



Abstracts

First (and hopefully last) Virtual Conference of the Ethologische Gesellschaft e.V. February 26th, 2021, 13:00 - 18:00

Session I – Regular talks (Chair: Erica van de Waal)

13:05 Differences in the pace-of-life syndromes between and within species

Irene Gaona-Gordillo, Niels Dingemanse & Benedikt Holtmann, Ludwig-Maximilians University München

Life history trade-offs are expected to be resolved differently between species, populations, or individuals. Consequently, behavioural, physiological, and life history traits will contribute or constrain how organisms solve the trade-offs between current vs. future reproduction. Adaptive state-dependent models postulate that organisms with a fast pace-of-life should invest more in current reproduction at the cost of survival, whereas slow pace-of-life organisms are expected to do the opposite. Empirical data mismatches the theory. An unsolved question is whether the same ecological mechanism is responsible for shaping the integration between behaviour, physiology, and life-history at different biological levels or if multiple ecological mechanisms are involved. Due to this, we investigated the integration of these traits of two closely related bird species, the blue (*Cyanistes caeruleus*) and great tit (*Parus major*). Our aim was to test if the pace-of-life syndrome between life-history and behaviour existed within and among these species. We collected data on the lay date and the clutch size of 167 broods, and the behaviour (i.e. exploratory behaviour), physiology (i.e. breathing rate), and morphology (i.e. body mass and tarsus length) of >300 adults. Our results showed support for the slow-fast continuum at species level in the life-history, morphological, and physiological traits. Blue tits start laying eggs earlier in the season, had bigger clutches, weighed less, had smaller tarsus, and higher breathing rates. Blue tits and great tits did not differ in the exploration. Furthermore, we did not find a similar integration of the behavioural, physiological, and life-history traits within species. Our results might suggest that multiple ecological mechanisms must be at play in the integrations of these traits at different hierarchical levels.

13:15 More than the sum of its parts: Individual behavioural phenotypes of a wild pinniped

Friederike Zenth & Jonas Schwarz, University of Freiburg

The proximate and ultimate mechanisms behind individual behavioural phenotypes are still only partially understood, with studies often focusing on a single or a few factor(s) that affect behaviour in a controlled environment. To understand the development and consequences of individual behavioural phenotypes in its complexity, a comprehensive approach is needed that analyses a broad spectrum of influencing factors and their interactions on behaviour within the natural environment. We used focal observations to quantify four key behavioural components of Galápagos sea lion (*Zalophus wollebaeki*) pups under natural conditions: general social interactions, swimming, resting, and social play behaviour. We then investigated the influence and interplay of age, sex, body condition, basal cortisol and testosterone levels, personality scores, and the social environment on the observed behaviour. We identified significant correlations between all measured factors and behaviour. Complex interactions between testosterone, boldness and social play especially stand out, with the effect of boldness on social play being dependent on testosterone levels. We also demonstrate the importance of a complex early social environment, defined as local population density, for more social play, and interestingly, for more swimming activity. This could have consequences for the development of social and hunting skills, crucial for later stages of ontogeny. For this endangered pinniped, a decline

in the diversity of social environments due to dwindling population numbers could lead to a decline in behavioural diversity and lower coping capabilities towards future changes in their environment. Our study reveals important factors for the development of individual behavioural phenotypes of young Galápagos sea lions and elucidates some aspects of the architecture behind this individual variation in behaviour.

13:25 LemurWorld: An agent-based model of female dominance and dominance style in lemurs

