

Session 1 – 18:00 Saturday 30th July, Marquee & The Sanctuary

A3 Adam Bakewell : Obligate delayed implantation and mammalian life histories

'Obligate delayed implantation' is an unusual adaptation where fertilized eggs at early stages of development enter a period of inactivity before implantation into the uterus. It is currently unknown which selective pressures have led to the evolution of obligate delays, and although confirmed to be present in at least six orders of mammals much of the research to date has concentrated solely on carnivores. We compiled the largest database about the nature and duration of delays across species and their life history traits. Using these data and phylogenetic comparative methods here we show that carnivores and artiodactyls compensate for the costs of delayed implantation in different ways. Carnivores produce more developed, precocial offspring of a similar size to their non-delaying counterparts, while artiodactyls produce similar offspring in size and development, but in a shorter active gestation period.

B60 Adrian Surmacki : The effect of light on incubating behaviour in birds

Results from recent studies suggest that light conditions during incubation may have positive effects on developing embryos and nestlings. Interacting effects of ambient light, eggshell pigmentation and incubation behaviour could mediate the amount of light that reaches eggs. The aim of this study was to investigate how light conditions in a nest affect timing and length of incubation breaks when eggs are exposed to the light. The surveys were conducted on nesting great tits and blue tits. Nest boxes were fitted with windows with adjustable shutters. Soon after incubation onset, windows in one half of occupied nest-boxes were opened. Using time-lapse recording from cameras mounted within the nest box, we recorded daytime incubation activity of birds. Our results demonstrate that mean incubation break length, ratio of breaks during incubation and the time of the first and the last break did not differ between darker and lighter nest boxes.

D20 Adriana Maldonado-Chaparro : Social control and reproductive skew in female marmots

Implications of complex sociality include reproductive advantages for dominant individuals, while others lose reproductive opportunities. Such reproductive skew can be measured by quantifying dominance ranks. However, social control may be better understood using social network statistics of centrality, because they acknowledge the influence of indirect relationships on how well a given individual can control other group members. We found that Global Reaching Centrality, a network-based measure of control, explained reproductive skew in female yellow-bellied marmots better than the degree of linearity of the dominance hierarchy. Although we expected that females would lose control as group size increased, the lack of support for the hypothesis, suggests that the reproduction of non-dominant females may be controlled by socially powerful females regardless of group size.

B42 Alberto J. C. Micheletti : Intrafamily conflict over warfare

Recent years have seen an explosion of interest in the study of war from an evolutionary perspective, fostered by recent archaeological discoveries of prehistoric mass graves and other evidence of lethal intergroup conflict. Using a kin selection model, we investigate conflicts of interest within the family over the level of altruism in warfare that a young male should express. We find that parents always favour a higher level of altruism than their son and that mothers and

fathers disagree whenever female and male dispersal do not coincide.

A16 Alex Ball : Sperm metabolism in the Zebra finch (*Taeniopygia guttata*)

Ever since the pervasive nature of promiscuity in birds was revealed, they have become a model for the study of sperm competition. However, little is known about the physiological constraints on avian sperm. Here I focus on one of the most fundamental questions “How sperm create energy?”. Nuclear Magnetic Resonance (NMR) spectroscopy is used to determine which of the two main metabolic pathways, Glycolysis or Oxidative phosphorylation (OXPHOS), is used by Zebra finch (*Taeniopygia guttata*) sperm to create adenosine triphosphate (ATP). The latter occurs only in the mitochondria of cells and since sperm have a midpiece filled with mitochondria it is predicted that OXPHOS will be the predominant pathway. However, recent work in our group has revealed that there is actually a negative relationship between midpiece length and ATP content. I will present these results in relation to sperm motility and morphology; the key determinates of fertilisation success in sperm.

D37 Alistair M. Senior : Linking computational simulation with group behaviours via social network analysis.

Agent-based models are increasingly used to generate and test mechanistic hypotheses about the emergence of complex group behaviors. However, the predictions from such models can be hard to compare to real world data, because emergent phenomena are difficult to quantify. We demonstrate how social network analyses provide a tangible tool to compare experimental results with theory. We illustrate our approach with the case of nutritionally mediated dominance hierarchies. We show that social networks can arise from competitive interactions among individuals attempting to balance their own diets. Importantly, the structural properties of these simulated networks bear similarities to those observed in captive and wild animals. Our results highlight the potential importance of nutritional mechanisms in shaping dominance interactions in a wide range of social and ecological contexts. Combining social network analyses with computational models from fields such as nutritional ecology may bridge the divide between computational models and animal data.

C27 Ally Harari : Courting, cannibalism and mate-choice in self-scarifying widow spider

Males of the widow spider *Latrodectus geometricus* mate with subadult females close to the females' final moult to adult. This mating rarely ends with the female cannibalizing the males as opposed to high frequency of sexual cannibalism when mating with adult females. Comparing the courting efforts of males when presented with virgin subadult, young adult and old females we found that males invest considerably less when courting sub adult females. Furthermore, males do not perform the summersault behavior, in which they typically present their rear part of the abdomen in front of the female fangs, behavior that facilitates sexual cannibalism. We hypothesized that reduced mating efforts and especially, surviving for additional matings after courting and mating subadult females, will lead males to choose subadults for mating. However, when all three types of females were equally available, most males chose webs with old females. This surprising result will be discussed.

D21 Amos Bouskila : Social network and home range dynamics among horses in Doñana Biological Reserve

Feral horses in Doñana Biological Reserve experience dry summers, while in winter, marshes may flood large areas of the reserve. These dramatic environmental changes affect availability of water

and forage and may thus affect the social structure of the horses. We documented horses' social network (by direct observation) and movements (by GPS collars) during Aug 2013-Feb 2015, and compared dry and wet seasons (based on monthly rainfall and NDVI). In spite of the general notion of stability in harem composition in horses, the correlation between social networks of the dry and wet season was only 0.74. During the dry season groups tended to be larger and more cohesive, possibly as a defence against highly abundant biting flies. In addition, group home ranges overlapped more during the dry season, due to scarcity of water and forage, forcing the groups to use fewer productive patches in the reserve.

B35 Amy Munro-Faure : Human cooperation: observations and experiments on wild public goods games

Contrary to much evolutionary theory, human populations are unusually cooperative. Laboratory studies of human cooperative behaviour have generally found high levels of pro-sociality. I used wild analogues of the pay-off structures commonly found in laboratory games to test whether these results are replicated when human behaviour is studied in naturalistic contexts. I carried out observational studies and experimentally manipulated the systems. For example, I replicated the structure of a laboratory dictator game by observing pedestrians interactions with homeless individuals. I then manipulated this system by, for example, changing the pay-offs by leaving money in the street that pedestrians could then use to make donations. I have found that people tend to behave less pro-socially in wild systems but that factors such as size of pay-off and degree of observation can have an effect on cooperative decision-making.

B56 Andres Rojas : Resource holding potential and resource value in harvestmen nest takeover

Males of harvestman *Poassa limbata* (Arachnida: Opiliones) build cup-like on rotting logs. Females mate and oviposit inside these nests, were males guard the eggs. Mating doesn't occur outside the nests, therefore, reproductive success is strongly associated to nest possession. However, nest construction may impose energetic costs, and males may benefit from displacing a male from his nest. We investigated if male size (RHP), nest size and number of eggs (RV) affect male turnover. We individually marked owners on four fallen logs and surveyed them during a year. Turnover probability decreased with owner's body length, but invaders were not consistently larger than previous owners. Increasing nest area marginally increases turnover, and number of eggs doesn't have effect. Larger males have lower probabilities of being displaced, suggesting that RHP plays an important role in nest possession. Large nests have great probability of being usurped, possible reasons will be discussed.

B41 Andrew Higginson : Selection for Individual Differences in Group Decision-making

Individuals that do not have strong opinions enable groups to make democratic decisions and stay together. Individuals that are neither bold nor shy are less behaviourally consistent. I modelled the decision-making process of a group of foragers that choose whether to move from a low-yield safe patch to a dangerous patch of uncertain yield. I assume that bolder individuals are less vigilant and so have a higher mortality risk but faster feeding rate. Group decision-making imposes negative frequency-dependent selection leading to persistence of personality variation. Intermediate individuals always follow the majority decision, whereas bold and shy individuals are less likely to change their mind. That is, intermediate individuals are more responsive and so would be less consistent in behavioural assays. This indicates that personality traits may co-evolve to be non-linearly related, meaning correlational studies will miss important trends.

B43 Andrew King : Investigating the functioning and performance of human teams

There is a distinct lack of quantitative data investigating human social dynamics in cooperative contexts. Here, we examine the functioning and performance of human teams in a central-place foraging arena using high-resolution GPS data. We show how density of foragers impacts on team coordination and efficiency. We explain the patterns we observe as a consequence of teams relying upon visual channels (local information) to achieve coordination but relying upon auditory channels (global information) to maximise foraging returns. These findings provide new insight for the development of more sophisticated models of human collective behaviour that consider different networks for communication (e.g. visual and vocal), potentially simultaneously operating in cooperative contexts. We discuss the situations in which our analytical approach could be useful to improving group structure and functioning in the real-world, e.g. corporate groups and sports teams.

B44 Anindita Brahma : Lose or retain: nest initiation potential of a eusocial wasp

In the primitively eusocial wasp *Ropalidia marginata*, although female wasps can opt to leave their natal nests and initiate new nests to produce their own offspring, most continue to stay back as workers. To examine the effect of age and tasks performed by wasps on their ability to initiate nests and lay eggs, given an opportunity, we monitored wasp colonies for two months and recorded the age of newly eclosed wasps. Following behavioural observation, we isolated the wasps to provide them with an opportunity to initiate nests. We hypothesized that the physiological ability to lay eggs might decline with age or with the intensity of high energy consuming tasks performed by the wasps. We find that wasps which initiated nests were significantly younger than wasps which did not but there was no significant influence of the tasks performed in their nests on their ability to initiate nests.

A28 Anjan K. Nandi : Provisioning dynamics in insect societies: Modelling the foraging trips

Resource provisioning is a crucial aspect in the life cycles of central place foragers. Using dynamical models to analyse the round trip flight time of the individuals in a tropical primitively eusocial wasp *Ropalidia marginata*, we uncover the differences among the individuals in their provisioning behaviour and interpret the associated mechanisms. The individuals' decision to return to the nest is modelled by considering two competing factors, namely exploration propensity and environmental stress. Our results show that the water foragers display the least propensity for exploration as they visit known spots repeatedly. Other foragers, which may have to explore different places, display higher propensities for exploration but such propensity declines with their age. Since the primitively eusocial species are intermediate between the solitary and highly eusocial insect societies, study of the provisioning behaviour in such species could shed light on the evolutionary processes by which the mechanism has been optimized.

B3 Anna Giermek : Effects of inbreeding on growth and telomeres in zebra finches

Inbreeding has negative effect on several phenotypic traits and on survival of the offspring, yet very little is known about its impact on telomere loss. Here, we aimed at checking whether inbreeding depression influences shortening of telomeres in birds. To produce inbred offspring ($f=0,125$) we used 52 pairs of double cousin (DC) zebra finches, and compared them with the offspring of the same mothers paired with unrelated males. All chicks were reared by unrelated parents. We found that neither male nor female DCs recognize their relatedness, thus our experimental design constitutes a good model to study inbreeding depression caused by genetic factors, while maternal effects and potential behavioral adjustments are negligible. We found that in comparison to outbred individuals, offspring of DCs have significantly lower body mass as

adults. The experiment is continued and we will present the potential effects of inbreeding on survival prospects and telomere dynamics.

C4 Anna L. K Nilsson : Timing of breeding – just about climate change?

Recent climate change has advanced spring phenology, but the phenological response to variation in the local environment, such as the physical and habitat characteristics, is less clear. Here we study how timing of breeding has responded to local variation in ecological conditions in a white-throated dipper *Cinclus cinclus* population in a river system in Norway during 1978-2011. Hatching date advanced almost six days - a response to the generally advanced phenology in the area, measured as increasing spring temperatures. The timing of breeding was strongly influenced by local environmental conditions such as water flow (state-of-the-art simulations), territory location and quality, and intraspecific competition. Earlier breeding was found at low altitude, high territory quality and high intraspecific competition. Territory location and quality were more important than individual variation, indicating that the local environment cannot be ignored in studies of breeding phenology.

C31 Anna Maria Skrzynecka : Genetic polymorphism changes copulatory behavior in bulb mites.

The maintenance of genetic polymorphism despite directional selection is one of the unsolved problems of evolutionary biology. Intersexual conflict might be one of the mechanisms maintaining genetic polymorphism. An example of such conflict is phosphogluconate dehydrogenase polymorphism (PGDH) in bulb mites *Rhizoglyphus robini*, which is associated with large differences in male reproductive success. Males bearing the 'winning' form have also a detrimental effect on the fitness of their female partners. Using behavioral observation of precopulatory and copulatory behavior we found that males with 'winning' polymorphism are more mobile and copulate more frequently than males with alternative PGDH form. Our studies suggested also that males with 'winning' form produce higher amount of sperm and have higher ability to replenish its supply. Combination of ability to more frequent copulations and higher sperm production may resulting in higher reproductive success of males bearing the 'winning' form of PGDH.

B18 Annemarie van der Marel : Vigilance in the Barbary Ground Squirrel: Cooperative Behaviour?

Sentinel behaviour is a special form of vigilance in social cooperative breeders where individuals forego foraging and take turns being vigilant. Although the invasive Barbary ground squirrels (*Atlantoxerus getulus*) of Fuerteventura (Canary Islands) appear to be facultative plural breeders, it is unknown if they are cooperative breeders. We hypothesised that, if sentinel behaviour is a cooperative compared to parental behaviour, then non-parents will be sentinel, sentinel behaviour would occur throughout the year, and not just at the emergence of an individual's offspring. Through focal follow sampling of sentinel behaviour, we found that both sexes were sentinels and that sentinel behaviour occurred when juveniles were present and absent. Females performed sentinel behaviour during all reproductive stages, including females that had lost their litter. Under this scenario, if sentinel behaviour is characteristic of cooperative breeders, then the Barbary ground squirrels are facultative cooperative breeders, a rare social system in mammals.

C15 Antonin Crumière : Arms race between the sexes orchestrated by two Hox genes

Sexual selection is one of the main drivers of phenotypic diversity in nature. However, only few studies were able to link developmental genetic mechanisms shaping specific secondary sexual structures, the functions of these structures and their impact on sexual interactions. Here we

study sexual interactions in *Rhagovelia antilleana*, a species of semiaquatic bugs that exhibits extreme sexual dimorphism. Males possess grasping structures on the first and third legs and females antigrasping structures on the back. Using behavioral observations, we determined that these structures function during pre-mating struggles and mate guarding after copulation. We have shown, using RNA interference, that Sex Combs Reduced shapes antigrasping structure in females and both Sex Comb Reduced and Ultrabithorax shape grasping structures in males. Furthermore, modifications of male structures affect mating performance. Our work highlights how the escalation in arms race between the sexes can be orchestrated by the action of various Hox genes.

C46 Arnaud Da Silva : Light pollution and timing of singing (and foraging): recent advances

Light pollution is currently the fastest growing form of environmental pollution. Many avian species use natural light cues to time daily and seasonal activities. During the first years of my PhD, I showed that light pollution affects the daily timing and the seasonal development of the dawn and dusk singing behaviors, which may have further consequences on individual mating patterns. In this poster, I will present the latest findings of my PhD. I will introduce the results of 1) a latitudinal study investigating how birds organize singing behavior in environments with moderate to extreme natural and artificial light conditions, and 2) a field experiment in which I manipulated the presence of artificial night lighting in a cyclic fashion in several forest patches, during spring and winter. Overall, these results demonstrate that songbirds can use plasticity in singing and foraging behaviors to cope with variation in natural and artificial light conditions.

D40 Ashlee N. Smith : Detection of Brood Parasites in Burying Beetles

Resource partitioning is generally accepted as the mechanism that allows multiple species of burying beetles to coexist. However, research has indicated that burying beetles cannot discriminate between their own offspring and conspecific offspring or offspring of other species of burying beetles. Therefore, we tested whether a small species of burying beetle, *Nicrophorus guttula*, could be brood parasites of the larger *Nicrophorus marginatus* as an alternative explanation for coexistence of burying beetle species. When offspring were switched between broods of opposite species, on average only 14% of *N. guttula* offspring survived in *N. marginatus* parented broods. Additionally, *N. guttula* brood parasites were significantly smaller in size than *N. guttula* that were raised by *N. guttula* parents. This data shows the first evidence that burying beetles can discriminate between their own larvae and another species' larvae and indicates that *N. guttula* are not successful at parasitizing *N. marginatus* broods.

D12 Audrey Turcotte : Prevalence and avian malaria transmission pattern in Tree Swallow

Avian malaria infections generally have negative effects on body condition and fitness of many bird species. To understand the actual impact of this infection, it is essential to estimate the prevalence, determine transmission periods and identify demographic and environmental factors that may cause variation in parasite prevalence. In this study, we evaluated the prevalence and transmission patterns of malaria over 4 years in a population of Tree Swallow (*Tachycineta bicolor*) breeding in southern Québec (Canada) over an area affected by agricultural intensification. We found moderate prevalence (19%) in all years. We also detected infection in fledglings, which confirmed the presence of summer transmission for this species. Also, our forthcoming analyses will assess the impact of demographic and environmental factors on prevalence which will bring important new knowledge on avian malaria infection dynamic for this declining migratory species.

D33 Barbara Laesser : Applying social network analysis to a wild giraffe population

The social structure of many animal species reveals non-random association patterns. Long-term studies of animal sociality are important for disentangling association patterns in order to understand which underlying factors can influence social relationships. The aim of our study is to compare the social networks of a wild giraffe (*Giraffa camelopardalis*) population from 4 consecutive years, in order to investigate the stability of social relationships, and elucidate which factors govern the social structure. Preliminary results suggest that giraffes associate non-randomly and have long-term associations that span four years among females, but not males, which may be due to the sex differences in the roaming and reproductive behaviour. Furthermore, we analyse correlations between social associations, space use and phenotypic traits (i.e., age and sex) in order to explain what factors drive observed associations.

B17 Bibiana Montoya : Parent offspring coadaptation differs by parental sex

Selective pressures favoring specific combinations of parental supply and offspring demand might lead to coadaptation between these traits. Disrupting this coadaptation is expected to entail costs. We used a cross-fostering design to investigate in the brown booby whether genetic parents provisioning and genetic offspring begging are correlated, and the consequences of disrupting this correlation on parents and offspring. In control and cross-fostered nests, provisioning by rearing parents and offspring's begging correlated positively. In cross-fostered nests, genetic mother provisioning and genetic offspring demand correlated negatively, whereas genetic fathers' provisioning and genetic offspring begging did not correlate. The disruption of the correlation between genetic mothers and their offspring decreased immune response of fathers and mothers. In the brown booby, there might be a negative mother-offspring coadaptation. The role of direct genetic and maternal effects and the fitness consequences of this potential coadaptation need further study.

C29 Biz R. Turnell : Nuptial gifts serve several functions in a Hawaiian cricket

Nuptial gifts may augment a male's fitness by increasing (1) the likelihood that a female will mate with him and use his sperm; and/or (2) the number or fitness of the female's offspring. In the Hawaiian swordtail cricket *Laupala cerasina*, courting males transfer multiple spermless microspermatophores, which have been shown to increase sperm transfer and paternity share. However, the effect of these 'micros' on female fecundity has not been examined. Here, we show that micros affect both egg production and hatch rate in two groups of females, one mated ad libitum in a field enclosure and the other mated to three males in the lab. Controlling for female size, females receiving more micros laid more eggs in both groups, and had higher hatch rates in the enclosure group. Neither the number of matings nor of unique mates affected egg number or hatch rate in the enclosure females.

D3 Bram Vanden Broecke : Does consistent exploration behaviour affect probability of virus infection?

Several studies have shown that expressing high levels of a certain personality trait may increase the individual's fitness. However, very few have looked at potential costs, such as an increased probability or rate at which individuals encounter pathogens. This study uses the multimammate mice (*Mastomys natalensis*) as a model organism to investigate the relationship between exploration and infection status with Morogoro virus (MORV). We hypothesized that MORV-specific antibodies should be more prevalent in explorative individuals, due to an increased probability of coming into contact with infected individuals or excretions. Exploration behaviour was quantified using an Open field and novel object test. Contrary to our predictions, we did not

find a link between the individual's exploration behavior and MORV infection status. This may indicate that MORV transmission occurs mainly through direct interaction between rodents and hence other traits, such as sociability, may be important in MORV transmission.

