognitive control and continuous updating of changing information. Dysfunctions of these processes are found in many animal models of brain disorders such as schizophrenia or neurodegenerative conditions. The talk will present a deficit in navigation, visuospatial working memory and cognitive control in an animal model of schizophrenia, effect of antipsychotics and specific receptor ligands. Deficits in cognitive control seen in neurodegenerative and excitotoxic models including beneficial effects of novel neuroprotective substances will be presented. Aim of the lecture will be to stress the immense importance of studying behavior in animal models of brain diseases for understanding disorder-related deficits in cognitive control and to show how important these approaches are for preclinical searching of efficacious and safe pharmacotherapy aimed at cognitive deficits. This work was supported by GACR grant 14-03627S, GACR P304/12/G069, IGA MZ CR NT13386, by AS CR M200111204 and by MSMT KONTAKTII LH14053.

(keynote speaker)

Modulation of cognitive control in rat's model of spatial working memory

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The daily life involves memory about events, place and time of these events, as well as effective problem solving and planning abilities, and efficiency of processing and response accuracy. It is realized by spatial memory and working memory processing in hippocampal-cortical circuits. Functioning of working memory required temporary storage of current information occurs simultaneously along with the execution of higher cognitive function and skill performance. It involves a multi-component system of short-term and long-term

memory. In dynamic environment efficiency of visuospatial memory demands segregation of distal, visual and self-motion information. This is a hippocampal-dependent process which engages cognitive control. We hypothesized that the transcranial direct current stimulation (tDCS) and NMDA receptors blockade, by memantine or MK-801, could induce a changes on synaptic level that modulate visuospatial working memory. In our study we used an allothetic place avoidance alternation task (APAAT), a variant of the active place avoidance test. In the APAAT the rat has to remember and avoid the place where shocks are applied, wherein the position of this place is altered every day, so a previous spatial representation must be extinguished and a new representation processed in a short time period. The shock location is described by relevant distal, visual cues, whereas information from proximal cues and from the self-motion is irrelevant, so performance of this task demanded cognitive control. We found that tDCS and/or low dose of memantine improves working memory but in different time. It suggested that different mechanisms exert a control on a highly challenging task. Grant MNiSW 8165/B/P01/2011/40.

(keynote speaker)

Spatial cognition in virtual reality: virtual tests developed for schizophrenia patients based on animal research

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The assessment of cognitive functions represents a crucial step in the diagnostics and in therapy of mental disorders such as schizophrenia. In order to produce test battery applicable in future comparative studies we have designed human analogues of two spatial animal tasks in virtual reality environments: the Morris water maze (MWM) paradigm and the carousel maze (rotating arena). Both tasks have been already applied in animal models of schizophrenia to test spatial learning, mental flexibility and memory processes. The task of the human subjects tested in both virtual tests was simply to find and remember several hidden goal positions placed in an enclosed circular arena or on an open arena rotating in a rectangular room. Both presented task are composed of four parts, representing analogies of the MWM or carousel maze variants. Both groups have been tested using traditional paper-pencil tasks as well, to assess their cognitive functions using standardized methods. Data obtained in 30 first-episode schizophrenia patients show deficit of spatial cognition in both tasks when comparing to matched healthy controls. Our results correspond well to both, to the data obtained in standard human tests and to studies testing the animal model of schizophrenia using comparable real task variants. We therefore assume that presented tasks could be used for screening of spatial

cognition in clinical translational studies. The study was supported mainly by IGA MZ CR grants No. NT13386, NT14291 and NT13843, and by the institutional support of ASCR (RVO: 67985823) and MH CZ - DRO (PCP, 00023752).

(oral presentation)

Processing of abstract spatial information in humans and monkeys: rotation vs. translation

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Processing spatial information to build a representation of an environment is one of the essential cognitive abilities in all animal species, including humans. It is possible to use different strategies and cues to build such a representation. Geometric cues are among the most prominent ones. In a series of experiments we have studied the ability of different species to perceive and process schematic (abstract) visual information presented on a computer screen. We tested the ability of monkeys and humans to orient in one spatial frame ("response frame") according to abstract spatial stimuli presented in another spatial frame ("stimulus frame"). The stimuli were designed as simple "maps" ("schemes") of the "response space". The subjects were trained to choose a particular position in the response frame - either on a touch screen (monkeys) or on a keyboard (humans) - according to schematic spatial stimuli presented on the stimulus screen. We have studied the impact of different transformations of the stimuli, such as translations and rotations, on the performance. The results show that both humans and monkeys use different strategies to process rotated and translated stimuli. Monkeys were able to perform "mental translations" but had difficulties with "mental rotations" with large angles. In contrast, humans performed both "mental translations" and "mental rotations" easily. However, also humans showed different reaction times with translated and rotated stimuli. However, humans had longer reaction times for rotated, compared to translated, stimuli. Supported by the GACR 14-03627S, Institutional support RVO 67985823, project AVČR M200111204 and Project Prvouk P34.

(oral presentation)

Episodic-like memory impairment in mild cognitive impairment

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Episodic memory enables us to recall personal past events by re-experiencing them using mental-time travel. According to an alternative approach, it associates spatial and temporal information with the content of the event. This type of remembrance is then called what-where-when or episodic-like memory and is mostly used in animals. These two properties of episodic memory, the re-experiencing and spatial and temporal context of events, is however not reflected in the conventionally used episodic memory tests. The aim of the study was to compare episodic-like memory performance with selected standard episodic memory tests in groups of patients with cognitive impairment, with various probability to develop Alzheimer's disease. Amnestic MCI patients single (aMCIs) and multiple domain (aMCIm) and non-amnestic MCI patients (naMCI) were compared to control subjects in their performance in a new computer test of episodic-like memory. The task of the subject was to drag to a box on a computer screen a series of pictures from predefined positions in a predefined order. Three measures of the episodic-like memory were distinguished: the order of pictures, the position of pictures and the order of positions. The results were also correlated with the standard cognitive tests. The aMCIs and aMCIm groups were impaired in all measures, but the naMCI group was impaired mainly in associating the presented pictures with their order. Multiple regression analysis showed that the score in the temporal order of pictures is significantly predicted both by scores in the standard memory and the executive tests used in MCI diagnosis. Standard episodic memory tests used in clinical practice may fail to detect memory impairment because they do not test memory for episodic associations.

(oral presentation)

Predator-prey interactions

No need for long range interaction in waves of agitation in starling flocks

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Fast transfer of information in groups can have survival value. An example is the so-called 'wave of agitation' observed in groups of animals of several taxa under attack that has been shown to reduce predator success. It involves the repetition of a signal all through the flock, transmitting the information of the attack very fast. It is unknown what mechanism causes this high speed, but long-range anticipation is generally assumed to be required. The specific signal is usually known, but not in large flocks of starlings, because these flocks are spatially too far from the observer when a wave happens. Here we infer the range of transmission of information and the type of signal for flocks of starlings in a computational model, StarDisplay, because its flocks have been shown to resemble starling flocks in many traits. By comparing in the model different behaviours of escape to qualitative and quantitative empirical data, we show that the escape manoeuvre by rolling sideward and back results in waves similar to empirical waves. Reacting to the escape of one of its 2 to 7 closest neighbours already generates the same wave speed as in empirical data. This shows that long-range anticipation is not needed and high speed of waves is obtained easier than expected.

(keynote speaker)

Peregrine falcons intercept targets using proportional navigation – the same feedback law as used by most guided missiles

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Aerial pursuits have been studied in insects, birds, and bats, but previous research has focused on identifying simple geometric rules describing their behaviour, rather than the guidance laws that produce it. Missile engineers have designed guidance laws to implement these geometric rules for over half a century, but the question of how they are implemented in nature remains unanswered. Here we identify the guidance law underlying the attack behaviour of peregrine falcons (*Falco peregrinus*), which are renowned for their

high-speed attacks. We use miniature GPS and onboard video cameras to record attacks against non-manoeuvring targets thrown to the ground by a falconer. We also combine miniature GPS and onboard video cameras with high-definition video to record attacks against aerial targets towed behind a manoeuvring remotely piloted vehicle. We find that peregrines use the same guidance law – proportional navigation – as do most guided missiles, and we show that like most modern missiles they are able to vary the gain of this guidance law. Although proportional navigation has been hypothesised previously as a potential explanation of the attack behaviours of flying animals, this is the first time that the guidance law underpinning aerial attack behaviour has been formally identified. Importantly, the same guidance law – proportional navigation – is able to explain all of the geometric rules that have been used to describe the attack and intercept behaviours of other species to date. It therefore has the potential to provide a unifying mechanism for the predatory behaviours of a disparate array of birds, bats, and insects. Future work will aim to test how widely proportional navigation is used by peregrines and by other aerial predators.

(keynote speaker)

Effects of perceived predation risk on great tits

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Predation avoidance is costly, thus individuals must trade-off investment in predation avoidance with other costly activities. Individuals differ consistently in behavior ('animal personality'), which may affect plasticity in risk minimization strategies. We studied how great tits (*Parus major*) of different personality responded to experimentally-induced increases in perceived predation risk. We predicted that birds should decrease exploratory tendency and mass with increased risk to avoid and evade predators respectively. We also expected individuals to leave risky areas. Slow exploring birds are reactive and thus expected to be more sensitive and responsive to risk. We increased perceived risk in 4 of 8 nest box areas situated in southern Germany by broadcasting the calls of a known predator (European sparrowhawk *Accipter nisus*) and conspecific alarm calls. Control areas received playbacks from non-threatening conspecifics (winter wren *Troglodytes troglodytes* and chaffich *Fringilla coelebs*). We captured all roosting birds (n=95) before playback (January) and again after 3 weeks of playback (February) and measured body weight and explorative tendency. On recapture, individuals exposed to increased risk had decreased in mass significantly more than controls. Birds in control areas also became more explorative after treatment, whereas birds exposed to increased risk did not. As expected, fewer of the slow explorers were recaptured in areas with increased risk

compared to controls. These findings imply that certain types of individuals respond to changes in perceived predation risk by leaving areas that become undesirable, and those that stay show adaptive phenotypic plasticity with respect to morphology and behavior.

(oral presentation)

Which parameters of prey an individual forager *Dinoponera quadriceps* can assess?

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The ants use individual decision criteria that allow the choice between different foraging strategies considering the parameters of prey. There are species that do not change the strategy, but that probably make some evaluation for that prey. In this work, our aim was to examine the evaluation of size, weight and volume by ants that perform foraging activity totally individual. We conducted laboratory experiments with workers of *Dinoponera quadriceps* (Ponerinae, Ponerini), in which we manipulate food in order to differentiate the parameters. First, we offered cylindrical food in four different sizes; second, we chose the size of the most units chosen among these of first experiment, and introduce a stainless steel ball to increase the weight in half of offered units; third, we maintained the same weight, but modified the volume, even so they were cylindrical yet. Before each experiment, we conserved ants in food privation for three days. Our results showed an effect of size and weight in the evaluation of prey by workers. The volume showed no effect on choice. They opted for smaller and lighter prey. As carriers of single prey, foragers of D. quadriceps seem to establish a minimum size of prey, when they are abundant.

(poster 57)

Consequences of geographical distance and environmental dissimilarity on cannibalism in pit-building antlions

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Cannibalism is a widespread trophic interaction in nature, having important consequences for population and community dynamics. A central question in evolutionary ecology is

under what condition cannibalism should be selected for? Clearly for cannibalism to be adaptive, kin cannibalism should be minimized. Yet the ability to recognize and avoid eating your kin varies both within and between species. Environmental effects may provide important cues assisting cannibals to distinguish between potential victims originating from similar or different environments, acting as a proxy for assessing genetic relatedness. We investigated the consequences of geographic and ecological distance on cannibalism rate in the pit-building antlion larvae *Myrmeleon hyalinus* using larvae originating from two Mediterranean and two desert populations. Specifically, we quantified cannibalism rate at four different hierarchical levels: within antlion zones (antlion clusters), between zones within a population, between populations within a climatic region and between climatic regions. As expected, increased body size difference between the cannibal and its victim led to a significant increase in the frequency of cannibalism and this pattern was consistent among the different spatial hierarchies. Notably, the frequency of cannibalism between individuals originating from different climatic regions or different populations, were significantly higher than those observed among individuals originating from the same antlion zone or the same population. We therefore suggest that *M. hyalinus* larvae can partially compensate for the potential cost of kin cannibalism by lowering their tendency to cannibalize individuals with whom they grew in a close proximity and are more likely to be their relatives.

(oral presentation)

Hidden eggs: does substrate choice affect egg predation in Japanese quails?

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Eggs of ground breeding birds are highly susceptible to predation. Choosing an environment for egg laying in which the eggs are optimally camouflaged may reduce the probability of detection by visual predators and thus lower the risk of nest predation. In Japanese quails (*Coturnix japonica*) there is a high variation in the amount and size of eggshell maculation among females. Within females, however, eggshell patterns are highly repeatable. We test the hypothesis that depending on their eggshell maculation, females have different preferences for the substrate on which they lay their eggs. Furthermore, we test if this choice is adaptive by assessing the predation rate of eggs on the substrate chosen by the mother versus a non-preferred substrate. Our study contributes to a better understanding of the role of predation in shaping eggshell maculation and nesting habitat choice in ground breeding birds.

(poster 58)

The relative importance of prey-borne and predator-borne chemical cues for antipredator behaviour in tadpoles

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Chemical cues are one of the most important modalities for the adjustment of antipredator responses in aquatic environments. Alarm cues released by prey during the event of predation have received considerable attention, but it is not known to what extent prey use the information contained in the smell of predators and in cues released through digestion. The lack of consensus is partly due to confusion over terminology, so we propose a more precise and consistent binomial nomenclature based on the timing of chemical cue release (stress-, attack-, capture-, digestion- or continually-released cues) and the origin of cues (prey-borne versus predator-borne cues). We also present an experiment investigating the importance of various types of cues for the adjustment of antipredator defences. We exposed tadpoles (common frog, *Rana temporaria*) to water originating from predators (caged dragonfly larvae, *Aeshna cyanea*) that were fed different types and quantities of prey outside of tadpole rearing containers. Variation among treatments in the magnitude of morphological and behavioural responses was highly consistent. Our results clearly demonstrate that tadpoles can assess the threat posed by predators through digestion-released prey-borne cues and continually-released predator-borne cues. These cues may, thus, play an important role in the fine-tuning of antipredator-responses and may significantly affect the outcome of interactions between prey and their predators in aquatic ecosystems.

(oral presentation)

Do cattle have a fear from sympatric or allopatric predators? A case study of cattle response on olfactory stimuli

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Olfactory sense plays a crucial role in antipredator strategies of ungulates. Its role could be suppressed during the domestication and breeding. Our objective was to determine

the response of cattle to predator by olfactory stimuli. Study was conducted on separate two herds of individually marked Limousine suckler cows (paddocks K6 and K8) on farm Gut Gruenschweige, Germany. We placed consecutively four different scent samples (wolf as sympatric predator, African wild dog as allopatric predator, eucalyptus oil as neutral stimulus and control sample without any scent) to the constructions of mineral lick in both paddocks. We measured frequency of visits of cows on mineral licks and the time spent there since June till September 2011. Cows visited mineral licks significantly more frequently when there were samples with no scent than with any scent on both paddocks. On the other hand, there was no difference in time spent on mineral licks when different scent samples were exposed. The average time spent on mineral licks was 7:57 min (SE ±0:16 min) and 6:27 min (SE ±0:15 min) on K6 and K8, respectively. When comparing the time spent on mineral licks before/after experiment without any sample and control scent sample, cows spent almost two minutes longer in the licking area when no sample was exposed. We may conclude that cows' decision to enter the licking area was affected by unfamiliar scents in general, not directly connected with predation. In addition, although cows decided to surpass the visual obstacle represented by presence of samples, they probably did not feel comfortable as indicated shorter time spent in the licking area with samples. We suggest, therefore, that animals completed the perception of olfactory stimuli with visual ones.

(poster 59)

Test of predation sensitivity hypothesis of sexual habitat segregation in monomorphic species, the European hare (*Lepus europaeus*)

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Considerable variation exists in what habitat is best suited for a given activity in respect to fitness prospects. Predation sensitivity hypothesis states that the degree of habitat segregation between males and females reflects sex specific variation in predation risk. Much of the evidence on sexual habitat segregation comes from dimorphic species where it is difficult to control for the confounding effect of body size. I test the predation sensitivity hypothesis of sexual habitat segregation in monomorphic species, European hare (*Lepus europaeus*), in which males and females are similar in size. At the study site in western Poland, hares were trapped using net enclosures in two habitat types (forest vs. field) and sex ratio was recorded from each trapping session. Results from the logistic regression on sex ratio with habitat included as an explanatory variable provided support for the predation sensitivity hypothesis in hares. Females, that are more sensitive to predation than males, more often utilized safer forest habitat. Males more often utilized field habitat. This study highlights the need for relaxing the assumptions of body size dimorphism if the aim is to imply habitat segregation of males and females in response to predation risk.

(poster 60)

Deactivation of neophobia towards novel and aposematic prey in tits (Paridae)

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Different levels of innate wariness towards novel and aposematic prey were found in European species of tits (Paridae). This wariness can be caused by neophobia, dietary conservatism or innate bias against a particular trait of the prey. We tested hand-reared juveniles of three species of tits (great tits *Parus major*, coal tits *Periparus ater,* blue tits *Cyanistes caeruleus*) in two different experiments. One group of birds was trained to attack red-painted larvae of Tenebrio molitor and the other was trained with natural coloured mealworm only. All birds were subsequently offered prey of a new colour and previously unknown shape, larvae of cricket with blue sticker, Acheta domestica followed by adult aposematic firebug, *Pyrrhocoris apterus*. We recorded latencies of the first manipulation with prey. The initial reaction of birds towards novel and aposematic prey differed among species as well as between experienced and non-experienced groups. Great tits and coal tits from the experienced groups have significantly decreased their neophobia towards novel and aposematic prey while the blue tits have not changed their reactions despite their experience with red coloured mealworm. We suggest that different and more complex processes play role in innate wariness of blue tits than explainable by merely a short-lasting response, the neophobia. Funded by CSF-grant P505/11/1459.

(poster 61)

The response of common marmosets to auditory and olfactory predator-based stimuli and the influence of these modalities on a visual stimulus

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The study of predator recognition by primates has been largely biased by a visual perspective. However, it is important for prey animals to also be able to detect predators through auditory and even olfactory means, as visual inspection may not always be possible. Furthermore, the information perceived in the sounds and odours of predators may provide alternate or additional information. Still, these modalities are rarely perceived discretely. We were therefore interested in whether the simultaneous presence of the sound or odour of a predator influenced the response to a visual stimulus. To this end, we presented twelve captive common marmosets (*Callithrix jacchus*) with predator-based stimuli in the visual, auditory and olfactory modalities, first individually

and then in combination with each other. We found that the predator-naive marmosets responded with anti-predator behaviour to stimuli within all three modalities, but that these responses varied; the marmosets mobbed a taxidermic predator, hid in response to predator vocalisations and avoided the predator odours. When the stimuli were combined, we found that, in comparison to the behavioural response to the visual stimulus alone, the marmosets looked down more often when either an auditory or olfactory cue were also presented, and took longer to approach the visual stimulus (and maintained a greater distance) when predator vocalisations were also heard, either alone or with the olfactory stimulus as well (trimodal combination). These results suggest that marmosets perceive and respond to specific auditory and olfactory information, and that these senses may be more important in modulating the response to visual stimuli than previously considered.

(oral presentation)

Effects of low environmental calcium on antipredator behaviour in prey fishes

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Industrialization has led to long term environmental effects that we are now only starting to see. Mining activity in central Ontario resulted in the acidification of several water bodies from effluent and atmospheric acid deposition from acid rain. As a result we are now seeing that calcium is disappearing in several small lakes in central Ontario. Many prey fishes use olfaction to assess predation risk by responding to chemical alarm cues released from injured conspecifics. Calcium is the major ion responsible for depolarization of olfactory receptors and loss of environmental calcium may impair the ability of prey fish to detect and respond to chemical alarm cues. In this study, we examined whether fathead minnows (in laboratory experiments) and juvenile pumpkinseed sunfish (in field experiments) could use chemical alarm cues in low calcium environments to assess predation risk. We found that bass naïve fathead minnows under low calcium conditions (1 mg/L) did not respond to chemical alarm cues from bass fed minnows and did not learn the identity of novel largemouth bass relative to minnows acclimated to 3 mg/L calcium. Similarly, we tested the response of juvenile pumpkinseed sunfish from a low calcium lake (~1 mg/L) in their own lake water to injury-released alarm cues and saw no avoidance response. However, when we added calcium to the water to bring environmental calcium levels above 2 mg/L we found that juvenile sunfish avoided sunfish alarm cues. Taken together our data show that depletion of environmental calcium can disrupt predator-prey interactions and may alter population and community structure.

(oral presentation)

Immobility as a gaining time tactic for predation avoidance in frogs

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To avoid predation, prey has improved tactics against predators. A representative anti-predator behavior against detection by predators is immobility. Immobility is a motionless state, the function of which has been considered as promoting crypsis. Thus, it is generally considered that once prey is detected by a predator, immobility lose the function of crypsis, and thus the prey should not keep motionless to avoid predation. Contrary to the general consideration, frogs often exhibit immobility even when they are detected by snakes. This may imply that immobility in frogs is still effective against predation by snakes that have already detected the frogs. To explain this response, we proposed the following hypothesis: basically predator approaches slowly to immobile prey rather than fleeing prey. The time gained by immobility increases probability of emergence of another prey. Consequently, the snake is distracted by the new prey, and loses the exact location of the frog in immobility. To test this hypothesis, we examined how long immobility gains time, a likelihood of emergence of another prey during the gained time, and foraging behavior of snakes toward the immobile frog and the newly emerged prey. Our results showed that immobility has function of gaining time enough to allow new prey to emerge nearby the immobile frogs. Snakes switched their target from the immobile frogs to the newly emerged prey, and finally the snakes lose the location of the immobile frogs. These results indicate that even if immobility may lose its cryptic advantage when predator has detected the prey, immobility has another function of gaining time, which still can make it effective choice to avoid predation.

(oral presentation)

Effects of nestling age and season on prey selection in pied flycatchers

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Many temperate passerines match their provisioning effort with a short peak of caterpillar abundance and with ontogentic shifts in the dietary preference of their brood. Past studies have found a seasonal decline in caterpillar provisioning, and an early age dependent provisioning of Arachnida in great and blue tits. However, few studies have looked at several prey types simultaneously to disentangle ontogenetic or season dependent constraints on prey selection in an experimental setup. We delayed hatching in a group of pied flycatchers, and compared their prey provisioning to a control group at

four different chick ages. We found that irrespective of season, Arachnida were provided more at early chick ages. Coleoptera were provided more when the nestlings were older. Moreover, caterpillar provisioning declined over the season with a concomitant increase in Coleoptera provisioning. We conclude that Arachnida carry important nutrients for early development, and that seasonal constraints may force insectivorous passerines to select lower quality prey items.

(poster 62)

Foraging behavior of a neglected pit-building predator: the wormlion

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Wormlions are fly larvae of the family Vermileonidae. These larvae construct conical pits in loose soils and ambush arthropod prey, similar to pit-building antlions. However, compared to other trap-building predators, spiders and antlions, wormlions' natural history in general and foraging behavior in particular are almost unknown. In this study we use a combination of field observations and laboratory experiments to close this gap and investigate factors affecting the investment in foraging, measured as the investment in pit construction and maintenance, and examine the competition among neighboring larvae. We found slight, mainly decreasing, changes in pit size with hunger and no change in response to prey. Surprisingly, body mass or length were not tightly correlated with pit size, unlike in antlions and spiders. Other factors may affect pit size, as the correlation between pits constructed in the field and in the laboratory was strong. The evidence for competition was mixed. On the one hand, we detected, in the laboratory, a change towards a regular spatial pattern with increasing pit densities, suggesting interference competition. On the other hand, we detected, in the field, a positive correlation between the size of neighboring pits and a negative correlation in the laboratory between pit size and distance to the nearest neighbor, both indicating clustering in favorable microhabitats, and not supporting strong competition. In general, wormlion larvae offer a wonderful model to study convergent evolution and foraging theory.

(poster 63)

Are captive Common hamsters (*Cricetus cricetus*) able to perceive predators from their scents?

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It is well established that the way by which individuals perceive and react to predators directly influence their fitness through their survival. These anti-predatory abilities have both genetic and environmental components. In a context of reintroduction or reinforcement, it is particularly crucial to ensure that captive animals bred for reintroduction are able to correctly perceive and efficiently react to predators, despite the fact that predation pressure (i.e. environmental component) has been erased for several generations. Within a conservation program, we evaluated the olfactory discrimination of predation of ten 2 years old Common hamsters (*Cricetus cricetus*): 5 males and 5 females. Individuals were tested in a Y-maze and recorded during 5 minutes. We increased their motivation by placing earthworm (i.e. highly appetitive food) at the end of both branches. Each worm was placed before a compress full of predators' urine (cat) at one side and "neutral" urine (goat) at the other side. This test enabled us to test whether olfactory perception of predation does exist in our captive colony of Common hamsters that will be released. We will further study their reaction to real predation cues and also estimate how theses behaviour's responses will impact survival in natural conditions.