Lauren Seex, Titus Hielkema & Charlotte Hemelrijk, University of Groningen

In monomorphic species, female dominance over males may have evolved because of differences in the valuation of resources between the sexes. In lemurs, females need more food than males because of the higher energetic cost for reproduction, and therefore may fight more fiercely for food. This does not explain why species of lemur differ in their degree of female dominance over males. We hypothesize that patchier food may cause more intense competition, causing females to become more dominant than males. Using modelling, we investigate the consequences of changing specific parameters such as energetic demand of females and distribution of food, which is not possible empirically. We created an agent-based model named LemurWorld. In it, individuals resemble lemurs and are guided by simple rules regarding grouping, eating and fighting. We show that stronger female dominance over males emerges when females have a higher energetic demand than males and when food is distributed more patchily. We compare our results to previous research on real species of lemur that differ in their degree of female dominance over males and dominance style. Our previous research suggests that a steeper hierarchy and stronger female dominance over males are associated with stronger cohesion of groups, resulting in more frequent aggression. While co-dominance of the sexes and a weak hierarchy are associated with weak spatial cohesion of groups because this may cause less frequent aggression, preventing the dominance hierarchy from differentiating. We measure several spatial and social patterns of groups: the nearest neighbour distance of individuals, steepness of the hierarchy, frequency of aggression and the proportion of undecided fights. We show that in the model, when the food is distributed in a patchier way, these patterns resemble those of a despotic species (*L. catta*) and when it is distributed in a uniform way resemble those of an egalitarian species (*E. rufifrons*).

13:35 Misters before sisters? - Competition for breeding positions in redfronted lemurs

Lea Prox, Claudia Fichtel & Peter Kappeler, German Primate Center Göttingen

Intrasexual competition for breeding positions can be intense within animal groups and can lead to the exclusion of members where breeding positions are limited. The intensity and form of competition can be very different for both sexes, depending on sex-specific dispersal patterns and other features of the social system. While most studies focus on competitive patterns in one sex, a more integrated view of how competition shapes societies could be gained by considering and contrasting both sexes. Here, we present preliminary insights into factors affecting intrasexual competition in male and female redfronted lemurs (*Eulemur rufifrons*) - a primate species with extremely intense female competition. Although philopatric, females are evicted under certain circumstances from their natal group by their close kin; most likely resulting in the premature death of the evicted individual. By running generalized linear mixed models on 25 years of demographic data of four groups, we show that group size and composition best predict emigrations of adult non-natal males and evictions of females. While the likelihood of a male leaving the group is mostly determined by the number of other adult males present, female eviction is more likely to occur when a group contains relatively many juvenile females. Our study thus contributes to a broader understanding of similarities and differences of drivers and mechanisms of competition in males and females.

13:45 Prenatal stress effects on gut microbiome in wild Assamese macaques

Simone Anzà, Michael Heistermann, Rolf Daniel, Dominik Schneider, Julia Ostner & Oliver Schülke, University of Göttingen

Early adversity can have long-lasting effects on offspring phenotype. Consistent with an internal predictive adaptive response, we have previously shown that variation in food abundance is correlated with prenatal maternal stress response with effects on infant growth and motor behaviour. As part of a more comprehensive study, we tested here for the first time in a wild primate, whether variation in prenatal maternal stress is also associated with variation in gut microbiome composition. We collected faecal samples for enzyme-immuno-assays quantifying glucocorticoid metabolites as our proxy of prenatal and postnatal maternal as well as offspring stress in three groups of wild Assamese macaques (*Macaca assamensis*) at Phu Khieo Wildlife Sanctuary Thailand. We used DNeasy PowerSoil Pro kit for the isolation of gut microbial DNA from faecal samples, and MiSeq Marker gene protocol to amplify and then sequence the V3 and V4 regions of 16S rRNA. We removed chloroplasts and extrinsic domains from the dataset. Faith's Phylogenetic Diversity and weighted UniFrac distances were estimated as proxy of alpha and beta gut bacterial diversity from 350 offspring faecal samples of 38 individuals divided in three age classes (infant, juveniles, adults), during two different seasons (rich, lean). With generalized linear mixed models we show how offspring gut microbiome diversity and composition was affected by prenatal maternal physiological stress after controlling for seasonal and age differences, postnatal maternal stress and offspring stress levels. Our results have the potential to extend our understanding of early adversity effects to the interaction between hosts and their associated gut bacteria.

13:55 Pair-living in elephant-shrews: how much do we really know?