B14 Caitlin Higgott : Long-tailed tits adapt their nest building to environmental conditions

Nests are built to provide a site to incubate eggs and rear nestlings, abiotic factors have been suggested to have an impact on building and incubation behaviour. Even within a species much variation can often be seen between individual nests, for example in size, quantity and quality of nest lining. This study hypothesised that temperature would affect the construction of long-tailed tit (*Aegithalos caudatus*) nests, especially affecting the lining of each nest. Ambient temperature was measured during nest building using temperature loggers (iButton). The cooling rate coefficients of eggs at each nest were determined using model eggs attached to temperature loggers (Tinytag). Incubation behaviour will also be recorded at each nest using Tinytags, which were placed inside the nest for 48 hours. We will discuss how ambient temperature affects the nest insulation and incubation behaviour. This study will allow a better understanding of how abiotic factors can influence behaviour.

C25 Carl Soulsbury : Spotty bums and signal of doom

In some species with areas of white plumage, black melanin spots can be found on parts of the feathers. The functional significance of these spots and the relationship with male quality is poorly understood. We investigated the relationship between black melanin spots in an otherwise totally white ornament, the undertail covert, in relation to fitness in the lekking black grouse *Lyrurus tetrix*. We found that spots at tips of feathers (tip spots) were negatively related to survival and reproductive success. In contrast, spots found further down the feather (vane spots) were unrelated to fitness. Our results show that melanin spots can indicate some relationship with male quality and that the location of the spots has some importance in this relationship. However, the exact drivers of melanin spot expression and how these link to male quality, are currently unknown

C17 Carla C. Vanderbilt : Repeatability of courtship performance and variation with male-female interactions

Individual consistency in the performance of particular courtship elements may relay important information about mate quality; however, changes in display performance in response to female behavior can also be important for mating success. To understand how courtship performance is consistent and variable with male-female interactions, we asked: 1) How repeatable is the display performance of individual males, and 2) How do males change their displays in response to female identity and behavior? We addressed these questions by partitioning variation in display performance across individuals and contexts in the acrobatic, cooperative displays of the lance-tailed manakin. Display performance was quantified as leap height and rate, and display composition (e.g. the proportion of time spent using each display element). By determining the extent to which displays vary among males or vary predictably in relation to female behavior, we can further understand how complex displays function in mate choice.

B6 Caroline Thomson : No evidence of familial coadaptation in blue tits

Parental and offspring behaviours may act as both the agents and targets of selection. This is expected to generate genetically correlated behaviours, and as a consequence parent-offspring coadaptation. Cross-fostering offspring between parents should therefore reduce the fitness of

parents and/or offspring. In addition, there may also be sibling coadaptation, where siblings raised together do better than those raised apart, irrespective of whether they are raised by their genetic parents or not. In order to test for familial coadaptation, we performed a cross-fostering experiment, in which eggs within nests were crossed to generate mixed broods, or broods of all siblings, raised by foster or genetic parents. We evaluated the effects of these treatments on the mass and fitness of chicks throughout ontogeny, and the subsequent fitness of parents, and found no evidence of parent-offspring coadaptation or sibling coadaptation.

C35 Chiaki I. Yasuda : Do weaponless hermit crabs give up contests without escalation?

We examined whether loss of the major cheliped (i.e. weaponless) by the hermit crab *Pagurus minutus* would affect their decision to escalate male–male contests over guarded females. Weaponless intruders showed no difference in the frequency of escalation compared with intact intruders, and the decision to give up was affected by the body size difference between the contestants. After escalation, compared with intact intruders, weaponless had significantly decreased success of takeover a female from opponents, suggesting a strong disadvantage of losing their major cheliped. Although the decision of weaponless intruders to escalate seems irrational, several factors, such as poor accuracy of resource holding potential assessment, the influence of body size, and a high benefit to cost ratio of male–male contests, may have affected their behavior.

C34 Chiharu Koshio : Inter-population variation of sexual selection on exaggerated male traits

Sexual conflict may lead to inter-population variation of sexual traits. Males of an oedemerid beetle show enlarged hindlegs and their allometries are different among populations. We examined mating experiments in three populations in which males are different in hind-femur sizes: Yonaguni with males possessing the most swollen hind-femur, Amami with males possessing the least swollen hind-femur, and Naruto with the intermediate males. We detected different selection pressures on male morphologies, possibly due to different mating behaviours: males from Yonaguni and Naruto use their hindlegs to control females struggling during mating attempts and the males with more developed hind-femur were favored, whereas in Amami females show a different resistant type and the males with thinner hind-femur were favored. Our findings suggest that different selection regimes derived from different types of sexual conflict lead to variation of sexual traits among populations.

C32 Christoph Gahr : Highly conserved olfactory signals in stickleback mate choice across continents

Maximizing offspring fitness despite ever changing parasites led to the evolution of mechanisms assessing the immunogenetic suitability of potential mates. One such mechanism is based on the Major Histocompatibility Complex (MHC). Female sticklebacks (*Gasterosteus aculeatus*) choose mates optimally complementing their own MHC-alleles. Because this olfactory signal consists of MHC ligand peptides, an additional “male validation factor” is required to distinguish it from MHC signals of other vertebrates. We assumed that, in the absence of MHC signal, females discriminate between mates from geographically isolated populations because the male validation factor has been differentiated by random drift.

Providing solely olfactory cues in a flow channel, we determined mate preference of Canadian and German fish. Females did not differentiate between males of the two continents. When spiking the male signal with synthesized MHC ligand peptides, mimicking male MHC signaling, females preferred the peptide side, proving that male signals contained the validation factor.

D30 Claudio de la O : Dominance relationships in wild white-nosed coatis (*Nasua narica*)

Dominance relationships imply consistent power asymmetries that impact on both the structure and dynamics of social groups and individual fitness. Coatis (*Nasua* spp. and *Nasuella* spp.) live in female-resident groups characterized by their cohesiveness and cooperative behaviours. Here, we investigate dominance relationships in a group of wild (semi-provisioned by tourists) white-nosed coatis (*Nasua narica*). Analysis of 1686 decided agonistic conflicts revealed moderately linear and stable, but mainly shallow dominance hierarchies. Kin presence influenced positively individual dominance values, i.e. the higher the number of putative relatives an individual had the higher its normalized David's scores. Mild aggressive interactions, frequent undecided conflicts and scarce reciprocity of aggression reflected the moderate power asymmetries between opponents, and likely are a strategy for minimizing the costs of social conflicts. Our results suggest an unusual dominance style, sharing properties of both egalitarian and despotic-tolerant societies.

A1 Corina Logan : Endocranial volume is heritable and associated with fitness in deer

Comparative studies of mammals have shown that variation in brain size is positively correlated with longevity and negatively with fecundity. However, as yet, no studies of mammals have investigated whether these relationships occur within species. We present results from a wild population of red deer.

C36 Daiping Wang : Do male zebra finches prefer high-fecundity females?

In monogamous species, the fecundity of a male's partner constitutes a major component of his fitness, but it is unclear whether males can assess female fecundity. We tested male zebra finches for their ability to identify the better mate-choice option when faced with a choice between a female of high fecundity (top 10% of the population) and a female of low fecundity (bottom 10%). Males preferred the high-fecundity female in 59% of two-way choice tests (CI 52%-66%) that lasted 20min. When extending such choice tests over several days (until just before the start of egg laying by females), male success in associating with the high-fecundity female was still modest (61% correct choices, CI 44%-76%). Overall, when faced with a choice between extremes in terms of natural female fecundity, male zebra finches seem to have only modest abilities to identify the more fecund female.

C30 Daisuke Kyogoku : Sexual selection within a species strengthens interspecific reproductive interference

Adaptive evolution can affect distribution and abundance of organisms via trait mediated species interaction. It has been suggested that sexual selection within a species and consequent harmful male trait may strengthen interspecific reproductive interference, yet the evidence is circumstantial. We tested this hypothesis by employing an experimental evolution, where the seed beetles *Callosobruchus chinensis* were kept with or without sexual selection for 17 generations. Though we found no significant divergence in genital morphology between monogamous and polygamous lines, sexually selected males in the polygamous lines had larger body sizes, demonstrating an evolutionary response to sexual selection. The sexually selected *C. chinensis* males interfered more severely with females of another species *C. maculatus* than males of the monogamous lines. Thus, our results support the hypothesis that sexual selection within a species can result in more intensive reproductive interference.

D26 Daniel Blumstein : Friendly marmots forage more after hearing alarm calls

Individuals vary in the number and type of social relationships they maintain. If beneficial, social relationships may increase an individual's sense of security because relationships may reduce predation risk. We tested this hypothesis by studying the responses of female yellow-bellied marmots (*Marmota flaviventris*) to broadcast alarm calls from unfamiliar individuals. We found that friendlier females (defined as those that were well embedded in their groups and had strong in-strength and out-strength) indeed foraged more during the second 30 s following playback than their less friendly counterparts. Our results demonstrate that strong social relationships may reduce the perception of predation risk.

D18 Daniel Sankey : The importance of body orientation in collective herding behaviour.

For social animals, coordinating movements to remain cohesive can provide selective advantages. An early study by Herbert Prins suggested that during stationary periods, ungulates use body orientation to 'vote' on their preferred travel direction. Modern empirical and theoretical studies have since emphasised the importance of inter-individual alignment in collective decision making, although generally this has not been explored in the 'predeparture period', or in free-ranging animal groups. I will present high-resolution GPS (1 Hz) and inertial sensor (40Hz) data for a herd of n=16 goats over a 10-day period in the Namib Desert, Namibia. I will show how integrating compass heading from magnetometer/ accelerometer data with other measures from GPS data (e.g. linear distance; speed) provide information on individuals' orientation even when sedentary or slow moving, allowing for a fuller understanding of the specific movement cues and social interactions that drive group movement dynamics.

C5 Darshana N. Rathnayake : Male mating behaviour in response to risk of sexual cannibalism

Pre-copulatory cannibalism is an extreme form of sexual conflict because it may eliminate current and future reproductive success for males. Female body condition, mating status and orientation are predicted to impact on sexual cannibalism, and males are expected to respond to these factors to avoid being attacked. We used sexually cannibalistic praying mantids *Pseudomantis albobimbrata* to test whether and how these female risk factors affect male mating strategies by recording frequency of cannibalism, mating success and male approach behaviours. As predicted, female body condition and mating status had an effect on sexual cannibalism, and cannibalized males had significantly lower mating success than non-cannibalized males. Female orientation was the least important factor in determining sexual cannibalism, with no significant difference between front- and rear- facing females. Contrary to our prediction, male *P. albobimbrata* did not alter their behaviours relative to any of the female risk factors of sexual cannibalism.

B19 Dave Shutler : The Parental Choreography Hypothesis

Bird eggs and nestlings are more often victims of predation than any other form of mortality. Accordingly, parents are predicted to invest significantly in strategies to keep nests concealed in all sensory modalities, including visual crypsis related to parental behaviour. The Parental Choreography Hypothesis (PCH) predicts that parents will coordinate arrivals and departures so that predators see fewer intervals of activity around nests. The PCH also predicts that approach vectors of one parent will more often be 180 degrees from departure vectors of the second parent so that visual predators will assume that a single bird has flown along a single vector, perhaps paused out of sight, but did not stop at a nest site. We use models to evaluate how these predictions are affected by predator search and foraging strategies. Ongoing work is testing whether parent birds avail themselves of strategies suggested by the PCH.

B59 Davide Baldan : Pair coordination is affected by workload in a provisioning songbird

As a result of sexual conflict, parents are expected to negotiate over parental care. Empirical and theoretical work reveals that parents negotiate and that the rules used crucially affect the outcome of sexual conflict. Recently, 'turn-taking' in provisioning visits has been proposed as a negotiation rule by which parents respond to their partner's behaviour. However, we currently do not know whether this response is flexible and varies with environmental or social factors, such as workload. To test this, we manipulated workload in 15 great tit (*Parus major*) pairs using a short-term brood size manipulation. When workload was experimentally reduced, provisioning rates decreased and parents alternated their nest visits more compared to control and increased broods. We analyse how provisioning behaviour changes between treatments to elucidate the behavioural mechanisms underlying negotiation rules.

C37 Diego Tuero : Which mechanism drives long tail evolution in a bird species?

Fork-tailed Flycatcher (*Tyrannus savanna*) is a migratory and socially monogamous bird. This species shows sexual dimorphism in tail length (males: 15.7-31 cm and females: 9.7-21.7 cm). Under a sexual selection scenario is expected that males with longer tails have higher reproductive success. We studied individual breeding success, frequency of extra-pair paternity and mate choice in Fork-tailed Flycatcher during three breeding seasons (2011-2013). We worked at El Destino Reserve (Argentina). Fledgling number and nest success were not associated with male or female tail length. We found a low frequency of extra-pair nestlings (5%-10% in 13-23% of the broods) and it was not associated with male tail length. Finally, long-tailed males bred with long-tailed females. Overall, we did not find evidence of an association between tail length and reproductive success in this species.

D1 Dominik W. Schmid : Sex under pressure - Predation affects parasite-mediated sexual selection dynamics

Females frequently choose mates based on the expression of condition-dependent sexual signals. These costly signals correlate with immunogenetic quality of the mate, i.e. selection for good/compatible alleles of the Major Histocompatibility Complex. Whereas, parasites and MHC gene pool play key roles in the evolution and maintenance of sexual selection dynamics (i.e. handicap principle), their interaction with predation remain elusive. In two consecutive years, 72 wild-caught male and female three-spined sticklebacks (*Gasterosteus aculeatus*) were transferred into 6 outdoor enclosures (N/enclosure=12) within their native lake, allowing for natural mating and parasite exposure. Three enclosures contained a Northern pike (*Esox lucius*) and despite this pressure, mating occurred. Here we report results from MHC genotyping of all adult fish with parenthood analysis of >7000 eggs directly linking the effects of predation on life-time reproductive success and parasite-mediated sexual selection for optimizing offspring MHC genetics.

B34 Douglas Mock : COOPERATOR RESPONSIVENESS?: DO INCUBATING MALES COMPENSATE, MATCH, OR COERCE?

We manipulated the contributions of incubating female house sparrows to test hypotheses for how two-player cooperation is stabilized. We engineered female incubation increases (via food supplements) and decreases (providing artificial heat only when females present), then compared parental patterns with concurrent control pairs. Theoretical models (Classic Negotiation, Tit-for-Tat, Coercion) make distinct predictions for how males should respond to female changes if cooperation is governed behaviorally, and we tested these by collecting data on the time males spent at the nest, the durations of their recesses and bouts, and the frequency of aggressive

interactions. Males did not differ across treatments on any of these variables. The general lack of male responsiveness to partner effort during incubation may stem from his not knowing the eggs' remaining thermal requirements and/or from his relative inability to provide such warmth.

C19 Elizabeth Scordato : Interactions between female choice and male competition in song divergence

The evolution of sexually selected traits results from inter- and intrasexual selection. Both processes affect trait variation, but they can operate independently, in concert, or in opposition, and are shaped by the ecological context in which selection occurs. I used experimental and observational data to evaluate the relative roles of inter- and intrasexual selection in driving song divergence in an avian ring species, the greenish warbler. Song repertoire size was under directional selection via female choice in three populations spanning 2400km of latitude. However, large repertoires correlated with male condition and aggressiveness only in poor-quality habitats. Song length was highly divergent among populations, a pattern best explained as a balance between directional female choice for long songs and male competition favoring short songs. Across populations, females consistently favor exaggerated male traits, but different intensities of male competition lead to divergence in both structure and information content of sexual signals.

C20 Emi Arai : Male pheomelanin pigmentation and breeding onset in Barn Swallows

Melanin-based color is one of the most common plumage coloration in birds. This color comprises two types of melanin pigments: eumelanin (black pigment) and pheomelanin (yellow-reddish pigment). In some birds, pheomelanin-based plumage color is related to several measures of sexual selection; however, pheomelanin is almost always expressed together with eumelanin and affected by post-molting processes. Therefore, it is still unclear whether pheomelanin can explain the observed relationship between plumage color and the measure of sexual selection. Here we examined the melanin concentration in relation to breeding onset, as a fitness component associated with sexual selection in male Barn Swallows (*Hirundo rustica gutturalis*). After correcting for depigmentation of melanin, males with more pheomelanin in throat feathers bred earlier than the others. Together with the results from previous studies, pheomelanin-based coloration may have evolved via sexual selection for pheomelanin pigmentation in Barn Swallows.

D23 Emily J. Uhrig : Helminth infections in garter snakes: implications for host reproduction

Even without affecting mortality, parasites can adversely influence host reproductive fitness including altering sexual signals, behaviors, and/or gamete production. Here, we explore reproductive fitness implications of helminth infections for male garter snakes (*Thamnophis* spp.) in Canada. These snakes harbor a suite of endoparasites including nematodes, trematodes, and cestodes. Using data from necropsies, we demonstrate that infections are highly prevalent, but infection intensity varies among host species and populations. Our histological data reveal infection by *Alaria* trematodes damages tail musculature, increasing the propensity for tail loss which directly affects fitness due to mechanical impairment. Additionally, our necropsy data demonstrate that the intensity of infections by nematodes and trematodes is predictive of body condition, testes mass, and sperm counts, all factors which directly affect male fitness. However, we also found evidence that fitness implications are not uniform across host populations which may indicate variation in host tolerance to infections.

A17 Emily R. Churchill : Consequences of Plasticity: How Environments Affect Copulatory Behaviours in *Drosophila*

Drosophila are polygamous; and so experience sperm competition. This has driven individuals to develop plastic responses to enable them to outcompete others. But what effect do variable environments have on these responses? Plasticity comes with a cost, often causing reproductive-survival trade-offs to occur.

Drosophila were placed under varying amounts of stress by manipulating their perceived levels of sperm competition, food, and quality of potential mates. Activity and survival were then studied using a DAM.

Lower levels of activity and survival were observed when males courted and copulated. This was further exaggerated when the males had experienced higher risks of sperm competition. This is probably due to an increase in spermatogenesis or accessory protein production. Activity and starvation resistance also decreased when the male's mate was more attractive. This is likely to be because of increased courtship efforts - a healthier female is more likely to produce successful offspring.

C44 Erika Ackerman : Mating under the influence: ethinylestradiol affects mate choice in Betta

Many endocrine disrupting chemicals (EDCs) are not removed during the wastewater treatment process and they enter bodies of water still in their active form. EDCs are known to have physiological and behavioral effects in aquatic organisms and, therefore, pose a threat to aquatic life. While exposure to the estrogen mimic 17 α -ethinylestradiol (EE2) can lead to population collapse after only a few generations in some fish species, the mechanism responsible for this collapse is unknown. One potential mechanism could be altered mating preferences. To determine if exposing female Siamese fighting fish, *Betta splendens*, to EE2 altered the mate choice decisions of male conspecifics, males were presented with pairs of females that differed in amount of EE2 exposure (high, low, no). Our results suggest that EE2 exposure could pose consequences to species fitness by causing changes in mate choice, a finding that is likely generalizable to other fish species.

B7 Espíndola-Hernández P : AGE AND PARENTAL INVESTMENT IN THE THORN-TAILED RAYADITO

The magnitude of parental investment during ontogeny may vary due to the trade-off between present and residual reproductive value. We evaluated the relationship between biological age (estimated by telomere length through real time PCR) and parental investment (estimated with field measurements of territory defense and provisioning) in a short-lived bird, the Thorn-tailed Rayadito (*Aphrastura spinicauda*). We found that older parents show shorter telomeres, lighter broods, and invest less in nest provisioning compared to younger parents. We also observed that rayaditos presented aggressive behavior related to territory defense around their nest, with a radius of approximately 40 m. However, contrary to our expectation, telomere length did not influence territoriality. Telomere length was related to chronological age and parental investment in Thorn-tailed Rayadito, hence it could be a key feature to understand life history traits in a short-lived species. (FONDECYT 11130245 y 1140548, ICM005002, PFB23CONICYT).

A19 Felix Zajitschek : Paternal transgenerational effects in fruit flies

Parental effects generally describe non-genetic contributions of parents to offspring development. The transmission of environmentally induced parental effects to next generations can happen through the inheritance of epigenetic marks (transgenerational epigenetic inheritance, TEI), without altering the DNA sequence. TEI can be a source of hidden phenotypic variation with

opposing effects on the rate of evolution, depending on the nature of the effect and stability between parental and offspring environment. Thus, a complete view of effects of TEI on offspring phenotype is necessary for a comprehensive understanding of the evolution of biocomplexity. Paternal TEI are increasingly recognized as significantly impacting a range of offspring phenotypes. Here, we show paternal diet effects on a postcopulatory sexually selected trait and on RNA expression levels in *Drosophila melanogaster*. Sons of fathers who were fed a high-protein diet as larvae had higher paternity success, compared with fathers reared on a low-protein diet.

B5 Franziska Lemmel-Schädelin : *Neolamprologus caudopunctatus*, From Cannibals to loving parents: when to stop egg cannibalism?