(poster 64)

Behavioural responses to four predator species of larval common toads (*Bufo bufo*)

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Prey species are known to adjust their behaviour to the presence of predators, often with surprising precision. Predator-induced changes in behaviour can be predator-specific or generalized responses. Predator-specific responses may more efficiently elevate survival probabilities of prey individuals if predators differ in their foraging ecology, but generalized responses seem to occur frequently as well. In our study we investigated how tadpoles of the common toad (*Bufo bufo*) react to the chronic presence of various predators exhibiting different hunting methods and voraciousness. We raised tadpoles

in 60 outdoor mesocosms in the presence or absence of a caged predator. As predators, we used backswimmers (*Notonecta glauca*, an invertebrate active forager), larvae of the southern hawker (*Aeshna cyanea*, an invertebrate ambush predator), adult male smooth newts (*Lissotriton vulgaris*, a vertebrate active forager) and three-spined sticklebacks (*Gasterosteus aculeatus*, a vertebrate ambush predator). Three weeks after hatching, we monitored mesocosms and noted the number of visible tadpoles, active tadpoles, and tadpoles in the vicinity of the predator cage. Tadpoles reacted to all predators with altered behaviour which appeared to be a generalized response because tadpoles did not differ in their activity patterns among treatments containing a predator. Consequently, it seems that tadpoles of the common toad do not distinguish between predators differing in dangerousness and hunting strategy, but rather employ similar anti-predatory responses in behaviour.

(poster 65)

From the side of the flock to the side of the predator: starlings against peregrine falcons

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A major functional role of avian flocking is predator avoidance. Here, we summarise a series of studies on the interactions between peregrine falcons and starlings conducted both in the field and under controlled condition. We aim to show how and under which circumstances collective responses are effective in reducing aerial predation by falcons on the hypotheses commonly adopted to explain protection from predators by grouping: many eyes theory, risk dilution effect, selfish herd theory and confusion effect. At the same time, we look at the side of the predator describing the hunting strategies and associated predation success of falcons. We show that flocking behaviour is flexible and context dependent in relation to the degree of perceived predation risk and that certain flock shapes are more likely to occur than others when and where the risk is actually high. Also hunting behaviour shows a large and flexible repertoire, with nine identified hunting strategies, the most successful being those that minimise the amount of collective evasion patterns. Such complex and dynamic prey-flock interactions appear in continuous reciprocal refinement. Finally, studies under controlled conditions mimicking predation risk by video playback show that a flock under predation, compared to a non-threatened flock, is effective in eliciting fear and vigilance responses (e.g. freezing, head turning) but differently depending on social context: singletons increase their anti-predator behaviour

more than individuals in groups, to compensate for potential increased predation risk. This suggests intrinsic mechanisms of dynamic social cohesion that translate individual behaviour into the emerging properties of a flock probably by increasing inter-individual correlation and synchronization.

(oral presentation)

Primate cognition: comparative and developmental perspective

Brain maturation and object recognition

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Our longitudinal MRI study showed that the volume of the macaque brain doubles between birth and adulthood, with the most robust development over the first 3 months and only a slight increase thereafter. In contrast, the brain of chimpanzees and humans has more protracted development through puberty with about 30% volume increase between early childhood and juvenile stage (Sakai et al., 2013). Over the same period, the human brain undergoes dynamic changes including expansion of white matter, not observed in chimpanzees to the same degree. This supports the hypothesis that the dramatic enhancement of neuronal connectivity during early infancy promoted the phylogenetic enlargement of the human brain. The accelerated development of the macaque brain makes the macaque species an excellent model for experimental manipulations with relevance to human developmental pathology. Maturation of various brain areas coincides with emergence of specific cognitive abilities. For example, object recognition memory, as measured by the delayed nonmatch-to-sample (DNMS) task, has protracted development because of the late maturation of brain areas that subserve this function, perirhinal and prefrontal cortices. Our data show that damage to immature cortex can result in compensatory adaptation that provide means of functional recovery. Thus, early damage to the inferior prefrontal convexity (IC), area critical for learning the DNMS rule, results in sparing of the function, whereas the same damage to the mature brain yields cognitive impairment. In contrast, early damage to the orbital frontal cortex, which matures earlier than IC, shows only a limited recovery. Thus, the level of maturity of a specific brain area at the time of insult modulates the possibility for functional recovery.

(keynote speaker)

Object permanence in macaques: who can win a shell game?

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Object permanence is a cognitive ability that allows to understand that an object continues to exist even when one cannot directly perceive it. This ability is essential to build mental representations and to manipulate them. In humans, object permanence develops in six discrete stages, parallel with sensory, motor and cognitive pathways. Reaching of the highest stage 6 is demonstrated by successful performance in invisible-displacement task and is completed in children between 18 and 24 months. With increasing interest in animal cognition the question arouse as to which animal species possess object permanence and to what degree. Using comparative approach, it was shown that among primates the last stage 6 of this ability occurs also in great apes and possibly also in gibbons and some New World monkeys (capuchin, marmoset and tamarin). However, the results in macaques are still ambiguous. In our experiment we have carried out a series of experiments to test whether macaques can reach stage 6 and whether they can use "representational capacity" or whether they depend on simpler non-representational strategies to solve the task. We have shown that at least one of four animals has a capacity to reach stage 6 and solve invisible-displacement task using representational strategy. However, we have demonstrated that performance of animals strongly relies on previous cognitive training and that object permanence can be trained as a cognitive ability not just as a performance in a particular task. Supported by the Institutional support RVO 67985823, project AVČR M200111204; by Project Prvouk P34 and GAUK 1508414.

(keynote speaker)

Perceptual concept learning of ecological and artificial stimuli by rhesus macaques

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Concepts are generally regarded as fundamental elements of higher-order human cognition. The study of concepts in animals is complicated by concerns about an animal's

ability to categorize on the basis of sensory inputs that are processed as perceptual gestalts, as opposed to its ability to categorize on the basis of open-ended categories that group stimuli by their physical similarity. These two possibilities have been difficult to distinguish with standard experimental methods, since pictorial stimuli necessarily convey some physical information, even if an underlying abstract concept is in place. Furthermore, no known stimuli provide a viable method for working with non-verbal subjects. Prior work suggests that animals use specific perceptual features to classify concepts. In two experiments, we trained seven Rhesus macaques in a conceptual variant of the simultaneous chaining paradigm. In the first, we trained three monkeys to simultaneously classify four distinct ecological concepts: birds, flowers, cats, and people. In the second, we created four novel classes of abstract artificial stimuli; paintings by four artists, each with a distinctive style: Claude Monet and Vincent Van Gogh (impressionists), Salvador Dali (a surrealist), and Jean-Léon Gérôme (a painter of the "academic" school). In both experiments, novel exemplars of each category were presented on each trial. Three out of three subjects classified ecologically stimuli correctly, and three out of four subjects classified the paintings correctly. Our results suggest that monkeys possess a flexible ability to form class-based perceptual concepts.

(poster 66)

A window on the proximal mechanisms of intentional communication in primates

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The use of gestures by pre-verbal children, for example to communicate about environmental entities through pointing, possesses strong parallels with the gestural communication of non-human primates. Although primates' spectacular skills to communicate with intent might develop through experience, the underlying mechanisms have not yet been addressed. Here, we investigated the influence of previous experience with humans on the communicative behaviour of olive baboons (*Papio anubis*) in a food-requesting paradigm using a human partner. The first experiment measured the effect of overt training in requesting gestures compared to passive exposure to humans on the production of gestural requests and gaze behaviour by baboons. We found that the training did not affect gaze frequency but modified its pattern of production. Trained baboons were more likely to combine gaze with gestures than untrained baboons. Training may thus reinforce the communicative nature of hand gestures. The second experiment addressed the underlying mechanisms of audience effect in intentional communication. We manipulated the human cues to attention the baboons were exposed to during

the training, and then examined baboons' discriminatory skills of human attention states in various test conditions. We found that baboons' ability to discriminate human cues to attention was affected by cues encountered during the training. These results are solid evidence that communicative skills develop through experience in baboons, which provides an exciting framework to the development of social understanding and intentional communication in primates. It also suggests that rearing conditions are essential component of this development, which invites to increased cautiousness in comparative studies.

(oral presentation)

Novel object test in macaques: neophobia or neophilia?

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Animals are consistently confronted with novel, unknown objects, food and situations. Some of animals are suspicious and fearful, while the others literally seek and investigate everything unknown. These types of behaviour are known as the neophobia and neophilia. We can often see the mixture of this behaviour, especially in primates. There are big differences between species influenced by ecology and ethology, but also affected by age or sex of the individuals. Up to date the majority of these experiments have been performed as food-preference experiments or as ethological observations of approaching, familiarising and manipulating new objects. These methods can be also combined. Preference towards objects was tested mainly at captive primates, who respond rather neophilicaly, while wild primates tend to be suspicious at the first contact. Our experiment was designed as a modification of an one-choice test, in which the monkeys were trained before. Two pieces of food of the same quality and quantity was hidden into two different cups. One of them was already known; the second one represented the novel object. These two objects were presented to the monkey for 12 times in one session. In the following session, previous novel object was presented as the „old one". Two series of six objects was presented overall. The results show a quite strong consistency in choosing specific objects regardless if they were old or new object. The tendency for neophobia or neophilia is not entirely clear and has to be discussed for each individual separately. Supported by the GACR (14-03627S), GA UK 1508414, Institutional support RVO 67985823 and project AVČR M200111204, Project Prvouk P34 and CSM7/CRP/2014.

(poster 67)

Development and signal variety of gestural communication in mother-infant dyads of wild chimpanzees

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The acquisition and underlying cognitive complexity of great ape gestures has been subject to considerable debate in recent years. To resolve this debate, we focused on a distinct set of communicative interactions —carry initiations— which occur frequently in mother-infant pairs of chimpanzees (*Pan troglodytes*) in the wild. Specifically, we asked two questions. First, are the gestures used to initiate carries due to genetic predisposition or are they learned? Second, does signal variety and complexity change during development? To answer these questions, we used video recordings to observe twelve mother-infant dyads over two three-month periods living in two different chimpanzee communities: The Taï South group, Taï National Park, Côte d'Ivoire, and the Kanyawara group, Kibale National Park, Uganda. We analyzed 220 carry initiations that were recorded during 578 hours of observation. Our results demonstrate that chimpanzee mothers differed greatly in their variety of gesture use, ranging from 4 to a total of 17 gestures performed. While we did not find evidence for group-specific gesture use, four dyads did engage idiosyncratic gestures. Although younger infants till ten months merely responded to their mother's initiations, the signals they used increased in diversity as they aged. In addition, we could identify two gestural milestones, with tactile gestures occurring first and visual gestures occurring later. We speculate that our results have several implications for the mechanisms of gestural acquisition and gestural 'motherese'.

(oral presentation)

Are humans the only primates who value innovation? Preliminary data from macaques (*Macaca mulatta*) and baboons (*Papio anubis*)

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There is growing evidence that innovative behaviour may have played a critical role in the evolution of the primate brain. Current data show the advantages of having innovation capacity on the individual's reproductive success. But, what are the consequences for an individual that innovates when other group members can benefit from this innovation as well? Our hypothesis is that this individual can improve its social status and, consequently,

its reproductive success. We studied four groups of macaques and baboons. Low-rank individuals in each group were trained to manipulate an apparatus that provided food to other group members as well as the subject. We detected shifts in the social relations among individuals, as well as possible changes in the social status of the innovative animals. Our results suggest that the "social value of innovation" may represent an additional selection pressure that may have favoured the emergence of complex nervous systems.

(poster 68)

Long-tailed macaques (*Macaca fascicularis*) understand what conspecifics can see in a competitive situation.

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Although we contend that apes are capable of understanding what others can see, i.e. Visual perspective taking (VPT), it is much debated whether this capacity is a common feature for primates. Several different paradigms have been developed to test its existence in monkeys, but all face interpretational problems since results can be explained by simpler cognitive mechanisms than VPT. Therefore, we adjusted one method where two individuals compete for access to food, visible or invisible for the dominant competitor. Our adjustment precludes cognitively simpler mechanisms; behavioural reading was prevented by a one-way mirror between the competitor and the food, and accessibility was equal to both food items. Overall, the long-tailed macaques tested, preferred the food item invisible over the item visible to the dominant competitor. In most of these trials, subjects retrieved only one food item. Surprisingly, they occasionally adopted an alternative strategy to obtain both food items, by first choosing the visible, most at risk food item. Faster animals adopted this strategy proportionally more often than slower ones. Contrary to previous research, our results cannot be explained by simpler cognitive mechanisms. This is the first unequivocal evidence of VPT in a monkey species, suggesting that this precursor to Theory of Mind is an evolutionarily conserved capacity present in monkeys, apes and humans.

(oral presentation)

Cooperative cheating: macaque females and subordinate males hide mating behaviour

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Cheating is providing others with false information. This may occur through engaging in behaviour when the cheated individual cannot see it or by actively seeking seclusion from the cheated individual. Cheating in concert may be more difficult than cheating alone, since it requires the coordination of behaviour from two individuals. Therefore, it is more likely to involve the simpler mechanism. Hiding sexual behaviour requires two participants and is an ideal situation to explore the mechanisms of cooperative cheating. This was investigated in macaques, primates that live in groups with several males and females. While dominant males strive to monopolize matings, females prefer promiscuous mating behaviour and subordinate males aim to mate as well. Therefore, female and subordinate male may cooperate to cheat the dominant male. In this research, we observed mating patterns when these could occur out of sight in social groups of rhesus and long-tailed macaques. The results indicate that females and subordinate males initiate matings and mate more often out of sight that in sight of the dominant male. In addition, matings were also hidden from relatively subordinate males and some females. Although both sexes engage in the hiding of matings and cheat the dominant male, we have no evidence that they actively coordinate their behaviour. Therefore, macaques simply, but actively, exploit situations where the dominant male is absent to cheat.

(oral presentation)

The wild Norway rat as a model for behavioral research

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The domestication process of the laboratory rat has been going on for several hundred generations in stable and artificial environmental conditions, which have affected rat's physiological and behavioural functions. Furthermore, various laboratory strains of rats began to differ in some aspects from one another more than they differ from their wild conspecifics. These facts brought us to conclusion that there are no representative strain or stock among laboratory rats. This means that conclusions from behavioral analysis performed on a given strain of laboratory rat may be only valid for that particular strain, and any generalization of results onto the general population of laboratory rats or the

entire species can only be tentative. In 2006 we successfully established a breeding colony of wild Norway rats in captivity - WWCPS (Warsaw Wild Captive Pisula Stryjek). The stock is kept at very early stage of domestication thanks to systematic refreshing its gene pool by adding newly caught wild rats to the colony. Studying wild, intact type of the rat seems to be a reasonable choice, particularly if one wants to study natural forms of behavior. In our presentation we would like to share our knowledge of capturing and breeding techniques of wild Norway rats, as well as describe pros and cons of conducting studies on this type of animals. We would also appreciate opportunity to briefly present results of our comparative studies concerning differences between wild and laboratory rats in some of natural forms of behavior such as exploration, food neophobia, circadian rhythm of locomotor activity, burrowing, and spontaneous swimming.

(poster 69)

Capuchin monkey's and adult human's understanding of object-directedness: inferring objects from actions?

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Understanding object-directedness from actions is a key socio-cognitive skill; however, we still know little about how object-directedness is understood. Here we investigated whether non-observed, potential objects can be inferred from perception of object-directed actions. We presented Capuchin monkeys and adult humans videos of an object-directed or a non-object-directed action directed at two occluded locations. After the occluders open, revealing an object's presence/position (Congruent, Incongruent, Absent), we measured monkeys' looking time (LT) and humans' reaction time (RT) as the indexes of expectations (i.e., longer LT or RT suggests unexpected). LT of monkeys in experiment one suggested they could not anticipate the presence of an object after watching the actions, but the object's presence may retrospectively trigger their memory of object-directedness only for the object-directed action. RT of humans in experiment two, however, showed no evidence of distinguishing the actions. RT to the object's absence was always longer than to its presence, but it was also so in a control experiment where no action was conducted, suggesting it may take longer to decide an object's absence than presence. The control experiment also suggested that when adults had known about the object's presence/position beforehand and if the action was not directed to the object, RT may be prolonged. In sum, we found no evidence that either monkey or human can infer an object from a object-directed action. They might understand object-directedness only when both the action and the object are directly known.

(poster 70)

Investigation of teaching behaviour in wild golden lion tamarins (*Leontopithecus rosalia*): work in progress

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There is currently considerable interest in animal teaching, including in primates. There are, at present, only three nonhuman species that fulfil Caro and Hauser's (1992) definition of teaching behaviour, a definition that allows the behaviour to be quantifiable. None of these three species are primates. The study in progress investigates evidence of teaching behaviour in the golden lion tamarin (*Leontopithecus rosalia*), a species in which there is highly suggestive evidence of this behaviour in two contexts: food offering and food calling. The goal of this study is to test the hypothesis that 1) once young forage independently they are more likely to incorporate in their diet food that has been offered to them previously (social learning), compared to food that they have foraged on their own (individual learning), and 2) the young are more likely to forage independently at sites where they have previously foraged in association with a food call compared to sites where no food calls were present. In doing so, we are also looking at whether both behaviours vary according to the juvenile's age. In both cases, the first two criteria of Caro and Hauser's (1992) definition have been fulfilled, but evidence is still lacking for the third: whether pupils learn from the potential teaching behaviour, or not. The project in progress addresses this issue by combining experimental and observational work in wild populations of golden lion tamarins in Brazil, as well as the application of cutting-edge statistical modelling which will facilitate the detection of this behaviour.

(poster 71)

Recent advances in our understanding of livestock and zoo animal vocal communication

Studying animal vocal communication in zoos: overview and practical example

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Zoos and aquaria can offer a variety of opportunities for studying vocal communication in animals that are logistically very difficult to observe and record in the wild. Moreover, the research carried out in captive settings is generally less expensive than fieldwork and several modern exhibits offer environments that replicate many natural conditions. Nevertheless, very little of the zoo research published in peer-reviewed literature is directed towards the study of vocal communication. Recent studies of animal vocalisations are also aimed to quantifying the similarities or differences between vocal signals by means of mathematical computational techniques. However, these techniques require a large database of calls, and zoo settings can offer the opportunity to collect large numbers of vocalisations in controlled conditions. Finally, in zoo exhibits is often possible to label calls with the emitter in species where this would be very difficult to achieve in the wild. I will present results from a study of vocal communication in captive African Penguins (*Spheniscus demersus*), as well as the contribution of captive animal recordings to test the reliability of machine learning approaches for revealing critically important information in vocalisations.

(keynote speaker)

Recent advances in our understanding of livestock vocal communication

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I will review recent progress in our understanding of livestock vocal communication. Over the last 10 years in particular, sound recording and analysis techniques have advanced greatly. Furthermore, the adoption of source-filter theory from speech research has resulted in a better understanding of the communicative roles that the various acoustic parameters of vocalisations are involved in; for example, they contain information linked age, sex, individuality and even social status. I will offer advice on how to record and

analyse calls, as well as carrying out playback experiments; drawing in particular from our own work on goats and deer, but also use examples from the wider literature. Gaining a more thorough understanding of livestock vocal communication is critical to improving the welfare of these species.

(keynote speaker)

Possibilities of a heart rate monitoring of the dog (*Canis familiaris*) in behavioral physiology - a pilot study

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The aim of this research was to determine the possibilities of the heart rate monitoring of the working dogs to assess their behavior during selected physical activities. In the pilot study there were observed 3 representants of German Shepherd Dog (2 females, 1 male) during these activities: sleeping, feeding, walking, activation of the fetch, searching for objects in the room and a simulated searching action. Based on the analysis of data from POLAR sensors measuring heart rate and GARMIN GPS collars it was found out that it is possible to dinstinguish the change of the heart rate caused by physical activity from the change caused by reactions to emotional stimuli. The results and methodology will serve as a base for a wider research using the analysis of the heart rate variability in the behavioral physiology of domestic dog.

(poster 72)

Expression of emotional arousal and valence in horses

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Emotional indicators are important to provide accurate assessment of non-human animal emotions, as well as a better understanding of the evolution of emotions through cross-

species comparisons. Emotions can be characterized by two dimensions; their arousal (intensity), and their valence (negative or positive). Unfortunately, studies investigating indicators of both emotional arousal and valence in the same species are rare. Furthermore, the emotional situations that are used often differ in both dimensions, resulting in confusion about which dimension affects each parameter. We investigated physiological, behavioral and vocal indicators of emotional arousal and valence in horses. We found six reliable indicators of arousal and seven of valence. Our results indicate that horses can communicate emotions to their conspecifics through behavior and vocalizations. The effect of emotions on vocal parameters revealed in our study are similar to those observed in humans and other species, suggesting that vocal expression of emotion has been conserved throughout evolution. We believe that our approach, which compares the impact of both emotional arousal and valence on measured parameters, can lead to more precise indicators of emotions in animals. Furthermore, using indicators of valence to discriminate between negative and positive emotions can promote positive welfare in animals.

(oral presentation)

Call classification design of the wild boar (*Sus scrofa*) complex vocalization system

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Wild boars live in complex social systems in which individuals interact intensively using olfactory and acoustic communicative signals. Quantification and structural characterization of their vocal repertoire is needed for a better understanding of this species' acoustic communication. Klingholz et al. initially described the heterogeneity found in wild boar vocalizations in an empirical study lacking statistical support and relying mainly on visual inspections and manual measurements of simple acoustic parameters. Thanks to technical advances and better knowledge of the physical properties of sound today, this classification could potentially be validated, or improved, using a more objective, "hands-off" analysis and statistical approach. Here, following a primary visual inspection and computer-aided extraction of acoustical parameters of a wild boar vocal database, we used a multivariate analysis to quantitatively classify wild boar calls. It seems that this vocal repertoire is more of a graded than discrete system; call types do not necessarily appear under a single condition, but are rather produced in a wide variety of contexts, in which valence and arousal level modulate sound characteristics. The diversity and difficulties encountered during the analysis could be related to the unique and complex vocal anatomy of boars, characterized by two pairs of vocal folds. This study

will provide a solid foundation for further investigation of the production mechanisms (excised larynx experiments) and usage (playback experiments) of boar vocal displays, and allow explicit comparisons with their close relative, the domestic pig.

(oral presentation)

A nap to recap: reward strengthens relational memory during daytime sleep

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Sleep contributes to memory consolidation. Yet, the factors influencing the selection of freshly encoded information for further consolidation during sleep remain largely unknown. Here, we hypothesize that motivational relevance prioritizes rewarded information for subsequent reprocessing during sleep, and may thus yield better long-term memory retention. Moreover, we asked whether recollective experience, as assessed by confidence ratings, would also be stronger for rewarded memories. Participants first learned sequences of pictures, half of which are associated with high and half with low reward. Then, they either took a 90-min nap or spent an equivalent period awake monitored by polysomnography. We then assessed memory for close and more remote pairs in the sequences as well as confidence ratings, both immediately and three months later. fMRI data were acquired during the learning, test, and retest sessions. Our results show that reward enhanced memory consolidation at test for sleep and wake groups, and at long-term retest for the sleep group only. The processing of rewarded memories was associated with increased hippocampal activation for the sleep group as compared to the wake group and sleep spindles boosted increase in memory performance from learning to test. Furthermore, sleep enhanced confidence ratings for highly rewarded hits at test and retest. This effect was stronger for remote pairs in the sleep group, and associated with increased hippocampal activation. In sum, our results suggest that sleep favors the selectivity of long-term consolidation by retaining the most important memories, and enhancing subjective confidence for these memories. These effects are mediated by hippocampal and dopaminergic midbrain circuits and are enhanced by sleep spindles.

(oral presentation)

Acoustic coding of emotional state: call types matter

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It is generally accepted that structure of vocalizations may be adapted for, or constrained by, the particular function of vocalization. Young mammals' vocalisations may inform the mother about the quality and intensity of the caller's emotional state. However, it is unclear whether gradation of an emotional state is reflected in a structurally similar way in different types of vocalization used by callers. We analysed two types of piglet calls (high-pitched screams and low-pitched grunts) recorded across three levels of a negative situation, namely physical restraint. In each situation level, scream and grunt were emitted in immediate succession (within 2s) allowing us to assume same emotional state for both calls and to include both call types in a single analysis. Overall, six calls from each of the 30 piglets were included in the analysis and four very basic acoustic parameters were analysed: duration, amplitude, central frequency, and harmonicity. We found significant interactions between situation intensity and call type for all four acoustic parameters suggesting that both call types changed their acoustic structure differently in response to emotional state. In accord with previous studies, amplitude and central frequency of both call types increased with emotional intensity (amplitude increased more for screams; central frequency increased more for grunts). However, duration and harmonicity changed in opposite directions in screams and grunts (duration and harmonictity increased for screams and decreased for grunts). Our study shows that some vocal features might probably be used universally across different vocalizations as indicators of emotional states while others show specific response to changing emotional state depending on call type.