Olivier Charlotte-Anaïs, Adrian V. Jaeggi, Loren D. Hayes & Carsten Schradin, Institut Pluridisciplinaire Hubert Curien Strasbourg

Elephant-shrews (*Macroscelidea*) have long been considered as the only mammalian order for which all extant species are believed to be monogamous, though this typically referred to pair-living. This assumption might have led to an underappreciation of variation in their social organization. We reviewed studies on social organization in elephant-shrews to evaluate whether they truly are pair-living. Seven out of eight of the elephant-shrew species studied in the field showed pair-living, i.e. one male and one female shared a home range. However, these seven species exhibited intra-specific variation in social organization, with two of these species also living solitary, two in groups, and the remaining three species living both solitary and in group; the eighth species was exclusively solitary. We reconstructed the ancestral social organization of *Macroscelidea* using Bayesian phylogenetic mixed-effects models and found that variable social organization, rather than exclusive pair-living, was the most likely ancestral state, though there was high uncertainty. Most species show pair-living (social organization), but intra-specific variation in social organization is common.

14:15 Moms mustache: Fitness consequences of foraging strategies in Galapagos sea lions

Jonas Schwarz & Friederike Zenth, University of Bielefeld

Stable individual behaviour differences, especially individual foraging strategies, are of great ecological interest, as they can have a strong impact on the ability of an individual to cope with different environments. However, such adaptive values and the resulting fitness consequences often remain speculative. In our study we describe with the help of dive, GPS and acceleration data three highly distinct foraging strategies in a population of Galapagos sea lions: benthic, pelagic, and night divers. We used the body orientation (pitch) of individuals during foraging episodes and Hidden Markov models to discover and describe digging behaviour in the benthic divers to prey on fish buried under sand. This foraging behaviour results in significant shorter vibrissae of benthic divers compared to the other strategies due to abrasion, allowing us to visually distinguish benthic divers. With the information on the vibrissae length of 78 females and their reproductive success over the last 16 years, we demonstrate different fitness consequences of foraging strategies. Birth rates and offspring's body condition of pelagic and night divers are higher during colder years, but lower during years with warmer sea surface temperature. In contrast, benthic divers' birth rates and their offspring's body condition is stable across sea surface temperatures. The low impact of high sea surface temperature on breeding success of benthic divers can be related to the higher site fidelity of benthic fish species even during unfavourable conditions, compared to the energy rich, but highly mobile schooling fish species preyed on by the other strategies. The trade-off between strategies is especially interesting when considering the coping ability of this endangered predator towards rising temperatures due to climate change and could help predict more precisely the consequences that the changing environment has on this population of sea lions.

14:25 Nitrogen narcosis leads to a deep understanding of sociality

Annika Freudiger, Dario Josi & Joachim G. Frommen, University of Bern

When planning a behavioural study, one of the big questions is if this study shall be conducted in the laboratory under controlled conditions or in the field under natural conditions. Both have advantages and disadvantages, which must be carefully weighed before a decision can be made. One unique feature of field research is that it can turn out to be a big adventure. Researches often have to travel to remote places on this planet, they have to live under simple and harsh conditions, they risk to get infected with nasty and exotic disease and may even encounter dangerous animals along the way. While for some this is reason enough not to do it, for others these thrilling experiences are very desirable side effects of field work. The Behavioural Ecology Research teams at the University of Bern and the Manchester Metropolitan University are conducting field work at and in Lake Tanganyika, which is one of the East African Great Rift Lakes. There, we are working on the evolution and ecology of cooperative behaviour in highly social cichlids by SCUBA diving. The work below and above the water surface comes with many difficult challenges that require a good deal of skill to cope with. In this science slam talk, I will provide the audience with an authentic insight into the life of diving scientists by presenting them the small and big challenges that we have to face daily. To underline why all the effort and strain is well worth it, I will also highlight the great potential of our research systems for the field of behavioural ecology.