The cichlid fish *Neolamprologus caudopunctatus* is a monogamous substrate breeder in which both sexes provide parental care. Non-breeding individuals, however, are aggressive egg-cannibals. Thus at some point a shift occurs in behaviour from egg-cannibalism to parental caring. To investigate this shift, we conducted (1) cross-foster experiments by swapping either 50% or 100% of eggs between nests of spawning pairs, (2) transferring eggs from spawning to pre-spawning pairs, and (3) removing and replacing eggs from nests of spawning pairs over short or longer intervals. We found (a) the inhibition of egg cannibalism requires both pair formation and spawning, (b) spawning pairs cared for foreign eggs as well as their own & (c) pairs cared for their own removed and replaced eggs over short intervals but sometimes cannibalized their eggs over longer intervals. These results lay the foundation of our investigation of the constraints and flexibility of mating systems.

D31 Friederike Hillemann : Vocalisations during foraging in mixed-species flocks

Acoustic communication plays an important role in spreading information about the presence of resources. While effective vocal recruitment to a food site has been documented in several socially foraging species, it has received little attention in mixed-species foraging assemblies. We studied vocalisations during foraging in mixed-species flocks of tits (*Paridae*) to determine whether group members acoustically signal the discovery of a shareable food source. We recorded calls from PIT_tagged birds at feeders filled with sunflower seeds, as well as at empty feeders. Feeder visits were recorded automatically, facilitating identification of foraging flocks based on the temporal arrival of individuals. At full feeders, multi-species flocks forage throughout the day, whereas empty feeders were visited only sporadically by few individuals. We considered calls produced upon feeder discovery and analysed call rates across different flock sizes, and discuss their potential recruitment function in the establishment of mixed-species foraging flocks.

C12 Gabrielle L Davidson : Evolution and function of iris colour in passerine birds

Many animals vary in eye colour, but the functional significance of this trait is poorly understood. Using phylogenetic comparative methods, we tested whether iris colour in passerine birds evolved in response to two traits proposed to be associated with communication through gaze sensitivity: coordinated biparental care and cavity nesting. Iris colour evolved dependently with respect to nesting behaviour, but not parental care. Contrary to the hypothesis that cavity nesters benefit from brightly coloured eyes to signal cavity occupancy, they were no more likely to evolve brightly coloured eyes than non-cavity nesters. Instead, there was strong selection against salient eyes in non-cavity nesting birds. Conspicuous eyes may be an unstable colour trait because without the concealment of a cavity, they may be more detectable to predators. Other traits associated with cavity nesting, such as competition (the need to signal to competitors) may also influence the evolution of eye colour.

A23 Giovanni Polverino : Body length correlates with activity and risk-taking in zebrafish

Animal personality is caused, at least in part, by individual variation in energetic-maintenance costs. Yet, recent studies have suggested that this link is not straightforward and might be modulated by numerous factors such as body size, assuming large animals being more risk averse. Here, we explored whether: (a) juvenile zebrafish from the same cohort differ consistently in activity and risk-taking and (b) variation in activity and risk-taking is linked to individual differences in metabolic rate, body length, and body condition. We observed that personality was manifested in both activity and risk-taking, with larger fish being less active and risk prone in a potentially dangerous open field. By contrast, routine metabolic rate and body condition were uncorrelated with both activity and risk-taking. Our findings suggest that body length is associated with risk-related behaviours in juvenile zebrafish, while the role of metabolic rate is relatively limited.

D25 Gloriana Chaverri : Social roles in communication networks

Communication networks are comprised of individuals with different vocal traits, but no studies to date have evaluated if certain individuals within groups emit more vocal signals, particularly in the context of contact calling; understanding this may allow us to determine if group cohesion is maintained by a few individuals. Here we provide evidence of social roles in contact calling communication networks by estimating the degree to which individuals within groups associate with others with a similar vocal behaviour for two contact call types. Our results show that variation in calling rates was greater within than among groups for one call type but not another. We propose that the reduced intra-group variation in calling rates for one type of signal may be explained by shared ancestry, whereas increased intra-group variation for the other call may be explained by mechanisms that favor groups comprised of individuals with diverse vocal strategies.

B46 Goncalo Faria : Sexual selection modulates genetic conflicts and patterns of genomic imprinting

There is growing interest in resolving the curious disconnect between the fields of kin selection and sexual selection. Rankin's theoretical study of the impact of kin selection on the evolution of sexual conflict in viscous populations has been particularly valuable in stimulating empirical research in this area. But the fitness functions derived in Rankin's study do not flow from his model's assumptions and, in particular, are not consistent with sex-biased dispersal. Here, we develop new fitness functions that do logically flow from the model's assumptions, to determine the impact of sex-specific patterns of dispersal on the evolution of sexual conflict. Although Rankin's study suggested that increasing male dispersal always promotes the evolution of male harm and that increasing female dispersal always inhibits the evolution of male harm, we find that the opposite can also be true, depending upon parameter values.

A20 Graziella Iossa : Micropyle number in Lepidoptera correlates to female promiscuity

In insects, the micropyle is a canal allowing sperm entry to the egg. There is considerable inter- and intraspecific variation in shape, number and position and this variation is largely unexplained. We investigated the micropyle in Lepidoptera to look for evidence of sperm-egg coevolution. We collated data from the literature on egg micropyle number and morphology, sperm morphology and spermatophore count in Lepidoptera. Using a phylogenetically-controlled comparative analyses, we found that, after controlling for egg size, the number of micropyles was positively related to number of spermatophore a female had, a measure of promiscuity. Our key finding is that females of promiscuous species tend to have a greater number of micropyles than non-promiscuous ones.

B58 Guy Cooper : Reproductive Division of Labour and Evolution of the Worker Phenotype

From the germ-soma divide in multicellular organisms, through the layered castes of insect societies, to the intricate social lives of microbes, there are numerous instances in nature of phenotypic plasticity leading to a division of labour between pure reproductives and worker morphs. We develop a simple, two-trait model in the public goods game to analyse the conditions under which the evolution of a worker phenotype is favoured. Inclusive fitness theory is employed to show that a reproductive division of labour is favoured, under positive assortment of genotypes, when the fitness returns from investment in the public good are accelerating and when the investment benefits are others-only over group-wide. We distinguish between the case where the non-linear fitness return arises due to individual commitment to the task rather than due to the increased efficiency of pooled labour and show that reproductive division is favoured in former.

A21 Hanna N. Støstad : Weak geographical structure in sperm morphology of the willow warbler

Geographical divergences in sperm traits might imply the formation of a reproductive barrier in a speciation process. Here we study sperm morphology variation of 330 male willow warblers *Phylloscopus trochilus* in Norway, across the range of two subspecies. Birds were on average larger and longer-winged in the north (spp. *acredula*) than in the south (spp. *trochilus*), and showed a sigmoid change in SNP allele frequencies and body morphology around 65° N. We found no evidence of genetic structuring in neutral microsatellites. There was no geographical variation in sperm traits across Norway, except that sperm heads were on average longer in the south. We conclude that sperm morphology remains a rather undifferentiated trait between the two willow warbler subspecies in Scandinavia, which is consistent with a pattern of a shallow genetic divergence. This indicates that sperm morphology is not a reproductive barrier maintaining the narrow hybrid zone.

B10 Haruna Fujioka : Brood type defines circadian activity of ants.

In group-living animals, social interactions influence various traits including circadian activity. Maternal care can have a strong effect on the circadian activity of parents or nurses. In social insects, nestmates have diverse activity rhythms, however, what kind of social environment is crucial in shaping an individual activity/rest rhythm is largely unknown. Here, we show that the focal brood types being taken care of have significant effects on individual activities, using monomorphic ant *Diacamma*. When isolated from a colony, nurses exhibited a clear circadian rhythm. However, when paired with eggs or larva, they exhibited around-the-clock activity. In contrast, a clear activity rhythm emerged when nurses were paired with a pupa. Such brood-type specific changes in circadian rhythm are considered to arise from the difference in caretaking demands. Our finding may contribute to the understanding of the organization of a colony in the context of behavioural plasticity.

D39 Hendrik Meister : Latitudinal patterns of immune response in moths

Among-population differences in traits of immunology help us understand how ecological factors have influenced the evolution of specific immune response and the occurrence of possible trade-offs with other life-history traits. Increase and also decrease in immune response have been reported with increasing latitude, though seldom differences stemming from natural conditions have been scrutinized. Here, we concentrated on the among-population genetic variation of two parameters - phenoloxidase (PO) and lytic activity - applying common garden design on three

polyphagous moth species caught from Oulu to Georgia. We reported differences in immune response dependent on population, temperature and host plant. Higher PO activity was revealed in northern areas and increased lytic activity in southern populations. Therefore, we clarified life history strategies in latitudinal scale, suggesting variation is fairly species-specific and that heightened response bares trade-offs in particular cases in instantaneous larval growth rate, pupal weight and developmental time.

C23 Ian Skicko : Investigating the Role of Sexual Selection in Adaptation

Natural and sexual selection are traditionally expected to oppose one another, each driving towards different levels of trait expression. This should cause sexual selection to slow adaptation as maladaptive traits are maintained by mating preferences. However, elaborate male traits can function as indicators of genetic quality, which allow beneficial alleles to be captured by females through their mating preferences. In this scenario females choose males based on sexually selected traits that are positively correlated with naturally selected quality. Natural and sexual selection would then act in concert, accelerating adaptation. I am testing this hypothesis in a wild population of field crickets. By providing half of the population with a dietary supplement I can create a group that is phenotypically analogous to optimally adapted individuals. Video monitoring and genetic data then allows me to determine if these individuals are indeed more attractive and achieve greater reproductive success.

C2 Ingo Schlupp : Female-female aggression in a sexual/unisexual species complex

Kin selection theory predicts that closely related individuals should be less antagonistic towards one another. In gynogenetic Amazon mollies, *Poecilia formosa*, females have been shown to differentiate between clones, preferring to associate with clonal sisters, and regulate their aggressive behaviors accordingly. We ask if Amazon mollies in resource-limited environments: 1) maintain the ability to regulate aggressive behaviors according to relatedness (heterospecific females, clonal sisters or non-sisters), and 2) how their aggressive behaviors change relative to social partner? We found that females regulated their aggressive behaviors depending on partner type. Heterospecific females and the non-sister clones spent more time behaving aggressively towards the focal females, and these females also received significantly more bites from heterospecific females. We are able to confirm that females show more aggression towards heterospecific females and non-sister clones in a food-limited environment, and that their aggression scales with relatedness.

C22 Jacqueline Weidner : Sexual selection based on multiple cues

Several species use multiple and often correlated cues in mate choice, but understanding how they integrate these different signals has proven challenging. In this study, we investigate the use of multiple cues for female choice in an evolutionary model that focuses on decision making in fish. The male fish exert several unrelated phenotypic signals. Females pursue different strategies in assessing these and females simultaneously assessing multiple cues are expected to be in advantage. Simultaneous assessment can be achieved by successive bouts or combined scores for cues. The multiple-cue strategy may reduce the total error in assessment by females, shield females from being lured by dishonest signals and reduce the energetic costs spent on searching for the "best male". Assessing several cues may take longer and require more advanced decision making routines. We investigate under which conditions multiple-cues strategies are most likely to evolve.

C42 Janet L Leonrd : Gender Plasticity and the Evolution of Sexual Systems in Animals

In animals there are two common sexual systems; dioecy and simultaneous hermaphroditism (SH) with outcrossing. Other sexual systems are rare and not evolutionarily stable. In animals the evolutionary paths from dioecy to SH are not understood. Phenotypic plasticity in gender, based on social cues, including sequential hermaphroditism and environmental sex determination (ESD) may be a path between outcrossing SH and dioecy in animals. SH often involves changes in sex allocation as a function of age, size and social environment. This can blur the distinction between simultaneous and sequential hermaphroditism. The distinction between sequential hermaphroditism and ESD is also blurry. A plausible evolutionary path between SH and dioecy might start with simultaneous hermaphrodites which alter sex allocation according to social conditions evolving to sequential hermaphrodites and then these sequential hermaphrodites evolving an earlier and earlier sex change in response to social cues until there is effectively ESD of separate sexes.

A2 Jere Tolvanen : Sequential use of social information guides behaviour of breeding birds

Breeding habitat selection and investment decisions are key contributors to fitness in animals. Individuals appear to collect and incorporate information on relative habitat quality during decision-making. We experimentally investigated whether migratory, cavity-nesting birds (pied flycatcher *Ficedula hypoleuca*) collect information about breeding habitat quality (nest site availability, presence/success of heterospecific tits), by prospecting during the post-breeding season. We also quantified additional social information sources present during the settlement period in next spring. Observed nest site selection patterns indicated sequential, individual-specific use of past and present information sources. The settlement patterns differed between two study areas stressing the importance of meta-replication across geographical areas and ecological conditions. Information simulated during the previous year did not affect breeding investment, but present availability of heterospecific information sources influenced the adoption of conspecific information in investment decisions. Our results highlight the complex nature of information use in animal behaviour.

B47 Jessica Browne : Gyrinid reproductive behaviour: Evidence of cooperative communication in *Dineutus hornii*

Species of Gyrinidae (aquatic beetles) are thought to reproduce via forced copulation. However, it has been suggested that certain species may not engage in coercive mating because they show some evidence of precopulatory communication. Using *Dineutus hornii* we conducted a detailed analysis of behaviour to determine whether we could find further evidence of non-coercive strategies. We identified behaviours that took place prior to mating and assessed whether they influenced a female's willingness to copulate. Both chasing and touching the tip of a female's abdomen preceded mating, resulted in more mating attempts, and increased the likelihood that a female would allow copulation. Furthermore, female aggression was associated with a reduced likelihood that females would allow copulation and fewer mating attempts by males. We conclude that the mating behaviour of *D. hornii* does not involve forced copulation but rather cooperative courtship and signaling.

A22 Jhoniel Perdigón Ferreira : Impaired sperm quality but no fitness costs in contest winners

Whether females mated with dominant males obtain fitness benefits or incur fitness costs remains enigmatic. Assessing costs and benefits of male dominance on female fitness is crucial to unravel conflict of interests between the sexes. We investigated dominance effect on male's pre- and post-copulatory reproductive investment and on female fitness using the field cricket *Gryllus*

bimaculatus. We allowed males to fight and measured their mating behaviour, sperm quality, and female fitness. We found that after a fight, in general, males delayed matings. Winner males produced sperm of lower quality compared to losers and to non-fighting control males, suggesting trade-offs in resource allocation between pre- and post-copulatory traits. However, we found no fitness costs for females mated to winners. Our findings highlight the importance of considering fighting ability when assessing male reproductive success, as winners may be impaired in their competitiveness at a post-copulatory level.

D38 Jin-Won Lee : Systematic genetic evidence corroborate biparental host specificity in *Cuculus* species

Avian brood parasites such as *Cuculus* species are comprised of host-specific races within a species; that is, each of races rely exclusively on a particular host species to breed. However, systematic evidence for how they choose hosts and its consequence on population genetic structures are lacking. Using the biogeographic characteristics of two disconnected area where common cuckoos *C. canorus* parasitize different host species with dissimilar egg morph whereas lesser cuckoos *C. poliocephalus* use the same host species, we show that significant geographic-genetic differentiation for both biparentally and maternally inherited DNA occur only in common cuckoos but not in lesser cuckoos. Our overall results suggest that both sexes of *Cuculus* species are imprinted directly on host species per se to breed, and such behavioral host specificity with non-assortative mating between host races play a primary role in shaping their population genetic structures.

D41 Joanna Sudyka : Telomeres and survival in malaria-infected wild passerine

Parasitic infections potentially drive host life-histories since they have detrimental effects on host fitness. Telomere length (TL) is a reliable biomarker of organism condition, can provide a key to predict survival and may underlie observed fitness reduction in infected animals. We examined the influence of infection status and intensity of Haemosporidian caused avian malaria on host TL and survival in free-ranging blue tits. Overall infection prevalence was 79% and increased with age constituting a serious, age-dependent selective pressure in our population. We found that individuals affected by more intensive chronic infections had longer telomeres, which is consistent with the parasite-mediated selection hypothesis. Our preliminary results showed a strong tendency for infected young individuals to lose more TL and to have lower survival probability than uninfected ones. We interrogated this finding in 112 longitudinally sampled individuals, complementing it with the survival data from the current field season.

A7 John Jackson : Spatio-temporal variation in the population dynamics of Asian elephants

Empirical studies linking environmental variation to spatio-temporal variation in population dynamics, life history and behaviour are becoming increasingly important to highlight conservation priorities and forecast extinction events in vulnerable species. For the endangered Asian elephant, *Elephas maximus*, the lack of quantitative population records and a poor understanding of population dynamics mean that the future of this species is uncertain. The aim of the current body of research is to investigate the factors influencing population dynamics and life history in *E. maximus*. More specifically, population viability measures including age-specific birth and death rates are calculated for a longitudinal data set of approximately 5500 semi-captive working elephants from 1950 to 2015 throughout Myanmar. Critically linking spatio-temporal variation in these population viability measures to environmental change and anthropogenic pressure will enable the development of targeted, evidence based conservation management strategies for elephants in Myanmar.

D6 John T. Rotenberry : Is silence always golden? Cricket satellite behavior in ecological context

Exploitation of sexual signals by predators or parasites increases costs to signalers, creating opportunities for alternative reproductive tactics (ARTs). In field crickets, males calling may attract acoustically-orienting parasitoid flies. Alternatively, males behaving as satellites forgo calling and attempt to intercept females attracted to callers. We modeled the contribution of calling vs. satellite behavior to male reproductive success in the larger context of variation in ecology (parasitism rate, background mortality), demography (density, sex ratio), and female behavior (phonotaxis, mating choosiness). Male mating success was most influenced by number of females (standardized effect size 0.42), then female choosiness (0.33), background mortality (-0.31), number of males (-0.28), and parasitism rate (-0.21). Smallest effects were female phonotaxis (0.10) and satellite behavior (-0.09). Although satellite behavior ameliorated effects of parasitism, its overall effect was slight. ARTs most likely persist when a single selection pressure is particularly strong.

B30 José Ricardo Paula : Cleaning interactions in the ocean of tomorrow

Cleaning mutualisms are key ecological components in coral reef ecosystems. Nonetheless, until now, there is no knowledge on the potential effects of climate change on such interactions. Here we investigated, for the first time, how cleaning mutualisms, between the cleaner wrasse *Labroides dimidiatus* and the client *Naso elegans*, respond to acclimation in future conditions of ocean acidification ($\Delta \text{pH}=0.4$) and warming ($+4^\circ\text{C}$). Following the acclimation period (45 days) pairs of cleaners and clients were allowed to interact in an observation tank for one hour. We measured motivation to interact and inspection quality and compared to cleaner and client neurotransmitter profile. Here we show, for the first time, that acclimation to ocean warming and acidification drastically reduce cleaner and client motivation to engaging in cleaning interactions. Our results provide the first evidence that future oceanic conditions might affect complex cooperative interactions between two different species

D9 Joshua B. LaPergola : Parasitism and group-living in the colonial Hispaniolan Woodpeckers

Parasites are often considered an automatic cost of group-living, but the consequences of aggregating should ultimately depend on the natural history of potential parasites. Larvae of the botfly genus *Philornis* rely on transmission via adult flies and might therefore function more like a predator than classic parasite. I test the hypotheses that Hispaniolan Woodpecker, *Melanerpes striatus*, coloniality reduces the risk and intensity of botfly parasitism, akin to predator swamping. Pooling across four breeding seasons (2012-2015), colonial nests (42% parasitized, $n = 71$) were slightly more likely than singular nests (31% parasitized, $n = 16$) to have botflies. However, singular and large colony (≥ 6 nests per tree) nests typically exhibited lower infestation levels than small colony nests (3-4 nests per tree; maximum intensity = 39 larvae on one chick). These preliminary results suggest *Philornis* parasitism might favor the evolution of group-living to dilute parasitic pressures beyond some threshold group size.

B45 Juan Carlos SENAR : More colourful Tit females fly further for nest-building materials

Interest in the adaptive function of female ornamentation is growing. We measured the distance female Great tits *Parus major* flew to collect nesting material and related this to their carotenoid-based plumage coloration. Wool threads of different colours were laid on the ground at different locations within our study area (80 ha). After breeding was completed, a search for the threads in nesting material allowed us to estimate the distance the females moved to collect them. Both

maximum ($212 \pm 20.8\text{m}$) and average ($113 \pm 9.7\text{m}$; $N=58$) transport distances went beyond average territory radius ($23 \pm 1.2\text{m}$, $N=63$; $p < 0.001$). Females with higher hue values in yellow breast coloration flew longer distances and collected more material ($r=0.82$, $p < 0.001$). Our findings show that females gather nest material far from their territories and suggest that female plumage coloration is related to female investment in reproduction.