(oral presentation)

Acoustic analysis of domestic cattle (*Bos taurus*) contact calls from a source-filter theory perspective

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Cattle vocalizations have been proposed as potential indicators of animal welfare. However, very few studies have investigated this idea using advanced analysis techniques. Vocalisations play key roles in a wide range of communication contexts, for example,

in individual recognition and coordination of social behaviours. In recent years, the adoption of the "source-filter theory" of call production, which links the acoustic structure of vocalisations to the morphology and physiology of vocalising animals, has significantly advanced our understanding of vocal communication. Likewise, new more rigorous call analysis techniques allow us to describe the variation in vocal parameters with unprecedented detail. Using these approaches, we examined the contact calls made between cows and their calves in a semi-natural setting. Two different types of cow calls associated with different behavioural contexts, and with differing acoustic structures, were distinguished. Low Frequency Calls (LFCs) were produced by cows exclusively when they were in close proximity to their calves, in the first two weeks postpartum (Fundamental Frequency (F0) = 81.17 ± 0.98 Hz). By contrast, High Frequency Calls (HFCs) were produced by cows when they were separated from their calves (e.g. not in visual contact) and often preceded nursing (F0 = 152.8 ± 3.10 Hz). The average F0 of calf calls was 142.8 ± 1.80 Hz. The detailed analysis of cow LFCs and HFCs, and of calf calls showed that all three types of calls allow individuals to be distinguished. Calf calls also change as they mature. These results represent an important advance in our understanding of cattle vocalisations.

(oral presentation)

Vocal activity of bush babies from the genus Galago kept in zoos: bioacoustics as an alternative for species determination in captivity

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Bush babies from the genus Galago (Primates: Galagidae) typically have small morphological variability, thus species determination can be problematical in zoos when using traditional morphological traits. Recently, analysis of mitochondrial gene (cytochrome b) was conducted to confirm previous species determination of bush babies from European zoos. Acoustic analysis of species-specific vocalizations (advertisement calls or tonal attention and alarm calls) might also be useful for species determination in zoos. However, successful application of this method is conditioned by the fact that bush babies living in zoos emit these vocalizations spontaneously and regularly. Thus, we conducted ten-day acoustic monitoring of three groups of Southern lesser bush baby (*Galago moholi*) and four groups of Senegal bush baby (*G. senegalensis*) from European zoos using the automatic recorder Song Meter SM2+. We found that larger and more diversely composed groups have larger vocal repertoires. The highest rate of emission of species-specific vocalizations was found in larger groups or in several smaller groups kept together in one room. As expected, acoustic analysis of the recorded advertisement

calls showed that the Southern lesser bush baby and Senegal bush baby can be clearly distinguished on the basis of their non-overlapping fundamental frequencies. Our results highlight the potential use of bioacoustics as an alternative method for species determination of mammals in captivity. The research was supported by Internal Grant Agency of the Czech University of Life Sciences in Prague (CIGA), project no. 20134311.

(oral presentation)

Reference frames in spatial memory

Interaction between hippocampus and cerebellum Crus I in navigation based on allocentric and egocentric reference frames

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To examine the cerebellar contribution to human spatial navigation we used fMRI and virtual reality. Our findings show that the sensory-motor requirements of navigation induce activity in cerebellar lobules and cortical areas known to be involved in the motor loop and vestibular processing. By contrast, cognitive aspects of navigation mainly induce activity in a different cerebellar lobule (VIIA Crus I). Our results demonstrate a functional link between cerebellum and hippocampus in humans and identify specific functional circuits linking lobule VIIA Crus I of the cerebellum to medial parietal, medial prefrontal and hippocampal cortices in non motor aspects of navigation. They further suggest that Crus I belongs to two non-motor loops, the activation of which depends on the used strategy: place-based navigation is supported by coherent activity between left cerebellar lobule VIIA Crus I and medial parietal cortex along with right hippocampus activity, while sequence-based navigation is supported by coherent activity between right lobule VIIA Crus I, medial prefrontal cortex and left hippocampus. These results highlight the prominent role of the human cerebellum in both motor and cognitive aspects of navigation, and specify the cortico-cerebellar circuits by which it acts depending on the requirements of the task.

(keynote speaker)

Independent cognitive maps of two reference frames dissociated by rotation in human

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Movement of one part of an environment relative to others, like on a carousel, dissociates them regarding orientation in space. A position in space can be defined relative to one or other of these references frames (RF). Reaching a goal in such environment requires that one selects the relevant frame of reference and reorients relative to it to estimate his/her own position. Hippocampal place cell recording in similar environment in rats suggests that distinct population of cells code position in both RF, an evidence of separated spatial representation. We used a virtual environment with a rotating platform dissociating the RFs of the room and the platform to study associated spatial cognitive maps in human. The subjects should point at and then reach hidden goals in either room or platform reference frame upon showing their name on a screen. The time to point to a hidden goal seems to be strongly influenced by the RF of previous goal: changing the goal RF was associated with a longer pointing time. This switch costs can be the result of the process of reorientation in the relevant RF and/or the activation of the associated and separated spatial representation. In the presentation we will explore the hypothesis that internal representations of two dissociated RF are not accessible simultaneously, suggesting that mental maps of the two dissociated RFs are stored in memory as two independent representations in human. The study was supported by IGA MZ CR grant NT13386.

(keynote speaker)

Measuring episodic-like memory in rats and cats

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Episodic-like memory in rats, the integrated knowledge of what, where, and when, was recently interrogated by several studies. We introduced some new solutions for its measuring in case of Wistar rats and domestic cats. Our aim was to validate the preference for the new (what-when) and the dislocated (what-where) objects in an eight-arm radial maze in rats and the memory of the open exit in cats in who-where-when paradigm. In the rat study, a group of ten male Wistar rats was presented with three types of objects. In two training phases each individual was presented with two copies of object - object A in phase 1 and object B in phase 2. In the test phase two arms remained empty for each rat,

while the other contained two new objects (C), a dislocated and a non-dislocated copy of A and of B alike. In the cat observation two male cats and a female were introduced into the modified open field with a start box and two perpendicular exits, all with sliding gates. Each cat received twenty four training phases and four test phases, which covered all possible sets of who-where-when. Each phase consisted of exploration, pause and choice. All sets were individualized and random. Rats' results show that the new objects were more often explored than A objects (BCI: 0.124-0.940) and were explored for a longer time than A and B (BCI: 1.86158-7.25381 and 2.46398-7.49567, correspondingly). In cats the older male responded properly in all four test phases, the younger male in 3 out of 4, and the female failed the test due to her preference for one gate. Our results provide strong evidence for the knowledge of what(who)-where-when and some implications for future research. More trials ought to be introduced to present the "where" aspect in the context of "what" and "when".

(poster 73)

Coordination of two spatial reference frames in activity of hippocampal neurons

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In their natural environment, animals can be exposed to large amounts of information and based on behavioral relevance they must decide what information to process at a particular moment. Often sudden changes in environment require fast switching between the processed information streams, using cognitive coordination. We studied hippocampal neuronal activity underlying cognitive coordination in rats. In double place avoidance task rats were exposed to two streams of spatial information that were concurrently relevant. On a continuously rotating arena (1rpm) a rat had to process its position in two reference frames – room frame and arena frame, in order to avoid two shock zones: one stationary – defined relative to the room landmarks –, and one rotating – defined relative to arena landmarks. In this task we recorded ensembles of CA1 hippocampal principal cells, a large number of which discharge according to the animal position in space (place cells). Location of animal in both reference frames was reflected in hippocampal discharge, showing that both streams of spatial information were processed. At any moment of the experimental session neuronal activity represented preferentially the room frame or the arena frame, switching between the two with period of hundreds of milliseconds to seconds. This dynamic grouping of hippocampal activity reflected behavioral relevance of the two frames. The representation processed at a particular moment matched the reference frame with higher momentary behavioral importance i.e. the reference frame corresponding to the shock zone that was closer to the animal. We identified and characterized dynamic grouping of hippocampal neuronal activity and its relationship to cognitive coordination of two spatial frames in rats.

(oral presentation)

Testing functions of bird vocalization in the field

Syntax-like structures in song sequences? A network-analytical approach

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Animals often present their communicative signals in long sequences of distinct units such as elements, syllables, or songs. This complexity has inspired inquiries into similarities of such communication systems to human language. For example, birds often sing their songs in sequences with syntax-like structures. Here, I present data proving that network analysis provides a powerful new tool to characterize the order in song sequences. Long nocturnal song sequences of Common nightingales (*Luscinia megarhynchos*) were analysed and translated into networks of song types with song transitions as connectors. Sseveral song measures derived from network analysis were compared with male characteristics such as age, pairing success or body measures. Furthermore, a playback experiment with song types of certain transition properties [those that opened a song sequence to more variety (branches), and those that narrowed sequences to passages of less variety (bottlenecks)] should unravel whether males attend to sequential patterns. Nightingales adjusted their singing depending on the playback, providing first evidence that transition properties of song types might indeed play a role in male-male singing interactions. I conclude that network approaches and measures provide biologically meaningful data to describe the song structure in species with large repertoires and complex rules of song retrieval.

(keynote speaker)

Variation in trill characteristics in bird song: different trills for different use?

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Transmitting information about singer's quality is an important function of song in many bird species, and this information should be useful in territorial interactions. Fast trills, being physically demanding song structures, are particularly suitable candidates for signalling of quality or aggressive motivation. We have evaluated trill characteristics in songs within a population of the Tree Pipit, a songbird with no sexual dimorphism, in which song apparently plays a key role in territory defence as well as mate choice. Two types of relatively fast trills were commonly observed in repertoires of Tree Pipit males.

Trill rates significantly differed among individuals, suggesting that these song structures may carry information about male quality. We tested by playback experiments whether both trill types are used in territorial encounters, and compared trill rates of males with their ability to hold stable territory (as a proxy for success in intra-sexual interactions). Males with stable territories had significantly higher rates of one of the trill types. This trill type was also sung by males in response to playback, regardless on the trill type played to them. In an immediate response to playback, they increased the frequency of use of this trill, and also significantly increased the trill rate in comparison with spontaneous songs. This further confirmed field observations suggesting that this trill is important in male-male interactions. On the contrary, the use of the fastest, apparently more demanding, trill type actually decreased after the simulated territorial intrusion. We hypothesize that the latter one is more directed towards females, and that while performance of both trill types may reflect male quality, they are primarily used in different contexts.

(keynote speaker)

Sexual dependent situations evoke real time adjustment in song composition in male Blackcaps (*Sylvia atricapilla*)

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Birdsong has two main functions, mate attraction and territorial defence. Some songbirds have a structural dichotomy in their song that might function in the two different functions of bird song. If a dichotomy functions in both situations it might be that the structural composition is adjusted to different situations. Through a playback experiment we show that male blackcaps (*Sylvia atricapilla*) can actively alter the composition of their song in reaction to events related to sexual selection within their territory. Each song of the blackcap consists of a warble, followed by a simpler but louder whistle part. Which were respectively hypothesised to function in intra- and intersexual selection. Territorial males were presented with either a male or a female dummy during singing. Males showed an increase in song and warble duration towards female but not male dummies. To test whether these structural changes were noticed and of importance to receivers another playback experiment was conducted. The songs that were recorded in the presence of a male or female dummy were presented to other territorial males. These second order receivers responded with the same structural and context dependent changes. These results support the hypothesis of the warble to be functional in mate attraction and the whistle in territorial defence. Males can shift the emphasis of their song function actively towards the seksual context they are in.

(oral presentation)

Interactive vocal communication between mates during breeding is correlated with reproductive success in great tits

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Monogamy in birds represents a real partnership as mates have to work as a team for parental care. This partnership requires a communication between mates, which is poorly understood. As birds produce a wide variety of vocalizations especially during the breeding period, acoustic communication may have a key role in this process. In great tits, Parus major, females produce calls inside the nest but little is known about interactive communication between mates. The aim of this study was to describe the structure and contexts of interactive vocal communication between mates during breeding in great tits, and to test the possible link between these interactions and reproductive success. For that purpose, pairs of wild great tits were acoustically recorded in their nest in the morning during laying, incubation and young nestlings (0-4 days) stages. Recordings were done using microphones inside and outside nest-boxes and birds' behaviours were simultaneously monitored by an observer. We observed one type of vocal interaction during laying stage, and three types of vocal interactions during incubation and young nestling stages. In all vocal interactions, the female answered to her male's vocalizations from inside the nest. We measured several parameters describing the acoustic structure of these vocal interactions. We found that some characteristics of pairs' vocal communication are correlated with parameters of their reproductive success.

(poster 74)

Straight from the jackdaw's beak – individual on-bird recordings from a colony of free-living jackdaws (*Corvus monedula*)

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Animal vocal communication has been extensively studied and there is wide evidence that it plays a vital role for survival and reproduction. In songbirds, most studies to date have focused mainly on the conspicuous song, often disregarding calls despite their importance in long- and short-range communication. This lack of information seems to be at least in part due to technical limitations. Especially in highly vocal, group-living birds, individual recordings are difficult to obtain and to be assigned to the correct signaller, but at the same time they are crucial to the understanding of proximate and ultimate factors

shaping specific vocalisations. Biologging has helped us understand various aspects of animal physiology and behaviour but only a few studies have used such methods to study vocalisations, partly because of the high energy and storage demands of audio recorders. However, fixing a microphone and recorder directly onto an animal would allow us to catch a glimpse of vocal behaviour previously unknown or extremely difficult to obtain, e.g. while they are covering large distances, moving in inaccessible terrain or when sounds interfere, as in noisy environments or in the presence of multiple signallers. To our knowledge, our study on a colony of jackdaws (*Corvus monedula*) is the first one to use miniaturised digital on-bird audio recorders in free-living passerines. Its aim is to describe vocalisations and vocal interactions inside a group in relation to non-vocal behaviour and different life-history stages. At this symposium, I will present preliminary results from individual vocalisation recordings and some unexpected but exciting physiological parameters and will discuss some of the wider implications of this method for bioacoustics and behavioural science.

(oral presentation)

Corticosterone-induced offspring begging modifications affect parental nest visits and foraging behaviour in wild zebra finch

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Nestlings beg to parents to communicate their need. Nevertheless, the specific signal driving parental feeding remains partially undetermined. In several species, elevation of plasma corticosterone induced by food deprivation or need of warmth increases begging call rate, a conspicuous signal for predators. Because a recent study on adult zebra finches (*Taeniopygia guttata*) revealed that corticosterone drives modifications of the fine acoustic structures of calls, we hypothesised that stress through a raise of plasma corticosterone could similarly modify begging calls' structure, leading to a less conspicuous signal than begging rate that modulates parental care. Therefore, we orally administrated either exogenous corticosterone or a peanut oil control to free-living zebra finch nestlings of one week-old and recorded begging behaviour directly after the treatment and during the first parental visits. We monitored the rate and duration of parental nest visits and foraging behaviour during six days post-treatment using an innovative PIT-tag detection system to test the effects of our procedure on parents. We show that corticosterone increased the amount of nestlings' begging as demonstrated in previous studies, but we demonstrate

for the first time that corticosterone also up-shifted the begging calls' spectrum, similar to the effects described in adults. In response, parents spent more time in the nest, but also in feeders to forage, and their nestlings gained more weight. Begging calls thus show a corticosterone-driven flexibility, informing parents on nestlings' physiological state, allowing them to give an appropriate care for the survival of the progeny.

(oral presentation)

Sing me and I will know who you are – individual acoustic monitoring of tree pipit males

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In field behavioural and ecological studies, it is often necessary to identify specific individuals. In birds, colour rings are often used as individual marks. However, rings might be difficult to observe, especially in small species and dense habitats. This is the case of Tree Pipit (*Anthus trivialis*), which is usually singing from perch high on top of trees. We show that acoustic monitoring, based on the syllable repertoire analysis, can be a more effective method than colour rings for individual recognition. To our knowledge, this is the first time when this method was used in migratory species with moderate or high song complexity. During our three-year research in Central Bohemia (2011-2013), we obtained over 500 recordings from 57 males (12 returning next season). Males banded with colour rings were repeatedly recorded (usually 5 to 10 minutes) throughout the season, and syllable repertoires were determined from spectrograms for each recording. Repertoire of each male was distinct and stable within as well as between seasons; and males with very similar syllable repertoires differed in syntax. Thus, we were able to reliably identify all singing males in the studied population (including non-ringed ones), from assessing their repertoires and song syntax based on a recording containing 20–30 songs. Acoustic data revealed: 1. dynamic within-season changes in territory occupancy that would otherwise be missed; 2. identity of returning birds that actively avoided approaching humans; 3. the real number and time of occurrence of males appearing on the locality. The Tree Pipit is a good example, how individual acoustic monitoring can provide valuable data on behaviour and ecology of bird species from dense habitat and potentially sensitive to handling.

(poster 75)

What the crows croak about?

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The primary means of communication among birds are sounds. One would expect that developed social life and cognitive complexity should require creating more sophisticated songs. Crows are monogamous species and like other corvids form fission-fusion societies (Emery, 2006). Social structure in this type of community is dynamic, depending on the time of day and age of birds that this society consists of. In such communities, individuals survival is highly dependent on their relationships with other members of the community. Thus, the aim of the pilot project is to provide an initial answer to the question, whether amongst Large-billed crows (*Corvus macrorhynchos*) any diversity of the sounds can be observed. The observations were carried out for 8 days from 29.07.13 to 8.08.13 in area of campus of Indian Institute of Science in Bangalore, India. Basing on aural perception and visual inspection of spectrograms we distinguished 12 different types of calls. 'Kaa' was represented by 4107 examples, which makes it the largest and the most diverse group. Only within this group we managed to identify 12 subtypes of calls.We then used cluster analysis to examine our classification in an objective and quantitative manner. Although these resultsshed some light on range of sounds that can be used by crows, this was only a preliminary attempt, and much more data on marked individuals is required to complete this study. References: Emery, N.J., 2006. Cognitive ornithology: the evolution of avian intelligence. Phil. Trans. R. Soc. B 361, 23–43.

(poster 76)

Other topics

The relations of maternal behavior and physiological condition with offspring growth in domestic cat (*Felis catus*)

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The period of the highest costs for females is related to lactation and offspring growth, particularly in species with long-term parental care. Reallocation of organism's resources processing at this time can result in significant metabolic stress and loss of immunity that may influence an intensity of maternal behavior and development of cubs. The aim of this study was to compare maternal behavior and physiological status with offspring growth in domestic cat. The study was conducted at the experimental station "Tchernogolovka" of IEE RAS in 2011-2013. Data were obtained from 15 litters of domestic cat with 1-7 kittens. We used video-taping of maternal behavior, collected blood samples and weighed females and their kittens during lactation. The time that females spent with their kittens was correlated with the duration of nursing (Spearman rank order correlations (SROC): N=11, R=0.69, p=0.02) which was correlated with the duration of grooming (N=11, R=0.91, p=0.00) during lactation. The cortisol concentrations in females were higher the time that they spent with their kittens was less (N=6, R=-0.89, p=0.00). And the testosterone level was higher the duration of nursing and grooming was lesser (N=6, R=-0.94, p=0.00). However, females' body mass and immunity status were not correlated with maternal behavior or hormone concentrations in females (SROC, ns). In addition, the testosterone level was related positively with offspring growth: the hormone concentration was higher the total mass and gain of litter was larger (N=6, R=0.94, p=0.01). Thus, there is the close bond between maternal behavior and cortisol and testosterone concentrations in domestic cat females. The offspring growth is correlated with females testosterone level too. Supported by RFBR grant 13-04-01465.

(poster 77)

Agonistic sounds signal male quality in the Lusitanian toadfish

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Acoustic signals may be used in mutual assessment during animal contests but the role of agonistic sounds in fish is poorly understood. Lusitanian toadfish males (*Halobatrachus didactylus*) experience sonic muscle hypertrophy (likely androgen-driven) in the breeding season and use sounds (boatwhistles) to defend nests from intruders. Agonistic boatwhistles present the main energy in either the fundamental frequency, defined by the contraction rate of sonic muscles, or in the harmonics which are fundamental frequency multiples. Here we investigated if agonistic boatwhistles signal male quality features relevant to resolving disputes. We carried out territorial intrusion experiments and related residents' boatwhistle features, such as sound duration, dominant frequency, dominant frequency variability and pulse period (the inverse of the fundamental frequency) with male features including male length, condition factor, energy reserves in somatic and sonic muscles, relative mass of liver, gonads and sonic muscles, and steroid levels. We found that the dominant frequency decreased with sonic muscle lipid content but dominant frequency variability increased with sonic muscle lipid content and relative sonic muscle mass. This suggests that males with higher sonic muscle condition can call with a lower frequency and exhibit higher plasticity in the main frequency of boatwhistle, which may be important in social interactions. Higher mean pulse period (i.e. lower fundamental frequency) reflected higher levels of 11-ketotestosterone (11KT), the main teleost androgen. 11KT was significantly related with male condition (relative body mass and glycogen content). Taken together, this study suggests that agonistic sounds may signal male features that are key in fight outcome.

(oral presentation)

Sibling aggression in lynx can be the payoff for fast growth

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Early sibling aggression was already found in three from four existing species of lynx: Eurasian *Lynx lynx* (Sokolov et al., 1994), Iberian lynx *Lynx pardinus* (Vargas et al., 2005; Antonevich et al., 2009); bobcat *Lynx rufus* (Antonevich, Naidenko, 2013). Despite of the

common name, sibling fights differ from sibling interactions known in any other species. Fights in Eurasian lynx litters being observed in only half of the litters allow to analyse the difference between fighting and non-fighting cubs. There are no clear behavioural advantages related to the fight. To trigger sibling aggression the main candidate is a change in growth rate. What affects a cub's growth enough that it provokes aggression? We analysed factors that can influence growth rates and how they are responsible for fighting in lynx reproductive strategies. The study was performed at the Tchernogolovka Research Station of the Institute of Ecology and Evolution, RAS. Data from a total of 38 lynx litters (100 cubs) kept with their mothers were used in the study. From birth, a cub's body mass depends on both external and internal factors. Dietary changes, mothers' aging or identity and the litter size affect cubs growth. The combination of those factors had period-specific effects. Two developmental strategies appear: one with high investment in the first weeks and high risks after, and another with a slow increase of investment with age and that is less risky. Compensatory growth can be very important advantage for small cubs even with a payoff as an increased risk for later survival. The study was supported by RFBR13-04-01465-a and Program Bioresources (III-8).

(oral presentation)

Beyond aggression: testosterone's modulation of social interactions among subordinate males in the cooperatively breeding meerkat

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Androgen function is best understood in the context of mediating male reproductive and aggressive behavior, often at the cost of male involvement in parenting or prosocial activity. Among members of social species, testosterone is typically invoked to explain rank-related differences; however, its role within a rank, particularly among subordinates, is underappreciated. We explored the actions of testosterone in subordinate, male members of a cooperatively breeding species, the meerkat (*Suricata suricatta*). No rank-related testosterone differences have been observed in male meerkats, yet subordinate helpers rarely reproduce. We manipulated testosterone, in the field, by treating well-habituated, subordinate males, in multiple groups, with an antiandrogen (21-day release flutamide pellets, s.c.). During a month of the breeding season in the Kalahari, we monitored androgen concentrations (via baseline serum and time-sequential fecal sampling) and recorded behavior (focal observations). Relative to controls, flutamide-treated animals initiated less and received more high-intensity aggression (biting, threatening, feeding competition), initiated more prosocial behavior (social sniffing, grooming, huddling), and less frequently assumed the 'dominant' role during social play (pinning while wrestling, play mounting, chasing). Although interfering with the actions of testosterone produced

the anticipated depressive effects on aggression, while enhancing prosociality, treatment also revealed rare evidence of testosterone's activational effects on adult play. Our findings show a more pervasive role for androgens in adult social behavior than is traditionally recognized, with possible relevance for understanding tradeoffs in cooperative systems. NSF IOS-1021633

(oral presentation)

Sociobiological aspect of reproductive failure in domestic dog

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It is a common practice to transfer a domestic dog bitch for mating out of her home environment and bringing her back after the mating. If the home environment contains a male, who is not father of the foetuses, a potential danger for future infanticide arises. We hypothesized that described practice may result in reproductive failure of a bitch as a counterstrategy against the male's infanticide. Based on records from dog breeders we analysed 501 mating attempts of 216 healthy bitches of 11 groups of dog breeds. Fifteen percent of 300 bitches mated out of home delivered no puppy after returning home. By contrast, only 2.5% of 201 bitches failed to reproduce after mating with a home male with whom they stayed in a pack (difference between the groups $P = 0.03$). When mated bitches returned home with a male and other females and were separated from others in a kennel ($n = 86$), 34% of them failed to reproduce. If they were not separated from them ($n = 141$), only 7% of them failed to reproduce. This did not differ from a situation, when a mated bitch returned into a pack of females ($n = 63$, 10% failing to reproduce). A number of other females in home environment was another important factor ($P<0.001$). In cases, when a mated bitch was separated at home from other males and females, probability to fail to reproduce increased with increasing number of females. With increasing number of females the probability of reproductive failure decreased in bitches mated and kept within a pack together with a male and other females. Our results showed that transferring a domestic dog bitch in heat for mating out of her home environment, bringing her back and keeping her in a kennel in separation from a male and/or females increases a risk of reproductive failure.