14:35 Effects of pre-mating and post-mating selection on reproductive trait evolution in the field cricket

Magdalena Matzke & Cristina Tuni, Ludwig-Maximilians University München

The question of how pre- and post-mating sexual selection jointly shape the evolutionary diversification of reproductive traits remains unsolved. Males should evolve better mate acquisition

abilities (pre-mating traits) under intense pre-mating selection, and better fertilization abilities (post-mating traits) under intense post-mating selection. Reproductive traits may nevertheless be correlated, with selection acting on pre-mating traits, for example, generating a congruent or opposite response on traits involved in post-mating. To solve our understanding of correlated evolution and constraints on adaptation (genetic trade-offs) we measured the evolutionary responses of key reproductive traits to experimentally manipulate pre- and post-mating selective pressures in the field cricket *Gryllus bimaculatus*. After 3 generations of experimental evolution, with animals evolving under i) intense pre-mating selection, through monogamous matings following male fights, courtship and female choice, ii) intense post-mating selection, through sequential polyandrous matings allowing for sperm competition and cryptic female choice, and iii) no selection through enforced monogamy, we measured a number of key pre-mating traits (male calling song, aggressiveness, attractiveness, body size, mandible size) and post-mating traits (sperm quality and testes size).

I'll report findings on whether trait divergence has occurred within this evolutionary timeframe, providing insights into the evolutionary processes underlying trait evolution.

14:45 **Can the memory of previous help be increased if it involves distinct interactions?**

Sophie Harrower & Manon K. Schweinfurth, University of St. Andrews

Reciprocity – that is, selectively helping those who previously helped you – has been documented in Norway rats (*Rattus norvegicus*). However, little is known regarding the psychological processes that underlie it. In order to repay help, received help needs to be memorized, which can be cognitively challenging the more information there is and the longer it needs to be stored. Here, we will address whether previous help is easier to memorize if it involves distinct compared to routine interactions. To do so, we will first train rats to use a food-sharing apparatus, in which half of the rats will be trained with strawberry and the other half with banana pieces. Once trained, the rats will be met with several different partners, i.e., the experience phase. Each rat will experience four conditions i) a co-operator providing bananas; ii) a co-operator providing strawberries; iii) a defector not providing bananas and iv) a defector not providing strawberries. After a period of 10 days (chosen to increase memory demands) focal rats will have the opportunity to donate oat flakes to each of the four rats they interacted with. We predict that the rats will be more likely to remember distinct encounters (when partners donated food that the focal rat was not trained with) than routine encounters (receiving the same food in both the training and experience phase). It is expected that focal rats will help co-operators more often than defectors after experiencing distinct encounters but will be less likely to differentiate between co-operators and defectors when encounters were routine. We have not yet conducted the study. Our aim for this talk is to receive feedback on the design before collecting the data. The results of this study will shed light on the mechanisms of how reciprocal cooperation can be maintained and under which situations it is more likely to evolve.

14:55 **The problem with puffins: A poem**

Jennifer Colbourne, Alice Auersperg, Megan Lambert, Ludwig Huber & Christoph Völter, University of Veterinary Medicine Vienna

The prevalence of anecdotal data and overly broad definitions of tool use has led to serious issues within the comparative research community. One particularly pertinent example of the mis-use of anecdotes can be seen in the controversy surrounding the case of the puffins (*Fratercula arctica*) that were claimed to be using tools by Fayet et al. (2019). Our analysis of the compendium of tool use behaviour by Shumaker et al. (2011) supports the prevalence of anecdotal data in the literature. We propose that anecdotal data be interpreted more conservatively and refrain from incorporating it as “evidence” into broader theories/analyses. We also suggest a transition to the more rigorous concept of “tooling” and discuss its application to previous research.

15:05 **A “mity” business - How mites choose their burying beetle partners**

Felicitas Pamatat, Nick Horrocks, SJ Sun & Rebecca Kilner, Heinrich-Heine University
Düsseldorf

Maybe mites are not everyone's favourite animal. You might think of ticks and the diseases they carry. But not only are mites and the species they interact with fascinating, they also are extremely hard to count and paint on. A fact I learned the hard way after counting 70000 of them and painting onto dozens - all in the name of science. Btw. science maybe we should get to that...