B24 Juan Diego Ibáñez-Álamo : Evolution of nestling feces removal in avian phylogeny

Nest sanitation is an important and widespread behavior in birds but still poorly understood. This lack of knowledge is particularly important in relation to the evolution of related traits on bird phylogeny since previous studies have used ecological perspectives. We have compiled detailed information for more than 400 bird species (19 orders) on several characteristics related to nest sanitation (i.e. nestling feces removal or presence of fecal sacs). By means of available comparative analyses, we have reconstructed the evolution of these traits on the avian phylogeny, and tested several functional hypotheses including the possible correlated evolution between these traits. We found evidences indicating that parental removal of nestling feces have driven the evolution of fecal sacs, while the ancestral states involved birds with fecal sacs removed by parents. These results provide an interesting new perspective about parent-offspring relationships in the nest environment.

C16 Juhani Hopkins : Is female mate attraction costly?

Male sexual ornaments are often costly, but little is known about costs of female ornaments. In the common glow-worm (*Lampyrus noctiluca*), females attract males by glowing nocturnally. Females do not eat so they have limited energy for mate attraction. Large brightly glowing females attract males sooner than small dull females. We manipulated female glowing time to estimate the costs of mate attraction, which revealed that glowing did not affect female fecundity but waiting for mates did, especially in small females. Small females lost on average two eggs/night if they failed in mate attraction. Our results clearly show costs in mate attraction but these costs are due to an extended pre-mating period and not signalling. Large attractive female ornaments reduce costly waiting time before mating and egg-laying. Future research on ornamentation should take in account the importance of waiting time in the evolution of female ornaments.

B48 Juliana Valencia : Maternal allocation in eggs in a cooperatively breeding bird

It was proposed that cooperative breeding birds should reduce investment in eggs when count on helpers, because helpers' provisioning can later compensate it. Some species appear to support this prediction but not so others. We hypothesised for the Iberian magpie an increase rather than a decrease in maternal expenditure in the presence of helpers, in agreement with previous findings at the nestling stage. Our results show that investment in clutches varied depending on years, date in the season and mother age, but there were no reductions of maternal expenditure per individual egg when they count on helpers. On the contrary, higher investment in eggs tended to associate with the future presence of helpers. Thus, reduction of egg investment is not a general feature of cooperative breeders and should respond to the optimal balance of present-versus-future investment by parents and the type of benefits accrued from helper contribution

A30 Justin Eastwood : Does early-life telomere length predict adult sociality?

Exposure to poor environmental conditions in either pre- or post-natal stages can have a profound impact on an individual's adult life-history. Poor nutrition, chronic stress, and disease early in life can lead to health issues in adulthood via a "benefit now, pay later" type scenario. The

costs ultimately influencing reproduction, longevity and survival. Telomeres are the protective caps on the end of chromosomes which shorten throughout life via normal cell replication processes but also as a consequence of physiological stress. Telomeres therefore make an ideal biomarker for testing hypotheses relating to early life conditions and adult life-history and sociality. Our study species is the purple-crowned fairy-wren (*Malarus coronatus*). These birds occupy territories in distinct social groups and exhibit a dominance hierarchy. Here we investigate if early life conditions, represented by telomere length, influence sociality.

B49 Karin Schneeberger : Rats smell hunger and produce food preferentially for needy partners

Direct reciprocity can establish cooperation among unrelated animals. In such interactions, the amount of help provided should depend on the relative benefit for the receiver, as this may influence the latter's propensity to reciprocate the help. Norway rats (*Rattus norvegicus*) have been shown to apply direct reciprocity in dyads of unrelated individuals enabled to produce food for each other. Here we show that in such situation, rats assess the need of their partner by odour cues. In an iterated food exchange task, rats provide more food to hungry than to satiated partners. Remarkably, merely the odour from a hungry rat is sufficient to release help of the focal towards a stooge, even if the hungry rat is kept in a different room. Our results suggest some form of awareness in rats of the relative benefits of a helpful act to a social partner, which otherwise is known from humans.

A18 Katsura Ito : Lethal male combats in nest-inhabiting spider mite

Male spider mites (Acari: Tetranychidae) guard preimaginal quiescent females to reserve paternity. In a few species of *Stigmaeopsis* that make densely woven silky nests on the surface of host plants, mature males attack and even kill rivals to gain their rights to inseminate young females. Here we report that the adult males of *Schizotetranychus brevisetosus*, who independently evolved nesting behavior, also exhibit highly aggressive behavior. Combat mortality was measured in an experimental design where two males in the treatment group were forced to live in a nest on a leaf arena, while one male in the control group was allowed to live in a nest on another arena. We found that the 5-day mortality of males in the treatment group was significantly higher than in the control group. However, we found no significant trend for the length of the first legs, which affect the outcome in other species.

B50 Kazuko Hase : Scale-dependent genetic influences on the tadpole collective behavior

To understand the evolutionary process of cooperation behaviour, clarifying the relationship between social preference and gene similarity at the group level is essential. In this study, we quantitatively analyzed the correlation between aggregation behavior and genetic diversity in three distinct lineages of toad tadpoles. Our quantitative analyses detected that, although there was no difference in degree of aggregation between sib and non-sib cohorts, the behavior is considerably influenced by genetic background. We postulate that the genetic mechanism of kin discrimination in tadpoles is likely to be scale-dependent, discriminating between genetic distances at the lineage level and the sib level: Tadpoles discriminate distantly-related individuals based on mitochondrial DNA differences and closely-related individuals based on MHC haplotypes. In short, effective kin discrimination by gene similarity is innate in wild tadpoles and it acts variably depending on group overall relatedness in the collective behaviour.

B27 Keiko Oku : Male behavioural plasticity depends on maternal mating status

In haplodiploid organisms including the two-spotted spider mite *Tetranychus urticae*, unmated

females produce only male offspring, while mated females produce both male and female offspring. A previous study reported in *T. urticae* that sons of unmated females (UM males) guard pre-reproductive females more quickly than sons of mated females (M males). It, however, remains unclear what factors cause the difference. Here, we examined effects of maternal mating status on the *T. urticae* male behaviour by changing their developmental environment. For both UM and M males, half of individuals were reared with males, while the rest were reared with females. We found that UM males that developed with males guard females more quickly than those that developed with females. However, such a difference was not observed in M males. These results indicate that male behavioural plasticity in mate searching is determined by their maternal mating status.

A15 Kentaro Matsumura : Dispersal syndrome, sperm competition and reproduction in a beetle

Female beetles, *Tribolium castaneum*, derived from the strains selected for longer walking distance (L strain) had higher reproduction, but shorter longevity than the strains selected for shorter walking distance (S strain). The result contradicts to dispersal syndrome; dispersers have cost in reproduction. On the other hand, males of L strain significantly increased the mating success, but decreased paternity success than S strain's males. Surprisingly, only males of S strains had significantly longer legs than L strains, suggesting female resistivity against males within the strain.

A8 Ki-Baek Nam : Nest and mate fidelity of Streaked Shearwaters in South Korea

Fidelity to a breeding nest or a mate is common in long-lived seabirds, especially, in Procellariiformes, with low fecundity and bi-parental care. In general, fidelity to a nest or a mate is influenced by previous reproductive performance. We investigated fidelity of Streaked Shearwaters *Calonectris leucomelas*, using data collected on Sasu Island, South Korea from 2012 to 2015 and detailed (1) the existence of fidelity and the degree to which it occurred in relation to both mate and nest, and (2) the influence of breeding performance on nest and mate fidelity. In our result, we found that fidelity of both male and female breeders to the previous nest and mate was comparatively high, but the previous reproductive performance of breeders was not likely to be a good predictor for mate or nest fidelity. We expect that a confounding effect of reproductive performance and individual quality on fidelity remains possible.

A14 Kim, Hae-Ni : Interspecific competition, spatial use and population fluctuation of two waterbirds

Competition between species has been assumed to be a driving force determining the pattern of biogeography. Recently, the population size of great cormorants (*Phalacrocorax carbo*) wintering in the Han-river, South Korea has been remarkably increased, which is closely associated with the continuous decrease of the originally dominant species with similar ecological niche, common mergansers (*Mergus merganser*). In order to determine direct competition between the two species lead to these population trends, we observed their wintering behaviour, collected distribution data and analysed spatial use. We found that their spatial niche overlapped considerably without any antagonistic interactions. However, mass fishing groups (e.g., >2000 birds) of cormorants were frequently observed, which may affect the wintering ecology of other species with similar ecological niche. Overall, our results suggest that direct competition between the two species may not be the primary reason of the recent population size fluctuation observed in the Han-river.

C18 Klaudia Witte : When the audience is fooled - costs of using public information

Animals use public information in different contexts of life. by observing individuals during sexual interactions to assess the quality of others as prospective mates. However, when observing individuals are recognized by choosing individuals, the latter individuals often change their mate-choice decision. We therefore asked, whether the audience will copy the pretended mate choice in Atlantic mollies (*Poecilia mexicana*) in the lab. We found that males and females changed mate choice decision when a same sex audience was present. The audience males and female, which experienced this pretended mate choice” copied that “wrong” mate choice. The audience was fooled and might make wrong decisions. Our controls could not support alternative explanations to copying this mate choice. Thus, the audience effect is an adaptive strategy to lead a competitor away from the preferred mate in both sexes. It also bears cost of using public information in mate choice for the audience.

A12 Kyle Summers : Dietary alkaloids and toxin sequestration: experimental approaches in poison frogs

Chemically defended organisms frequently obtain defensive chemicals from their diet, but few studies have addressed acquisition and sequestration in detail. We present experiments aimed at elucidating the connections between prey consumption and toxin sequestration. Experiments with the green and black poison frog (*Dendrobates auratus*) and sympatric fire ants (*Solenopsis invicta*) revealed that *D. auratus* don't preferentially consume toxic ants in comparison with non-toxic prey of similar size. Biochemical analyses of the ants revealed many alkaloids, but analyses of the skins of frogs that fed on ants over several months demonstrated that these alkaloids were not sequestered into skin glands by the frogs. We consider several potential explanations of these results, and focus on the possibility that the length of the carbon side chain present in specific alkaloid types may determine whether toxin sequestration is physiologically feasible (or economical) for these poison frogs (the “alkaloid specificity hypothesis”).

B20 Lejeune : Population variation of plasticity in parenting behaviour in blue tits

Phenotypic plasticity enables individuals to cope with spatio-temporal variation of the environment.

Parental care has an important influence on fitness, and varies with the environment when parents must balance their own survival with investment in offspring. Numerous studies have shown that parental care is plastic, but whether the shape of plasticity in parenting behaviour varies among individuals both within and between populations remains unclear, especially among contrasted environments. We temporarily manipulated brood size bidirectionally to quantify plasticity in offspring provisioning of blue tits breeding at different altitudes. Parents are indeed plastic and our analysis quantifies the degree of variation in plasticity among individuals within a population, as well as the degree of variation in reaction norms across contrasted populations. Variation among populations provides some insight into past selection on plasticity in different environments whereas variation within a population represents the evolutionary potential of different populations to future challenges.

C45 Leon Green : Mucus gland secretions affect sperm performance in a goby

Non-sperm components, such as ovarian and seminal fluids, are important components of the fertilisation process, however, their positive influence on fertilisation success and subsequent development of eggs has only recently become fully appreciated. Yet, we still know very little about other means to chemically alter the reproductive environment. Since sperm are relatively sensitive to environmental perturbations, enhancing the immediate environment or protecting

them from the surrounding environment can increase fertilisation success. In many gobiid fishes, nest-spawnings are slow and asynchronous: The nest-holding male deposits a sperm-embedded mucus to the nesting-substrate where multiple females later deposit their eggs, a process that often takes hours. The mucus is produced by the sperm duct glands (SDG), accessory organs connected to the sperm duct between the testes and the genital opening. To test the importance of SDG content on sperm function in the sand goby (*Pomatoschistus minutus*) we assayed sperm motility, velocity and viability over time, with and without SDG mucus added to the seawater, using computer assisted sperm analysis (CASA). Sperm were found to swim faster and had higher viability when tested with SDG mucus. Our results show the contribution of SDG content in the reproductive system of the sand goby. This adaptation to affect the sperm microenvironment is likely a conserved trait in the Gobiidae and a contributing factor to the successful spread and speciation of gobies into a range of habitats.

A34 Li Li : Individual performance of bumblebee correlates with density of synaptic connections

In bees, learning, experience and age have all been associated with synaptic volume and density changes in the mushroom bodies (MBs). But how particular types of learning relate to specific changes in synaptic connections is still poorly understood. Here we examined the relationship between visual learning performance and synaptic connections in the MBs microglomeruli, the interfaces between projection neurons and Kenyon cells. We trained individual bees on a visual discrimination task. One group of bees was collected immediately after training. A second group was left in the hive for 2 days without any further foraging experience and collected when they finished a retention test on day 3. Bees' learning speed and performance on the retention test correlated positively with the density of microglomeruli in the visual input region of the MB ('collar'). No such correlation was detected in the olfactory input region of the MB ('lip').

B31 Liam Bailey : Dangers of reduced nest density in mobbing birds

Density dependent predation is an important factor influencing nest site selection in birds. In mobbing species, increased vigilance and mobbing effectiveness at high densities may help reduce nest predation. If populations decline, therefore, predation rates may increase as nest densities drop, yet this possibility is currently poorly considered in population projections. We investigated density dependent nest predation in the mobbing Eurasian oystercatcher (*Haematopus ostralegus*). 100 artificial nests were placed across a range of *H. ostralegus* nest densities. Predation rate of artificial nests was reduced in high density areas, suggesting that *H. ostralegus* will benefit from high density nesting. Preliminary analysis confirmed this effect in real nests. As nest density is strongly correlated with population size in this species, we predict that nest predation will increase as populations decline, potentially accelerating population declines further. This raises the possibility of an Allee effect of nest density in mobbing birds.

B21 Lisa Filippi : Fitness effects of maternal egg stimulation in a subsocial bug

Egg-guarding mothers of a subsocial burrower bug, *Sehirus cinctus* (Heteroptera: Cydnidae) twitch on their eggs near the time of hatch, resulting in hatch synchronization and improved nymphal survivorship. It was speculated this synchronization would increase female fitness by minimizing cannibalism and unequal access to food. Since fitness is dependent on the number of offspring surviving to reproduce, we investigated whether the positive effect on offspring lasted through to the reproductive stage. We tested the hypothesis that offspring experiencing maternal twitching during hatching would have increased success to the adult stage. We monitored survivorship and weight of adult offspring that had been exposed to, or deprived of, maternal egg stimulation during hatch. Adults exposed to mothers showed significantly increased body weight and

survivorship than those deprived of mothers during hatch. The findings indicate that the maternal care of twitching on the eggs has direct fitness benefits to female *S. cinctus*.

C6 Luisana Carballo : How do frogs avoid acoustic interference?

Male frogs singing in leks experience acoustic interference, which impairs mate choice. This could be minimised by alternating calls with neighbours. We analysed call timing in dyads of *Eleutherodactylus johnstonei* males in natural assemblages. We addressed whether males alternate their calls with those of other males, and if they do it with only a subset of their neighbours, following acoustic characteristics. In assemblages of fewer than three individuals, males alternated with specific neighbours regardless of their call characteristics. In larger assemblages, males did it with those perceived with the highest amplitude, and with similar call periods. Alternating calls in response to perceived amplitude may relate to behavioural hearing thresholds. Conversely, responding to the similarity of call periods may relate to the properties of the oscillators controlling calling rhythms. Alternating with a subset of neighbours allows males to avoid interference only with their strongest competitors without impairing their own performance.

B15 Maaïke Griffioen : Filling the gaps: turn taking as a parental strategy

A new parental strategy has recently been proposed that could provide a resolution for the conflict over parental care. It is a form of cooperation that implies that parents alternate or take turns in their feeding visits. However, criticism about this strategy is raising, because it remains speculative whether turn taking is still valid in various (a)social contexts. Filling these gaps is vital for our general understanding of the evolutionary stability of biparental care. In particular, we should acquire more understanding about whether and how turn taking is an honest strategy across different social contexts, how such a resolution of conflict between parents affects the parent-offspring conflict, how important compatibility between pair members is, how such compatibility can be achieved and finally how the environmental conditions shape this parental strategy. Experiments will be discussed that have the potential to fill these knowledge gaps in this conditional cooperation theory.

A11 Madeleine Beekman : Weird sex - The underappreciated diversity of sexual reproduction. Upcoming issue of the Philosophical Transaction of the Royal Society, Biological Sciences.

Textbooks and general reviews that consider mating systems or sexual selection tend to make implicit yet strong assumptions about the kind of organism that one has in mind. The typical organism is usually assumed to belong to the kingdom of animals, have sexually dimorphic sexes and internal fertilization. Large, charismatic organisms that students of sexual selection first think of, may often satisfy all these criteria, yet a large part of nature's biodiversity does not. Our general understanding of sexual reproduction is clearly hampered if we make a decision to phrase general theories based on rules that only apply within a subset of species. Our special issue brings together experts who were asked to (1) explain the rules of a 'deviation from the norm' that is the focus of their expertise, and, importantly, (2) invite readers to think about how this might change the way we view the 'norm' itself.

A9 Manvi Sharma : Oviposition site selection response to larval predation risk in *Aedes*

Animals ovipositing in discrete aquatic patches avoid patches with high predation risk on their offspring. In nature, magnitude of larval predation risk varies across patches yet this risk has mostly been studied at one level of magnitude. We tested how *Aedes* females assess a gradient in

larval predation risk across oviposition sites. To understand underlying trade-offs associated with patch-selection decisions, we quantified consequences of possible patch selection decisions by measuring larval survivorship across a predation risk gradient. We find larval survivorship reduced drastically with increasing predator density. Surprisingly, adult females did not reject predator pools altogether, but reduced oviposition in “unfavourable” pools. We suggest that larval predators may provide a release from intense larval competition and that the interplay between larval predation and competition may influence the nature of female-avoidance response to larval predator densities. We also suggest that females make oviposition decisions at pool network scale.

B51 Mar Unzeta : Environmental conditions and the evolution of cooperative breeding

In the last decades, much effort has been devoted to understand which factors have driven cooperative breeding evolution. While slow life histories, monogamy and lower levels of promiscuity have been shown to be central in the evolution of cooperative breeding, the attempts to understand the role of environmental conditions have led to contradictory hypotheses and findings. Thus, cooperative behavior has been suggested to be favored in both stable and variable environments. Here, we discuss previous evidence in support of these contradictory alternatives and use phylogenetic-based comparative approaches in birds to ask whether this reflects either that the environment is little relevant or that there exist several evolutionary routes toward cooperative breeding depending on environmental conditions.

C24 Marcela Méndez-Janovitz : Sexually-selected sexual selection and the origin of female colouration

By choosing mates with increasingly costlier ornaments, females cause an escalation of male reproductive costs. This may promote male selectivity based on fecundity-linked female attributes, leading to female ornamentation in species with traditional sex roles. Consequently, female ornamentation should evolve more frequently in taxa where male mating is costly than in comparable taxa where it is cheaper. We assessed the prevalence of female ornamental colouration in two clades of viviparous Cyprinodontid fish; the Goodeinae, where stringent female choice imposes male mating costs, and the Poeciliinae, whose males can circumvent female mate choice. We found that while in the Poeciliinae female ornamental colour is a paler version of, and phylogenetically correlated with, male colour, females of the Goodeinae often display distinct ornamental colours than males. Thus Goodeinae ornaments are not (phylo)genetically correlated in the Goodeinae. Female choice has promoted male ornaments, and evolutionary retribution has promoted different female ornaments.

C7 Maria J Albo : How ecological conditions affect worthless gifts probability in spiders?

Alternative reproductive tactics (ARTs) where males use alternative behaviours to secure copulations is widespread across taxa. ARTs occur in two gift-giving spiders as males can offer either genuine (prey) or worthless gifts where non-nutritious items are wrapped in silk. We hypothesize that inter-sexual competition and/or ecological conditions maintain alternative strategies in the population. We examined how operational sex ratio, prey availability and male condition, affected the frequency of genuine and worthless gifts during the reproductive season in the Palaearctic terrestrial *Pisaura mirabilis* and in the Neotropical semiaquatic *Paratrechalea ornata* (30% and 70% worthless gifts, respectively). In the Palaearctic spider, decreasing male bias was associated with higher frequency of worthless gifts. In contrast, male body condition influenced the probability of offering a worthless gift in the Neotropical species. We discuss how variation in selective forces over the mating season affects the maintenance of ARTs within populations

B22 Marie Trabalon : Physiological costs during maternal care in *Pardosa saltans* (Araneae, Lycosidae)

We used the free-moving wolf spider *Pardosa saltans* as a study model to examine how maternal care affects energy resources in this species. Mothers guard eggs until hatching and then the spiderlings for 27-30 days. Spiderlings desert the maternal abdomen gradually 7-8 days after hatching. The females lost weight over time despite regular food intake, and their weights gradually increased during dispersal of the young. The contribution of protein, carbohydrates and lipids to the maintenance energy was calculated. The energy stock varied during maternal care, particularly the stock of lipids, during young care when the predatory female behavior was inhibited. The results presented here show that maternal care provided by female *P. saltans* is especially physiological costly, during the 30 days following egg sac and young development, even when high food supplies are available.