(oral presentation)

Artificial insemination-induced pregnancy block in domestic horse mares as a counterstrategy against potential infanticide

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We found that bringing a pregnant mare mated out of home with a strange stallion into a vicinity of a male who was not the father of her foetus increased probability of pregnancy disruption. Repeated sexual activity either by a home stallion or dominant gelding was observed shortly after the mare came from out-of-home mating and shared the enclosure with a male or males. Pregnancy disruption was 7 times more likely event when the mare had no male company in her enclosure while home stallions or geldings were present in an adjacent enclosure. Thus a mare manipulates the male's paternity assessment by promiscuous mating as a counterstrategy against potential infanticide (Behav. Ecol. Sociobiol. 65, 1567-1572). If she has no chance to do that she activates her pregnancy block. We extended the investigation and tested whether pregnancy induced by artificial insemination (AI) may result in a similar behavioural response from the mare as mating with a stallion. We collected data on 77 artificial inseminations of 51 mares. As in the previous study, probability of failing reproduction was 8 times more likely when the mare had no male company in her enclosure while stallions or geldings were present in an adjacent enclosure than when the mare was sharing the enclosure with stallions or geldings. Thus the mare perceives conception after AI equally as mating with a strange stallion. Thus AI is as effective as transporting the mare for mating and then bringing her back to an environment with males, stallions or geldings, which did not sire the foetus. This practice seems to be one of the main causes of high percentages of pregnancy disruption in domestic horses. Supported by AWIN, EU FP7 No. 266213

(oral presentation)

Effect of *Rickia wasmannii* (Ascomycetes: Laboulbeniales) on the aggression and braveness of *Myrmica scabrinodis* (Hymenoptera: Formicidae)

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The interactions of parasitic Laboulbeniales (Ascomycetes) fungi and their hosts are understudied. *Rickia wasmannii* is the commonest ant parasitic Laboulbeniales species in Europe. Workers of *Myrmica scabrinodis* (Hymenoptera: Formicidae), the commonest host in Hungary, are heavily infected with this fungus and can be easily collected in high

numbers. *Rickia wasmannii* is therefore a quite available model species of Laboulbeniales to study the effect of such fungi on their hosts. Thalli of this fungus can form a strong surface on the ant body and we supposed this structural cuticular change could influence the behaviour of the infected ants. The behaviour of infected and uninfected *M. scabrinodis* workers were studied individually under lab conditions, hundreds of infected and uninfected specimens in two experiments. The time of leaving a dark tube was measured in the bravery test and the number of aggressive behaviour patterns was registered in the one-to- one aggression test. Based on our results the infected individuals were significantly less aggressive and brave than the uninfected ones. According to these, we can conclude that *R. wasmannii* has an effect on the behaviour of *M. scabrinodis*. Reduced aggression and braveness suggest this effect to be negative as these can cause disadvantage against the competitors of the host ants. Further research would be necessary to tell the level of this negative effect and it also would be important to do similar research with other Laboulbeniales species. Supported by: the scholarship of Collegium Talentum; a 'Bolyai János' scholarship (MTA); the "AntLab" Marie Curie CIG.

(poster 78)

New-house-effect: change in housing conditions provokes mating in Zambian *Fukomys anselli* mole-rats

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Mole-rats of the genus Fukomys live in eusocial multi-generational families. Only the founder pair reproduces whereas their offspring (non-breeders) remain reproductively inactive as they stay within their family. Incest avoidance between parents and offspring and between brothers and sisters is based on individual recognition. If two unfamiliar sexually mature non-breeders of opposite sex meet, mating takes place usually within minutes. In a previous study, we investigated the mating behaviour in adult non-reproductive Ansell's mole-rats (*F. anselli*). Pairs that showed courtship behaviour were tested repeatedly (maximally three times a week for ten weeks); between the trials the animals were put back to their respective family. The animals displayed sexual behavior in each test session. Recently, we compared copulation frequency in breeding pairs of established families under different conditions. Factors implying new surroundings (e.g. change of substrate or terrarium) triggered a higher occurrence of copulations. Although the subterranean ecotope is buffered against many fluctuating abiotic factors for most time of the year, abrupt changes in such parameters might occur and signalize expanding or opening new territories and announce new foraging opportunities (e.g. due to rains). Although Ansell's mole-rats can be considered aseasonal breeders, and are known for their regular sexual activity, this activity is apparently enhanced by some environmental changes. Provoked enhanced mating is important for luteolysis and induced ovulation

in this species. We speculate that the "new-house-effect" is based on activation of dopaminergic pathways similar as in the Coolidge effect. Our results might inspire fertility studies, husbandry and breeding programmes in zoo animals.

(oral presentation)

Yolk hormones influence in ovo olfactory learning and feeding behaviour in domestic chicks

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In precocial birds in ovo perceptual learning plays an important role in the development of a large range of behaviors. In domestic chicks we found that in ovo olfactory learning guides later feeding preferences. Here we tested whether an increase in yolk hormones (mimicking maternal stress in hens) influences in ovo olfactory learning and later feeding preferences. To this end we experimentally enhanced testosterone, progesterone and estradiol concentrations in eggs prior to incubation. The embryos from these treated eggs as well as sham embryos that had received the vehicle-only were exposed to an olfactory stimulus (menhaden oil) from embryonic day 11 (ED 11) to ED 20. Embryos from a control group received the vehicle only. After hatching all chicks were tested for their food preferences in simultaneous choice tests between non-odorized food and food odorized with menhaden. In 3-min choice tests with familiar or unfamiliar foods, control and treated chicks showed no preference for the odorized or non-odorized foods. On the contrary sham chicks show significant preference or avoidance of the menhaden scent. Treated chicks were also less willing to incorporate a novel food in their diet on a 24h time scale compared to control and sham chicks. Our results suggest that an increase in yolk hormones may impair the capacity of embryos to acquire perceptual information.

(poster 79)

Benefits of adversity: the impact of life history on the behavioral profile of mice varying in serotonin transporter genotype

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Behavioral profiles can be shaped by both life history and genotype. Concerning the effects of life history on anxiety-like behavior, adverse experiences are generally considered to affect individuals negatively. However, a growing body of evidence indicates a positive effect of limited adversity in contrast to not only high lifetime adversity but also no history of adversity. It is also discussed that not the degree of adversity but the degree of mismatch between the early and later environment plays an important part in shaping the anxious phenotype. Considering the impact of genetic predispositions, variations in the expression of the serotonin transporter (5-HTT) gene can modulate behavioral profiles. In the present study, mice varying in 5-HTT genotype were provided with four different life histories: Two groups grew up under mildly adverse social conditions during early phases of life while two other groups experienced beneficial early circumstances. In adulthood, mice faced a situation that either matched or mismatched the conditions experienced so far. The main findings were: (1) Life history strikingly modulated the behavioral profile, with exposure to early beneficial and later escapable adverse conditions causing lowest levels of anxiety-like and highest levels of exploratory locomotion. (2) Genotype significantly influenced the behavioral profile, with homozygous 5-HTT knockout mice displaying highest levels of anxiety-like and lowest levels of exploratory behavior. These results demonstrate that the behavioral profile is substantially influenced by both life history and genotype. Concerning life history, evidence indicates that the experience of early beneficial living conditions followed up by limited adversity in adulthood promotes subsequent resilience.

(poster 80)

How does local social environment influence song patterns in the black-capped chickadee?

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A growing number of studies draw attention to the fact that individuals living in the same population often do not experience the same social environment. Rather, each individual usually engage in different social relations, and hence they each experience a unique local social environment. The local social environment may have important effects on the behaviour of the individual, including communication patterns. We investigated the relationship between local social environment and song patterns in the Black-capped Chickadee (*Poecile atricapillus*), a parid bird with a single song type. Using 13 songs from each individual, we measured individual variation in six time- and frequency-related song parameters. As measures of local social environment we used number of territory neighbours and mean difference in dominance score to the neighbours. Both of these measures were found to be positively correlated with individual variation in one of the song parameters (song length and a frequency modulation measure, respectively). We furthermore investigated whether territory neighbours had more (or less) similar songs than non-neighbours. We found no such patterns. Our results suggest that local social environment influences individual song variation in the Black-capped Chickadee. The correlation between number of territory neighbours and song length variation suggests that individuals may benefit from increasing their communicative variation when exposed to a more complex social environment. This investigation takes a novel approach to the study of bird song by taking into account the social environment that each individual experiences. The approach may be useful in other species and communicative systems for elucidating the relationship between social structure and communication.

(poster 81)

Social Credibility Index: a new approach to explaining leadership processes

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The mechanism underlying decision-making during collective movements in many species involves certain specific group members that have a key role in such processes. Even if all group members can initiate collective movements, the success of initiators seeking to be followed by other group members can vary considerably. Besides signalling behaviours before departure, social status has been found to impact an initiator's success in different primate species. However, hierarchy, kinship and affiliative relationships have often been considered as separate issues, and the possible importance of personality has been neglected in most primate studies. In the current study, we have built a social credibility index (SCI) composed of hierarchy, affiliative relationships, kinship and the social dimension of personality. We then investigated the link between this SCI and the success of initiators by recording each individual's following success after each initiation. Success was measured according to the number of followers in two semi-free ranging groups of macaques with opposite social systems: the tolerant *Macaca tonkeana* and the despotic *Macaca mulatta*. We expect individuals with a high SCI to be elevated to leadership roles. Although the two species seem to display a similar decision-making process, different combinations of the SCI components may influence initiator success.

(oral presentation)

Is there a cost of social centrality? A study from a non-territorial herbivore, the domestic horse (*Equus ferus caballus*)

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Grouping behavior is a phenomenon widespread throughout the animal kingdom since individuals can derive a variety of benefits from their close proximity to others such as resources, protection and/or reproduction. Conspecific interactions is therefore often characterized by consistent interindividual distances and a synchronization of activity. Interindividual distances are also seen as a proxy of social preferences between members of a group. However, social interactions are not equally distributed and some individuals are more connected than others. It has been shown that high connectivity can result in some benefits for the individual. Indeed, it is frequently positively correlated with

leadership or social status' stability after group's perturbation. However researchers have given less attention to the costs of being highly connected. Still, theoritically speaking, maintaining social relationships requires time and energy and therefore should also represent a disadvantage. In this context, we studied three different groups of domestic horses and evaluate the social position of every members. To estimate the cost of social centrality, we calculated and compared the individual frequency spent in spatial proximity and social interactions. We found that the more central individuals where the more engaged in agonistic interactions suggesting that occupying a central role has a cost.

(poster 82)

Physiological difference between crib-biters and control horses in a standardised ACTH challenge test

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Stereotypies are repetitive and relatively invariant patterns of behaviour, apparently functionless, which are observed in a wide range of species in captivity. They can occur when a situation exceeds the natural regulatory capacity of the organism, and particularly in situations that include unpredictability and uncontrollability (chronic stress). Many studies proposed that stereotypic behaviour may serve as coping mechanism, but results are contradictory. We measured the endocrine responsiveness of 21 crib-biters and 21 control horses in a standard ACTH challenge test, which triggers a physiological stress reaction, in order to better understand the coping process of stereotypies. Heart rate was measured continuously and saliva cortisol was taken during 3 hours every 30 minutes. We did not find any difference in heart rate or RMSSD between groups. However, crib-biters had a higher cortisol response during the ACTH challenge test (Mean ± SE: crib-biters, 5.36 ± 3.00 ng/ml; controls, 4.28 ± 3.33 ng/ml; Linear mixed model (LMM), $P<0.01$). Interestingly, it seems that this difference in cortisol was largely due to the crib-biters that did not crib-bite during the test (5.9 ± 3.06 ng/ml). Indeed, these horses had higher cortisol responses than all other horses. Our results suggest that crib-biting horses differ from control horses in their hypothalamo-pituitary-adrenocortical (HPA) axis reactivity. This difference could be a consequence of chronic stress and/or genetic predisposition. Crib-biting might be a successful coping strategy that helps horses to gain control over situations and reduce cortisol levels. We conclude that preventing them to crib-bite could be counter-productive and that it would be better to change their environment.

(oral presentation)

Behaviour of dairy cows after relocation and housing change

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The hypothesis that relocation of cows with a housing and milking change temporarily affects cows' behaviour has been proved. 41 cows were relocated from the tie-stall barn into the free-stall barn with herringbone parlour. They were observed for three 24 hours (first, second and tenth day) observations after moving into the new barn. Cows lay down up to ten hours (596.3 min.) after removing. Second parity cows and non-pregnant cows lay down sooner than cows in the first lactation and pregnant cows (532.2 min. vs. 678.3 min.; 588.5 min. vs. 603.8 min.). Primiparous and pregnant cows had shorter lying episodes following the relocation (25.0 min. vs. 51.4 min., $P<0.001$; 38.3 min. vs. 46.0 min.). Latencies for total lying and lying on the left side were progressively shorter from the first milking session to the fourth milking session. Cows in second lactation and non-pregnant cows began ruminating sooner than cows in first lactation after the first and fourth milking sessions. The shortest times of lying and ruminating were recorded at the first day after relocation ($P<0.001$; $P<0.001$), the longest time in duration of standing (1103.7 min.; 811.9 min.; 683.9 min.; $P<0.001$). The period's number of lying and ruminating were the lowest at the first day and highest at the tenth day after relocation ($P<0.001$). The opposite trend was found in the period's number of feeding and standing. The results of this study suggest that relocation may alter behavioural measures. However, behaviour observations indicate that older and non-pregnant cows are more able to quickly adapt to environmental change. This work was possible through project APVV-0632-10 of the Slovak Research and Development Agency Bratislava, Slovakia.

(poster 83)

Non-invasive method to determine the stress in fish

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Fish are very sensitive to any changes in their environment. Fish in the wild react naturally to many stressors. Freshwater fish in factory farms are subjected to stress-related haul and transport to hatcheries or to transportation to processing. In fish exposed to stress can monitor multiple increase in plasma cortisol concentration. It is shown that extraction of fish out of water for several minutes causes very quickly to fifty times increase cortisol levels. The aim of this study was to verify the suitability and possibility of using non-

invasive methods for the determination of cortisol in fish for assessment of stress factors on fish. For this study were used fish of the common carp (*Cyprinus carpio*) directly during the sale. Fish were customers at the store stunned and killed. The fish were removed from the body surface by scraping mucus of area about the size of 10x10 cm in plastic tubes and the samples were frozen until analysis. Analysis of cortisol in samples of mucus was performed by ELISA. Response of fish to stressful stimuli is species-specific. The results obtained values of cortisol in fish slime method used can be a good indicator of stress in fish. The advantage of this method is to limit the stress on the fish's own sample, which may due to the rate of increase cortisol levels in fish affect the outcome being stress during blood collection. Since the method used is friendly to fish and is suitable for the assessment of welfare in fish noninvasive way. The author thanks the Grant project UVPS Brno IGA 34/2014/FVHE for their support of this study.

(poster 84)

A preliminary study of the function of social play in captive wolves

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Social play may represent an important tool for establishing social relationships during both the juvenile and adult phases. It has been suggested that social play may allow playmates to determine dominance relationships by competing for their rank position in a relaxed context. Accordingly, agonistic encounters outcomes should reflect social play bout outcomes. Social play may also strengthen inter-individual affiliative relationships and reduce aggression; thus, it should be associated with both an increase in affiliative interactions and a decrease in aggressive encounters. These two non-exclusive hypotheses remain largely untested, especially in non-primate species. Because of their high sociality and reliance on cooperation both for breeding and hunting, wolves may be especially suited for testing these hypotheses on play function. To reach this aim data on social play bouts as well as on agonistic and affiliative interactions occurring outside the play context were collected on 12 wolf pups from 3 to 6 months of age before and after their introduction into established packs. We found a significant positive correlation between being the winner of play bouts and being the winner of agonistic interactions. We also observed divergence from the 50:50 rule asserting that participants should win an equal proportion of play bouts to continue playing across dyads. This result suggests that social play may allow wolves to establish, and continuously test, their reciprocal rank position in the pack. Dyadic play distribution was not affected by affiliative relationship nor was it negatively correlated to aggressive interactions suggesting that play in wolves is not associated to social affiliation. Videos are in the process of being coded and other analyses will be presented

(oral presentation)

Sex-biased differences in maternal effects in red deer (*Cervus elaphus*)

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In Ungulates, maternal effects occur when the phenotype of the mother influence that of the calf, with a long term relevance in terms of survival, growth or fitness. It is common a strong effect of the maternal identity, but there is some plasticity in these maternal effects related to the maternal condition, experience or senescence. We studied how different aspects of the maternal phenotype (age, weight, body condition, and dominance status) influenced relevant aspects of birth and early growth of the calf (birth date, birth weight, weight at weaning, and body condition at weaning). Analyses were conducted on 188 births from 75 hinds aged from 2 to 19. For each possible effect, 4 single GLMMs were built (one for each maternal trait) including hind ID as subject, and the best models were selected using AIC. As expected, hind weight influences calf birth weight ($p<0.001$) and weaning weight ($p=0.001$). However, the effect in weaning weight is different between sexes: while only hind weight affects weaning weight of female calves ($p=0.001$), it is affected by hind weight ($p=0.043$) and age ($p=0.026$) in male calves. The main differential investment is related to birth date: when growing a female, hinds give birth earlier in the season only if they have a good body condition ($p=0.039$), but when growing a male they give birth earlier when older ($p=0.017$). Early birth and fast early growth is usually an advantage for calves, but much more for males since this has a great influence in the development of the first antler; however, it may be a challenge for the mother if there is a delay in the increase of food availability in spring. Thus, only old and experienced females can achieve this extra investment, but only when they are growing a male which may improve their fitness.

(poster 85)

Acoustic stimulation of puppies can improve their response towards sudden noise

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Tactile short manipulation of newborn puppies can improve their ability to cope with stress in military dogs. The aim of the study was to find whether also an acoustic stimulation during early ontogeny can improve response of puppies towards unfamiliar noise during selection behavioral test at 7 weeks of age. Puppy test has been routinely used to assess in advance a later working ability of police dogs in the Czech Republic. After birth, puppies were divided into treatment and control groups. Treatment subjects (N=19) were exposed to a common broadcasting of a radio for 20 min during the period between 16 and 32 days of age at their home kennel three times a day. Control group (N=20) was isolated from the radio. In the experiment mothers of the puppies (N=3) were repeatedly used in the both groups. Puppies were then exposed to the behavioral test. This test consisted from 10 individual tasks and for the recent study the reaction to acoustic bang (made by hitting a concrete floor with a shovel) was analyzed. Reactions of the pups were scored from 0 to 5 points; the better the response, the higher the score. The fixed effects in a generalized linear mixed model (GLMM) were treatment, puppy body weight and identity of the mother. Results showed better reaction of the treatment puppies ($F_{1, 32} = 7.62$, $P<0.01$) compared to control puppies and of heavier puppies ($F_{1, 32} = 7.62$, $P<0.05$) to acoustic bang. There was a significant effect of the mother (GLMM $F_{2, 32} = 5.1$, $P<0.05$). In conclusion, it is suggested that daily short-termed acoustic stimulation of puppies by radio broadcasting during early ontogeny can improve response of the puppies to sudden noise.

(poster 86)

Ocean acidification impairs learning of predators and lowers prey survival via neurotransmitter interference

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Ocean acidification (OA) is one of the most pressing environmental concerns of our time. We are gaining considerable insights from work focused on the physiological impacts and ecological consequences of changes in ocean chemistry, but further advances require a

greater integration across disciplines. We showed that projected near-future CO2 levels impaired the ability of a common coral reef fish to learn the identity of predators, but these effects could be reversed when fish were treated with gabazine, an antagonist of the GABA-A receptor - a major inhibitory neurotransmitter receptor in the brain of vertebrates. The effects of CO2 on learning and the link to neurotransmitter interference were manifested as major differences in the survival of fish in the wild. Lower survival under elevated CO2, as a result of impaired learning, could have a major influence on population recruitment.

(poster 87)

Collective cognition in fish and humans: observing others allows individuals in groups to overcome a fundamental limitation to decision accuracy

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Group living has evolved due to the many advantages it provides to the individuals being part of a collective, such as better anti-predator defence, spotting food or finding a mate. These advantages often result from the ability of groups to solve cognitive problems that exceed individual ability. For example, the trade-off between true positives (e.g., escape when predator present) and false positives (e.g., escape when predator absent) is a fundamental limitation to decision accuracy of single decision makers. But recent research has shown that individuals in groups can overcome this trade-off and can simultaneously increase true positives and decrease false positives. In this context, we quantified the response of Trinidadian guppies (*Poecilia reticulata*) in various group sizes to two red stimuli, one edible and the other non-edible in natural stream systems. We showed, using a Bayesian decision-making model, that a randomly chosen individual is more likely to approach and peck an edible stimulus when it belongs to a bigger group. In a related experiment in which groups of humans saw a group of animals (projected on a screen) in which a cryptic predator was either present or absent, and were allowed only to move in space to indicate their decision to stay or escape, we found that locomotive behaviour as a simple and common way of information exchange allowed individuals in groups to simultaneously increase true positives and decrease false positives compared to single decision makers. Given that movement and foraging behaviour is widely used by animals as a cue for decision-making, our results suggest that this mechanism is applicable to many animal groups.

(oral presentation)

Elucidating the effect of internal state in nutritional decision-making dynamics in *Drosophila melanogaster*

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Animals need to trade-off exploration and exploitation when foraging. We investigated how decision making dynamics is modulated by sensory information and internal state, by studying foraging behaviour in *Drosophila*. Flies balance protein and carbohydrate intake depending on their metabolic and mating state to maximise fitness (Lee et al, 2008; Ribeiro & Dickson, 2010). Therefore, nutrient balancing provides a useful framework to study neuroeconomic decision-making since the value of the available options directly depends on the internal state of the animal. To reverse engineer the decision making mechanisms we characterised kinematic behaviour parameters around different food patches to quantitatively relate them to decision parameters capturing these trade-offs, akin to human decision making experiments (e.g. Faisal & Wolpert, 2008). We developed a machine-vision setup which records single fruit flies (n=290) as they forage during 2 hours in a circular arena (rad=3.3cm) containing 9 sucrose and 9 yeast spots, as carbohydrate and protein-rich food patches, respectively. Mated or virgin flies under selective nutritional deprivation were evaluated. We developed a probabilistic machine classification approach to define engagement with a food patch and describe the highly variable temporal sequence and durations of individual engagement bouts systematically. We found that the internal state modulates the departure decision ("explore or exploit") and the arrival decision ("choose or move on") as captured by the differences in the distributions of yeast and sucrose bout durations and by the transition probabilities between patches. Our automated analysis makes these computational questions directly amenable to testing by genetic and neuronal manipulation.

(oral presentation)

Effects of maternal allostasis and intrauterine position on litter features in a social rodent *Octodon degus*

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Sex allocation theory predicts that the parental investment in male and female offspring is equitable; however intrinsic and extrinsic factors may affect the resource/care allocation

between sexes in the same litter. Stress may be important proximate mechanisms underlying variation in mammalian litter features, and female pup phenotypical masculinization. In addition, Intrauterine position (IUP) affect in similar direction female phenotypes. We studied the effect of maternal stress and intrauterine position effects on litter sex allocation and in the offspring female phenotypes, using the social caviomorph rodent, *Octodon degus*. Results suggest that maternal allostasis affect mostly litter size, while IUP affects the litter sex ratio. In addition, both mechanisms affect the proportion of masculinized females produced in the litters. In conclusion, both mechanism have effects on litter traits and female phenotype.

(poster 88)

Resting heart rate variability is related to sexual desire in both sexes

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Previous research in clinical samples shows that erectile problems are related to lower vagal tone and sympathovagal imbalance as reflected in lower high-frequency heart rate variability (HF), higher low-frequency heart rate variability (LF) and higher low-frequency/high-frequency ratio (LF/HF). Also, patients with non-organic erectile dysfunction who responded favorably to trazodone showed increases in HF, and decreases in both LF and LF/HF, which this raises the question of whether higher vagal tone and better sympathovagal balance reflect central processes relevant for greater sexual motivation. Thus, the present study aimed at examining, in a young sample of both sexes, the associations of sexual desire with time and frequency-domain measures of heart rate variability. Sixty three women and 43 men (mean age = 22.37 years; SD = 3.42) had their resting heart rate measured during five minutes, reported their past month frequency of penile-vaginal intercourse, and completed the desire dimension of the International Index of Erectile Function (men only) and the desire dimension of the Female Sexual Function Index (women only). In partial correlations controlling for age, female sexual desire correlated directly with higher HF and higher LF, as well as with almost all time domain measures. For men, sexual desire correlated directly with HF, and inversely with LF and LF/HF. Additionally controlling coital frequency left the results essentially unchanged. The results suggest that central processes relevant for sexual motivation are reflected in higher vagal tone and better sympathovagal balance in men, and in both sympathetically and parasympathetically mediated heart rate variability in women.