Interactions within and between species are subjects of intensive studies in behavioural ecology and evolutionary biology. Although it is increasingly important to consider how these two forms of interactions contribute to biodiversity and ecosystem functioning, empirical evidence investigating the interactions between intra- and inter-specific interactions remain rare. A very recent study showed that the social environment of the host species can shift the symbiotic interaction from mutualism to parasitism. But so far there is a lack of the impacts of the social environment of the host species on the general behaviour and the host choice of these associated animals. In my Master thesis, I focused on understanding the ultimate consequences of the social environment of a host species on the associated species.

Although many studies have previously investigated the consequences of mite presence for burying beetle fitness, the relationship has been much less well studied from the mites' perspective.

In my Master thesis I was able to show that the social environment of the host is an important component in mediating the effect of interspecific interactions. Furthermore, it is crucial to incorporate the impacts of every aspect of the key species. Additionally, my research demonstrated, for the first time in insects, that intraspecific competition and the social environment of a species can indeed impact the host choice and general behaviour with closely associated species.

Session III – Regular Talks (Chair: Thomas Bugnyar)

15:25 Individual variation in foraging decisions: Exploring the unknown or playing it safe?

Jonathan Kunkel, Valeria Mazza & Melanie Dammhahn, University of Potsdam

For actively foraging animals, exploration is an essential part of their behaviour because they require information about resources, predators and conspecifics in their environment. While exploring individuals have to make choices in how they allocate their time and effort between updating previous information or gathering new information and have to trade-off speed and accuracy of decision-making. How animals solve these problems might be predicted by consistent individual differences in exploration and boldness, but contrasting theories make opposite predictions. Here, we aimed to test the link between an exploration decision in a foraging context and animal personality in bank voles (*Myodes glareolus*). We first assessed among-individual variation in activity and boldness via repeated novel object and open field tests of 16 individuals. Then, we exposed single individuals to a series of changes in accessibility of food sources in indoor experimental arenas. At the end of the experiment individuals had to choose between two food sources they had differing knowledge about: a known but previously always inaccessible food source and a food source that was accessible in the past but had become inaccessible lately. Based on video-recordings, we scored how often individuals sampled different food sources before the decision phase and which food source they chose in the end. We found that boldness was the only trait that explained the individuals' choice of a food source. With increasing boldness individuals were more likely to choose the food source they had no experience foraging in. This result is in line with the observation that shy individuals tend to be slow thorough explorers and, thus, supports the boldness-exploration behavioural syndrome.

15:35 Preferences for different enrichment items in laboratory mice

Ute Hobbiesiefken, Paul Mieske, Birk Urmersbach, Anne Habedank, Kai Diederich & Lars Lewejohann, Bundesinstitut für Risikobewertung Berlin

Implementing enrichment items in the housing conditions of experimental animals is known to have several positive effects on the expression of normal behaviour, growth and stress physiology in mice. Enrichment is therefore reflecting an approach in increasing animal welfare in animal experiments as well outside the experiment. Despite the growing popularity of enrichment items, little is known about its suitability from the point of view of mice. Preference tests are an appropriate method to include the animal's needs into the decision-making process. For this aim we "asked" female C57BL/6J mice about their preferences regarding a set of enrichment items categorized as cage structuring, shelter giving, or active engagement. Preferences was tested using a home-cage based system of two connected cages, these provided information about side preferences for cages furnished with the tested enrichment items over a period of 46 hours each. With a new analysing method to combine all single decisions, the enrichment items were then ranked by their worth value for the mice. This home cage based testing system resulted in the lattice ball from the 'active enrichments' with the highest worth value in comparison as the most preferred in this category, the second plane from the 'structural enrichments' and as a 'housing enrichments' the wooden angle with hole to be the most appropriate from a mouse's point of view. Giving a worth value to the provided items and thus ranking the enrichments lead to further information about the needs of the mice in terms of positively influencing cage furnishment and therefore may help to provide more suitable enrichment items, to increase animal welfare.

15:45 Social disappointment explains long-tailed macaque behaviour in an "inequity aversion" experiment.