B13 Marina Louter : Is fidelity an extinction curse in threatened Thick-billed Grasswrens?

Cryptic female choice via extra-pair paternity is considered a key factor in songbird speciation. Australia harbours the least faithful songbirds in a specious bird lineage, the Maluridae. Among many *Malurus* nests, over 90% contain extra-pair offspring; *Malurus* species are thriving and common across Australia. In contrast, sister genus *Amytornis* is comprised of vulnerable and threatened species with unknown information on extra-pair paternity (EPP). We investigated the social and genetic mating system of the threatened Thick-billed Grasswren (*Amytornis modestus raglessi*), a close relative of *Malurus*. From 2013-2014, video analysis of parental care at 10 Thick-billed Grasswren nests confirmed cooperative breeding for the species. We used Restriction-site associated DNA (RAD) sequencing to estimate genetic relatedness among nestlings in broods and assign putative fathers. We found low levels of EPP, supporting the view that genetic monogamy may be an evolutionary dead end in arid Australia.

B23 Marta Rossi : Blue tit nestlings discriminate between familiar and unfamiliar conspecific odours

Offspring competition for parental care is a key characteristic of bird species with more than one chick in the nest. According to kin selection theory, competing offspring should modify their begging behaviour depending on the degree of relatedness to their nest-mates. Empirical evidence indicates that lower relatedness among brood mates correlates with more intense begging. This suggests that nestlings can recognize kin, but the mechanism is unclear.

We experimentally tested whether olfactory cues may allow blue tit (*Cyanistes caeruleus*) nestlings to discriminate between familiar and unfamiliar conspecifics. Therefore, we compared the begging behaviour of nestlings exposed to a familiar versus unfamiliar conspecific odour stimulus. We found that individuals responded with longer begging bouts to an unfamiliar compared to a familiar odour stimulus.

Our findings provide first evidence for a role of olfaction in modulating offspring begging behaviour, and potentially sibling competition, in a natural bird population.

C40 Martin Bulla : Unexpected diversity of socially synchronized daily-rhythms in wild shorebirds

In the wild, individuals synchronize their activity with those of others. Activity rhythms that emerge from such social synchronization and the selection pressures that shape them are understudied. Here, we describe the diversity of rhythms that emerge in biparentally-incubating shorebirds, where parents synchronize to achieve continuous coverage of eggs. We show

remarkable within- and between-species diversity in the rhythms across 91 populations of 32 species (N =729 nests). Between-species the period of female+male incubation varied from ~6h to ~42h. Rhythms entrainable to the daily light-cycle were less likely at high latitudes and absent in 17 species. The length of incubation bouts was unrelated to energetics, but predicted by anti-predation strategy. Our results indicate that even under similar environmental conditions and despite 24h environmental cues, social synchronization of a complex behaviour can generate far more diverse activity rhythms than expected from studying single captive individuals.

C8 Martin D. Garlovsky : Experimental sexual selection causes divergence in a life history trait

Experimental manipulation of the operational sex ratio in laboratory reared populations over a number of generations can highlight traits under the influence of sexual selection and sexual conflict. In this study we exposed 4 replicate lines of the naturally promiscuous fruit fly *Drosophila pseudoobscura* to either enforced monogamy (M) or elevated promiscuity (E). Using a controlled density protocol, we measured the length of juvenile development time from 1st instar to adult emergence and adult body size at 3 evolutionary time points. Here we show flies from the E treatment achieve a larger body size and emerge later than M flies. These results highlight the potential for sexual selection to effect the timing of eclosion through selecting for a larger body size in males which may be associated with a trade-off between time needed to invest in secondary sexual characteristics in males and the benefits of a faster development time.

C9 Martin Reichard : Spatial cognitive ability affects success of an alternative mating tactic

The ability to attract mates, acquire resources for reproduction, and successfully outcompete rivals for fertilisations may make demands on cognitive traits by which an individual acquires, processes, stores, and acts upon information from its environment. Consequently, cognitive traits may undergo sexual selection in some mating systems. Rose bitterling (*Rhodeus ocellatus*) is a freshwater fish with a complex mating system and alternative mating tactics. We quantified the learning accuracy of males and females in a spatial learning task. Males were then allowed to play the roles of a guarder and a sneaker in competitive mating trials, with reproductive success measured by paternity analysis. When males played a sneaker role, learning accuracy predicted mating success, but not as a guarder. We then demonstrated that learning accuracy is heritable, with significant additive maternal and paternal effects. Our results imply that male cognitive traits may undergo intra-sexual selection.

C21 Masahito Tsuboi : A peculiar road to sexual size dimorphism in Tanganyikan cichlids

The research of sexual size dimorphism played an iconic role in Behavioral Ecology, as a catalyzer of the theory of sexual selection. However, a more recent study challenges the classic view that evolution of sexual selection is mainly a result of intra-sexual competitions. In my presentation, I report an extremely peculiar path towards the evolution of sexual size dimorphism in Lake Tanganyika cichlids. A phylogenetic comparative analysis of the rate of trait diversification revealed that adaptation to reside and breed in gastropod shells, a dramatic behavioral adaptation found only in cichlids from Lake Tanganyika, has an overwhelming effect over sexual selection in evolution of sexual size dimorphism. Implications of the results will be discussed in contrast with the role of sexual selection.

D29 Masato S. Abe : Relationship between rank difference and aggressiveness in dominance hierarchy

Dominance hierarchy defined by aggressive behavior is widely observed in animal groups from

insect colonies to mammal groups. Previous studies have considered the patterns such as linearity or network structures in dominance relationship after discarding the information of aggressiveness (i.e., number of dominance interactions between two). However, the relationship between rank difference and aggressiveness, if exists, should be crucial for understanding how dominance hierarchy emerges. To address this issue, we analyzed the rank-aggressiveness relationship in dominance hierarchies of various taxa ranging from ants to chimpanzees. We found that in some taxa the smaller the rank difference is, the stronger the aggressiveness is. This pattern can be explained by a simple decision-making rule of individuals. We will also discuss the evolutionary implication of the observed relationship in dominance hierarchy.

D17 Matthew Silk : Unstable hierarchies: the cost of not knowing top dog

Dominance hierarchies are fundamental in reducing key costs associated with sociality, for example, by minimising the frequency of aggressive interactions. However, dominance relationships determined by age and/or status are often highly dynamic, which could limit their benefits for certain individuals. This is particularly likely where dominance relationships are more complex (ie. central regions of a hierarchy) or still being established (eg. amongst younger individuals). We used social network analysis to investigate dominance relationships in a sex-age graded hierarchy in a population of free-ranging feral dogs. We found that the outcome of dominance interactions was harder to predict for individuals in the central region of the hierarchy containing subadults, leading to elevated levels of aggression for these individuals. This shows that more dynamic regions of hierarchies exert a behavioural cost on the individuals within them, highlighting the importance of considering hierarchy dynamics in understanding the benefits they provide.

A24 Melissah Rowe : Characterisation of the zebra finch (*Taeniopygia guttata*) sperm proteome

Spermatozoa exhibit remarkable variability in morphology and performance, and are a target of sexual selection due to sperm competition and sperm-female interactions. While knowledge of the causes and adaptive significance of sperm variation is accumulating, our understanding of the genetic and molecular basis of sperm structure and function remains limited. We used LC-MS based proteomics to characterise the sperm proteome of the zebra finch, a model organism in studies of sperm competition. We identified 495 sperm proteins, and Gene Ontology analysis revealed numerous protein categories essential to sperm structure and metabolism/energetics, findings consistent with mammalian and insect sperm proteomes. Additionally, and in comparison to other sperm proteomes, the zebra finch sperm proteome is enriched in (i) oxidoreductases, (ii) actin-related functions and (iii) associated processes at, or near, the membrane surface. These results will help elucidate mechanisms underpinning the outcome of sperm competition and sperm-female interactions.

B29 Michael Griesser : Fine-scale kin recognition of unfamiliar individuals in a social bird

A critical element to kin cooperation is kin recognition, but recognition of socially unfamiliar kin is found only in species where promiscuity prevents recognition of first-order relatives. Here, we show that genetic relatedness modulated aggression among group members in Siberian jays, a genetically monogamous bird species. Jays groups are formed through the retention of offspring beyond independence, and the immigration of socially unfamiliar non-breeders. Observations on feeders show that breeders chase most intensely the immigrant group members that are genetically the least related. Based on earlier studies, we propose that inclusive fitness benefits may play a role for the evolution of fine-scale kin recognition. Our results suggest that fine-scale kin recognition can evolve independently of social familiarity, highlighting the evolutionary

importance of kin recognition for social species.

D2 Michael Martin : Characterizing the Genetic Basis of Behavioral Immunity in Fruit Flies

The genetic basis of cellular immunity has long been a focus of immunological research. While mounting a successful cellular immune response has obvious fitness benefits, cellular immunity can be energetically costly and only functions as a reactive strategy to infection. There is a growing understanding that behavioral immune defenses are a common strategy that hosts employ to avoid and treat infection. However, the genetic mechanisms underlying these behavioral strategies remain largely uncharacterized. *Drosophila melanogaster* and their parasitoid wasps offer a unique opportunity to understand the genetic mechanisms of behavioral immunity in an ecologically relevant context. Female flies reduce the number of eggs laid in the presence of wasps. We conducted a genome-wide association study (GWAS) using the *Drosophila* Genetic Reference Panel to identify candidate polymorphisms affecting this oviposition reduction behavior. Our screen has uncovered candidate genes with known function in the central nervous system and reproductive tract.

D10 Michal Šulc : Common cuckoo females are not choosy

Females of avian brood parasites have evolved various tactics to succeed in their reproductive strategy. However, one peculiar habit is still mysterious – egg removal by adult parasitic females before laying their own egg. Here we examined two hypotheses to explain this behaviour in the Common cuckoo. First, ‘parasite competition hypothesis’, which proposes that the cuckoo removes an egg from the host nest to get rid of a previously laid parasitic egg from another cuckoo. Second, ‘mimicry improvement hypothesis’ stating that the cuckoo removes one host egg to improve mimicry of its egg in the host clutch and thus increase the chance of acceptance. However, we found that cuckoo females are not selective and remove randomly chosen egg. We suggest that egg selection behaviour could be too costly, because it requires time and the cuckoo rather minimizes the time spent at the nest, e.g. due to aggressiveness of the host.

A31 Michelle Hares : Banded Mongoose: early life effects and telomeres

I will use long-term data on *Mungos mungo* to test if differences in early life affect individuals senescence (telomeres) and if these differences in telomere length are adaptive. These highly cooperative mammals are ideally suited to the study of maternal and social influences on development because (i) multiple females in each group give birth together on the same day in each breeding attempt, so we can compare the offspring of different mothers within the same communal litter, (ii) postnatal care is provided by non-kin adult helpers or ‘escorts’ who form exclusive one-to-one relationships with particular pups, disentangling genetic and cultural effects on postnatal learning and development; and (iii) because there is extreme variation within litters in both the level of care received by individual offspring, and their later behaviour and helping effort as adults. I will present data testing the predictive adaptive response.

B52 Mitzy Porras : Viruses increase trophic facilitation between phytophagous insects

A challenge in ecology is to understand the mechanisms underlying facilitative interactions between species. Aphids are keystone phytophagous insects that affect plant epidemiology by virus transmission during feeding. *Rhopalosiphum padi* is a pioneer aphid that is first to arrive to grasses and transmit two viruses. Colonization by *R. maidis* in the field follows *R. padi* arrival. We examined whether this orderly assembly pattern had positive, neutral, or negative consequences for the involved species. We used EPG recordings, demographic analysis, and characterized virus-

induced phytochemical effects on a host species. Experiments show that *R. padi* pre-colonization speeds up the time required for *R. maidis* to find food, increases ingestion and population growth rates. Furthermore, viruses transmitted by *R. padi* unexpectedly increased feeding rates of *R. maidis* by over 100% and boosted reproduction. Our study demonstrates how pre-colonization and viruses interact to produce trophic facilitation between phytophagous aphid species.

B53 Ms. Tejasvini Chalikonda : Increased prenatal cortisol improves foraging skills in meerkats

Variation in maternal cortisol levels during pregnancy can have long-term effects on the development of offspring in mammals.

We experimentally tested the hypothesis that increased cortisol levels during pregnancy affects the development of foraging success in the offspring of wild meerkats in South Africa.

Six treated dominant females were fed cortisol-infused scorpions and six control dominant females were fed oil infused ones during the third trimester of their pregnancy.

Our analysis revealed that pups from treated females have a higher rate of finding food compared to pups from control females. Prenatal cortisol increases vigilance rates; however, daily weight gain analysis shows that both groups of offspring gain the same amount of weight.

This study indicates that increased prenatal cortisol levels lead to higher foraging efficiency in offspring, but does not result in divergent growth trajectories possibly as enhanced foraging skill coincides with increased vigilance.

C26 Murray Fea : Cavernicolous Combat in the New Zealand Weta *Pachyrhamma waitomoensis*

We investigate the mating system of the cave weta *Pachyrhamma waitomoensis*, a subterranean native of New Zealand's Waitomo district. We focus on the factors that have led to the species' remarkable, sexually dimorphic hind leg exaggeration; those of the male weta have developed to extraordinary lengths, reaching to nearly five times their body length. These elongated structures appear to be used in two areas of mating behaviour – aggressive competition between males and guarding of females. Initial results indicate that there are significant advantages to long-legged males in fights, and that the guarding of females using their hindlegs results in a reproductive benefit. Interestingly, the advantage of guarding females appears not to stem from preventing access by rival males to the mate, but in reducing disturbance by heterospecific organisms such as spiders and other species of cave weta that cohabit in the weta aggregations.

B2 Natalie Pilakouta : Does the outcome of fighting contests influence reproductive investment decisions?

Winner-loser effects occur when an individual's prior experience with a fighting contest influences the outcome of subsequent contests. Despite an extensive literature on this topic, very little is known about the wider implications of winning or losing a fight beyond an effect on the likelihood of success in future fights. For example, we might expect the outcome of a prior contest to influence subsequent reproductive decisions by providing individuals with information about their size and condition relative to their competitors. We address this gap using a burying beetle that breeds on small vertebrate carcasses for which there is fierce intrasexual competition. Because losing a contest over a carcass is an indication of limited prospects for success in future breeding attempts, we hypothesized that a loser might increase its parental effort in the current breeding attempt, with consequences for both its own fitness and the fitness of its offspring.

D24 Natasha D. G. Hagemeyer : Cryptic movement and extended social networks in a cooperative breeder.

Dispersal is an important life history stage that remains poorly understood. The cooperatively breeding acorn woodpecker (*Melanerpes formicivorus*) is a model system with a well-documented social environment and a complex system of cooperative dispersal. Over 2 years, we monitored 60 individuals continuously using a novel automated radio telemetry system. Helpers exhibited high foray rates, with many individuals detected >90% of the time outside their natal territories. Same-sex same-clutch helpers had high spatiotemporal overlap, while related same-sex helpers had lower overlap, and related different-sex helpers and unrelated helpers had little overlap. Breeders forayed less often, but cliques were not limited to group members. Helpers had significantly higher degree centrality than breeders, suggesting that helpers maintain more social connections, potentially in order to detect breeding vacancies. These findings reveal for the first time the surprising extent of cryptic movement and extra-group social connections in this species.

D27 Noa Pinter-Wollman : Uncovering the effects of keystone individuals on collective behavior

Groups often consist of a diversity of phenotypes that interact to produce collective outcomes. An extreme case of within-group behavioral variation is the presence of keystone individuals, such as leaders, which have a disproportionately large effect on collective outcomes. Keystone individuals can catalyze behavioral changes in other group members thus altering the composition of the group, its collective behavior, and tradeoffs between ecological situations. We use computer simulations to examine mechanisms that allow keystone individuals to exert their influence on group members. We further characterize a tradeoff between two potentially conflicting collective outcomes, cooperative prey attack and disease dynamics. Our simulations match empirical data and produce testable predictions for the causes and consequences of the influence of keystone individuals. We find that behavioral distribution can be impacted both by interaction patterns among individuals and/or by behavioral persistence, influencing collective outcomes and tradeoffs among them.

C33 Ola Fincke : Signal apparency trade-offs maintains female-specific color polymorphisms

Color polymorphisms should confuse visual receivers, but measuring rates of signal detection and recognition under field conditions remains challenging. In the damselfly *Enallagma hageni*, relative to green female morphs, blue females perched near the blue males are more difficult for males to recognize as 'female'. To test whether green females are more difficult for males to first detect, I measured male responses elicited by live individuals glued to green bracken ferns. Males detected green females less readily than the blue morphs, but once detected, male recognition rates of the two morphs did not differ. By following marked individuals in the field, I found no difference in sexual harassment rates of the two morphs; females behaviorally reduced their signal apparency to male receivers. Thus, context-dependent signal apparency, which requires no learning by receivers, likely drives negative frequency-dependent selection in this and similar systems (e.g. predators of polymorphic prey) .

B25 P. L. Schwagmeyer : USING VINTAGE DATA ON MALE EPF SUCCESS TO UNDERSTAND TRADEOFFS

Trade-offs between two alternative reproductive activities, such as providing parental care versus seeking alternative mates, or tending to one mate versus attempting to attract another, can result in reduced success in whichever activity provides the lower fitness payoff. Often, though, estimates of the success of mate acquisition efforts are confounded by variation across male activity states in the abundance of mating opportunities. We outline a simple method for statistical analyses of data on known extrapair sires that corrects for this confound and allows identification of male activity states that are associated with compromised extrapair mating

success relative to the mates potentially available. We illustrate the method using results from house sparrows, which revealed that the incidence of EPFs was particularly low when males were provisioning nestlings and when males were attempting to retain or attract a social mate.

B54 Pablo Capilla : Does the social environment mitigate inbreeding depression?

Inbreeding depression is central in our eco-evolutionary understanding of biological systems. Inbreeding effects often act in an environment-dependent manner. While most studies have focussed on the mitigating effects of the physical environment, the social environment too has the potential to markedly ameliorate inbreeding depression. Here we investigate the potential social mitigation of inbreeding depression in a cooperatively breeding bird, the white-browed sparrow weaver. Using life-history and genetic data we analysed how inbreeding and the social and physical environments interact to drive variation in female breeding rate. Social group size and rainfall had strong positive effects on female breeding rates. Preliminary results also suggested that this reproductive trait was not strongly affected by multi-locus heterozygosity. We discuss our results combining the theoretical background on inbreeding depression and the current theory for cooperatively breeding species, hoping for understanding the eco-evolutionary implications of inbreeding in social systems.

D19 Paloma Corvalan : Is sociability a predictor of survival in female kangaroos?

Among primates and other group-dwelling animals, an individual's sociability can be a strong predictor of their longevity. Measuring longevity usually requires the recording of both the date of birth and death of individuals. However, yearly survival may be estimated without following the entire lifespan, using mark-recapture methods. We estimated yearly survival (2010-2016) as a function of sociability traits, including network metrics and durability of social bonds, in a population of wild female eastern grey kangaroos. In this species, females do not have a dominance hierarchy or exhibit cooperative behaviours. This provides the opportunity to examine the fitness consequences of sociability in the absence of direct costs or benefits incurred from complex social interactions. Kangaroos live in a dynamic social environment with group size and composition changing many times per day. To understand the fitness consequences of sociability, we need to study animals with diverse social systems.

D4 Pat Barclay : Partner choice versus punishment in human Prisoner's Dilemmas

Two factors promoting cooperation are partner choice and punishment of defectors, but what do people prefer to use? Punishment should be more common when organisms cannot escape bad partners, whereas partner choice is useful when one can switch to a better partner. We use an iterated Prisoner's Dilemma to examine people's cooperation and punishment when partner choice was versus was not possible. Results: cooperation was higher when people could leave bad partners versus when they could not. When they could not switch, people preferred to actively punish defectors rather than withdraw. When they could switch, punishment and switching were equally preferred. Contrary to predictions, punishment was higher when switching was possible, because cooperators then deserted the defector they just punished. Punishment did not increase defectors' subsequent cooperation. Our results support the importance of partner choice - but not that of punishment - in promoting human cooperation.

A25 Patrice Rosengrave: Sneaky salmon secrets: how to sneaker males outcompete rivals?

In many species, males differentially allocate reproductive investment in response to sperm competition risk. In chinook salmon, a species with sneak-guard mating system, males rapidly alter

ejaculate investment and sperm function in response to perceived social status and the level of competition. Here we seek to determine if these tactical changes affect a male's reproductive success, and whether any of these tactical adjustments enable males to bypass a known mechanism of female sperm selection in chinook salmon.

D35 Paul Rose : Is flamingo vigilance affected by social grouping?