(oral presentation)

Cooperative investment in public goods is kin-directed in communal nests of social birds

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Social systems are vulnerable to exploitation by individuals attempting to maximise personal fitness at the expense of other members of their social group. Yet, societies have evolved in many animal taxa, demonstrating that a 'tragedy of the commons' leading to social collapse is not inevitable. An individual's social environment, especially interactions with kin, can play a critical role in reducing conflict and influencing the extent to which individuals cooperate. Here, we show that cooperative investment in the massive communal nests of sociable weavers _*Philetairus socius*_ is, despite the very large size and low mean relatedness of these communities, kin-directed. Individual weavers occupy one or more nest chambers that are embedded within a supporting, communal thatch that confers thermoregulatory benefits and can hence be regarded as a public good, requiring construction and maintenance. Using fine-scale population genetic structure and social network analysis, we first show that despite low mean kinship within colonies relatives are spatially and socially clustered within communal nests. We then show that males are the principal thatch-builders and that they contribute to the communal structure in the proximity of nest chambers belonging to themselves and to relatives. Finally, we show that nest-building males have higher local relatedness to other colony members that benefit from their investment than do non-building males. We conclude that the benefits of the public good are shared with kin and that cooperative investment is, despite the large size and low relatedness of these communities, kin-directed.

(oral presentation)

Hormonal control of non-breeding territoriality in male American martens

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Mammalian territoriality is generally regulated by gonadal androgens like testosterone (T). During the non-breeding season, territoriality can be, however, partly or completely androgen-independent, and dehydroepiandrosterone (DHEA) may be the key hormone in its regulation. To investigate the mechanisms of non-breeding territoriality, we studied spatial patterns and hormone profiles in 40 male American martens (*Martes americana*)

on a hichagof Island (Alaska, USA). Using the capture-recapture and radiotelemetry methods, we discriminated between resident (n = 33) and transient (n = 7) males. We evaluated the levels of DHEA and other androgens (T, androstenediol, androstenedion and dihydrotestosterone) using the blood sampling techniques. We predicted: (1) a higher production of DHEA and other androgens in residents than in transients, (2) a higher production of DHEA and other androgens in older than in younger males, and (3) a higher production of androgens, including DHEA, before than after the breeding season. Consistent with our predictions, residents produced higher levels of androgens (excluding DHEA) than transients ($p < 0.001$). By contrast, residents and transients did not differ in their DHEA levels ($p = 0.69$). Younger residents produced higher levels of DHEA than older residents ($p = 0.02$). Independent of territorial status, males produced higher levels of androgens (excluding DHEA) before than after the breeding season ($p < 0.001$). Our results indicate that higher levels of DHEA facilitated marten males to gain own territories, while higher androgen levels (excluding DHEA) facilitated them to maintain a territorial status. Pre-breeding androgen elevation can be especially important for residents, in which it can promote breeding territoriality.

(oral presentation)

Social influences on the courtship behavior of the male greater sac-winged bat, *Saccopteryx bilineata*

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Courtship behavior demonstrates the willingness to mate and the fitness of mating partners; thus, it is usually encoded in distinct behavioural patterns. Despite the stereotypic nature of courtship displays, the social environment and the estrus of the female mating partner can have a strong influence on male courtship as well. In the greater sac-winged bat, Saccopteryx bilineata, male courtship consists of complex multimodal displays, the most conspicuous of which is a stereotypic hover flight in which the male displays in the visual, olfactory and auditory domain. We studied social influences on male courtship activity (i.e. hover flights and courtship songs) of 10 male S. bilineata from 5 different-sized colonies over a four month period in Costa Rica. Male courtship activity, i.e. the number of hover flights, was significantly correlated with both the number of harem females and rivals within the colony as well as the overall colony size. Hover flight length was positively correlated with the number of females, indicating that males invest more time and energy in courtship with increasing number of possible mating partners as well as with increasing male-male competition. Courtship songs are multi-syllabic vocalizations with strongly modulated trills as the most prominent syllable type. In contrast to the hover flights they accompany, courtship songs are not stereotypic but highly variable. We found evidence

for social influences on the complexity of courtship songs, e.g. the number of syllables used was positively correlated with colony size, and individual differences in the use of syllable types. Our results indicate that courting S. bilineata males adjust their courtship displays in response to social influences from conspecifics.

(oral presentation)

More ornamented males are more cuckolded in the collared flycatcher

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Extra-pair copulations (EPC) are common among passerine birds. Females are expected to engage in this behavior if they obtain direct or indirect benefits from extra-pair sire. Alternatively, females might be attracted by extra-pair males or behave maladaptively because of strong between-sex genetic correlation for courtship behavior. In the collared flycatchers (*Ficedula albicollis*), males have two white patches, one on the wing and the other on the forehead, that have been shown to play a role in sexual selection. If females engaged in EPC due to genetic benefits, as is often assumed, they should choose extra-pair mates with larger ornaments than their social mates have. To test this hypothesis we identified extra-pair young and their fathers during four consecutive years. First, we examined whether presence of extra-pair young in the nest correlates with the ornaments' size of social fathers as well as with the morphology of both social fathers and their mates. Second, we compared social fathers with the extra-pair males that cuckolded them. Contrary to our expectation, males with larger wing patches had more extra-pair young in their nests than those with smaller patches. The forehead patch as well as male and female morphology and age were not significant predictors of paternity losses. Similarly, there was no difference between the social and the extra-pair fathers in any studied trait. These results could be explained by the mate guarding behavior of the male. Males with smaller patches may guard their females more actively to prevent cuckoldry while those with larger patches court extra-pair females. However, there is still a lack of behavioral data about extra-pair copulations and mate guarding in this and other species.

(poster 89)

Relationship of reproductive behavior and sexual dimorphism in Felidae

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Sexual dimorphism is expressed differently among Felidae. We suppose that the possibility to make choice of a sexual partner for a female depends on the degree of sexual dimorphism. The aim of our study was to estimate if there is a relation between the degree of sexual dimorphism in body size and reproductive behavior of females in three feline species. This study was carried out at the biological station "Tchernogolovka", Russia in 2002-2013. We used Eurasian lynx (*Lynx lynx*) as a species without marked sexual dimorphism (SD - male body mass/female body mass = 1) (n=6♂♂;11♀♀); domestic cat (Felis silvestris var. catus) was a species with the average degree of SD (1.15) (n=10♂♂;11♀♀); Far-east wild cat (Prionailurus bengalensis euptilura) was a species with the high degree of SD (1.5) (n=10♂♂;12♀♀). In the mating season relationships between partners were influenced by a female in Eurasian lynx. They demonstrated elements of courtship towards males 7.6 and 15 times higher than female domestic and Far-east cats, respectively. Also frequency of friendly contacts between a male and a female was two times higher in Eurasian lynx than in domestic and in Far-east cats. The character of relationships was determined by a male mainly in species with more expressed sexual dimorphism. As opposite to females of Eurasian lynx, female Far-east and domestic cats could avoid an undesirable mating only with demonstrating the high level of aggressive behavior or hiding in a shelter. This study was supported by grants of RFBR (13-04-01465-a) and Program Bioresources (III-8) RAS.

(poster 90)

Getting ready for invasions: can background level of risk predict the ability of naïve prey to survive novel predators?

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Factors predicting the outcome of predator invasions on native prey communities are critical to our understanding of invasion ecology. Here, we tested whether background level of risk affected the survival of prey to novel predators, both native and invasive, predicting that high-risk environments would better prepare prey for invasions. We used naïve woodfrog as our prey and exposed them to a high or low risk regime either as embryos (prenatal exposure) or as larvae (recent exposure). Tadpoles were then tested for their survival in the presence of 4 novel predators: two dytiscid beetles, crayfish and

trout. Survival was affected by an interaction between risk and predator type. High risk was beneficial to prey exposed to the dytiscids larvae (ambush predators), but detrimental to prey exposed to crayfish or trout (pursuit predators). No effect of ontogeny of risk was found. Our results provide critical insight into the relationship between risk and resilience to predator invasions.

(poster 91)

Calling predicts mating success in the Lusitanian Toadfish

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Females often choose males of high phenotypic or genetic quality. In Lusitanian toadfish (*Halobatrachus didactylus*) calling rate reflects male quality and appears to predict male reproductive success (i.e. number of eggs in the nest). However the number eggs may not be an adequate proxy of male reproductive success if sneaking or nest takeovers occur. We tested the influence of calling activity on reproductive success with two experiments. First, we tested the relation between acoustic signalling and male reproductive success by comparing brood size among muted (deflated swimbladder, the sound-producing apparatus), sham-operated (intact swimbladder) and unmanipulated males in the Tagus estuary (Portugal). Males were confined in artificial nests that only allowed females to enter. Individual calling rate was quantified using a matched filter of Ishmael software. We did not find significant differences in the number of obtained eggs among male groups probably because the sample size for muted fish was small (N=5). However, when excluding muted males, egg number was significantly correlated with calling activity but not with male length or weight. In the second experiment we used microsatellites to quantify the percentage of eggs sired by unrestrained nest-holders in the population. We found a mean of only 14% of eggs sired by free nest-holders. In summary, this study suggests that calling activity, but not male size, influences reproductive success in Lusitanian toadfish. Moreover, it calls for the need of offspring parental analysis when assessing fish reproductive success.

(oral presentation)

Genetic and phenotypic mechanisms of begging in canaries

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Begging, i.e. the solicitation of food from parents, is one of the first coordinated behaviours performed by nestlings of altricial birds species. Begging stimulates the transfer of resources from parents and has thus significant positive effects on growth and survival. But unrewarded begging on the other hand entails costs for the offspring in terms of energy consumption and enhances predation risk, and is therefore subject to trade-offs. Begging furthermore exerts a selective pressure on parental behaviour, but because it is influenced by the parental response, it is also target of selection. Begging consequently follows a complex evolutionary trajectory – additionally flavoured by a conflict over parental investment due to a different weighing of the costs and benefits of parental care. It requires therefore detailed information on both selection and inheritance of begging in order to understand its evolutionary potential. Using canaries (*Serinus canaria*) as model species, we applied a bidirectional artificial selection on low and high begging behaviour, which is a powerful tool to study its genetic architecture. I will present results of the first two years of artificial selection. I will focus first and foremost on (a) the heritability and response to selection (b) the coadaptation of offspring begging and parental provisioning (c) the consequences for sibling competition and potential indirect fitness costs and benefits and (d) underlying mechanisms and possible covariances.

(poster 92)

Beauty of mammalian species as perceived by local people in Dja biosphere reserve in Cameroon: differences between Baka hunters and Bantu farmers

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We explored the beauty of mammalian species on the basis of aesthetic preferences of local people in Cameroon. We explore the diffrences in aesthetic ranking of animals between local Bantu farmers and Baka hunters living in Dja biosphere reserve. We present the standardized pictures of 43 species of mammal species living in Dja reserve in Kamerun to the local people. We asked Baka hunters (N=94) as well as Bantu farmers (N=94) to order the pictures of mammals according to perceived beauty. We used respondent's aesthetic

ranking order (from the most beautiful animal to the ugliest one) for the following statistical analysis. Firstly we analyzed congruence among the respondents. Kendall's coefficients of concordance revealed significant agreement among the respondents (for pooled dataset: W = 0.157, n = 188, $\chi 2$ = 1511, df = 43, P < 0.001). This agreement was higher within Bantu (W = 0.338, n = 94, $\chi 2$ = 1367, df = 43, P < 0.001; for men and women W = 0.379 and 0.303, respectively) than within Baka respondents (W = 0.138, n = 94, $\chi 2$ = 558.6, df = 43, P < 0.001; for men and women W = 0.225 and 0.097, respectively). Hoewer, there are substantuial diffrences among Baka and Bantu respondents, when the particular species are evaluated. Bantu farmers mostly prefer small species of mammalas like pangolins or big rodents that are part of their diet frequently. Intrestingly, the Baka hunters prefer bigger species like great apes or elephants. However, there are also species that are evaluated congruently according to beauty in Baka and Bantu local people.

(oral presentation)

Die another day: Non-infective eyeflukes make fish less vulnerable to the predation

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Parasite manipulation of host behavior is now a well-known phenomenon. For trophically transmitted parasites the main aim of manipulation is to make their host more vulnerable to the next host. However it is true only for the infective stage of the parasite. But do non-infective parasites also manipulate their hosts? Model predicts that non-infective parasite should alter host behavior to decrease predation risks; moreover such alteration can evolve more easily (Parker et al., 2009). Studies, which concern influence of non-infective parasites on host behavior, are still rare (but see Dianne et al., 2011). We studied influence of non-infective stages of the eyefluke, *Diplostomum spathaceum*, on the behavior of juvenile cyprinids (sunbleak, roach, bream, bleak). Infective metacercariae of D. spathaceum are known to manipulate their hosts (e.g. Seppälä et al., 2003). This parasite makes fish more vulnerable to the piscivorous birds (next host) increasing fish preference for the surface layers. We hypothesized that influence of the non-infective eyeflukes should be opposite. Fish harbouring non-infective eyeflukes preferred to stay deeper in the water column than control fish (t-test; t=2.84, df=87; p<0.006). Our experiments imitating avain predation showed that individual's caution positively correlated with the infection intensity (four shoals were tested; Rs=0.31-0.52; p<0.05 for all cases). We observed these changes in the behavior of fish infected with a moderate amount of non-infective cercariae (2-20 parasites/ind.-1) which is typical of natural intensities. Our results suggest that non-infective parasites manipulations of host behavior are widespread and may strongly influence predator-prey interactions.

(oral presentation)

Effect of previous ramp exposure and regular handling on heart rate, ease of handling and behaviour of near market-weight pigs during a simulated loading

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Loading has been shown to be a physically and psychologically challenging experience for slaughter pigs. Finding ways of helping pigs cope better with this procedure will contribute to reduce stress and therefore improve their welfare. Thus, the objective of this study was to assess whether stress response during simulated loading could be reduced by providing pigs with experience prior to the event. Two weeks before simulated loading, 160 Large White x Landrace near market-weight pigs were allocated to one of four treatments: physical training (EXERCISE), psychological training (RAMP), EXERCISE and RAMP trainings (BOTH) or no training (CON). Once training was completed, pigs were loaded into a simulated trailer compartment, and the metrics of behaviour, pig and handler's heart rates, loading time and handling difficulty were measured. During loading, heart rate was lower ($P < 0.05$) for EXERCISE and BOTH pigs compared with RAMP and CON pigs. The numbers of touch/slap and push were lower ($P < 0.05$ and $P < 0.05$, respectively) for EXERCISE pigs compared with CON, RAMP and BOTH pigs, which did not differ ($P > 0.05$). The number of balks was the lowest ($P < 0.05$) for EXERCISE pigs, whereas there were no differences ($P > 0.05$) between BOTH and CON or RAMP pigs. This study demonstrates that daily exercise, by itself, improves the ease of handling and reduces cardiovascular response, while it appears that previous exposure to a ramp had no beneficial effects. Further investigations are needed to determine whether the decrease in the behavioural and cardiovascular responses reported in this study was due to an improvement in physical fitness, habituation to handling or both.

(poster 93)

Environmental and intrinsic factors in determining sex-roles? A comparison of black and white-browed coucals

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The majority of birds is socially monogamous or polygynous and shows bi-parental or female-only care. Less than 1% of all species are 'sex-role reversed' with polyandry and male-only parental care. Typically, this mating system – termed classical polyandry – is found only in precocial birds, but there is also one altricial species, the African black coucal (*Centropus grillii*). It has been suggested that classical polyandry is possible only, because – in contrast to closely related coucals – the black coucal relies on a temporally superabundant food sources, thus enabling females to quickly gather resources to lay a large number of eggs within a short period of time, and allowing males to raise a brood without help from the female partner. I tested this idea in a long-term study comparing the black coucal with a close congener, the white-browed coucal. At my study site, the two species co-occur in the same area and rely on similar food resources, but despite this fact the white-browed coucal is socially monogamous and both parents provision their young at equal rates. In my contribution I will present a detailed comparison of the phenology, breeding behavior and parental effort of these two species. In contrast to previous ideas current data suggest that the difference in mating strategies between the two congeners may rely on subtle differences related to nest predation, breeding density and the adult sex ratio. In summary, the results support recent advances in the theoretical foundation of sexual selection and parental investment theory.

(oral presentation)

The impact of visitors on a wild population of red squirrels (*Sciurus vulgaris*) in a wildlife park

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As the invasive grey squirrel continues to spread in Europe, red squirrel populations are becoming severely impacted and are dying out in many regions. This could result in red squirrels becoming isolated to managed parks, where grey squirrel access can be controlled. However, public presence can often have a negative effect on the presence of wildlife. The study aimed to investigate the effect of visitors on an existing red squirrel

population in Ireland's fourth biggest tourist attraction, as well as examine whether this park could successfully sustain a healthy, viable red squirrel population. Fifty five individual red squirrels (26 ♀, 29♂) (139 captures) were caught over 1080 trap nights from March 2013- March 2014. At the time of trapping, faecal samples were collected to analyse cortisol levels in order to monitor varying stress levels at times of high visitor numbers. Ten squirrels (5♀, 5♂) were fitted with radio tags and each time a fix was obtained the number of visitors visible from that location was recorded. Overall daily visitor numbers were also obtained and squirrel counts were conducted in public and non-public areas. The park supports a healthy squirrel population which exist at a higher density than other areas of the island. At times when the park is open, squirrels restrict themselves to areas outside the public domain and confine their activity to smaller, quieter areas of the park. However, tagged squirrels were observed to move further and explore public access areas to a greater extent when the park was not open to visitors. Non resident squirrels also enter the wildlife park at this time. This study indicates that while public parks can support viable squirrel populations, it is important to provide areas where public access is prohibited.

(poster 94)

Within season-divorces of male and female European Reed Warblers *Acrocephalus scirpaceus*

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We analyzed the phenomenon of within-season divorces in a small passerine monogamous bird species, the Reed Warbler, a long-distance migrant in which a change of mates between seasons is a rule, while parents generally stay together throughout the whole single breeding season. However, we have found that among pairs that laid at least two clutches a total of 11.3% (0-32% a year) switched mates between successive nesting attempts. We observed re-mating of females more often that that of males. Divorcing females moved farther than did males. Annual breeding success of divorced females was higher that that of males. Divorced females did not re-mate with their previous extra-pair partners. We suggest that in small migratory passerines with high annual mortality different mechanisms of divorce are involved than in long-lived species. As most females have only one breeding season in their life, some of them, after successfully rearing the young from their first broods, change mates to ensure higher genetic variability of their young.

(poster 95)

Effects of habitat urbanization on the breeding success of great tits (*Parus major*)

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Urbanization rapidly changes the habitat of wild animals. In many avian species, reproductive success is lower in urban environments than in more natural habitats. However, little is known about the relative importance of urbanization-related environmental factors (e.g. scarce vegetation, pollution, human disturbance) that may cause the birds' poorer reproduction in cities. In our study, we observed wild great tits breeding in nest-boxes in two urban and two natural (forest) habitats. Using field observations and geoinformatics, we analyzed how various environmental factors (e.g. vegetation cover, built-in areas, roads) affect occupancy of nest-boxes and number of fledged chicks. We found that nest-box occupancy was influenced by nest height and vegetation. In one urban habitat, where trees were relatively abundant, birds preferred nest-boxes that were higher from the ground, thus probably less disturbed by humans and predators. In the other urban habitat, where vegetation was scarce, they preferred nest-boxes surrounded with more trees, where the density of insects, thus food availability may be higher. We found no correlation between occupancy and environmental factors in forest habitats. In line with previous studies, we found that urban pairs start breeding earlier and have a lower number of offspring than forest pairs. Brood size did not correlate with our environmental variables except that in one urban population we found a higher number of fledged offspring where there was a greater variety of tree species around the nest. These results indicate that several environmental factors shaped by urbanization can have significant effect on avian reproduction.

(poster 96)

The effect of nutritional deprivation and the distribution of nutrients on socially foraging mosquitofish (*Gambusia holbrooki*)

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Aggregating with conspecifics has many benefits and is a widely encountered behaviour in the animal kingdom. A central question arising from studies of animal grouping is what effects internal and external stimuli have on movement and space use. The most

important parameter defining an animal's state is nutritional intake. While the effect of nutritional deprivation on the physiological status and swimming performance of individuals has been investigated, important questions regarding the effect of nutritional deprivation on the movement characteristics of socially interacting, free swimming fish still remain unanswered. We examined the movement of fish with multi-agent automated tracking software, and found that hungry shoals of mosquitofish not only moved faster and had higher turning speeds than individuals in satiated shoals, but also had had greater variation in both speed and turning speeds. Additionally, hungry individuals explored more of the arena and were more likely to leave the arena's walls. Although we were able to differentiate shoal behaviour based on hunger level, it is now known that animals have specific nutritional demands and that total energetic intake is not sufficient to accurately describe their foraging behaviour. Therefore, we compared the movement and grouping behaviour of shoals of mosquitofish in the lab as they socially foraged in nutritionally heterogeneous and homogeneous environments and were able to show that the spatial positioning of fish shoals within the environment is dependent on the distribution of specific macronutrients, especially protein. This is the first fine-scale examination of the interaction between nutritional state, nutritional environment and sociality in fish shoals.

(oral presentation)

Organization of work in a collective building species, *Mus spicilegus*

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The understanding of the mechanisms involved in the organization of work in social animals is a fascinating field of study. In a collective task such as building, humans show a highly centralized organization with specialized individuals. An individual specialization is also observed in social insects but the work organization is decentralized. The complex structure resulting of such work is therefore the fruit of emergent properties. This difference in the organization of work could be explained by specific characteristics of humans, such as cognitive abilities and social organization, or it can originate from more constitutive differences between mammals and arthropods. To gain insight in the origin of this difference, we studied the organization of work in mound-building mice during the collective construction. The building of the mound can be elicited and studied under laboratory conditions, and an individual specialization has already been shown. We studied the temporal dynamic of transport of two different materials. Mound-building mice displayed an individual specialization for the transport of the construction materials and showed a temporal sequence of transport that followed the natural sequence of construction. Our results revealed a decentralized organization of work modulated by individual specialization as observed in social insects. As a consequence the centralized

organization of collective work appears more as a characteristic of the human species than as a mammalian feature.

(oral presentation)

Sex-specific mating preferences for familiarity and genetic dissimilarity in Japanese Quail (*Coturnix japonica*)

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Mating decisions play an important role in sexual selection and have a strong influence on fitness. Often individuals not only base their preferences on secondary sexual signals that indicate quality, but also on genetic compatibility, personality or familiarity. However, so far little is known about the importance of these factors when assessed together. We investigated the interplay of familiarity and mate quality on mate choice decisions of males and females in a captive population of Japanese quail, for which we have established lines for high and low maternal egg investment. As egg size is a highly heritable trait tightly linked to fitness, individuals from the high lines are predicted to be of higher quality. In mate-choice experiments, male and female Japanese quail could choose between a sexually familiar and an unfamiliar mate from the different selection lines. We found that females spent more time with their familiar partner, whereas males showed a preference for unfamiliar females. These opposite preferences were strongest when the unfamiliar individual was from a different line than the choosing individual. Our study shows that the relative importance of familiarity in mate choice is sex-specific. Males may benefit more from multiple matings, whereas females may have to carefully balance the potential benefits and costs of mating with an unfamiliar male. Also genetic quality did not have an overall effect on mate choice but genetic dissimilarity did. These results show that previous social interactions need to be considered to understand mate choice decisions in animal populations.

(oral presentation)

Do domestic sows react on increase litter competition by not releasing milk?

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Piglets which do not succeed in the neonatal litter competition for teats can starve to death. An increased litter competition might indicate that more piglets have no teat access, and sows will prevent milk ejection in order to suppress litter competition. Nursings without milk ejection lower the milk intake over time and can affect piglet survival. We predicted that the likelihood of the sow having a nursing without milk ejection either by not releasing milk or changed posture before milk ejection would increased with more fighting/ screaming piglets. A total of 19 sows and their piglets were directly observed for 6 h on Day 1 post partum. Piglet behaviour was scored in 5 intervals (i.e. 75 s) prior to milk ejection. The proportion of piglets which missed the milk ejection, postural changes by the sow, and whether the nursing was with milk ejection were noted. Logistic regression models (GENMOD) were applied to test the predictions. A higher number of piglets with fights ($P < 0.0001$) and screams ($P < 0.02$) were associated with a higher proportion of piglets missing a milk ejection. Out of 156 49% were without milk ejection; the sow did not release milk (n=54) or changed the posture to prevent the milk ejection (n=22).There were no significant effects of the number of piglets with fights or screams detected on the probability of nursings without milk ejection. But a shorter interval after the last milk ejection increased the probability of a nursing without milk ejection ($P< 0.0001$) and as well a posture changes before milk ejection ($P< 0.05$). In conclusion, our results suggest that sows ignored neonatal litter competition but they responded with nursing's without milk ejection when the nursing started too soon after the last milk ejection.

(oral presentation)

Potential leaders trade off goal-orientated and socially-orientated behaviour in fish schools

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Leadership is widespread across the animal kingdom. In many groups, such as schooling fish, individuals are thought to reconcile goal-oriented motion, such as towards a known resource, with their tendency to be social. A key prediction of models of such leadership predict that potential leaders can increase their social influence as their motion is increasingly directed towards their preferred target, but that strongly goal-oriented motion can result in potential leaders failing to achieve followership and groups splitting.