Rowan Titchener, Constance Thiria, Timo Hüser, Hansjörg Scherberger, Julia Fischer & Stefanie Keupp, German Primate Center Göttingen

Aversion to inequity is thought to have played a central role stabilizing cooperation in humans. Several nonhuman species, for instance chimpanzees, capuchin monkeys and crows, have also been tested in experimental inequity aversion paradigms. Initial reports were that these species show human-like behaviour, becoming frustrated and demotivated when made to work for a lesser reward compared to a conspecific. Other studies followed, which contested this view. One recent alternative explanation - the “social disappointment” hypothesis - contends that frustration arises from an expectation the subject holds around how the experimenter should treat them; frustration arises because the subject expected the experimenter to treat them well and is consequently upset about the experimenter’s behaviour rather than about an unequal reward outcome. We tested this account in 12 long-tailed macaques (*Macaca fascicularis*), following and extending the chimpanzee study. Our subjects had to pull a lever and were rewarded with low-value food for their exertions. In half of the trials a partner worked alongside the subjects and received high-value food. Crucially, rewards were distributed by either a human or a machine. In line with the social disappointment hypothesis, monkeys rewarded by the human refused food more often than those rewarded by the machine. In both distributor conditions, partner presence resulted in lower refusal rates – the opposite of what inequity aversion predicts. In a control condition both monkeys received low-value food. For monkeys in the human distributor group, refusal rate dropped from experimental to control condition; for monkeys in the machine distributor group, refusal rates were low in both conditions. This study has conceptually replicated and extended previous findings in chimpanzees. We discuss that social disappointment in addition to social facilitation or food competition effects explain the refusal patterns we observe.

15:55 Evidence of positive contagion in common ravens (*Corvus corax*)

Katharina Wenig, Lisa Pacher & Thomas Bugnyar, University of Vienna

Emotional contagion is the ability to align with others on an emotional level and is supposed to be highly beneficial in social species engaging in group living. While emotional contagion is well-studied in humans, studies in non-human animal that reliably test for transfers of emotional states, especially those of positive valence, are scarce. Evidence for positive contagion mainly derive from research on animal play; however, most studies fail to clearly distinguish between behavioural and emotional contagion. In the present study, we therefore aimed at adding observational evidence of contagion in a positive context while being able to separate aspects of behavioural and emotional contagion. In a group of non-breeder common ravens (*Corvus corax*) we examined whether witnessing conspecifics in positive social interaction, namely allopreening, would affect an observers’ behavioural and emotional state. By comparing observers’ behavioural (i.e., self-directed, affiliative, agonistic) expressions in post-preening observation phases to those in matched-control observation phases, we found indicators for behavioural contagion as observers were more likely to engage in allopreening themselves (behavioural matching); however, they also showed elevated levels of non-preening affiliative interactions, approached conspecifics more often and spent more time in close proximity to conspecifics after observing other’s allopreening, indicating an effect on their emotional states. Our results therefore provide evidence for positive behavioural and emotional contagion in common ravens in the previously understudied context of allopreening.

16:05 Siblings as rivals — Kin competition in a social hierarchy

Iris Madge Pimentel, Simon Vitt & Timo Thünken, University of Bonn

Hamilton’s inclusive fitness theory predicts benefits for grouping with kin, since cooperative behaviour is promoted by genetic relatedness. Particularly if resources are limited, however, kin-structured groups also imply costs because competition among relatives can reduce the indirect fitness. We investigated how the degree of relatedness and food competition affect dominance hierarchies in adult females, using the biparental cichlid *Pelvicachromis taeniatus* as model organism. To that end, we quantified dominance behaviour before and after feeding in groups of three unfamiliar females that were either unrelated to each other (“non-kin” groups) or contained one sister pair (“mixed”

groups). Besides using traditional behavioural observations, we developed an automated analysis that counts the number of approach-avoidance events based on tracking data from the open-source software Ctrax. Here we show that dominance hierarchies are similarly pronounced in mixed and non-kin groups, but that the asymmetry in dominance is elevated before feeding. Plastic responses in social behaviour to resource availability may be mediated by despotic behaviour of dominant group members when they are hungry. The lack of kin discrimination illustrates the stage- and context-dependence of kin selection. Juveniles of the same species show enhanced cooperation and better growth in related groups, whereas the costs of competition among related same-sex opponents in adult stages may outweigh the benefits of kin grouping. In addition, the automated analysis showed an excellent agreement with traditional quantifications of dominance and has the potential to improve reproducibility in behavioural studies and to enable high-throughput analysis.