Flamingos are highly social birds, occurring in massive flocks in the wild. However captive birds can be kept in much smaller groups. Current husbandry guidelines recommend a minimum of 20 birds for "good welfare". Vigilance in wild flamingos has been noted as an indicator of disturbance, and hence may be a good metric for assessing captive welfare. Measurement of social networks in a very large (over 250 birds) and a small (35 birds) flock of greater flamingos (*Phoenicopterus roseus*), and recording counts of birds being vigilance across a daily timeframe, was undertaken at two UK institutions. Flock behaviour was scan sampled from photographs. Results showed there to be no effect of group size on level of vigilance and that vigilance performance was low overall. Results do support the guidance that flamingos should be maintained in the largest flocks possible, as this allow birds more opportunities for associating and social exchange.

D4 Paula Marjamaki : Bayesian pedigree reconstruction: advantages and application in quantitative genetic analyses

Pedigrees can provide a great deal of information about a population, and are often a key parameter in studies of ecology and evolutionary biology. However, the structure of wild populations often precludes accurate estimation of pedigree links using behavioural data alone, while pedigrees based solely on genetic data can miss ecological detail. I use MasterBayes, an R package that implements maximum likelihood and MCMC methods for pedigree estimation, to reconstruct a pedigree for a badger population naturally infected with bovine tuberculosis. MasterBayes utilises both genetic and ecological data to simultaneously estimate pedigree structure and population-level parameters while also accounting for genotyping error and size of the unsampled population. This gives us valuable information about the reproduction and movement of badgers, but can also be incorporated into quantitative genetic analyses investigating variation in disease traits, thus shedding light on the evolutionary dynamics of tuberculosis in a wild host.

B37 Peter A. Bednekoff : Just hanging out? Sentinels & socializing by nonbreeding Florida scrub-jays

In cooperatively breeding Florida scrub-jays, breeders do all the work during nest building, egg laying, and incubation. Aggression by breeding males toward nonbreeders peaks during egg laying and incubation. Starting a few days after hatching, nonbreeders help provision and protect offspring. This study examined the behavior of nonbreeding Florida scrub-jays during the nesting period before they begin helping with young. Time budgets were compared with and without supplemental feeding. When nonbreeders were fed peanut bits, they substantially decreased foraging and increased sentinel behavior during the following 30 min. Nonbreeders also spent more than 15% of their time on "Other" behaviors, and increased these behaviors somewhat when fed. Nonbreeders often socialized with nonbreeders from both nearby and distant groups. Some close associations between opposite sex nonbreeders showed coordinated sentinel behavior. Further analyses will examine how spring socializing by nonbreeders may contribute toward obtaining breeding space.

B4 Peter Santema : Blue tits dont increase provisioning in response to begging playbacks

Offspring often solicit for food from their parents through elaborate begging displays. Begging is thought to reflect offspring need, but short term fluctuations in begging do not necessarily provide reliable information. Parents thus have to adjust their provisioning behaviour to the changing demands of their offspring, whilst minimizing the costs of responding to unreliable information. We performed two experiments in which we tested how parents respond 1) increased begging during a single nest visit and to 2) increased begging during every nest visit for the duration of one hour. Parents did not change their provisioning rates in response to the short-term manipulations, but, contrary to our expectations, also not in response to the long-term manipulations. Instead, parents spent more time in the nest-box in response to both manipulations. Our results highlight that the general pattern of increased provisioning in response to increased begging may not be universal.

B16 Philip Downing : When Do Females Help More Than Males?

In some cooperatively breeding species, female helpers invest more in the care of their siblings than male helpers. Since helpers are equally related to the young in their natal group, this difference in investment cannot be explained by relatedness. Instead, the philopatric sex is predicted to invest more in helping because its future fitness depends on the success of its natal group. We tested this prediction using a phylogenetically controlled meta-analysis across birds, quantifying the difference in how much the sexes help using Hedge's D - an effect size. We obtained 97 effect sizes from 26 cooperative bird species. We found that females help more than males when they are philopatric. Furthermore, female philopatry was associated with high constraints on independent reproduction. These results support the prediction that future fitness considerations shape investment in care and suggest that females are 'forced' to help by limited options for independent reproduction.

B40 Piotr Matyjasiak : Communal nest defense and nest predation – an experimental test

We performed an artificial nest experiment to test the hypothesis that group breeding birds that aggressively attack nest predators are capable of successfully ward these predators off the vicinity of nests. We put experimental lines of artificial nests in meadow fragments that were used by breeding Lapwings and Black-tailed Godwits. Control lines of artificial nests were located in similar areas of meadows but without waders. We have found that Hooded Crows, which are the major nest predators of waders in our study area, were harder to get access to the vicinity of artificial nests located within breeding groups of waders. At the same time the predation rate was significantly lower for artificial nests located within breeding groups of waders compared to control artificial nests. We discuss the possibility to use the aggressive Lapwings and Godwits in the protection of biodiversity of river valleys.

B32 Piret Avila : Conflict in eusocial societies over resource allocation

In general, the optimal life-history strategy for an annual eusocial colony is thought to proceed in two phases: in the ergonomic phase, all effort is directed towards producing workers; in the reproductive phase, all effort is directed towards producing sexual offspring. Using optimal control theory, we show how the switch from the ergonomic to the reproductive phase can happen earlier in the season because of conflict over sex allocation between the workers and the queen. The timing of the switch depends on the power that the queen and the workers have over resource allocation decisions as well as other life-history traits, such as mortality rates of the individuals in the colony and the per capita productivity of the colony. Our model can be useful for empiricists studying conflict resolution in life-history decisions in annual eusocial insects.

D22 Priscila E Hanisch : Foraging Ecology and visual cues of the ant *Dinoponera australis*

We evaluated foraging behavior and trophic ecology of *Dinoponera australis* in subtropical forests in Argentina. We found that *D. australis* colonies are over dispersed, and the species reaches a wet biomass of more than 2.5 kg/ha. Workers exhibit relatively high degrees of route fidelity, with different individuals specializing on different areas around the nest. Data from stable isotopes of Nitrogen and from direct observations of foraging success suggest these ants are among the top predators in this terrestrial invertebrate community. We tested the hypothesis that *D. australis* foragers use visual cues for orientation by setting up an arena in the field with mobile visual cues. Foraging routes were mapped for individually marked workers before and after the visual cues were moved. Together these data provide insight into the biology of one of the world's largest ants and why they may be able to attain such high densities.

A13 Qiao Wang : Bodyweight dependent polyandry: both sexes play a role

Why females mate polyandrously is a central concern in evolutionary biology but little attention has been paid to understanding the question from both a female and male perspective regarding factors that may simultaneously influence polyandry levels. Using a moth where last male sperm precedence was persistent and no direct material gain from polyandry was evident, we tested how body weight of both sexes affected their lifetime reproductive fitness and whether polyandry was related to these traits. We show that heavier males ejaculated more sperm, inseminated more females and fertilized more eggs and heavier females mated more often and had higher fecundity and fertility. Polyandry was more likely to occur with the increase of female body weight and body weight difference between males (weight of the second male minus that of the first male). These results suggest that polyandry occurs for genetic benefits and both sexes play a role.

B55 Ramona Rauber : Functions of different sentinel call types in meerkats

Risk assessment is an important factor for animals living in an environment with unpredictable levels of predation risk. The sentinel system is a form of coordinated vigilance where one individual is on guard, while the group is foraging. In contrast to most species, in which sentinels confirm their presence vocally with repeating the same call type, meerkat (*Suricata suricatta*) sentinels produce six different call types of unknown function. With playback experiments we investigated both producer and receiver of the signal and showed that the two most commonly emitted sentinel calls act as all-clear signals while the two rarest calls have a warning function. Our findings suggest that meerkats increase the efficiency of their sentinel system by producing different sentinel calls that represent subtle changes in predation risk. This likely optimizes their foraging efficiency, which can have large fitness consequences.

D28 Rebecca Branconi : Does the presence of SCUBA diver influence fish behaviour?

The majority of animal behaviour studies involve direct human observations. However, few studies have investigated how animals respond to such observations. The goals of this study were to assess whether the presence of a SCUBA diver influenced fish behaviour and to compare alternative methods of measuring coral reef fish behaviour. We developed an ethogram for the humbug damselfish *Dascyllus aruanus* and then I) investigated the effect of SCUBA diver presence-absence on multiple classes of fish behaviour and II) compared the effectiveness of in situ measurements versus video recordings for scoring behaviour. We found that the presence of a SCUBA diver did not influence fish behaviour and that the relative efficiency of each technique depended on the behaviour being scored. These results provide a foundation for future

behavioural research on *Dascyllus aruanus* and other coral reef fishes where SCUBA is the prevalent means of data collection.

A32 Regina Vega-Trejo : Inbreeding depression and stressful environments: does fitness decrease?

Mating with close relatives often reduces offspring fitness due to inbreeding depression. Moreover, it is generally assumed that the negative effects of inbreeding are exacerbated in stressful environments. Low food availability, in particular, limited food during juvenile growth is known to reduce adult fitness. Life history traits and sexually selected traits offer an ideal test case to investigate the alleged interaction between inbreeding and environmental stress. Here we use the mosquitofish (*Gambusia holbrooki*—an invasive species that inhabits Australia) to investigate the interacting effects of inbreeding and stressful environments on growth trajectories and adult phenotypes. Most importantly, we test whether there is an ultimate effect on reproductive success on males.

B11 Reinaldo Marfull : Early incubation, hatching asynchrony and offspring hierarchy: A correlational study

Hatching asynchrony is ubiquitous among birds and may be adaptive. It is determined by the parents' incubation behaviour and influences size asymmetries among siblings. In this field study on blue tits, we examined the relationships (i) between the amount of incubation before clutch completion and hatching asynchrony, and (ii) between hatching asynchrony and offspring size asymmetries four days after hatching. We quantified females' incubation behaviour from temperature profiles recorded by loggers placed between the eggs, and hatching asynchrony was estimated by daily nest visits from the day of first hatching onwards until the last chick had hatched. As expected, total incubation time before clutch completion and hatching asynchrony were positively correlated. Additionally, higher levels of hatching asynchrony resulted in greater offspring size asymmetries. Potentially, hatching asynchrony can have long-term consequences for offspring condition and survival. Further research aims to reveal such fitness consequences of hatching asynchrony in this population.

B39 Rene van Dijk : Inbreeding avoidance in a highly social passerine

Cooperation among relatives may confer substantial fitness benefits that may lead to increased sociality. However, there are also potential costs of living in proximity of kin, including kin competition and an increased risk of inbreeding. The sociable weaver, *Philetairus socius*, is a highly social and cooperatively breeding sociable weaver. Both sexes show high levels of philopatry, resulting in kin-structured populations with a substantial risk of inbreeding. Here, we investigated whether sociable weavers avoid inbreeding by comparing the relatedness of observed pairs with the relatedness of random pairs generated under multiple null models of pairing behaviour. We found that, overall, an increased risk of inbreeding was not associated with an increased level of relatedness of observed pairs. Additionally, the level of relatedness of observed pairs was lower than expected under different null models of pairing behaviour. These results indicate that sociable weavers avoid mating with relatives.

B1 risk matiya : Validity of the parental investment questionnaire among Zimbabwean parents

The current study sought to evaluate the reliability and validation of a parental investment in children questionnaire among Zimbabwean parents. Items were generated from focus group discussions and personal interviews among parents. Parents from different socio-demographic characteristics were used across race and ethnicity. Appropriate statistical analysis including

reliability, validity and factor analysis were computed. The instrument yielded a four factor solution which included separation anxiety, delight, acceptance for parenting role, knowledge and sensitivity. The results indicate that the parental investment in children questionnaire is reliable and valid among a population of Zimbabwean parents. However recommendations are made as regards the cultural competence of the same instrument.

D32 Robert Heathcote : Fear of predation drives social relationships in guppies

Social relationships can have important consequences for fitness in animals. Whilst numerous studies have investigated group-size effects of predation, the importance of predation in driving the formation and stability of social relationships within groups has been relatively ignored. We experimentally tested how predation threat influenced fine-scale social structure in Trinidadian guppies (*Poecilia reticulata*). When perceived predation risk was high, guppies developed stable and more differentiated social ties compared to when perceived risk was low. Intriguingly, the increased social differentiation coincided with shoals being somewhat smaller under high-perceived risk, suggesting a possible conflict between forming stable social relationships versus larger social groups. Individuals most at risk of predation (large and bold individuals) showed the most exaggerated social responses. Taken together, this is the first experimental evidence that proximate risk of predation risk can drive the intensity of social relationships in animal populations.

D11 Romina C. Scardamaglia : Patterns of use of communal roosts by avian brood parasites

We analysed temporal and spatial roosting patterns by radio-tagged males and females of two avian brood parasites: the generalist shiny cowbird (*Molothrus bonariensis*) and the specialist screaming cowbird (*M. rufoaxillaris*). Screaming cowbirds are socially monogamous, while shiny cowbirds are not. Tags served to determine roost locations, dawn departure times and parasitic events. Females of both species used mainly a communal roost near their diurnal home ranges, which was maintained throughout the breeding season. Males of screaming, but not shiny cowbirds shared the females' communal roost. Male shiny cowbirds were rarely found in the area at night. Females left the roost both before and after sunrise, but parasitized hosts almost exclusively before sunrise. This is consistent with the hypothesis that females leave the roost in the dark on days when they are ready to lay, and attack either previously located suitable host nests or nests located by following informed conspecifics.

D42 Sabine Tebbich : The impact of invasive species on Darwin's finches

Introduced plants have invaded a unique forest on the Galapagos island of Santa Cruz, which is a key habitat for Darwin's finches. This has led to lower species richness and changes in forest structure. The intense use of herbicides to control invasive species may also have altered plant and invertebrate communities. Additionally, the invasive parasitic fly *Philornis downsi* has a strong negative impact on the breeding success of Darwin's finches. We investigated the impacts of parasitism and habitat change on breeding success and arthropod abundance in three study sites with varying degree of plant invasion ranging from heavily invaded to recently controlled with herbicides. Additionally, we manipulated parasite intensities in the nests by injecting insecticides. Breeding success increased at all three sites after elimination of *P. downsi* from the nests but did not differ between sites. However, arthropod abundance was lower at areas which had been recently controlled

A5 Sally E Street : Globally traded and introduced species are highly productive

Humans do not introduce alien species at random; rather, we prefer (either accidentally or intentionally) to introduce prolific breeders. We currently do not know, however, whether these preferences are specific to introduced species, or apply more broadly to species transported internationally. With the increasing volume of international trade, answering this question is critical in identifying which species may become invasive and developing evidence-based prevention policies. We combine large and comprehensive life history and invasion datasets for mammal, reptile and amphibian species with US trade data, used as a proxy for global trade volume. Using phylogenetic comparative analyses, we find that both internationally traded and introduced species are highly productive through a combination of fast life history traits and long reproductive lifespans. Therefore, human preferences favour species with progressively higher productivity in the early stages of the invasion pathway – transport and introduction – which subsequently promote successful invasions in novel regions.

C1 Sasha Hoffmann : Personality, mate choice and reproductive success in sengis

Individual differences in behaviour, or personality, are being recognised as widespread across animal taxa. The maintenance of such diversity within and across populations is linked to fitness benefits hence personality can be assumed to be subject to selection. Mating according to behavioural type has been shown to be beneficial and some bird pairs with comparable exploration traits or matching scores of territorial aggression have been found to raise offspring in better condition. We evaluated the contributions of personality on mate choice and reproductive success over 5 years in an individually marked wild population of eastern rock sengis (*Elephantulus myurus*) in northern South Africa. We used direct behavioural observations and microsatellite data to identify mates and determine paternity to evaluate the contributions of personality to mate choice, extra-pair paternity and offspring survival. The evidence for a role of personality in mate choice and fitness pay-offs will be discussed.

B8 Scott K. Sakaluk : Experimentally manipulated incubation periods in house wrens: whither the costs?

Fitness costs of incubation ensue whenever the tradeoff between incubation and foraging leads to suboptimal incubation or decreased parental body condition. We examined the costs of incubation in a wild population of house wrens by experimentally extending (by 5 days) or decreasing (by 5 days) the incubation period by cross-fostering eggs between nests at different stages of incubation (eggs of controls were cross-fostered at the same stage of incubation), holding clutch size constant. There was no difference in hatching or fledging success across treatments. There was also no difference across treatments in the proportion of females producing a second brood. Neither return rates of females, nor the number of offspring recruited the following year, differed across treatments. We conclude, therefore, that although prolonged incubation must entail increased energy expenditures, females are able to offset these losses while foraging off the nest, thereby negating costs of increased incubation effort.

C13 Shaghayegh Soudi : Strong cryptic isolation despite lack of behavioural isolation in beetles

The major goal in speciation is to understand which isolation mechanisms form the first barriers to gene flow. We investigate the presence of behavioural and cryptic barriers between sympatric races of *Lochmaea capreae*. Behavioural isolation did not have any effect. Yet despite pairs mating indiscriminately, no offspring produced from one of the heterospecific matings due to the inability of males to transfer sperm. We found evidence for differences in genital morphology and the observed incompatibility might be due to mechanical isolation. The other heterospecific matings resulted in viable offspring. Yet fecundity and hatchability was remarkably reduced due to lower

efficiency in sperm transportation and storage and lower survival of sperm. We provide evidence for the contribution of mechanical and several prezygotic barriers which predate behavioral isolation and act as primary inhibitors of gene flow. This is a surprising, yet perhaps often overlooked feature of barriers acting early in sympatric speciation.

C10 Shilpa, M. C. : Do mated wasps develop ovaries faster than unmated wasps?

In the primitively eusocial wasp *Ropalidia marginata* mating is unnecessary for a female to develop her ovaries, lay eggs and become the sole egg layer of the colony, in spite of the presence of mated females. When kept in isolation, virgin females develop their ovaries to the same extent as mated females. Here we show that when virgin and a mated female are paired together, both develop their ovaries equally and ovarian index of mated females is not significantly different from that of virgin females ($P > 0.05$). The probability of becoming the dominant member of the pair is also not significantly different between mated and virgin females ($P > 0.05$). The absence of any advantage for mated females appears to reflect the situation in nature where mating is unpredictable and virgin females may have opportunities to get a head-start and develop their ovaries even before they can mate.

B26 Shintaro Nomakuchi : Cooperation and conflict between mothers of fused subsocial bug families

There are two major evolutionary pathways to eusociality. The subsocial route may be a more plausible evolutionary transition because offspring remaining at the nest as helpers have higher relatedness. In the parasocial route, several unrelated females share a nest and care of offspring, that is, lower relatedness constrains the evolutionary transition due to conflicting female interests even if they share a nest, but this has not been sufficiently demonstrated. Mothers of the subsocial burrower bug, *Adomerus triggutatus*, show complex parental cares, and often share a nest and care of nymphs, "family fusion", in the field, a situation that suggests the start of the parasocial route. We examined whether family fusion can evolutionarily progress toward eusociality by observing maternal care behavior in a simple experiment where two families were artificially forced to fuse. The actual conditions for cooperation and conflict in females sharing the same nest will be shown.

A4 Siiri-Liia Sandre : Low cost of melanism in larvae of a geometrid moth

Intraspecific plasticity of melanin-based coloration is a common phenomenon, however the underlying mechanisms are not known in most cases. Melanin and its precursors have multiple roles in animals, e.g. coloration and UV protection. The synthesis of melanin requires nitrogenous resources, which are usually scarce for herbivorous animals and needed for other important functions like growth and reproduction. Thus it could be hypothesized that the variation of melanic darkness arises from trade offs within the organism. Negative genetic and phenotypic correlations between darkness and other important nitrogen limited traits would indicate the existence of trade offs as the reason for color variation. In an extensive quantitative genetic study with half-sib design we found negligible genetic and phenotypic correlations between darkness and important life-history traits of *Ematurga atomaria* larvae, thus dark coloration does not seem to be costly in this species.

A29 Simon Eckerström Liedholm : Life history and risk-taking behavior in killifish

There are many proposed explanations for differences in behavior between individuals, populations and species. One theory is the pace-of-life syndrome (POLS), which predicts that the

distribution of the life-pace of different organisms will fall on a fast-slow continuum. A fast life-pace is thought to be signified by a high growth rate and high metabolism. Because of this, a faster life-pace is also predicted to result in proactive and risk-taking behavior, since faster growth requires increased foraging. Up until now there has been a lack of comparative evidence to support this theory. Using killifish as a model system, a clade exhibiting remarkable variation in growth and life span, we test whether the POLS theory holds up in a comparative framework. Open field tests and emergence tests were used to assess proactive and risk-taking behavior, and the implications of the results will be discussed.

D36 Sophie J. Potter : Preference for sexually attractive conspecifics in the absence of females

In social species, non-random social associations among same-sex individuals can have individual fitness consequences. We used a dichotomous-choice apparatus to test for male shoaling preferences in Trinidadian guppies (*Poecilia reticulata*) originating from each of three populations differing in predation level. Focal males were offered the choice to associate with either of two conspecific shoals, comprising either more or less sexually attractive males than themselves, both in the presence and absence of females. In the presence of females, males did not shoal preferentially with either stimulus shoal, regardless of population of origin. In the absence of females, however, males from all populations tested preferred to associate with shoals of males who were more sexually attractive than themselves. By associating preferentially with more attractive rivals, a less attractive male may be more likely to encounter and mate with females, who are initially attracted to the nearby more attractive males.