These predictions have not been explored experimentally. We trained fish (golden shiners, *Notemigonus crysoleucas*) to associate a spatial target with a food reward before testing each singly with a group of untrained eight fish who were uninformed ('naïve') about the target. When tested with untrained fish, trained fish with faster and straighter paths (indicating higher assertiveness) were more likely to reach their preferred target as well as doing so more quickly, confirming that seemingly assertive behaviour was indeed indicative of tendency toward a goal. However, such behaviour was associated with an increased tendency to leave untrained fish behind, with the trained fish isolated and failing to transmit their preference to others. Whether untrained fish stayed with the trained fish depended on a consensus between untrained fish as either all or none stayed with the trained fish in the majority of trials; spacing between untrained fish increased only at intermediate levels of assertive behaviour by the trained fish. Effective leadership thus requires individuals to appropriately balance goal-oriented and socially-oriented behaviour.

(oral presentation)

Adhesive properties of setae of a gecko, *Gekko gecko* on different rough surfaces

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Geckos Gekko gecko are the heaviest animals in the world who can freely move on various substrates such as walls, smooth ceilings etc. In the learning of locomotion behavior and adhesion mechanism of geckos, the seeked principle of their locomotion can be an important inspiration on the design of wall-climbing robot. Geckos have optimized two ways to climb various substrates, by developing claws and adhesive pads. The interaction of claws with a substrate is determined by the roughness of the substrate, the friction coefficient between the claw and the substrate, and the relative dimension between the claw and the substrate. The adhesion of pads is thought to be due to dry adhesion, which is generated by van der Waals force between ten millions of setae on the pad and the substrate. In this paper adhesive properties of setae of geckos with claws removed on different rough surfaces were focused. Gockos were placed on vertical substrates of sandpapers with 14 roughness. They would slip slowly and try to adjust the posture on the substrates under the action of bodygravity as time passed. The behavior of adhesion and sliping of geckos were recorded and analyzed. The results showed that there were differences in the slip velocities and adduction velocities of geckos on various rough substrates. With the increasing of the ratios between diameters and intervals of particles

in sandpapers, the slip velocities decreased. The surface roughness is not key influence factor on geckos' adhesion ability. The friction force and adhesive properties of gecko setae spatula were calculated by adhesive friction model, which verified the experimental results.

(poster 97)

Genotype-dependent reduction of anxiety-like behaviour in male mice following cohabitation with a female

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In the past, certain "vulnerability genes" have been identified that seem to enhance an individual's risk to suffer from psychiatric diseases by increasing its vulnerability to negative environmental influences. Among them is the serotonin transporter (5-HTT) gene, of which is known that a lower expression leads to increased susceptibility for negative experience and as a consequence higher risk for anxiety disorders or depression. In the present study, a 5-HTT knockout (KO) mouse model (including homozygous KOs with two inactivated copies of the 5-HTT gene, heterozygous and wildtype mice) has been used to investigate, whether 5-HTT genotype also affects susceptibility to rather "positive" social experience, as suggested by some authors lately. For this purpose, adult males having been mated with a female for two days and nights were compared to naïve males in tests on anxiety-like behaviour and exploration. The main findings were: There was a strong genotype effect with highest levels of anxiety-like behaviour and lowest levels of exploration in homozygous KO mice. Most interestingly, a significant genotype X treatment interaction existed concerning the time the mice spent in the center of the open field: While mating lowered anxiety-like behaviour in heterozygous mice, it did not affect both other genotypes. This actually suggests a higher susceptibility to beneficial social experience in heterozygous 5-HTT KO mice and corroborates the conception of the 5-HTT locus as a "plasticity" rather than a "vulnerability" gene.

(poster 98)

Pre-hibernation orientation and microhabitat use in the Japanese treefrog (*Hyla japonica*)

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Although amphibians undergo drastic changes in physiology and behaviour before hibernation, this phase of the life cycle is least understood. Using Harmonic Direction Finder, we investigated the orientation and the pre-hibernation behaviours of Hyla japonica, which migrates between wetlands for breeding and forests for overwintering. We collected 40 individuals in a forest and reared them in the standard conditions in a lab for 30 to 43 days before experiments. For the orientation experiment, 10 treefrogs were individually tracked at a low lying rice-paddy complex bordered by the forest where they were collected. They displayed non-random and highly directional orientation from the breeding site towards the forest. To understand the pre-hibernation behaviours, 30 treefrogs were released and individually tracked in the forest. In the either state of being active or buried, treefrogs tended to be on the ground, rather than on vegetation or trees. Furthermore, humidity, body temperature, and substrate temperature were significant factors for brumation, whereas temperature, luminosity and height were not. This suggests the presence of long-term memory for recognition of the area and directional orientation.

(poster 99)

Receivers matter: sex-specific responses to alert calls in nectar-feeding bats (*Glossophaga soricina*)

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In many species, individuals signal to both male and female audiences. While sexually selected vocalizations normally elicit antithetic behavioral responses in both sexes, is generally assumed that vocalizations shaped predominantly by natural selection pressures, e.g. alarm calls or group cohesion calls, elicit the same type of response in male and female receivers. However, when the sexes differ in their evaluation of potential dangers and benefits in any given situation, the same signal can trigger different behavioral responses in male and female receivers. We studied such a scenario in Neotropical nectar feeding bats, *Glossophaga soricina*. Both sexes produce alert calls when encountering conspecifics at feeding sites or when flying vigilantly after being disturbed. When broadcasting alert calls at artificial flowers in an experimental setup, males were repelled by these calls and avoided the respective flowers, whereas females were attracted by them and preferentially

visited those flowers. When we repeated the playback experiment with other social calls that were not produced in a vigilant context, females retained their preference whereas males neither avoided nor preferred the flowers with broadcasted social calls. Our results indicate that female *G. soricina* prefer to forage in the vicinity of conspecifics regardless of potential aggressive interactions that could result in displacement. Males, on the contrary, rather forage by themselves than in the vicinity of potentially aggressive conspecifics. Further studies are needed to determine whether these sex-specific responses to alert calls are caused by differing levels of boldness/fearlessness or by different levels of aggression towards foraging males and females.

(oral presentation)

Ant-snake interplay in Madagascar

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A Madagascan ant *Aphaenogaster swammerdami* constructs underground nest and workers guard their nest by aggressively biting intruders. However, a colubrid snake, *Madagascarophis colubrinus*, often inhabits active nest of *A. swammerdami* without being attacked. Accordingly, this snake is called 'Ant's Mother' by Madagascan people. Another sympatric snake, the giant blind snake *Typhlops decorsei* is a specialized predator on ants' brood. The presence of seemingly-harmless and predator snakes suggests that the ant would enjoy selective advantage if they are able to discriminate snake species and react properly. We presented *M. colubrinus*, *T. decorsei*, and *Thamnosophis lateralis*, *T. lateralis* is a sympatric, colubrid snake as a control of the other two snakes, toward the entrance of ant nest one by one. As a result, the workers of the ant showed totally different reactions toward respective snake species. This result demonstrates that *A. swammerdami* has evolved the ability to discriminate sympatric snake species. Also, we found two kinds of highly unusual, possibly species-specific reaction of the ant; specialized anti-predator reaction against the ant-eating blind snake, and acceptance of *M. colubrinus*. Possible factors underlying the ant's reactions toward those snakes are discussed.

(poster 100)

Are calves sensitive to magnetic field?

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Exposure to extremely low-frequency (50/60 Hz) magnetic fields (ELFMF) showed significant changes in spatial behavior of cattle and deer grazing under and near high voltage power lines. It has been previously suggested that ELFMF might negatively affect physiology through disruption of circadian rhythmicity via primary disruption of magnetoreception. Here we tested the hypothesis that the effect is pronounced in young individuals, in which multisensory integration is still immature. Four calves housed in wooden boxes were exposed to ELFMF for 5 weeks and four calves served as controls. Concentration of melatonin (MC) was assessed as a marker of circadian rhythmicity from saliva collected at regular intervals four times a day. We tested the association between MC and whether the calves were or were not exposed to ELFMF, time of the day, sex, age and weight of the calves, using a GLMM designed for repeated measurement. The analysis revealed that MC was significantly lower in ELF MF-exposed calves than in controls (P = 0.011) and lower in males than in females (P = 0.021). MC levels were not affected either by the age or the body weight of the calf.

(poster 101)

The older rules; the effect of age, residence and maternal rank on the hierarchy within young domestic horses

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Our study is focused on factors influencing dominance position (rank) in young horses, with emphasis on the role of the mother. Horses form stable linear dominance hierarchies based on agonistic interactions. Higher rank is believed to be connected, in both sexes, to better condition and higher reproductive success. Many variables play a role in forming the dominant-submissive relationships between horses; however, the maternal effect upon the rank of the offspring still remains unclear, as do the possible mechanisms of transference ("inheritance"). We hypothesized that the maternal rank plus differences in suckling parameters or maternal style may be responsible for later outcome of the offspring's rank, characterized by two variables: index of fighting success (CB); and rate

of winning encounters (RW). Our study animals were 8 groups of Kladruby horses, loose-housed lactating mares with foals (n = 66 mare-foal pairs); and subsequently 4 groups of the same foals at 3 years of age. Our results revealed the impact of age on the rank of the young horses ($P < 0.001$ for CB, and $P < 0.01$ for RW), and residence in the group ($P < 0.01$, $P < 0.01$, respectively); not the maternal rank. Older foals reached higher rank, independent of the rank, age, or experience of the mother; therefore, we did not find support for direct inheritance of maternal rank. Nevertheless, the foals born to the same mare in two consecutive seasons (n = 16 mares) revealed fair repeatability in the rank they obtained at 3 years of age (intraclass correlation coefficient = 0.46). This suggests an important constant effect of the mother on the social success of her progeny; however, we did not find a significant effect of any of the tested variables describing maternal characteristics or maternal care. Dominance position depended significantly on the foal's age at observation, and the residence in the herd formed via sequential introducing of later weaned groups of foals. The most dominant horses were mainly recruited from the first weaned group of the season, and thus were also the oldest individuals in the herd.

(poster 102)

High occurrence of allosuckling in farmed eland (*Taurotragus oryx*) supports misdirected parental care hypothesis

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Milk provisioning to non-filial offspring called allosuckling represents extreme situation of parental care. This phenomenon has been documented in many mammalian species and several hypotheses like 'misdirected parental care', 'kin selection', 'milk evacuation', 'reciprocity' or 'parenting' has been suggested to explain this behaviour of lactating female. From offspring's perspective the most plausible explanations involves 'milk theft', 'compensation' or 'immune gain'. To test many of the hypotheses above we observed the herd of 10-60 individuals of farmed common elands (*Taurotragus oryx*) during the period of 8 years. In total, we recorded 2,391 suckling events including 62% of suckling bouts (lasting longer than 5 s) and 38% of unsuccessful attempts to suck in 31 individual females and 89 various calves. Allosuckling was recorded in 15 individual females which nursed 41 various non-filial calves (21% of all suckling events). Although suckling bout duration of filial and non-filial calf did not differ, the duration increased with increasing number of the sucking calves up to three and then it decreased. The suckling and allosuckling bout duration was not influenced by relatedness, parity, kinship and other factors as sex of the calf, position or the age of calf and lactating female. In addition, we found that no female which lost her own calf was nursing longer and that the probability of successful suckling bout was 65% for filial calves, whereas that for non-filial was only 42%. Our study

represents one of the highest occurrences of allosuckling that has been ever recorded in mammalian species. In line with the many other studies on ungulates the misdirected maternal care remains only and the most plausible explanation of allosuckling occurrence in captive elands.

(oral presentation)

Flying on the wings of love – the role of wings in mating in a flightless cockroach *Eublaberus distanti*

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Wings are one of the most iconic evolutionary innovations in insects. Nevertheless, many insects exhibit a certain degree of wing reduction. In many cases only females lose the wings while males are still macropterous. It is usually believed that females profit from the wing loss. However, what if wing maintenance even in flightless form is an important issue for males? Here we propose the hypothesis that retention of wings in males is essential for their mating. To test it, we chose macropterous but flightless cockroach Eublaberus distanti (Kirby, 1903) which performs an expressive courtship ritual. Freshly moulted adult males were divided into three experimental groups: macropterous, brachypterous (wings halved) and apterous (wings cut off) and were individually introduced to a receptive female. We recorded if and how quickly they mated. According to observations, the wings play a key role in correct performance of courtship ritual. Therefore, partial or complete absence of wings significantly decreases the probability of successful mating of E. distanti males. Moreover, comparing only males which successfully mated, wing reduction significantly increases the number of female's climbs on the male's abdomen and the total courtship time. After mating is achieved, wing state does not affect the duration of mating. Although a number of brachypterous and apterous males achieved mating, in natural conditions, where cockroaches aggregate and many males are present at once, any prolonged or unsuccessful courtship attempt can lead to replacement of such male. We suppose that wing reduction in cockroaches should have been preceded or coupled with another major evolutionary event, probably with a change in epigamic behaviour.
The project was supported by GAUK 1700-243-253471.

(poster 103)

Contest vs. scramble competition between males pursuing alternative mating tactics

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Reproductive investment patterns of individuals pursuing alternative reproductive tactics (ARTs) should be influenced by the particular type of competition. Evolutionary theory predicts that the relative frequencies of alternative male genotypes in a population are stabilized by negative frequency dependence, implying that competition is greatest between males of the same type. The cichlid Lamprologus callipterus exhibits three male ARTs involving an extreme intrasexual size dimorphism determined by Mendelian inheritance. Large males construct nests of empty snail shells in which females breed, investing heavily in courtship and nest defence. In contrast, dwarf males do not court but enter shells surreptitiously during spawning, allowing them to fertilize the majority of eggs after successful entry. A third, temporary and conditional tactic allows sneaker males entering nests during spawning to steal occasional fertilizations from nest owners. In an experiment exposing males pursuing divergent ARTs to rivals of different types and competition intensities, we found the predictions of a tactic specific focus in competitive effort confirmed in bourgeois nest males, whereas the predicted aggression between males pursuing the same tactic was not observed in dwarf and sneaker males. This may be due to the very low, natural densities of these male types, which select for alternative forms of rivalry. Scramble competition selecting for a rapid response when opportunities for parasitic reproduction arise seems more appropriate and may be more likely to stabilize tactic frequencies of parasitic males. We discuss the consequence of our result for the conceptual understanding of the coexistence of ARTs in animal populations.

(oral presentation)

Production and perception of ultrasound in the weeping lizard: a puzzling mismatch

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Liolaemus chiliensis belongs to a genus with more than 240 species, and this is the only species of the genus that vocalizes. Sound production occurs when lizards are subdued by a predator, reason by which the species is called the weeping lizard. Its distress call is a high pitch that can reach ultrasound. Data indicate that calls can alert conspecifics on

predation risk, but also can act as a predator deterrent. Here we tested if the weeping lizard responds to the ultrasound of the distress calls. We recorded the behavior of individuals submitted to three types of distress calls: complete (audible + ultrasound), audible and only to the ultrasound part of these calls. We also determined the tympanic response to these calls and to tones from 0.1 to 40 KHz. Lizards took longer to restore their activities when they were exposed to the complete and audible calls compared to when they were exposed to ultrasound. In addition, lizards experienced a reduction of their activities after being exposed to the complete and audible calls, but not when the ultrasound was presented. The tympanic membrane of this lizard did not respond to ultrasound stimuli, and had a maximal response around the fundamental frequency of the distress calls. Data indicate that the weeping lizard does not respond to ultrasound. It is necessary to test if the predators of the weeping lizards, such as mammals, respond to the ultrasound part of these vocalizations. We cannot rule out, however, that ultrasound production be just a by-product of sound production. Funds: FONDECYT 1120181. CONICYT-PCHA/Magíster Nacional/2013 – 22130605 (CR-O).

(oral presentation)

Is the interest of a male in unfamiliar females affected by the duration of prior monogamy? A study in the mound building mouse.

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Special attention has always been paid to monogamy because of its scientific value for studying social bonds, its rarity in mammals and its adaptive value. Molecular techniques have questioned the “idyllic” view of monogamy, revealing that in many species described as strictly monogamous, sexual interactions between partners were far from being exclusive. The mound-building mouse, *Mus spicilegus*, is an east-European mouse with a monogamous mating system. In this species, individuals generally start to reproduce at 2 month old, except for mice born in autumn which first mate at about 6 month old. After pair formation, intense sexual activity leads to the first reproduction. However, the subsequent reproductive events result from drastically reduced sexual activities. We hypothesize that, after several reproduction with the same sexual partner, males would experience a motivational conflict between staying with their mate and leaving his partner for a new unfamiliar female. We performed a double-choice olfactory paradigm to test the interest of males for the odor of a virgin unfamiliar female simultaneously presented with the odor of the male’s partner and pups according to: (i) the age of the males at pairing (2 vs 6 mo), (ii) the duration of pairing and the reproductive experiences. Our results suggest that, whatever the age of the males at pairing, the duration of pairing and the reproductive experiences significantly affect the interest of male for the odor of an unfamiliar female. More males stay for a long time and reproduce with their partner,

less they are interested in the odor of a stranger female. In the mound-building mouse, pair-bonding seems to be a continuing process sustained by the duration of pairing and by the reproductive experiences.

(oral presentation)

MHC – what do we learn from wild mice?

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MHC genes exhibit an extremely high degree of polymorphism and heterozygosity. Despite decades of intense empirical and theoretical research, the evolutionary mechanisms of the origin and the long preservation of allelic diversity are not fully understood. MHC diversity has so far not been directly assessed in wild mouse populations, only for inbred strains derived from such samples. We aimed to identify the degree of natural polymorphism in different populations. Nevertheless, a clear picture of MHC influence on mate choice in natural populations of house mice cannot be drawn yet. This is partly due to the fact that the majority of the studies were carried out using lab inbred strains missing a natural genetic background. In a previous study we analyzed mate choice between two wild caught populations of *M. m. domesticus*, from France (F) and Germany (G). Individuals of both populations were kept in a semi-natural environment and had free choice of mating partners. F1 offspring showed a specific assortative pattern, i.e. a preference for paternally matching mates. This study raised the possibility of paternal genomic imprinting and/or early learning driving the decision for a certain mating partner. The current study aims at disentangling the cues for such mate recognition. We study the association preference of the same mouse populations under controlled cage conditions. The mice can choose between partners of the same and different population origin and hybrids of both. Also the choosing mice consist of all four possible genotypes. The aim of this study is to elucidate MHC – driven mate choice behavior in house mice and to assess the father's role in this game. Or did both populations diverge long enough for population specific mate recognition cues to evolve?

(oral presentation)

The beauty of primates: do we perceive our closest relatives as attractive?

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Previous studies revealed that pandas, large cats, and koalas were perceived as the most "beautiful" mammals among human respondents. Our closest relatives – the primates, however, were perceived as only moderately "beautiful", probably due to the absence of important key features like the details of facial marks. Thus, we focused on primates in more detail in a subsequent study, in which we asked human respondents to score 117 standardized pictures of primate faces. The set consisted of 107 unique species selected across all primates and 10 control pictures depicting different individuals of duplicate species. We received answers from 289 Czech and Slovak respondents and we found that among the four great clades of primates (prosimians, New World monkeys, Old World monkeys and hominids), the prosimians were preferred the most. When human respondents score animal pictures according to perceived beauty in similar studies, they also unconsciously perform the task recognized as unsupervised categorization. This usually results in organization of animals that resembles scientific taxonomy as more related animals tend to share similar appearance. However, the PC analysis of the collected data revealed that this may not apply when human respondents evaluated primate faces. According to the main trend (PC1axis), the control duplicate species were not clustered together but rather appeared far away from each other. The second PC axis followed the usual trend, grouping primates into clusters of relative or duplicate species. Our results suggest that when evaluating the "beauty" (or attractiveness) of primates, human respondents may rely on different cues than those which they use for the evaluation of animal species of more distant taxa. We hypothesize that these cues may include key features considered by human respondents when evaluating the attractiveness of human faces.

(poster 104)

Great tits hide their success

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Coevolution between pairs of different kind of entities, such as providers and users of information, involves reciprocal selection pressures between them as a consequence of their ecological interaction. Pied flycatchers (*Ficedula hypoleuca*) have been shown

to derive fitness benefits (larger clutches) when nesting in proximity to great tits (*Parus major*), presumably because they this way discover and obtain information about nesting sites. Tits suffer from the resulting association (smaller clutches). An arms race between the tits (information host) and the flycatchers (information parasite) could thus result. Great tits often cover eggs with nesting material before, but not during incubation. We hypothesized that one function of egg-covering could be a counter-adaptation to reduce information parasitism by pied flycatchers. We predicted that tits should bring more new hair to cover their exposed eggs when a pied flycatcher is present near to tit nest than when a neutral (non-competing) species is present. We conducted decoy and playback experiment in Oulu and Turku, Finland. First, we removed and collected all the hair covering the tit eggs. Then, we measured how the perceived presence of flycatcher or waxwing (*Bombycilla garrulus*) affects tits' egg-covering by collecting and weighing the hair brought on the eggs and photographing the nest 24 h after the playback. Tits brought more hair into the nest and covered the eggs more carefully after flycatcher treatment, compared to waxwing treatment. We also found that the tits in Oulu had more hair on the top of their eggs in general. Together, these results suggest that the counter-adaptation function of egg-covering against information parasites may be an extension of original function to protect eggs from low temperatures.

(oral presentation)

Social parameters like sex or mating status have an influence on homing performance of a familiar route in pigeons

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In the last years the knowledge of homing behaviour in pigeons has greatly increased. It is known that pigeons develop individually distinct routes when released alone several times from the same site and can come into conflict in the case of pairwise releasing if there are differences in two bird's directional preferences. But up to date there are no studies about the influence of social parameters like sex or mating status on homing performance although it is known that there are a lot of social differences - e.g. males show a strong territorial behaviour and thus, are under higher competitive pressure than females. In our study, we investigated the influence of social parameters on homing performance of a familiar route. For this, we employed GPS tracking technology. 18 mated pigeons (9 males, 9 females) and 6 unmated females were released at least 10 times alone from the same site (about 10km) following by different combinations of pair and group flights. Mated pairs were allowed to build a nest and to breed during the experimental duration. Comparisons of route efficiencies (measured as a quotient between air-line distance and pigeon's track) reveal that unmated females show the best efficiency and that group flights generally have a better efficiency than single or pair flights. However, mated pairs

exhibit the poorest performance. Besides, just before hatching of the squabs, both sexes show differences in their homing efficiency at different times of the day. Particularly the females perform better if releasing was when they were due to sit on the nest. Our results indicate that route efficiency could give an insight in individual motivation and that sex and mating status has an influence on motivation respectively homing performance of a familiar route.

(oral presentation)

Also mouse girls like to chatter - the ultrasonic vocalisation of female and male wild house mice from two different populations

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It is known for a while that house mice produce ultrasonic vocalisation (USV) in different social contexts, amongst them being courtship and mating. Most studies so far deal with the USV of male mice from different lab strains. To study a possible evolutionary impact of USV mediated mate choice it is, however, necessary to analyse the vocalisation behaviour in wild mice. Our study animals belong to two populations of the western house mouse (*Mus musculus domesticus*), one from Southern France, the other from Western Germany. Under semi-natural conditions, our mice showed a preference for mates of their own population. To test, if this mating preference is mediated by ultrasonic vocalisations, we investigated the acoustic structure of the USV for population differences. We recorded and analysed the USV of males and females from both populations emitted within different social contexts. For acoustic analysis, we extracted several temporal and spectral features and compared them between populations and sexes in a multivariate approach. We further investigated whether the USV show a syntactical pattern. For this, we analysed if different elements of vocalisation (syllable types) are arranged sequentially or come at random. With our multivariate approach, we are able to distinguish between USV of the two populations and between sexes. The results of our syntax analysis support the hypothesis that mice do not emit syllable types randomly but use syntactical structure in their songs.

(oral presentation)

The effects of serotonin-transporter genotype and social experience during adolescence on anxiety-like and aggressive behaviour

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Across mammalian species, behavioural traits like anxiety and aggressiveness are means to optimally cope with environmental challenges. However, in their exaggerated form they pose psychiatric problems to human societies and are regarded as pathologies from a biomedical viewpoint. Extensive research has shown that anxiety and aggressiveness can be shaped by genotype and experiences during early life phases. However, the period of adolescence has mainly been neglected so far. To elucidate how levels of these behaviours are shaped by genotype and experience during adolescence, experiments were conducted with serotonin-transporter (5-HTT) knockout mice. During adolescence, males of all three genotypes (wildtype, heterozygous and homozygous 5-HTT knockout mice) either experienced a mildly adverse social situation or they found themselves in an excellent social environment. For this purpose both groups were housed in custom-made cage systems. Mice experiencing a mildly adverse environment were repeatedly introduced to the territory of an established couple; but had the possibility to escape to a safe cage. Mice encountering beneficial social conditions had free access to a mating partner. Afterwards, anxiety-like behaviour was assessed in three standardised tests; aggressive behaviour was determined in a resident-intruder paradigm. The main results were: (1) Surprisingly, unfavourable conditions during adolescence led to decreased anxiety-like behaviour and increased exploratory locomotion. (2) Aggressive behaviour was more pronounced in animals that experienced social adversity. (3) Concerning genotype, homozygous knockout mice were more anxious and less aggressive. In conclusion, genotype and environment during adolescence can profoundly shape anxiety and aggressiveness.