16:15 Cooperative nest building in wild jackdaw pairs

Luca G. Hahn, Rebecca Hooper, Guillian E. McIvor & Alex Thornton, University of Exeter

Animals create diverse structures - crucial for fitness - both individually and cooperatively by using materials from their environment. One of the most striking examples are nests that birds build for reproduction. Nests protect the offspring from external stressors such as predators and temperature, therefore nest quality impacts reproductive success. To construct a nest successfully, birds need to make various decisions, for example regarding the nest material and their time budgets. These decisions have rarely been quantified objectively and research has concentrated on species in which predominantly one sex builds the nest, covering different social systems. Little is known about cooperative nest building in monogamous birds, limiting our understanding of construction behaviour and cooperation in contexts other than offspring food provisioning. Using observational video data from nest boxes, this study quantitatively investigated nesting behaviour and its fitness correlates in wild monogamous jackdaw pairs (*Corvus monedula*, N = 62 observations). Here, we illustrate partners exhibited a similar behavioural repertoire and cooperated during nest building. Whilst both sexes were similar in how much they showed a particular behaviour, they also differed in some behaviours. These findings suggest a moderate degree of division of labour, which may facilitate cooperation. Some behaviours were related to measures of reproductive success (lay date and egg volume), implying selection pressures during the nest building phase. Further research using behavioural observations could unravel coordinative mechanisms during cooperative nest building. This study demonstrates jackdaw pairs cooperate during nest construction and these behaviours could have fitness consequences.

Session IV: Chair: Barbara Caspers

16:45 Individual vocal signatures in male house mice

Maria Adelaide Marconi, Doris Nicolakis, Reyhaneh Abbasi, Dustin J. Penn & Sarah M. Zala, University of Vienna

Many social interactions involve vocal signals exchanged between individuals and might be used for individual recognition by conspecifics. However, a few studies have investigated whether courtship vocalizations contain individual signatures crucial for individual recognition. Ultrasonic vocalizations (USVs) of male house mice (*Mus musculus musculus*) show a high spectrographic complexity especially during courtship and mating, and males might emit USVs to attract females and enhance their reproductive success. Our aims were to 1) analyse in detail males' courtship USVs before and during exposure to female odours; 2) investigate whether males show individual variation and individual consistency in USV emission; and 3) use different statistical approaches (univariate and multivariate statistics and machine learning) to detect USV candidates as individual signatures (i.e., number, repertoire and spectrotemporal features). We recorded 22 adult males before and during female odour stimulation once per week over three consecutive weeks. USVs were detected using an automated software, the Automatic Mouse Ultrasound Detector (A-MUD) and manually classified into 15 categories. We found that males hardly vocalized without any stimulus, but dramatically increased the number and repertoire of their vocalizations upon exposure to female odour. The number and repertoire of male USVs were individually distinct between mice (individual variation) and consistent over the recording sessions (individual consistency) for most individuals. Consistent low or non-vocalizers were rare. Different statistical methods and models confirmed that most spectrotemporal features were good candidates for individual signatures and were stable over time and recordings. Our findings suggest that these individual signatures might be used by conspecifics for individual recognition.

16:55 Infatuating fragrance: Do male spiders add chemical cues to their silk that facilitate female mate acceptance?