C40 Sreejani Sen Majumder : WHY FREE RANGING DOGS TEND TO MATE WHEN IT RAINS!

In India, free ranging dogs seem to mate, not whelp, when it rains - an observation unexplained by resource abundance hypothesis. The work reported here includes two different sampling methods; year-long population level census and four year observation of free-ranging dog groups during monsoon. In long term data, frequency of mating related behavior(MRB) was strongly dependent on precipitation levels on a given day. In the year long census the frequency of MRB observed per location within a fortnight strongly depended on average precipitation level, which shows reproductive activity in free-ranging dogs is not only seasonal, but shows spectacular concordance with precipitation levels. In urban environment, dogs are exposed to lots of olfactory noise, which can dilute the signal present in sex pheromones of the females in heat. A shower leads to increased humidity and reduced air temperature, leading to intensification of pheromone signals triggering a sexual response.

D15 Sruthi Unnikrishnan : Dominance behaviour predicts reproductive queue in a primitively eusocial wasp

In the primitively eusocial wasp, *Ropalidia cyathiformis*, the queen is a highly aggressive individual and is usually the at the top of the dominance hierarchy. When the queen is removed, only one worker becomes hyperaggressive and becomes the next queen within 1-10 days. This 'Potential Queen' (PQ) is never challenged suggesting that the identity of the PQ maybe predetermined. In the current study we have shown that there is not just one PQ but there are atleast 3 PQs in the reproductive queue who become hyperaggressive and future queens as and when the individual above them in the hierarchy is removed. We have also shown that the level of dominance behaviour exhibited by the workers in the presence of the queen predicts their position in the reproductive queue such that queen succession runs down the dominance hierarchy. On other hand age and behavioural profiles failed to make similar prediction.

C14 Stefanie Gierszewski : Check-up for virtual lovers in sailfin mollies

Computer-animated stimuli represent an innovative and flexible technique to study mate-choice in fish. The validation of this new technique, however, is often missing. We designed custom-made simulation software for freely steerable virtual 3D-sailfin mollies presented as stimuli in mate-choice experiments. Behavior and appearance of 3D-fish could be changed easily. We tested these 3D-stimuli in binary choice tests. Real females responded similar to animated 3D-males as to a video or even a real male. Movement of the animation was important but females responded stronger to the virtual swimming fish than to a 'swimming' box. Real males could discriminate between 3D-males and 3D-females based on sex specific characteristics. We conclude that our software is a useful tool in mate-choice in sailfin mollies. It opens new horizons for studying fish behavior, since it allows interactions between the 'virtual lover' and real fish.

B57 Sylvia Dimitriadou : Effects of cooperation under predation threat on brain monoaminergic activity

Brain monoamine neurotransmitters such as dopamine play an important role in stress responses in fish. Social interactions and social stress have also been shown to modify brain monoaminergic transmission in fish and other vertebrates, both in the short and the long term. The aim of this study is to explore the immediate effects of predator exposure and social context on brain monoamines, and its correlation with behaviour. We tested female Trinidadian guppies (*Poecilia reticulata*) in a predator inspection paradigm, manipulating both the threat of predation and the degree of cooperation. We quantified the concentration of dopamine, norepinephrine, serotonin and their metabolites in the forebrain, midbrain and hindbrain of the fish immediately after the exposure. The results indicate that brain monoamine neurotransmission differs with brain region and treatment and we discuss the implications of these findings for understanding the mechanistic underpinnings of variation in behavioural responses to predation risk and cooperation.

A27 Thomas Merkling : Including past reproductive history to improve sex allocation studies?

Sex allocation patterns remain unclear in vertebrates. Many studies have shown that reproductive success varies with age or pair-bond duration but fewer have examined sex-ratio, although the fitness benefits of producing either sex could theoretically vary with age or pair-bond as well. We investigated which variable(s) best explained sex-ratio variation over eight breeding seasons in a long-lived seabird, the kittiwake (*Rissa tridactyla*). Besides parental age and pair-bond duration, we also considered commonly tested explanatory variables such as environmental and parental condition, and laying date.

Using a multimodel inference approach, we showed that pair-bond duration was the only important predictor of offspring sex, and had a quadratic effect. Further analyses revealed that this was caused by a combination of between- and within-pair effects. Hence, considering past reproductive history could thus help shedding light on the fitness benefits of sex-ratio variation.

C38 Tim W. Fawcett : The coevolution of aggressive behaviour and weaponry

In many animal species, males compete for access to females and have evolved horns, antlers, enlarged teeth, claws or other forms of weaponry. Although such weapons can potentially inflict severe damage on an opponent, this usually happens only rarely, perhaps because fearsome weapons act as a deterrent against escalated fighting. Our understanding of the costs and benefits of weaponry is limited, however, because most existing models of aggression assume a fixed cost of losing a fight and do not allow the ability to inflict injury to evolve. Using an evolutionarily stable strategy (ESS) approach, I have been modelling the coevolutionary dynamics of weaponry and

aggressive behaviour. The models identify conditions under which selection favours fierce fighting with weapons, as opposed to a 'cold war' situation in which heavily armed individuals threaten aggression but rarely deliver it.

D8 Tina Henrich : Disassortative mating preferences of two parasites

Mate preference can play a crucial role in reproductive isolation if it can prevent wasteful unfavourable matings between two species. We investigated the importance of mate preference as a prezygotic reproductive barrier in two cestode species (*Schistocephalus solidus* and *S. pungitii*), which diverged 20-25mya and show an extraordinary degree of specificity to different intermediate hosts. Both species reproduce in the same final hosts and hybridize in the laboratory. Yet, natural hybrids have not been detected so far.

We tested whether the parasites prefer conspecifics over parasites from a different species in dichotomous mate choice trials. Our results indicated that both parasite species prefer mates of the different species over conspecifics.

Assortative mate preference cannot sufficiently explain the persistent segregation of the two tapeworm species in nature. Hence, postzygotic ecological selection against hybrids is presumably the more important driving force, which limits gene flow between the two parasite species.

B28 Tom Ratz : The evolution of plasticity in parental care in variable environments

Parental care is a major component of individuals' investment into reproduction and affects both parental and offspring fitness. Moreover, parenting behaviours and the level of care provided are known to be highly responsive to environmental conditions (e.g. climatic, ecological and social factors). Phenotypic plasticity is then expected to be a key mechanism in the response to short-term environmental variation and should play an important role in the evolution of parental care. However, no theoretical work has addressed these assumptions and the environmental and life-history conditions allowing plasticity in parental care to evolve in populations remain to be clarified. Here we fill this gap by incorporating phenotypic plasticity into a model of the ecological dynamics of a species with parental care. We investigated the effect of environmental and life-history parameters on the success of plastic mutants invading a resident population displaying fixed levels of care.

A26 Torvald B. Egeland : Sneaker males may fully compensate for their disadvantaged mating role

We used controlled in vitro fertilization trials with experimentally produced dominant and subordinate, sneaker males of Arctic charr (*Salvelinus alpinus*) to test what effect relative synchrony in gamete release, sperm quality (motility and velocity) and sperm quantity have on a male's fertilization success in pair-wise sperm competitions. When the sneaker males released ejaculates after the guarding male there was no overall difference in fertilization success. The quality of a male's sperm relative to that of the competing male was the best predictor of male fertilization success regardless of their mating tactic and spawning synchrony. The relative number of sperm cells also had an effect on fertilization success, but mainly when the dominant and sneaker male ejaculated synchronously. Our close imitation of natural sperm competition shows that the sneaker males of external fertilizing species may fully compensate for their disadvantaged mating role by producing ejaculates of higher quality.

C11 Toubiana : Evolutionary and genetic basis of an exaggerated sexually dimorphic trait

Sexual selection is a potent force that accounts for a large proportion of sexual dimorphism observed in nature. In some species, males can display impressive phenotypic variation in

secondary sexual traits that impact mating success. However, we still know very little about how environmental and genetic factors interact to maintain this variation in nature. Here we study a new model system, the pond skater *Microvelia longipes*, where males exhibit exaggerated and hypervariable third pair of legs compared to females of the same species. In addition to show strong condition dependence, this exaggerated trait is used by males to fight and dominate spots where females mate and lay eggs. Males with longer legs generally win fights while males with shorter legs sneak to achieve reproductive success. These results will be later combined with artificial selection experiments to determine the environmental and genetic mechanisms underlying phenotypic variation in secondary sexual traits.

C43 Tsuyoshi Takeuchi : Do butterflies really engage in aerial wars of attrition?

Males of various butterflies perform conspicuous aerial interactions around their mating stations. The broadly accepted interpretation of this behavior is a war of attrition, where two contestants perform costly displays, and the one that reaches its cost threshold earlier gives up. The implicit requirement in this model is that some forces to match the intensity of display of the two contestants are necessary, and failure to enforce matching allows foul contestants that stop their display to avoid paying contest costs. In addition, wars of attrition require butterflies to distinguish the sex of flying conspecifics, because their aerial interactions begin when intruders fly into the territory. We investigated past research to clarify whether the two prerequisites are fulfilled. After all, we could not find any evidence that the two requirements are filled. Based on the principle of parsimony, butterflies' aerial interactions are better interpreted as erroneous courtship between sexually active males.

B33 Valentina Balzarini : Repeatabilities of behaviours determining social structure in a cooperative breeder

Behavioural interactions determine the structure of animal societies. Assessing behavioural consistency of social interactions of group members is inherently difficult, as each individual's behaviour depends on that of its interaction partners. Thus, behavioural consistency in social contexts and its effect on social structure are little understood. We tested repeatability of social behaviour in a cooperatively breeding cichlid, where group membership is fundamental for survival and reproduction. The breeders' propensity to accept helpers and their social interactions were measured repeatedly in different individual combinations. Pairs were highly consistent in their decision to accept or evict different helpers, but their behaviour towards helpers was flexible. In contrast, helpers behaved consistently towards different breeders, but they had little influence on being accepted in the territory. This shows that different social behaviours are repeatable in dominant and subordinate group members, which strongly influences group structure.

A6 Verónica Quirici : TELOMERE DYNAMICS AND SURVIVAL IN A SHORT-LIVED BIRD

Telomeres, the terminal end of chromosomes appears to predict remaining lifespan in a variety of taxa. Our main objective was to evaluate the effect of telomere dynamics on inter-annual survival using the Cormack-Jolly-Seber model (CJS) in a short-lived passerine bird, the Thorn-tailed Rayadito (*Aphrastura spinicauda*), using capture data generated during five reproductive seasons. Our selected CJS model based on AICc value indicated that the change in telomere length was a good predictor of inter-annual survival and that the direction of the relationship changes over time. We also observed some telomere elongation in certain individuals up to four years of age and those individuals presented a higher survival probability. We suggest that the mechanism involved in telomere maintenance and telomere elongation proposed for long-lived species, may

be acting in short-lived species as well.

D13 Veronika Bartáková : The role of zebra mussels on bitterling oviposition

Non-native species can affect coevolved relationships. Bitterling fish lay their eggs into live unionid mussels. In experiments in laboratory, semi-natural and natural conditions, we examined: a) the effect of zebra mussel (*Dreissena polymorpha*) on oviposition decisions of male and female European bitterling (*Rhodeus amarus*) from two populations with a different level of sympatry; b) the effect of zebra mussel on bitterling reproductive success. We found that zebra mussel decreased bitterling oviposition rate into the unionid mussels in the wild and in mesocosm. There was no effect of bitterling-zebra mussel sympatry in the wild, but a stronger decrease in bitterling reproductive success with increasing zebra mussel fouling on unionid hosts in the mesocosm. Female bitterling used infected unionids only rarely. Sometimes, they oviposited into a zebra mussel, followed by a failure to develop. Female decisions were active - they inspected infected and non-infected mussels at the same rate.

B36 Victoria Garcia : Reproductive senescence in three species of cooperatively breeding birds

Cooperative breeding is a system in which individuals other than the breeding pair help produce offspring. Senescence is a decline in physiological functioning with age that can lead to reduced survival and decreased reproductive output. Senescence is now understood to be widespread although patterns of reproductive senescence are not well understood, and the extent to which reproductive behaviors such as cooperative breeding mitigate or impact senescence are unknown. Here we examine patterns of reproductive senescence in three species of birds that breed cooperatively: Acorn Woodpeckers, Red-cockaded Woodpeckers, and Florida Scrub-Jays. The cooperative system of each species differs. For example, some Acorn Woodpecker populations are polygynandrous, whereas the other two species are predominantly monogamous. Differences between the sexes and the extent to which helpers truly help also differs among species. We discuss how these differences are correlated with and affect patterns of aging.

D16 Victoria J West : Exploring neophobia and group dynamics in juvenile jackdaws (*Corvus monedula*)

Both neophobia, an aversive response to novelty, and group dynamics are linked with survival and breeding success. However, it is not known how these factors interact. We conducted Social Network Analysis (SNA) over two phases (Early: Nov-Dec 2015, and Late: Jan-Feb 2016) in two groups of juvenile jackdaws (N=16). We tested neophobia between phases by measuring response latency to enter a new enclosure. In the early phase, social network position (eigenvector centrality, EVC) was not correlated with neophobia. In the late phase, a positive correlation between neophobia and EVC was found for one group, and the opposite but non-significant relationship was found in the other. Dominance scores and EVC were correlated across phases suggesting that juvenile jackdaws' interactions with others are consistent across time, and further that these interactions have a lasting effect on group structure. Results also suggest that neophobia may shape these networks further.

D14 William Jones : Avoiding Malaria: The importance of nesting site for *Ficedula* Flycatchers

Nest site choice can have major impacts on both parent and offspring survival and fitness. One of the lesser studied aspects of this is the importance of parasitism in this choice. Using a population of Collared and Pied Flycatchers from Öland, Sweden I aim to investigate the importance of microhabitat on the number and diversity of malaria vectors attracted to nests. Over 80% of

infected individuals have European strains of malaria and females are more likely to carry infections. I will present preliminary data suggesting that nest site can be crucial for females and offspring to help avoid malaria and that abundances of vectors can widely vary across short distances.

B12 Yanina Poblete : Compatibility in animal personality and parental care in *Aphrastura spinicauda*

The variation in parental effort among individuals of monogamous species, might not only depend on the intrinsic phenotypic differences between them, but also how its features relate to its partner. This phenomenon, called compatibility, is an emergent property resulting from the interaction between the traits of both members of a breeding pair. Personality as an indicator of compatibility has been poorly studied. We assessed the compatibility on personality and on parental care in 40 pairs the rayadito (*Aphrastura spinicauda*), in a population located in Navarino island, southern Chile. Personality was assessed by using different tests and under different contexts. Parental care was quantified by estimating nest attendance rates (feeding and fecal-sac removal). Evenness index (J) were used to describe compatibility. We found a positive and significant relationship between personality and parental care compatibilities, suggesting that personality traits could be subjected to sexual selection.

C39 Yasuhiro Nakashima : Spiteful Sexual Cannibalism in a Simultaneously Hermaphroditic Nudibranch

Sexual cannibalism has been studied in detail in gonochoristic animals such as orb-weaving spiders and mantises, whereas it has not yet studied precisely but simple descriptions in simultaneous hermaphrodites. We observed behavior patterns in *Gymnodoris citrina*, a simultaneously hermaphroditic nudibranch. Immature juveniles rarely showed aggressive behavior toward conspecifics, rather they exhibited escape behavior at most of encounters. The rate of aggressive behavior at encounter gradually increased with growth. Whenever full-grown adults contacted with mature conspecifics, they showed mating and cannibalistic behavior. Copulation was achieved during cannibalism using huge copulatory apparatus. This nudibranch can hardly multiply the amount of egg mass, because it devoured its partner with eggs. Further, the fertilization rate of egg masses was extremely low. This means cannibalism in this nudibranch does not contribute to raise reproductive success of both preyed and predated sides. Several evidences suggest that this is a new example of spiteful behavior.

C28 Yolitz Saldivar Lemus : Sexual conflict and genomic imprinting in a viviparous matrotrophic fish

Sexual conflict is expected to arise when the genetic interests of the sexes differ. Conflict related to the antagonistic effects of genes controlling maternal allocation of resources during embryonic development has been demonstrated in therian mammals, but has not been found in monotremes, birds, or viviparous fish. Among fishes, the degree of matrotrophic development varies greatly among species, as does the strength of sexual conflict over maternal allocation. We used *Girardinichthys multiradiatus* (Goodeinae), a matrotrophic fish, to test whether a gene involved in embryonic growth (insulin-like growth factor 2 -*igf2*-) is parentally imprinted in the Goodeinae as a result of sexually antagonistic coevolution. Our results suggest that *igf2* is imprinted in this family, with only the paternal allele being translated in developing embryos. This suggests that previous evidence showing a paternal effect on the size of newborn fish, may be related to males indirectly affecting maternal allocation.

A10 Yue-Hua Sun : Nest-site Choice: A Pathway Linking Personality and Reproductive Success

Animal personality has been linked to individual fitness. However, the exact path by which personality translates into fitness is rarely identified. We collected the personality, nest-site choice, and reproductive success data in a population of the Chestnut Thrush (*Turdus rubrocanus*) at the Lianhuashan Natural Reserve in 2013 and 2014. Activity and boldness were significantly repeatable across time. Using path analysis, we found that human disturbance and nest site with respect to nest density might both mediate the link between personality and reproductive success. Bolder females might choose nest sites with lower nest density, while the low nest density in turn being responsible for a positive effect on nestling number, and having negative effect on nestling mass. Bolder females might also prefer nest sites farther from settlements, resulting in a negative effect on nestling mass. Our findings provide exact mechanistic pathways by which boldness might be translated into reproductive success.

C3 Z. Valentina Zizzari : Mating without meeting

Several species have adopted a mating system where males deposit their sperm in the environment for females to pick up, without any contact between the sexes. In the soil arthropod *Orchesella cincta* males deposit their sperm (spermatophores) on the substrate, irrespective of female presence. Yet, *Orchesella* females gain benefit by choosing among spermatophores. Moreover, male-male competition affect spermatophore attractiveness. Olfactory cues are known to play an important role in animal sexual communication. However, whether olfactory cues alone can lead to spermatophore localization and assessment in species performing indirect sperm transfer has never been tested. By integrating chemical and behavioural research tools we investigated the sexual communication in *Orchesella*. Spermatophore extracts were subjected to GC/MS analyses and the pheromone components in the extracts were tested for female attraction in olfactometer bioassays. Our results indicate that in species performing indirect sperm transfer males produce pheromone-emitting spermatophores that attract females.

Session 2 – 18:00 Monday 1st August, Marquee & The Sanctuary

B33 Aaron Bartholomew : Habitat complexity affects darkling beetle abundance, species richness and size.

We deployed artificial vegetation with 4 different interstructural space widths (complexities): 6, 10, 14 and 27 mm. At the high levels of habitat complexity used in this study, the main effect of increasing complexity was excluding beetles from higher complexity treatments, particularly larger beetle species. The 6 mm (highest complexity) treatment had significantly lower abundance than the other three treatments. The treatments also had significantly different beetle widths (sizes), and the 27 mm (lowest complexity) treatment appeared to have slightly wider beetles than the other three treatments. Increasing complexity appeared to lead to decreasing beetle widths. 9 beetle species were relatively rare in, or absent from, the higher complexity treatments, including 5 of the 6 largest species. 2 rare, small beetle species were only found in higher complexity treatments. There were no apparent differences in beetle species richness between treatments, due to these conflicting results.

C28 Adrian Baños-Villalba : Grasshoppers colonising novel habitats increase crypsis by individually selecting microhabitat

Behaviour can play a key role in adaptation, especially in novel environments. In this study we demonstrate how microhabitat selection interacts with body colouration in increasing crypsis in ground-perching grasshoppers that colonised street pavements as novel habitats. Grasshoppers perched on the line that arises where two tiles meet more than expected by chance. By performing a virtual predation experiment we confirmed that this behaviour decreases detection. Surprisingly, grasshoppers with a poorer cryptic colouration made greater use of this behavior. These results show that individuals are aware of their level of crypsis, and accordingly change between a back-ground colouration strategy or object-resemblance strategy.

B50 Aida Nitsch : Sibling competition, dispersal and fitness outcomes in humans.