(poster 105)

Parental effort in relation to age and number of nestlings in the reed bunting *Emberiza schoeniclus*

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We studied parental care in small passerine altricial bird species. We observed the rate of feeding by female and male of the reed bunting *Emberiza schoeniclus*. The observations

were carried out in 2013 year on overgrowing, not used fish-ponds in Liwiec river valley (E Poland). Generraly prental effort increased with age of nestlings, but only female increased significantly their feeding frequency as the nestlings became older. In average females fed significantly more often than males. The frequency of nestling-feeding depended on age of nestlings but not on their number. Sex differences in parental effort have been observed in a many of biparental-care bird species. In the reed bunting it may be related differences in roles the parents play at different stages of brood development and high level of extra-pair paternity.

(poster 106)

Behavioral strategies and acoustic signaling involved in the highly cohesive social structure of a leaf roosting bat

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The limited availability of refuges may represent an important constraint promoting sociality, particularly in bats. Disc-winged bats (*Thyroptera tricolor*) show highly specialized morphological adaptations that enable individuals to roost inside furled musoid leaves. This roosting ecology presents major challenges, as leaves rapidly unfurl, forcing bats to locate new roosts on a daily basis. *T. tricolor* form stable group associations and recent evidence suggest the presence of natal philopatry in both sexes. We studied the social mechanisms involved in maintaining the group stability observed in *T. tricolor.* For this purpose, we evaluated the visiting behavior of potential roosts by placing a video and acoustic recording system in the vicinity of suitable furled leaves. We determined that when assessing the suitability of a potential roost, bats produce a variety of distinctive social calls. Analysis of the overall acoustic characteristics of social calls revealed the presence of a mosaic pattern of vocal variation. To evaluate if this vocal variation is influenced by population structure, we studied the geographic variation in microsatellite allele frequencies at multiple sites on the Caribbean and Pacific mountain slopes of Costa Rica. Our results of genetic structure analysis indicate the presence of two distinct populations corresponding to the presence of vocal dialects of contact calls. Further, the high rates of gene flow within regions may be explained by vocal learning, suggesting a selective advantage for individuals who can match acoustic signals. This study provides a comprehensive picture on how ecological pressures associated with ephemeral roosting resources have impacted the behavioral strategies and population dynamics of a highly specialized bat.

(oral presentation)

Sociosexuality and infidelity after traumatic brain injury: linking evolutionary biology and neuropsychology

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Introduction: Sociosexual orientation (SO) refers to individual differences in people's willingness to engage in uncommitted sexual relationships and is universal across cultures. Traumatic brain injury (TBI) is related to sexual and neuroendocrine dysfunction. The objective of this study was to explore sex differences in SO and infidelity in individuals with TBI and healthy controls (HC). Methods: Thirty-eight individuals with mild to severe TBI and 67 HC were recruited from Montreal. Individuals with TBI were recruited at a rehabilitation centre and HC from the general community. The TBI sample consisted of 16 men (42.1%) and 22 women (57.9%), with an average age of 38 years (SD = 9.9) and 12.9 years of education (SD = 2.8). TBI participants had Glasgow Coma Scale (GCS) at admission of 12.6 (SD = 3.5) and were 2.3 years post-injury (SD = 1.08). The HC consisted of 35 men (52.2%) and 32 women (47.8%), with an average age of 38.5 years (SD = 11.9) and 12.6 years of education (SD = 3.3). Groups were comparable in terms of gender, age, and education (all p's>0,05). SO was assessed with the 9-item Sociosexual Orientation Inventory - Revised (SOI-R) and infidelity with the 12-item Attitudes Toward Infidelity Scale (ATIS). Results: Independent-samples t-test show that in HC, men score significantly higher than women in SO, $t(65) = -2.56$, $p < .05$, but not in infidelity, $p = .18$. In particular, men scored higher than women in all of the SOI-R subscales: Behavior, Attitude, and Desire, (p's < .05). However, these differences disappeared in individuals with TBI (all p's>0,05). Conclusions: TBI can modify deeply rooted evolutionary / cross-cultural characteristics, such as sociosexuality. Implications are discussed in terms of evolutionary theories of human sexuality.

(oral presentation)

Male larval nutrition affects adult reproductive success in wild European grapevine moth (*Lobesia botrana*)

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In Lepidoptera, males transfer to females a spermatophore containing sperm and accessory gland secretions that are reinvested into female reproduction, providing a fitness gain to females. One of the key factor shaping male spermatophore size is probably the resources that males have acquired as larvae. In this study, we investigate how male larval food contributes to shaping the spermatophore quantity and quality and how it affects female reproduction in the European grapevine moth (*Lobesia botrana*). Specifically, we examined the effect of male origin (cultivar or geographical site) on their mating success by scoring individual motivation to mate, male spermatophore size and amount of sperm, and finally female fecundity and fertility. A strong effect of larval origin (cultivar or site) was found on spermatophore size and amount of fertilizing sperm produced by males. These male performances had strong repercussions on the female reproductive output. Indeed, females mated with males producing the biggest spermatophore and the more fertilizing sperm were the most fecund and fertile. Finally, females seemed able to recognize males of different qualities during the precopulatory phase and to motivate their mating behaviour accordingly. The present results suggest that male nutritional quality could have profound consequences on mate choice strategies in natural populations.

(poster 107)

Goats that stare at men - Dwarf goats (*Capra aegagrus hircus*) alter their behaviour depending on the head and body orientation of a human

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Knowing if one is observed by another individual or not would have adaptive advantages in situations of predation and deceiving others. We here report the effect of different body postures of a human in a food-requesting paradigm on the behaviour of a non-primate mammal – the dwarf goat (N =11; 2-3 years of age). The experimenter was sitting opposite to the subject, separated by a mesh. He then placed a food reward inaccessible for the subject on a sliding board and waited 30 sec until sliding it towards the mesh

to deliver the reward. During this time, the experimenter engaged in one of the four condition: 'Control' (head and body oriented towards subject), 'Head' (only head oriented away from subject), 'Back' (head and body oriented away from subject), and 'Out' (experimenter left the room for 30 sec). We recorded the time a subject was oriented towards the mesh and the experimental set-up and engaged in a) active anticipatory behaviour (nervous tripping in front and repeatedly snouting through the mesh) and b) standing alert (standing motionless in front of the mesh while facing the experimental set-up). We found that the level of subjects´ active anticipatory behaviour was positively correlated with the level of attention the experimenter was paying to the subject (linear mixed model; $N = 9$; post-hoc comparisons $P < 0.05$), while standing alert increased when the experimenter was present, but showed reduced attention to the subject ('Back' and 'Head' condition) compared to the 'Control' and 'Out' conditions (linear mixed model; $N = 9$; post-hoc comparisons $P < 0.05$). The results suggest that subjects were able to interpret the presence and absence of the experimenter in general and his body and head orientation in particular as a means for reward delivery.

(oral presentation)

Sex-specific effects of unsaturated fatty acids on spatial learning in guinea pigs

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Unsaturated fatty acids (UFAs), including the n-3 and n-6 polyunsaturated and the n-9 monounsaturated fatty acids, are essential nutritional factors involved in modulating the properties of neuronal cell membranes and therefore affecting different aspects of physiology, behaviour, and cognition. However, due to pronounced sex differences in neurobiological mechanisms, dietary UFAs may show sex-specific effects. We therefore determined the effects of UFAs on spatial learning abilities in male and female domestic guinea pigs in relation to saliva cortisol concentrations, a marker for physiological stress. 40 males and 40 females were assigned to four groups and fed on diets high in n-3, n-6, or n-9, or a control diet, for 16 days. Thereafter their spatial learning abilities were tested in a radial-Y-maze for 3 consecutive days. The high-UFA diets significantly affected the corresponding fatty acids in plasma, which serves as a general marker for the fatty acid status. Saliva cortisol concentrations had no effect on learning abilities but were significantly higher in males than in females. Males generally showed significant learning abilities, determined by the latency to pass the test and the conducted errors, irrespective of the diet. In females, n-3 and n-9 positively affected learning, while no effects were detected in n-6 or control females. Comparing the sexes revealed that only control males and females differed significantly in their performance, with males exceeding females,

while no sex differences were detected in the UFA-supplemented groups. These results indicate sex-specific effects of dietary UFAs, apparently enhancing spatial learning abilities only in female guinea pigs, resulting in an elimination of the sex difference identified in control animals.

(poster 108)

Defence against pathogenic fungi in the ambrosia beetle *Xyleborinus saxesenii*

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The success of social insect colonies often depends on their ability to cope with a variety of pathogens. This involves immune responses of individuals and a 'social immune defence' consisting of different behaviours suited to reduce pathogen prevalence. This defence mechanism is especially important in fungus growing species, because the microclimate conducive to the proliferation of cultivated fungi usually promotes the growth of competing fungi and pathogens as well. The fruit tree pinhole borer *Xyleborinus saxesenii* is a fungus gardening ambrosia beetle exhibiting cooperative breeding. It lives in colonies founded by a single female in the heart wood of weakened or freshly dead trees. Young females mate with their brothers and delay dispersal to help raising siblings by grooming them and tending the fungus garden. We have manipulated laboratory colonies by injecting different pathogenic fungi and monitored the behaviour of colony members to check for a potential social immune response. We found that the colonies respond specifically to several pathogens by enhancing grooming frequencies and cannibalism of apparently infected larvae. Ambrosia beetles exhibit a variety of social organizations ranging from solitary breeding to eusociality, which makes them ideal models to study the ultimate and proximate mechanisms of colony hygiene.

(poster 109)

The rat grimace scale: Method for quantifying psychological stress adaptation of laboratory rats

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Nonhuman animals exhibit similar facial expressions to emotional states as do humans. Facial expression can be useful for quantifying pain of laboratory mice and rats, rabbits as well as in horses. The aim of our study was to evaluate the effect of psychological stress on the occurrence of negative emotions in laboratory rats. Six males and six females Wistar rats (aged 68 – 69 days) were tested in the two experimental conditions. First, animals were set in their home cages, next animals were put into restraint chamber. We took 10 photographs of tested animals during 10 minutes testing period in both experimental conditions. The three independent observers have scored 4 action units (orbital tightening, nose/cheek flattening, ear changes and whisker change) of the rat grimace scale (RGS), data were analysed using paired t-test (Sigmaplot 11.0). We found significant differences in the RGS score between experimental conditions. Both, males as well as females have increased RGS score during restraint stress in comparison with home cage. Gender differences were observed only during restraint stress, where females have significantly decreased RGS score. When analysing each action unit separately, significant differences between experimental conditions were observed in orbital tightening, nose/cheek flattening, ear changes, but not in action unit whisker change, in both, males and females. In the restraint stress males have significantly increased score in action units orbital tightening and whisker change in comparison with females. Our results indicate that the RGS score can be used like method for quantifying stress adaptation of laboratory rats. The study was supported by grants: APVV-0291-12.

(poster 110)

Increased heart rate in domestic horse mares during artificial weaning of their foals

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Artificial weaning was found stressful for the females of domestic ungulates. Within AWIN project we study the impact of artificial weaning of previous foal on behaviour and welfare of the pregnant mothers, as well as survival, growth, behavioural development and welfare of the offspring. Here we present the results on changes in mares' heart rate

(HR) associated with routine procedure of abrupt weaning of their foals. We observed 19 mares; 9 lactating pregnant mares with foals and 10 non-lactating pregnant mares as a control group in the National Stud Kladruby nad Labem, Czech Republic. Foals (aged from 4 to 7 months) were led away from the home stable at one time. The mares stayed in the stable for 4 hours, then were led away from the stable, joined with control mares and moved by foot to the other facility 3 km far from the home stable. Weaning of the foals significantly affected both, mean and maximal HR recorded in particular time periods (during and after weaning, before moving, during moving, after moving in a new facility; $P<0.001$, general linear model, PROC MIXED, SAS). "Weaned" mares compared to non-lactating ones showed higher mean as well as maximal HR during and after weaning. The difference was still apparent in resting HR before moving as well as in a new environment. Individual differences among mares in HR reaction to weaning were also found. Our results indicate at least short-term negative effect of abrupt artificial weaning on domestic mares. Supported by AWIN, EU FP7 No. 266213

(poster 111)

Examining growth rate and starvation endurance in pit-building antlions from semi-arid and hyper-arid regions

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Stressful or stochastic environments may have significant selective effects, leading to increased plasticity or stress resistance. Starvation is a type of stress commonly encountered among organisms inhabiting stochastic environments. Indeed, starvation endurance is an important trait, especially in sit-and-wait predators, which experience frequent fluctuations in prey arrivals because of their limited mobility. We conducted an experimental comparison of starvation endurance in pit-building antlions, originating from semi-arid and hyper-arid environments. We hypothesized that individuals from the climatically harsher and biotically poor environment should be better adapted to endure long starvation periods. Additionally, we posited that faster-growing individuals are expected to be more sensitive to starvation because of their need to sustain higher metabolic rates. We found that antlions originating from the semi-arid region maintained higher activity levels, which led to slightly higher mass loss rates during starvation, but enabled faster recovery when food supply was renewed. Conversely, antlions originating from the hyper-arid region had lower activity levels, consistent with their lower rate of mass loss during starvation, but this came at the expense of decreased response to prey and lower growth rate when food became available again. Results from both regions were consistent with the predictions of the growth compensation phenomenon: antlions that were fed less frequently pre-starvation grew at faster rates when food supply was renewed. Our study demonstrates that individuals originating from different environments adopt different strategies in order to endure starvation, exemplifying antlions' ability to compensate for mass lost during starvation.

(oral presentation)

Modeling leadership hierarchy in wild horses

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Gregarious animals need to make collective decisions in order to keep cohesiveness during movements. We build two modeling approaches for the collective motion of a herd consisting of sub-units. Our models where inspired by an observed Przewalski horse herd (Hortobágy, Hungary), but can be aplicable for many species living in multilevel societies. In the first model we investigate the decision-making process of a group combining self organization and social dynamics, and reproduce the simultaneous emergence of a hierarchical and modular leadership network. All individuals in the model try, with varying degrees of ability, to find a direction of movement, with the result that leader-follower relationships evolve between them, since they tend to follow those who seem to be more successful. The harem-forming ambitions of male individuals lead to modular structure that is similar to the one observed in the horse herd. In this approach we find that the harem-leader to harem-member ratio observed in horses corresponds to an optimal network regarding common success. We also find that the experimental and model harem size distributions are close to a lognormal. In the second model the collective motion of groups is simulated by a self-propelled particle approach, where the balance of attractive and repulsive forces between the individuals ensures the coordinated movements. The two individual types have different preferences and interaction ranges giving rise to a herd consisting of collectively moving sub-groups.

(oral presentation)

Interspecific variation in the structural properties of flight feathers in birds: an adaptation to flight and habitat

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The functional significance of intra- and inter-specific structural variations in the flight feathers of birds is poorly understood. Here, a phylogenetic comparative analysis of 4

structural features (rachis diameter, barb and barbule density, and the feather mass/length ratio) of proximal and distal primary feathers of 137 European bird species was conducted. Flight type (flapping and soaring, flapping and gliding, continuous flapping or passerine-type), habitat (terrestrial, riparian or aquatic), migratory behaviour, diet and moult strategy were all found to affect feather structure to some extent. For example, species characterized by low wing-beat frequency flight (soaring and gliding) have broader feather rachises (shafts) and feather vanes with lower barb and barbule density than birds associated with more active flapping modes of flight. Rachis diameter and feather vane density are likely related to differences in force distribution across the wingspan during different flight modes. An increase in shaft diameter and barb density from the proximal to distal wing feathers was also found, and was highest in species with flapping flight indicating that aerodynamic forces are more biased toward the distal feathers in flapping flyers than soarers, and gliders. In addition, habitat affected barb and barbule density, which was greatest in aquatic species, suggesting that the need for water repellency and resistance to water penetration may influence feather structure. Barb density was also affected by moult pattern and rachis diameter by migratory strategy. It appears then, that rather than a single functional driver there is in fact a suite of selective pressures influencing flight feather structure. These selective pressures are discussed in detail.

(poster 112)

Experimental evidence of learned spatial maps in a dart-poison frog, *Allobates femoralis*

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Spatial learning has been studied in variety of mammals, birds and insects, and has become one of the most comparative fields in animal cognition. However, ectothermic vertebrates, especially amphibians, have been neglected in this field, at least in part because they were not considered to have advanced learning abilities. At the same time, directed long distance movements, such as mass spring migration to breeding ponds in temperate-region amphibians, have drawn attention to amphibian orientation mechanisms. Some form of landmark learning has been implied in several studies but the role of learning in orientation has never been addressed directly. Furthermore, orientation has been mostly studied in temperate regions, while some of the most complex spatial behaviors (e.g., territoriality and tadpole transport) are found in tropical amphibians, such as the dart-poison frogs (Dendrobatidae). We investigated the role of spatial learning in movements of *Allobates femoralis*, a dendrobatid frog with paternal tadpole transport. We manipulated artificial tadpole deposition sites in the field and experimentally displaced males from their territories. We quantified movement patterns by telemetry and focal following. We

found that males return to their home territories by a nearly straight line from several hundred meters but only from areas that have potentially been explored during their lifetimes. We also found that tadpole-transporting individuals arrive to the exact locations of deposition sites even after the sites have been removed. Taken together, our results demonstrate that spatial learning plays a major role in *A. femoralis* spatial behavior. It suggests a formation of a large-scale spatial map but the exact landmarks being used remain unknown.

(oral presentation)

Cooperation and conflict in dog families

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Parental care is an essential component in the life history of mammals, and is manifested in various forms in different species. In group living animals, cooperation and conflict determine social dynamics. While parents provide care to their young, they can also enter into competition over resources with their offspring. We observed free-ranging dogs in their natural habitats in Indian streets to understand the nature of care that mothers provide to their offspring, and conducted experiments to test the presence of conflict over extended parental care between the mother and pups. We demonstrate parent-offspring conflict in the dogs over extended parental care, and the presence of alloparental care in family groups, which is reminiscent of cooperative breeding in many canids.

(oral presentation)

Red deer bachelor group membership - friends or rivals?

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During the antler growth period red deer stags integrate into unstable bachelor groups. Although physiological reactions arise from rank, they are sensitive not only to the rank but also to the social setting in which the rank occurs. We predicted that stags associate with either 'Friends' (those who like to be together and therefore do not fight) or 'Rivals' (those who compete for rank position). A group of 17 stags was observed from June to August. Using GPS collars, we have detected inter-individual distance between all pairs of stags over the whole period. Cluster analysis revealed a group of closest associates who

moved on average within the range of 22 m. Based on agonistic interactions, these close associates were divided into two groups, Friends (total of 8 interactions and less) and Rivals (more than 8). We found that number of interactions were dependent on average distance from the associate nested within the Friend/Rival class (P<0.0001). While Rivals with increasing distance increased number of interactions with associates (P<0.0001), there was no such relation for Friends (P=0.80). In another GLMM it was shown that average distance between associates tended to increase with age only (P<0.02). On the other hand, it was neither dependent on whether the associate was Friend or Rival (P=0.92) nor the total number of agonistic interactions (P=0.62). Our results thus suggest that there are both, friends and rivals within a bachelor group. Friends and rivals keep the same inter-individual distance within the group. Rivals tend to be on distance from opponents, but once they get closer, they attack each other frequently. In the next step we are planning to verify these two categories by measuring cortisol and testosterone concentrations.

(poster 113)

Adult sex ratios are biased towards the homogametic sex in amphibians and reptiles

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Sex is a fundamental aspect of individual life history. Differences between sexes in traits such as growth, age of maturation or survival play principal roles in population dynamics and the evolution of mating systems, sex roles and parental care. In most vertebrates sex is determined by a single genetic locus for which either males (XY) or females (ZW) are heterozygotic. As sex chromosomes evolve, the Y or Z chromosomes degenerate and this may expose the heterogametic sex to deleterious mutations on the X or W chromosome which in turn may cause higher mortality in that sex (unguarded sex chromosome hypothesis, Trivers 1972). Here we test this idea for the first time by comparing the adults sex ratio (ASR) between amphibian and reptile taxa which differ in their genetic sex determination systems. We collected data on ASR of amphibian and reptile populations from published sources, and tested whether ASR differs between XY and ZW species (n=106) using Phylogenetic Generalized Least Squares models. According to the unguarded sex chromosome hypothesis, we found that species with heterogametic females (ZW) have more male-biased sex ratios than species with heterogametic males

(XY). Combined with the typically female-biased sex ratios of mammals (XY) and male-biased sex ratios of birds (ZW), our results suggest an association between genetic sex determination systems and ASR in tetrapod animals that has profound implications for our understanding of the evolution of life histories and reproductive behaviour.

(oral presentation)

May allosuckling in zebras be important for the discussion on the meaning of suckling duration?

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Several studies including meta-analyses and study on feral horses (*Equus caballus*) suggested no significant relationship between suckling bout duration and milk or energy intake. Allonursing (nursing non-filial offspring) represents costly behaviour to the female. Although it occurs in a variety of taxa including ungulates, the reports of allonursing in equids remains anecdotal. During our long-term (42 months including 1626 hours) observation of three zebra species (plains zebra *E. quagga*, Grevy's zebra *E. grevyi*, and mountain zebra *E. zebra*) in the Dvůr Králové Zoo we recorded two cases of adoption and allonursing (one in plains zebra and the other one in Grevy's zebra). Plains zebra adopted 9 days-old non-filial foal several hours after she gave birth whereas Grevy's zebra made the adoption six months after parturition of her own progeny. In both cases the lactating mares nursed regularly two foals: filial and non-filial. These cases represent the first evidence of adoption and allonursing in these species. When we compared suckling bout duration between filial and non-filial foal we found that whereas allonursing plains zebra mare did not distinguish between filial and non-filial foal, the Grevy's zebra mare nursed her own foal for longer time than the non-filial one. In both cases suckling bout duration of non-filial foals was shorter than that of all filial foals in the herd. In both cases non-filial foals had more rejected suckling attempts and their suckling bouts were more often terminated by a mare than those of filial foals. Since the mares nursing two foals terminated suckling bouts earlier than the other mares we suggest that high differences in the suckling bout duration actually does reflect milk intake.

(oral presentation)

The effect of colour, pattern and shape on human evaluation of fear and beauty of coral snakes

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In the nature, aposematic colouration acts as a warning signal of a dangerous prey to its predators not to devour it. The highly poisonous American coral snakes possess this colouration pattern. Snakes elicit fear in most of the primates, included humans, due to shared coevolutionary history of snakes and primates with snakes acting as their main predators. The aim of this study was to find out if humans perceive various aposematic colouration and patterns of coral snakes as a dangerous and if so, which visual factors of the snakes affect this fear reaction (i.e., a warning colouration, pattern or shape of snake). The testing was done using an already established method of picture/photographs presentation to volunteering respondents, who sort the pictures of snakes according to their perceived fear and attractiveness. The agreement was high among the respondents, but evaluation was different when the photographs were sorted according to attractiveness or fear. Tricolour species like *Micrurus corallines*, *Micrurus mertensi* and *Micrurus remotes* were highly preferred. Humans are able to evaluate fear of the coral snakes, although they do not share long common coevolutionary history. The snakes perceived as most dangerous were *Micrurus averyi, Micrurus corallinus* and *Leptomicrurus narduccii*. These snakes bear a high proportion of red and black colour. When presented within geometric shapes, the aposematic colouration per se elicited less fear in human respondents. The specific snake body form is an important part of aposematic signalling of coral snakes.

(poster 114)

Nasty neighbor effect in the queenless ant *Dinoponera quadriceps* (Hymenoptera: Formicidae)

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Colony's spatial distribution and population of many ant species are controlled by density dependent competitive processes. In some species, a high population density leads to an increase in intraspecific competition and workers tend to adopt aggressive strategies against ants from other colonies. Being less aggressive to a neighbor than to an unfamiliar individual is known as dear enemy effect. On the other hand, being more aggressive to neighbors than to ants from distant colonies is called nasty neighbor effect. We investigated the occurrence of these effects based on interactions between

Dinoponera quadriceps workers from different colonies. Each pair was observed during 10 minutes and their behavior was registered each 1 minute. The results suggest that *D. quadriceps* workers are more aggressive in interactions with non nestmates from near colonies than with non nestmates from distant colonies. Workers initiate the aggression faster with neighbors and wait longer to begin the aggression with workers from distant colonies. The aggression index is also higher with neighbors than with distant colonies workers. These data suggest that the nasty neighbor effect occurs in this species instead of the dear enemy effect. This study increases the amount of evidences indicating that the nasty neighbor effect may be a general phenomenon among animals that defend territories and compete for limited resources.

(poster 115)

Impacts of anthropogenic noise on alarm-call behaviour

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Anthropogenic (man-made) noise has changed the acoustic environment both on land and underwater and is now recognised as a pollutant of international concern. A range of impacts on animals have been investigated the topic receiving the most research attention has been acoustic communication. However, the majority of those studies have considered the effect on song with potential consequences for reproductive success. We have used field experiments on a habituated wild population of dwarf mongooses (*Helogale parvula*) to investigate how traffic noise affects alarm-call behaviour, which has direct survival consequences. Playbacks of traffic or ambient noise were simultaneously broadcast with alarm calls to examine the possibility of masking. Preliminary results suggest no evidence of masking, with response types and time to response not being affected by traffic-noise playbacks. However there was a slower return to foraging compared to during playback of ambient noise. Simulated predator presentations were combined with either traffic-noise or ambient-noise playbacks to explore whether signallers change the acoustic structure of their alarm calls; acoustic analyses has yet to be conducted. Our work emphasises the need for studies on the impacts of anthropogenic noise to consider a wider range of vocalisations, especially those pertaining directly to fitness.