Michelle Beyer, Julia Mangliers & Cristina Tuni, Ludwig-Maximilians University

Convincing a prospective partner of your eligibility as a mate is key for successful courtship and ultimately mating. However, even with best eligibility, courtship is not bound to be successful and an individual might have to overcome the resistance of their prospective partner, potentially giving rise to sexual conflict. Males of the hunting spider *Pisaura mirabilis* use silk to wrap up insect prey, forming a nuptial gift that is crucial for mate acceptance and mating. They offer it to the female during courtship and if they are rejected, they add additional silk threads to their gift, which leads to acceptance after reoffering it, suggesting chemical cues in male silk that facilitate female acceptance. We investigated the functional role of male silk-borne chemicals in the silk of nuptial gifts to understand if there are stimulating chemical effects of the silk that affect female acceptance behaviour. We used no-choice assays to test female gift acceptance behaviour when exposed to standardized gifts consisting of freshly killed flies covered with male silk that was either unwashed or washed in solvents to remove chemically active substances. If male gift silk contains chemically active substances, which induce acceptance behaviour in females, we expect females to accept gifts with unwashed silk more often and quicker in comparison to washed silk. I will present our findings that will contribute to advancing our understanding of the role of chemical cues in male silk in the context of reproduction and its impact on sexual conflict.

17:05 Effects of genetic relatedness on ultrasonic courtship vocalizations and reproductive success in house mice

Doris Nicolakis, Maria Adelaide Marconi, Sarah M. Zala & Dustin J. Penn, University of Vienna

House mice emit ultrasonic vocalizations (USVs) during different social and sexual contexts. USVs consist of different syllable types and have complex spectrotemporal features similar to songs of songbirds. Although the functions of USVs are still unclear, previous studies reported that USVs might provide information about kinship, identity or male's quality, and they might facilitate courtship and mating. Thus, it has been suggested that USVs can serve as a secondary sexual trait, but the effects of USV emission on reproductive success are still unknown. The aims of our study were (1) to record wild-derived house mice (*Mus musculus musculus*) during the early phases of courtship interactions, (2) to compare USVs emitted when mice interacted with related versus unrelated partners and (3) to correlate USV emission with a pair's subsequent reproductive success. We recorded 26 males during interactions with either unrelated or related females, and then let them breed to measure the pairs' reproductive success. USVs were automatically processed with the Automatic Mouse Ultrasound Detector (A-MUD) and manually classified into 15 syllable types. We found that mice emitted significantly more USVs and with a longer duration during direct interactions, compared to interactions through a perforated divider. Unrelated pairs emitted longer and more complex USVs and had a higher and faster reproductive success compared to genetically related pairs. Additionally, we found that USV number and duration were both negatively correlated with the latency to have the first litter in unrelated pairs. Thus, our study provides evidence that mice modulate their USV emission depending upon their relatedness to a mating partner and that USV emission correlates with subsequent reproductive success.

17:15 Activity patterns of two sympatric predators and their prey in a Peruvian rainforest

Mark Thomas, Manchester Metropolitan University

Human disturbance and habitat loss are among the top drivers of decline in tropical biodiversity with as much as ~64,000 km² yr⁻¹ disappearing each year. However, it is also estimated that ~21,500 km² yr⁻¹ is regenerating on abandoned land. Nevertheless, such disturbances can lead to changes in predator-predator and predator-prey interactions. Understanding how disturbed habitats affect animal activity can help determine how competing species coexist and provide important information to implement effective conservation strategies. We studied the activity overlap of Jaguars (*Panthera onca*) and Pumas (*Puma concolor*), two sympatric species, and their main prey using extensive camera trap surveys over two years. The study was carried out at six different locations in the Peruvian Amazon, five of which have experienced a range of disturbances such as logging, land-conversion, and hunting. We compare animal activity between these disturbed locations and undisturbed primary forest site located within Manu National Park, Peru. We used kernel density estimation and overlap coefficients to generate species activity patterns between predator-prey, and predator-predator. Our results show that Jaguar and Puma had a medium to strong temporal overlap with prey species across different habitats. Further, Jaguar and Puma showed no temporal segregation between locations and had medium-high overlap coefficients, this is in concordance with studies in other regions (Brazil, Venezuela, Costa Rica). Moreover, activity patterns of predators between sites (i.e. Jaguar vs Jaguar and Puma vs Puma) showed similar activity patterns with medium to high overlap coefficients. These results suggest that temporal segregation and prey are not the main mechanisms facilitating their coexistence in these areas. We further explore differences in animal activity between sampled locations by comparing the magnitude of disturbance and vegetation structural variation that exists between sites. By providing a greater understanding of behavioural shifts and their drivers we hope to provide insights into the conservation of large mammals within regenerating tropical forests.