(poster 116)

A method of selection against mortality in layers, based on ethological knowledge and applicable under commercial conditions

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This abstract is neither a review nor a description of results. It is a theoretical remark on the use of group selection against severe feather pecking in layers. The efficiency of selection against severe feather pecking under commercial conditions has a high priority in order to limit beak trimming with all its negative effects on poultry welfare. Group selection has been around for several years but, as far as I know, nobody has ever mentioned that this method is mainly efficient in the selection against traits that are in some degree present in all individuals (e.g. aggression). However, from applied ethology we know that severe feather pecking is no aggression but a disturbed behaviour performed by particular individuals. A more efficient method to select against severe feather pecking, therefore, seems to be to pick out the individuals that perform severe feather pecking. In small groups the number of severe feather peckers present and their position in the rank order may influence the results. A more standardised method, applicable under commercial conditions, seems, therefore, to keep a selection candidate with only one standard hen of a breeding line that hardly performs severe feather pecking. By scoring the mortality among these standard hens it is possible to pick out the selection candidates that perform severe feather pecking. Eventually the quality of the plumage of the standard hens may also be scored. No time consuming behavioural observations are necessary. When the standard hens lay eggs of a different colour than the selection candidates simultaneous selection on production traits is possible. When selection candidates are too valuable to be put in one cage with a potential cannibal, her sibs or offspring may be used in pairs with a standard hen.

(poster 117)

Social learning facilitates foraging behavior in Pallas' Long-tongued Bats

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Social learning describes the acquirement of knowledge from other animals. Mechanisms of social learning are documented in insectivorous and frugivorous bat species, but there is little information whether flower-visiting nectarivorous bats (Phyllostomidae: Glossophaginae) can acquire information such as flower positions via observation of conspecifics. These Neotropical bats have elongated tongues to extract nectar while

hovering in front of flowers that are usually detected by shape and olfactory signals. We hypothesized that the social learning of new flower positions by observing foraging conspecifics could help to reduce the energy-costly search effort. In this study, we used a demonstrator-observer experiment to show how information transfer between conspecifics facilitates foraging behavior in Pallas' Long-tongued Bats (*Glossophaga soricina*). During the experiment, bats had the task to find one rewarding artificial flower filled with odorless sugar water on an array among 15 unrewarding flower dummies. We quantified the search effort (unsuccessful flower visits) of 12 captive bats that were each tested in three different test situations: (1) focal bat alone (trial-and-error situation), (2) focal bat freely interacting with naive conspecific (social facilitation situation) and (3) focal bat freely interacting with a demonstrator bat that was trained to feed on the rewarding flower (social learning situation). We observed significant differences between the three test situations with a distinctly reduced search effort in the social learning situation. We conclude that *G. soricina* is able to apply a social learning strategy that facilitates foraging behavior of unexperienced individuals.

(oral presentation)

Coexistence and foraging in harsh environments – observations in a free-living small mammal species community in Alashan desert

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Time budget and foraging in species of a free-living small mammal desert species community including Desert hamsters (*Phodopus roborovskii*), Midday gerbils (*Meriones meridianus*), and Northern three-toed jerboas (*Dipus sagitta*) was investigated focusing on strategies of coexistence. The study was performed during 2009, 2010 and 2012. Activity was determined in hamsters using RFID technique which allowed measurements of onset and offset of activity above ground, length of foraging walks and inside stays during the night. For that purpose animals were caught in the field and marked with passive transponders; burrows were equipped with integrated microchip-readers and photo-sensors for detection of movements into or out of the burrow. Foraging strategy of all species was determined by measurements of the giving up density and by video observation at food patches. Hamsters living in communities dominated by gerbils shortened their activity tremendously, instead lunar illumination especially during full moon lead to a prolongation due to earlier onsets. Nevertheless, for hamsters and for the both other species moonlight avoidance was performed in waning and waxing moon based on video observation. During new and full moon with constant light conditions ambient temperature was more influential, i.e. all animals preferred the warmer periods of the night and intensified foraging behavior. In sum, the factors coexisting species, moonlight, and ambient temperature (including habitat, food availability, shelter, density,

predation, thermo-neutral zone) resulted in a dynamic feedback cycle presented here for a truly wild living species community in a semidesert habitat.

(oral presentation)

The influence of the prenatal disruption of the mechanisms regulating blood pressure on postnatal stress adaptation in laboratory rat: using the rat grimace scale on quantifying emotions

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In accordance to FOAD (fetal origins of adult disease), adaptions on suboptimal intrauterine conditions may lead to changes in regulatory mechanisms of blood pressure and in the end to the development of hypertension. Moreover, hypertension is accompanied with important behavioral changes, including emotionality. The aim of our experiment was to find out, how prenatal disruption of regulatory mechanism of blood pressure, represented by the intrauterine exposition of elevated levels of angiotensin II (Ang II), influences the intensity of experiencing emotions in mild stressful situation by using rat grimace scale (RGS). On the basis of current knowledge, we hypothesized increasing of emotionality. The fetal manipulation of the regulatory mechanisms of blood pressure was applied from the 6th to 21th day of intrauterine development in Wistar rats. We implanted osmotic minipumps into experimental mothers from which Ang II was continually released. We tested the offspring (Ang: 6♂, 6♀; C: 6♂, 6♀) at the age of 68th and 69th day. We took 10 photographs during 10 minutes in two experimental conditions (home cage and restraint chamber). The four action units of RGS (orbital tightening, nose/cheek flattening, ear changes, whisker change) were scored and analyzed by three independent observers. We found out that, animals in restraint chamber showed higher score of RGS in both groups in comparison with home cage. Differences were observed in both genders. In addition, Ang females reached higher score of RGS in restraint chamber in comparison with control females. In conclusion, we confirmed our hypothesis that prenatal exposure of Ang II increased emotionality, which was represented by higher score of RGS. This work was supported by grants APVV 0291/12, VEGA 1/0686/12; 2/0107/12.

(poster 118)

Size matters: effects of habitat urbanization on nestling provisioning and breeding success of house sparrows (*Passer domesticus*)

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With the increasing number and extension of human settlements our impact on the wildlife has never been as intense as in the last few decades. However, our understanding on the effects of landscape urbanization to the biota is still not satisfactory. Lower reproductive success per nesting attempt has been demonstrated for urban passerine species in general, but we know little about the underlying mechanisms of this phenomenon. In this study we chose the house sparrow (*Passer domesticus*) as a model species, because it is one of the most tightly linked bird species to humans, yet its population has been decreasing worldwide, especially in European cities. In our research we monitored reproductive success and nestling development of sparrows living in different levels of habitat urbanization. We also collected observations on the parents' nestling feeding behavior from 2010-2012 to compare feeding rates and size distribution of chicks' diet between habitats. We found that breeding success (i.e. the ratio of hatched to ringed nestlings at 9-11 days old) was significantly higher in rural compared to suburban nests and that rural chicks grew significantly greater before fledging. Investigating parental provisioning behavior, we found that chick-feeding rates did not differed between suburban and rural nests; however, rural parents delivered significantly more large prey items to their nestlings. These results indicate that in urbanized habitats, the poor nestling development and reduced survival might be the consequence of inadequate nestling diet as parents are not able to provide proper quantity and/or quality of arthropod food to their offspring which would be required for their optimal development.

(poster 119)

Stress-induced behaviour in adult rats: long term effects of exposure to extremely low frequency magnetic field

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In the present study, we examined the effects of chronic exposure (1 weeks) to an extremely low-frequency magnetic field (1 μT) (ELFMF) of (50 Hz) on memory of rats.

(poster 120)

Dominance hierarchy between males and females of freshwater prawn *Macrobrachium rosenbergii*

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Sexual dimorphism is a common characteristic of many species and can be associated with dominance relationships between individuals. In *Macrobrachium rosenbergii*, a freshwater prawn, dominance is related to body size and claw size. Males present three morphotypes which differ in size and color, the translucent and small males, the orange claw males, with intermediate size, and the blue claw males which are bigger and dominant. Females present a more uniform size distribution. Few data discuss dominance hierarchy in this species including females i.e. intersexual dominance rank. Based on that our aim is to compare weight, body size and dominance score between males and females of M. rosenbergii juveniles. In this stage of growth animals show differences in size but not in coloration. Twenty eight individuals were distributed randomly in four aquariums (seven prawns per aquarium). Each aquarium was observed once a day, during 30 minutes, along ten days. The recording method was continuous focal animal sampling. We recorded agonistic behaviors exhibited and the individuals involved. At the end of the experiment prawns were weighed, measured and classified according to sex. Each prawn received a position in a dominance rank through the David's score method. Males showed higher body weight (significant) and size (non significant) than females. In all the groups females occupied the highest position in the dominance rank even though males and females scores were not significantly different. For females access to resources is a limiting factor for reproductive success, so dominant females may have an advantage in acquiring these resources with consequent gains to fitness.

(poster 121)

Reproductive output and overwintering strategies in female common hamsters

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To survive the winter period Common hamsters (*Cricetus cricetus*) accumulate body fat as internal and food stores as external energy reserves. Previous studies on foraging behaviour showed that adult females cached food throughout the active season and, as opposed to males, were rarely observed feeding outside their burrows. Females produce one to three litters per season and some individuals lactate until early autumn. These differences in reproductive effort and timing could be reflected in body fat accumulation prior to winter and therefore might affect hibernation patterns. We investigated foraging behaviour, body fat proportion and hibernation patterns in free-ranging females by applying capture-mark-recapture and focal-sampling techniques. Body fat was calculated

using morphometric parameters and body temperature during winter was recorded by subcutaneously implanted data loggers. Storable food items were cached very selectively and individuals spent 68-100% of the observed time above-ground collecting such plant parts. According to differences in reproductive effort, females varied in body fat proportions prior to winter. In addition, body temperature patterns ranged from regular torpor bouts throughout the winter in some individuals to extended euthermic phases in others. Experiments in constant condition chambers revealed similar results in that females with low body fat content before winter consumed more food and spent less time in torpor than individuals with higher body fat. In conclusion, reproductive effort seems to limit body fat accumulation in females resulting in fewer torpor bouts in individuals with high reproductive output, which thus highly depend on external energy stores.

(oral presentation)

Take time to smell the frogs: vocal sac glands of reed frogs (Anura: Hyperoliidae) contain species-specific chemical cocktails

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Males of all reed frog species (Anura: Hyperoliidae) have a prominent, often colourful, gular patch on their vocal sac, which is particularly conspicuous once the vocal sac is inflated. Although the presence, shape, and form of the gular patch are well-known diagnostic characters for these frogs, its function remains unknown. By integrating biochemical and histological methods, we found strong evidence that the gular patch is a gland producing volatile compounds, which might be emitted while calling. Volatile compounds were confirmed by gas chromatography-mass spectrometry in the gular glands in 11 species of the hyperoliid genera *Afrixalus*, *Heterixalus*, *Hyperolius*, and *Phlyctimantis*. Comparing the gular gland contents of 17 specimens of four sympatric Hyperolius species yielded a large variety of 65 compounds in species-specific combinations. We suggest that reed frogs might use a complex combination of at least acoustic and chemical signals in species recognition and mate choice.

(poster 122)

The effect of early social environment on the avoidance distance in dairy heifers

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Human-animal relationship has a significant influence on the farm animal welfare and performance. Avoidance distance is a measure that is often used to assess fearfulness of humans in farm animals. Previous studies in mammals indicated that behavioural reactivity can be durably influenced by early social environment such as premature weaning or isolation. Therefore, the aim of this study was to assess whether the avoidance distance is influenced by early social environment in dairy cattle. Thirty three female dairy calves of two BREEDS (HOLSTEIN and CZECH RED PIED were randomly assigned to one of four treatments according to a 2x2 factorial design. The treatments were MOTHER (WITH or WITHOUT mother during the 4 days after birth) and HOUSING (INDIVIDUAL or GROUPED housing between 1 and 8 weeks of age). After 8 weeks of age all of calves were housed in groups. The avoidance distance was measured by a trained observer in heifer home pens at 13 months of age. The influence of MOTHER, HOUSING and BREED as fixed effects was tested with mixed linear model in SAS. We did not find a significant influence of MOTHER (WITHOUT: 975 mm (median), WITH: 875 mm; $F_{1,29} = 0.17$, $p > 0.05$), HOUSING (INDIVIDUAL: 937.5 mm, GROUPED: 650 mm; $F_{1,29} = 0.28$, $p > 0.05$) or BREED (HOLESTEIN: 650 mm, CZECH RED PIED: 1225 mm, $F_{1,29} = 0.90$, $p > 0.05$) on avoidance distance in 13 months old dairy heifers. The avoidance distance of heifers in 13 months of age was not significantly influenced by the manipulations in early social environment. It is possible that avoidance of humans is more influenced by later experience with humans and that the early social environment will rather affect later social interactions with conspecifics.

(oral presentation)

Behavioral changes in an invasive parasitic fly and its avian hosts, the Darwin's finches

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The parasitic fly *Philornis downsi*, is an obligate parasite of bird nestlings. In its larval stage it lives in birds' nests and sucks blood from the nestlings. This recently introduced parasite has a dramatic impact on the unique bird community of Galápagos. Observational as well as experimental studies did show that especially the Darwin's finches suffer a high brood loss due to *Philornis* parasitism and this contributes to the dramatic decline of several species. Our data suggest that behavioural changes have evolved in both the host and the

parasite in this recently established host parasite interaction. Due to the very high parasite load, chicks often die within the first days and larvae do not have enough time to develop to the final larval stage. During the last years we observed a change in the oviposition behaviour of the parasite: while previously it laid its eggs only in nests where chicks had already hatched, it now already lays in incubating nests. At least one host species seems to react by abandoning the parasitized nests during the incubating stage and several host species have shown a new form of tool use. They take leaves of an endemic plant species (*Psidium galapageium*) with repellent properties and rub them into their feathers. An experimental study demonstrated that *Philornis* larvae that took their blood meal through gauze treated with the Psidium leaves had lower growth rates-and survival probability than larvae from a control group.

(oral presentation)

Influence of selected factors on the behaviour of female guinea pigs during birth of their youngs

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The aim of this study was to examine selected factors that influence the behaviour of female domestic guinea pigs (*Cavia aperea f. porcellus*) during the birth of youngs. Females do not treat up to 45% of the born young that subsequently die due to asphyxiation in embryonic covers. Following determinants were observed: sex of the young, birth weight, condition of the young, litter size, season, daytime. In the overall evaluation, a relation between the alive or dead young and other observed values was assessed using Pearson's chi-squared test. A statistical significance was unambiguously proved in the case of daytime, which clearly reflected the influence of light and darkness on a loss of maternal behaviour and instinctive urge of female guinea pigs. Another parameter in which statistical significance was clearly proved was the litter size. Some females do not manage to clean all their youngs after giving birth to a large litter, they are more exhausted and the impact is fatal on the newborn youngs. The ethological observation has also led to a finding that the females devote special care to their firstborn young and neglect the others. This phenomenon often leads to the late rupture of embryonic covers and suffocation of the young as well. Birth weight of newborns is another indicator that has an impact on mortality of the young at birth. It is closely connected with litter size. In conclusion, the study has proved a relationship between selected parameters which can have an effect on the behaviour of female guinea pigs during birth with an impact on giving birth to the live young.

(poster 123)

Reducing oral-nasal manipulation in commercially farmed pigs: fresh wood enhances the efficacy of straw

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Lack of suitable materials for rooting and chewing in commercial pig farming has been found to increase harmful behaviours. The aim of this study was to test whether the behavioural benefits of small provisions of straw could be enhanced by the continuous presence of fresh wood. The study was carried out on 167 breeder gilts on a commercial farm in Finland. The pigs were housed in 12-m2 pens with partly slatted floors, six to eight pigs/pen. About 1 litre of straw was given on the floor once a day. The two treatments were: continuous access to either three pieces of fresh birch wood per pen (N=11) or one piece of dried wooden board and one metal feeder chain per pen (N=12). At the age of 4 months, video recordings were made for behavioural analysis. Two periods were observed, totalling 2 hours: before and after distribution of feed and straw. The frequencies of oral-nasal manipulation of conspecifics were analysed with a paired-samples T test (SPSS 21). Receiving straw reduced pig-directed manipulation only in the treatment with fresh wood. Before receiving straw, the mean frequencies of manipulations were 39 events/pig/hour (SD=12) in the pens with fresh wood, and 42 events/pig/hour (SD=12) in the pens with board and chain. After receiving straw, the frequencies were 31 (SD=11) and 41 (SD=9), respectively. The difference between before and after was significant in the pens with fresh wood ($t=3.3$, $P<0.01$) but not in pens without ($t=0.36$, $P>0.1$). A possible explanation is that fresh wood, but not dry wood and chain, potentiated the effect of a small amount of straw in reducing pig-directed behaviours. It is concluded that in commercial farming, where animals have limited resources, behavioural effects of one resource may depend on the quality of the other resources.

(oral presentation)

Lack of plasticity in reproductive behaviour of female smooth newts

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Environmental heterogeneity and dispersal (with the resulting gene flow) are hypothesized to be major factors in the evolution of phenotypic plasticity as high gene flow increases the likelihood that individuals disperse into environments to which they are genetically not adapted. However, environmental challenges can be counteracted with a variety of phenotypic responses, and we have limited knowledge about which traits are the most likely to become plastic, especially in species with complex life cycle. In this study I examined whether gravid smooth newt (*Lissotriton vulgaris*) females show plasticity in

reproductive behaviour during a choice test in response to the presence of chemical cues that are potentially important for offspring' survival. 79 females were collected during the reproductive season from four ponds belonging to one metapopulation and transported to the laboratory, where each female was tested in the presence of chemical cues from invertebrate predators (*Acilius sulcatus* adults and *Aeshna cyanea* larva). Oviposition preference was measured by counting the number of eggs laid overnight and wrapping ratio in each environment (compartments of a testing container). I found that females did not discriminate between the two environments and laid equal amount of eggs in both. Besides, wrapping ratio was not higher in the presence of predator cues, suggesting that wrapping behaviour do not serve primarily to enhance egg survival. On the other hand, adult activity and some aspects of oviposition preference showed considerable variation between individuals from different ponds. These results indicate that female smooth newts' reproductive behaviour is not likely to be plastic, or at least exhibited irrespective of the presence of predator-related chemical cues.

(poster 124)

Play as an indicator of welfare in dairy calves

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It's generally known, that welfare quality can generally influence animals performance. The newest studies demonstrate play behaviour as a good index of welfare in farm animals. The aim of this work is to evaluate the effect of the presence of the dam during the colostrum feeding period and subsequent housing with peers on play behaviour in dairy calves. 40 female calves were randomly allocated to one of four treatments according to a 2x2 factorial design. The treatments were MOTHER (with or without mother during the 4 days after birth) and COMPANION (SINGLE, or GROUPED housing between 1 and 8 weeks of age). After 8 weeks of age all of the calves were housed in groups. The play behaviour of the calves was observed at 2, 5, and 12 weeks of age in situations: 6 hours of behaviour in the home pen and 15 min. in an open-field test and 15 min social test with unfamiliar calf. Presence of the dam during the colostrum feeding period and subsequent housing with peers did not affect frequency of play in the home pen. During open-field tests ($p=0,05$) and social tests ($p=0,01$) were more playful single housed calves. Individual differences between calves explained a considerable amount of 41 and 31% of variation in play in the home pen and open-field/ social test. This variability between individuals might explain the non significant results of play behaviour analysis in the home due to play behaviour may not be a reliable indicator of welfare in the home pen. But by the open-field and social tests we can estimate the level of welfare due to the „rebound effect" where

animals which are „deprivated“ by housing in a small space without posibility of social contact increase their activity after moving to the new environment.

(poster 125)

Caring not for the wings - absence of flight-oogenesis syndrome in cockroaches

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Regardless the wings are recognized as one of the most important innovations in insects, a great number of their representatives exhibit wing reduction. In many cases only females lose the wings while males not. It is usually believed that lower investments into wings save energy for reproductive gain in females (flight-oogenesis syndrome). Cockroaches are the insect order with one of the highest occurrences of forms with reduced wings and, therefore, are a good model group for testing the hypotheses concerning the wing reduction.

We chose macropterous but flightless cockroach *Eublaberus distanti* to test life-history trade off between keeping wings and reproduction success of cockroach females. Freshly moulted adult females were divided into two experimental groups: macropterous and apterous (wings entirely cut off). During the first receptive period they were offered three males for mating. After the mating, females were kept together with the male until death. We recorded mating preferences of females as well as reproduction success (number of broods, nymphs, abortions). We did not find any difference between macropterous and apterous females during the courtship and mating. Although macropterous females lived longer and produced more broods than apterous females, we found out that after the 4th brood rapidly increases the proportion of abortions. Therefore, surprisingly, both groups did not differ in total number of hatched eggs. We conclude that wings presence or absence has no effect on reproduction success of E. distanti females. We thus expect different reason why to retain wings in cockroaches. Contrary to previous hypothesis, we hypothesise the importance of wings in mating behaviour of males. The project was supported by GAUK 1700-243-253471.

(poster 126)

Tolerance and social attentiveness in dogs and wolves: tracking the evolutionary origins of dog-human cooperation

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At present, little is known about the motivational and cognitive effects of dog domestication, beyond the fact that dogs can be socialized with humans easier than wolves. Despite, dog-human cooperation has been suggested to be facilitated by selection for increased tolerance and social attentiveness in dogs compared to wolves. At the Wolf Science Center, in order to investigate the evolutionary origins of dog-human cooperation, we tested similarly raised and kept dogs and wolves socialized with humans as well as with conspecifics, both in intra- and interspecific contexts. We compared their tolerance and aggressiveness during food competition and found that dogs had a steeper dominance hierarchy and could be easier inhibited by their dominant (both human and conspecific) social partners. In two social learning tasks, we found that wolves were at least as attentive as dogs to their social partners and their actions. Regarding their cooperativeness, we tested the animals with three social cues offering food in an object-choice task: human pointing, human gaze and conspecific gaze. In contrast to dogs, the wolves did not follow human pointing but could locate the food based on conspecific gaze, indicating their cooperativeness in an intraspecific context. Based on these findings and their social ecology, we suggest that wolves are characterised with high tolerance, attentiveness and cooperativeness, which might have been a good basis for the evolution of dog-human cooperation (canine cooperation hypothesis). Furthermore, because we found that dogs were more sensitive to social inhibition than wolves, we hypothesize that dog-human cooperation needs to develop during relaxed/tolerant interactions with humans and that it strongly relies on the leading role of humans.

(oral presentation)

Physiological and socio-demographic influences on sex ratio at birth (SRB) in primates

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Environmental and socio-demographic factors can influence the variation of SRB (number of males/number of males plus females). This work investigated the effects of females' socio-economic status on SRB in humans and non-human primate species, the Barbary macaque, using three different data sets. In our first sample we examined the SRB in a Western population of mothers working at the University of Vienna, with regard to different educational levels, academics versus non-academics (N = 1,1847). The second study analyzed the effects of ownership of dwellings on a Ugandan sample (N = 438,640) and the macaque study analyzed SRB in relation to maternal dominance rank (N = 12). Multivariate statistics of demographic and social variable regressed on SRB showed increased male births in mothers who live under favorable environmental conditions: (i) for academics during spring season, (ii) for Ugandan mothers who owned a dwelling and (iii) for macaque females who were members of high ranking maternal lineages. These results give evidence for both the maternal dominance and the better environmental condition hypothesis.

(poster 127)

Courtship behaviour of Montagu's harrier *Circus pygargus*

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From 1992 to 2012 many aspects of breeding behaviour of Montagu's Harrier on calcareous marshes in eastern Poland were observed. Every season, harriers were monitored from April to end of July. Pair formation in harriers was non random process, based on behavioural cues in mate choice. Males performed vigorous displays (sky-dancing) to advertise their good condition. Sky-dancing was honest criterion of mate choice because is difficult to fake. Males in poor condition can't display frequently. Sky-dancing was performed by both sexes, but males displayed more often and vigorously than females. Other display as „flight play", was a ritualized form of aggressive behaviour because males performed this 'attack" without talons presentation. During courtship, males of Montagu's harrier were more aggressive than females. Intraspecific and interspecific aggression comprised direct attacks, escorts, pursuits and „mirror behaviour". The cases of communal mobbing behaviour were observed too. The significant element of pair

formation was courtship feeding. Food transfer during courtship period was performed by two ways: on the ground or in the air. Both methods of food transfer were significant for pair bond and pair formation. Courtship feeding was pre-copulatory behaviour in Montagu's Harrier. Copulatory behaviour was observed inside male territory or in the nest. Semi-colonial nesting is associated with risk of extra-pair copulation. However this behaviour was rare in Montagu's harrier. Good way of paternity assurance in harriers and others species of birds were frequent within pair copulations. The number of copulations in clumped pairs was higher than solitary ones. The cases of polygyny was extremly rare in population breeding in natural habitat of eastern Poland.

(poster 128)

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