Determining the consequences of dispersal and its interplay with sibling interactions is pivotal for understanding the evolution of family living. First, dispersal could be a strategy to avoid sibling competition, thereby increasing access to competing resources. However, dispersal could also provide indirect benefits through a decrease of the intra-familial competition in the natal territory. These two explanations imply different fitness outcomes between philopatric and dispersing siblings. Moreover, the intensity of intra-familial competition is likely to influence the outcomes of each strategy and studies considering it are lacking. Using a demographic dataset on humans from preindustrial Finland (n=10,000), we investigated the fitness consequences of dispersal on lifetime reproductive success according to sex-specific birth rank. Contrary to our predictions, the negative effect of same-sex elder siblings on reproductive success was similar between philopatric and dispersing individuals for both sexes.

B14 Aleksandra Jakubowska : Soft song during agonistic and predator-prey interactions

The soft (low-amplitude) song in birds is a poorly understood acoustic communication phenomena. We present results from a project design to test all working hypotheses on soft song functionality in the ortolan bunting.

The first experiment was designed to test hypothesis that males use soft song during territorial intrusions to avoid being predated. We presented or did not a predator model and then we simulated rival intrusion. We found no significant relationship between predator presence and amplitude of males vocal response. In the second experiment we played back loud or soft songs of a non-neighbour male. We found that loud songs evoked stronger response. But males used soft songs like an acoustic tool for verifying if the potential rival is close. These results suggest different function of soft song than in any hypotheses presented earlier. (Financial support: National Science Center, Poland, grant no. 2013/09/B/NZ8/03275).

C20 Alex G. Cones : Plasticity in embryonic heart rates in cooperative chestnut-crowned babbler

Developmental rates are now known to have defining phenotypic consequences in adulthood, leading to a need for a greater understanding of the factors affecting such rates. While measuring such rates in neonates is straight-forward, we have a relatively poor understanding of the factors affecting developmental rates pre-birth. Here we investigate the factors affecting heart rate, a known associate of developmental rates, in artificially-incubated eggs of the chestnut-crowned babbler (*Pomatostomus ruficeps*), a 50g avian cooperative breeder from Australia. As expected, heart rates were profoundly influenced by egg-shell temperature, and to a lesser extent embryo age. However, such effects were also modified by egg volume and laying order, suggesting maternal effects have a significant influence on embryo metabolic rates. Further, we found significant temperature-mediated plasticity on heart rates, eggs laid in large groups changing heart rate more significantly than those laid in small groups.

B53 Alex Schnell : Lateral battles: cuttlefish displays include multiple messages & back-up signals

Animals engaged in agonistic contests typically perform displays involving a lateral aspect of the body to advertise some feature of their competitive ability. Lateral displays are often comprised of multiple signals that may be used to confer advantage in agonistic contests. Several theories have been proposed to explain the occurrence of multiple signals in agonistic displays, including the multiple messages hypothesis (i.e. multiple signals convey different information), back-up signal hypothesis (i.e. multiple signals are used to enhance the accuracy of the information) and the unreliable signal hypothesis (i.e. individual signals convey unreliable information). Male giant Australian cuttlefish, *Sepia apama*, produce spectacular lateral displays during contests. These displays involve multiple signals including turning (head-to-head, head-to-tail), extension of the dimorphic arm, and chromatic signals in the form of dark and light bands (i.e. passing cloud) and dark eye rings. We examined agonistic contests in the field between male cuttlefish to determine which features of the lateral display influenced contest escalation, duration and success. We tested the effects of frequency of turning, dimorphic arm extension and mantle length. We also measured the effects of chromatic aspects of the passing cloud (i.e. number of bands and contrast between the bands) and dark eye rings. We found that the frequency of turning and mantle size predicted contest duration. Chromatic aspects of the passing cloud signal and dark eye rings were positively associated with contest escalation. The extension of the dimorphic arm and the mantle size were positively associated with contest success. Results show that multiple signals in cuttlefish lateral displays simultaneously convey independent sources of information about competitive ability and enhance the accuracy of the information being conveyed. These findings support both the multiple messages and back-up signals hypotheses and highlights how multiple agonistic signals can evolve through a combination of selective forces.

A4 Alexander Grendelmeier : Rodent-mediated numerical response of mammalian carnivores affects passerine reproduction

Varying behavior of predators in relation to fluctuating primary prey can affect secondary prey such as birds, driving their population dynamics and fitness. During six years we monitored rodents, mammalian carnivores and wood warbler nests in northern Switzerland, to test whether rodents influence wood warbler reproduction directly via predation or indirectly via mammalian carnivores, which incidentally prey on wood warbler nests (numerical response) or switch from other prey to wood warbler nests (behavioral response). In rodent outbreak years, wood warbler daily nest survival rate was lower and abundance as well as the proportion of nests predated by mammalian carnivores was higher than in rodent crash years. Mammalian carnivores but not rodents were important nest predators, confirming a rodent-mediated numerical response of mammalian carnivores, which incidentally prey on wood warbler nests. We provide insight on how predators react to a varying food source and how incidental prey is affected.

C26 Alice Exnerova : Chemical aposematism: Do aldehydes take a part?

Effect of chemical warning signals on behaviour of predators is well documented, but the only thoroughly studied chemicals are pyrazines. Being highly volatile, aldehydes are another candidates for chemical warning signalling. They are produced by several insect taxa, particularly Heteroptera, in which they form part of defensive secretion. We used one aposematic and one cryptic firebug species (*Pyrrhocoris*) to test effect of aldehydes (2-hexenal, 2-octenal, 2-decenal) and their interaction with warning coloration on innate wariness, avoidance learning and memory in juvenile great tits (*Parus major*). The aldehydes increased birds' initial wariness, but only when paired with aposematic coloration. The birds handled prey more carefully when presented with aldehydes, which resulted in lower prey mortality; this effect was independent of coloration. Aldehydes affected neither rate of

avoidance learning nor prey memorability. Aldehydes thus increase birds' initial wariness, but their effect is stronger in combination with visual warning signals.

B36 Alice Trevail : Does environmental predictability drive individual behavioural-consistency?

Consistent individual differences in behaviour have been comprehensively reported across a wide range of taxa, and have implications for ecological processes, population dynamics and evolution potential. The degree of individual repeatability differs between populations and species, however the underlying mechanisms of such variation are poorly understood. Here, we examine the importance of environmental predictability, indicative of resource availability, in shaping foraging consistency in a European seabird. By comparing the behaviour of individuals from multiple colonies governed by different oceanographic regimes, we will investigate whether the stability of the environment drives behaviour among individuals. This study is exploring whether resource availability may vary the optimal foraging strategy within and between populations, providing a mechanism through which different levels of consistency may emerge. Our work will increase our understanding of the origins of individual behaviour with potential consequences in a changing environment.

C2 Alison Greggor : Rearing environment not neophobia predicts developmental stress in wild jackdaws

Many species show individual variation in neophobia and stress hormones, but the causes and consequences of this variation in the wild are unclear. Such variation could impact total offspring production and offspring quality. Being highly neophobic, wild jackdaws (*Corvus monedula*) are an excellent species for exploring if parental neophobia impacts nest success, the rearing environment and stress hormones of developing offspring. Despite being consistent across the breeding season, parental neophobia did not predict nest success, provisioning rates or offspring corticosterone (CORT) levels. Parents with lower provisioning rates fledged fewer chicks, chicks from larger broods had elevated baseline CORT levels, and chicks with later hatching dates showed higher peak CORT levels. Therefore, despite its suggested importance for survival, neophobia did not impact chicks' development. Instead, sibling competition and poor parental care contributed to natural variation in stress responses that could explain the development and maintenance of neophobic variation within the population.

D12 Aliya El Nagar : Visual perception of depth in cuttlefish

Do cuttlefish visually perceive three-dimensional objects, and what camouflage patterns do they respond with? Do they use similar monocular cues as humans to perceive depth?

Shadows and shading are known to be some of many three-dimensional visual cues. The dynamic camouflage of cuttlefish is visually driven and can be used to study what they are perceiving. Here I test their visual perception by placing them on different backgrounds with varying heights of three-dimensional objects, each with and without shadows, and also on two-dimensional background replicates. I then photograph and analyse the camouflage patterns.

Cuttlefish were found to distinctly perceived three-dimensionality from two-dimensional backgrounds and reproduced appropriate shading in their own camouflage in response.

B28 Allert I. Bijleveld : Understanding spatial distributions: predators trade-off prey quantity with quality

The 'functional response' couples a predator's intake rate to prey density. Intake rate is generally

thought to increase asymptotically with prey density, which predicts the highest predator densities at the highest prey densities. We measured density and quality of bivalve prey (*Cerastoderma edule*) across 50 km² of mudflat, and simultaneously tracked their avian predators (*Calidris canutus*). Because of negative density-dependence in the individual quality of cockles, the predicted energy intake rates of Red Knots declined at high prey densities. Resource-selection modelling revealed that Red Knots indeed selected areas of intermediate cockle densities where energy intake rates were maximised given their phenotype-specific digestive constraints (as indicated by gizzard mass). Because negative density-dependence is common, we suggest that predators commonly maximise their energy intake rates at intermediate prey densities. Prey density alone may thus poorly predict intake rates, carrying capacity and spatial distributions of predators.

A1 Amaël Borzée : Recent population dynamics and behavioural performances in Korean Hylids

A species with a recently contracted population on a narrow distribution range may be less fit in behavioural performances when compared with a widespread taxa. Field observations and laboratory experiments suggests that the widespread *Hyla japonica* outcompetes the endangered *H. suweonensis*. In this study, we compared physiological capacity, exploratory behaviour and response delay between these two sympatric species. Despite being smaller in size, *H. suweonensis* had significantly larger locomotor muscle mass and swam faster than *H. japonica*. In behavioural assays, *H. suweonensis* had longer response delays, lower endurance and was less exploratory than *H. japonica*. These results suggest shyness in *H. suweonensis*. Although there is no causal link between recent population dynamics and behavioural performance yet, outcompetition by the widespread species may result in shyness in the species with the rapid population decline. This in turn may accelerate the decline of the species with the contracted population.

B37 Andrea Soriano-Redondo : Predicting cranes distribution using flexible point process models

Predicting the dynamics of a population into the future, especially with regard to its spatial distribution is a fundamental problem in ecology. Current methods require a high degree of knowledge of the populations, such as survival, productivity and dispersal; however, in many cases obtaining this information is difficult or not possible. In this study we use breeding locations of Eurasian Cranes in the UK to predict population trends and colonization rates using spatio-temporal point process models. Cranes became extinct in the UK 400 years ago, and in the early 80s the first pair re-established, since then the population has steadily increased to 22 breeding pairs. Our results indicate that the population will continue to increase in the future and that cranes will recolonize adjacent wetlands. Our study suggests that point process models provide versatile methodology for the prediction of colonization rates in the absence of sufficient biological information.

C21 Anne E. Winters : Marine butterflies: a putative mimicry ring in nudibranch molluscs

Nudibranchs can be considered 'butterflies of the sea' in terms of their conspicuous colourful displays and sequestered chemical defences. Here we investigate a putative mimicry ring through objective analysis of colour pattern convergence in 11 co-occurring species. We examine spectral reflectance and pattern geometry, assess shared ancestry through phylogenetic analysis, identify and quantify defensive metabolites, and measure defences using palatability and toxicity assays. We show that these species display similar visual characteristics (in terms of colour and pattern) compared to other closely related species. We also show that defensive metabolites differ among these species, and that these compounds vary in the level of defence they provide. We propose this nudibranch group as an example of a quasi-batesian mimicry ring. This comprehensive study is the first quantitative analysis of nudibranch defensive mimicry, and sheds light on mechanisms that drive the evolution of colour patterns in these colourful marine molluscs.

A27 Annie Murray : Leaders and Followers in Manta Ray (*Manta Alfredi*) foraging groups

Within groups, certain individuals can emerge as leaders with a stronger influence on decision making, whereas others become followers. Here we investigated factors determining the propensity of Mantas to become leaders or followers. We filmed these large filter-feeding elasmobranchs as they fed in large aggregations in areas of high plankton abundance. Within aggregations, individuals fed either solo or in groups, forming chains with a clear leader and on average one follower. Our data showed that age had no effect on leadership or grouping behaviour, however, females were significantly more likely to be leaders than males in times of low food availability and high competition. As females are generally larger than males, our results indicate a benefit to them adopting the leadership role such as increased plankton intake. This long term study of an unfished population of Mantas resident in the Maldives provides unique opportunities to test hypotheses concerning sociality.

A28 Aparajitha Ramesh : Foraging division of labour in the Asian Honeybee, *Apis cerana*

Division of labour amongst the foraging workforce has been extensively studied to understand task allocation in eusocial insects. While specialisation can improve foraging efficiency in some species, specialists and generalists have similar foraging efficiencies in others. Studies on foraging task partitioning in *Apis mellifera* suggest that most individuals specialise on either pollen or nectar. We examine pollen and nectar foraging along the specialisation-generalisation axis in the Asian honeybee *Apis cerana* in southern India. Naive workers were monitored over their lifetimes for degree and persistence of foraging specialisation. Preliminary results suggest that pollen foragers often switched to nectar over their lifetime, while the reverse was rare. Foragers did not collect both resources during a single trip and switching between pollen and nectar within a day was rare. We discuss these findings in the context of what is known in temperate honeybees.

D36 Arian Kolahi Sohrabi : Boldness and memory in the field cricket, *Gryllus integer*.

Although many studies on animal personality have focused on boldness and its correlations with other behavioral traits, virtually none have examined the possible correlation between boldness and memory. Here, we used the field cricket *Gryllus integer* to look for such a correlation. We hypothesized that bolder animals might have keener memories to cope with their presumed added exploration of the environment. We measured boldness using previously established methods and assessed the cricket's relocation capability using a circular arena with one small, circular surface that was cool and the rest of which was heated to an aversive temperature. The memory of the crickets was measured by how fast, in each successive trial, they located the cool spot. The results of this study can shed light on the relationships between memory and personality traits in insects.

D13 Ariana Victoria Weldon : Flossing Behaviour of a *Hamadryas* Baboon: A First Report

Flossing behaviour is the simple process of cleaning between one's teeth. In primates this can involve the use of individual fingers or external tools, such as hair, from either conspecifics or humans, or toothpicks, from either sticks or twigs. To our knowledge, flossing behaviour among primates has not been reported outside of macaques or capuchin monkeys. Here, we present observations of a single adult male *Hamadryas* baboon (*Papio Hamadryas*) plucking his hair and using it as a tool to floss between his teeth. Using a Generalised Linear Model, we explore the factors that may have allowed for his innovative behaviour to develop, such as general activity behaviours or more specifically, the oral, tactile or visual interactions with himself, others and enrichment items.

D3 Asaf Moran : Use increases arbitrary preference: a test of alternative learning models

Facing two options offering identical payoffs and variances, animals are not expected to prefer one over the other. Yet, experiments with house sparrows showed that a significant preference is developed in such cases by about half of the birds. While the emergence of such arbitrary preference can be attributed to particular chance events, its persistency is neither consistent with expected utility theory nor can it be explained by the Linear-Operator or Rescorla-Wagner learning rules. However, arbitrary preferences may be reinforced by other learning rules in which the frequency of use can influence the attractiveness of an option. An experimental test of this possibility showed that sparrows can indeed develop a significant preference for one of two identical options given that this option is provided to them more frequently during training. The adaptive value of this mechanism may be related to relying on large samples, safe habits, or specialization.

C22 Attila Hettyey : Induced defences and their fitness-effects in Bufo bufo tadpoles

Knowing costs and benefits of expressing predator-induced phenotypes is important for understanding inducible defences. We raised Bufo bufo tadpoles in the presence or absence of four types of caged predators, and evaluated survival, behaviour, morphology and development of tadpoles. We also conducted bioassays exposing predator-induced and predator-naive tadpoles to free-swimming predators. Finally, we kept metamorphosed froglets in seminatural outdoor enclosures until winter, and repeatedly assessed weight gain and survival. Tadpoles responded only weakly to the presence of predators: survival was unaffected, but age and mass at metamorphosis were somewhat reduced. Induced tadpoles had higher survival with free-ranging dragonfly larvae but experienced higher mortality with fish predators. Survival and growth of metamorphosed individuals remained unaffected by predator presence during the larval stage. Thus, weak phenotypic responses of Bufo tadpoles appeared to have low costs and benefits, and toad tadpoles may instead largely rely on defensive toxins.

A16 Aysel Kekillioğlu : Effects of Toxins on Developmental Stages of Forensic Insects

Drugs can have a variety of effects on development rates of arthropods. Coleopteran and Dipteran insects are the most commonly used insect in entomotoxicology and any altered stage in the development of these insects can often indicate toxins in the carrion on which the insects are feeding. Morphine and heroin were both believed to slow down the rate of fly development. However, closer examination of the effects of heroin on fly development has shown that it actually speeds up larval growth and then decreases the development rate of the pupal stage. This actually increases the overall timing of development from egg to adult. Some effects of toxins on these arthropods depend on the concentration of the toxin while others simply depend on its presence.

Key words: Entomotoxicology, Insect, Drugs, Development, Forensic sciences

B40 Baptiste Schmid : Quantifying the coincidence in aerial abundance of birds and insects

Radar has been used for monitoring aerial animal migration since more than 60 years. Flight behaviour is commonly investigated using tracking radar that follows single targets. This however does not allow a proper quantification of migration, as retrieved from static beam radar systems. To quantitatively monitor flight behaviours, the BirdScan-MR1 radar system uses a slight nutation of the beam to simultaneously track multiple targets. The temporal variations of the echo intensity (echo signature) further enable to classify each target as insect or as one of the bird subgroups. BirdScan-MR1 thus monitors, in real-time, the temporal patterns of bird migration, the height distributions, direction and speed. In addition, BirdScan-MR1 may estimate the aerial density of insects within the lowest few hundred meters. The quantitative analyses of migratory flight behaviour allow to investigate the

response of migrants to environmental conditions and to open new perspectives in aerial ecology.

D35 Bednarz Paula Antonina : Exploration - a measure of personality in the yellow-necked mouse

Individuals of many species exhibit consistent differences in behavior called “animal personalities”. Studying this phenomenon requires standardized, repeatable field tests of behavioral traits. We examined whether exploration in neutral arena can be used as a personality measure in free-living yellow-necked mice (*Apodemus flavicollis*). The exploration tests lasted 2 minutes and consisted of measuring the number of times a test subject crossed a 4.5 cm high partition that divided the test box (40 x 36 x 50 cm) into four equal parts. We found high intraindividual repeatability of test results (adjusted repeatability 0.52, 95% CI: 0.34 – 0.66), no difference between male and female individuals, and a strong tendency for heavier mice to obtain a higher exploration score. In conclusion, exploration in neutral arena can serve as a personality index in yellow-necked mice.

D34 Bert Thys : Personality and behavioural syndromes across seasons and years in starlings

Insights into how personality traits and behavioural syndromes vary over time and context are crucial for adequately estimating their developmental, evolutionary and ecological significance. We repeatedly quantified novel environment exploration and different aspects of the behavioural response towards a female conspecific (sociability traits) in captive male starlings (*Sturnus vulgaris*) across seasons and years. (Co-) variance-partitioning revealed moderate repeatabilities for all traits across seasons and years (range: 0.25-0.41), however, no significant among- (or within-) individual correlations between them. Our results indicate that exploration and sociability traits are context-general and relatively stable personality traits, but do not interlink into behavioural syndromes. This strongly suggests the independent evolutionary potential of these traits under selection, hence not constraining each other’s evolutionary trajectories. More informed predictions about ecological and evolutionary implications await cross-validation with results from the wild and studies addressing the relation with life-time fitness variation.

B48 Bharat Parthasarathy : Inter-individual differences and factors shaping dispersal in social spiders

Social spiders have reduced dispersal propensity, inbreed with natal kins and are considered to be evolutionary dead-ends. Not much is known about the differences between pre-mating and post-mating dispersal, and what inter-individual differences guide dispersal behaviour. In this study, we examine inter-individual differences guiding pre-mating and post-mating dispersal behaviour in the Indian social spider *Stegodyphus sarasinorum* Karsch (ERESIDEAE). Pre-mating dispersal is movement of groups of individuals whereas post-mating dispersal is movement of a single mated female. Through experimental colonies subjected to long term differential food treatment, we show that individuals with lower body condition are more likely to undergo pre-mating dispersal whereas post-mating dispersal is independent of body condition. We also show that more spiders undergo pre-mating dispersal with increasing nutritional availability and population density whereas post-mating solitary dispersal is independent of these two variables.

A9 Carin Magnhagen : Foraging fish are affected by motorboat noise – a field experiment

The negative impacts of anthropogenic noise on marine animals are currently receiving an increasing attention. In order to study the effect of motorboat noise on foraging behaviour in fish, we used two species with different hearing abilities in field enclosures. Eurasian perch and roach are common in the Bothnian sea where the study took place. The roach has a more well-developed sense of hearing

than the perch. Groups of fish were fed twice a day, over time periods of thirty minutes, with and without the disturbance of an outboard motor. The trials were repeated for five days. Roach responded to noise exposure with a lower food attack rate and longer time in the vegetation compared to the controls without noise. Perch also showed a lower foraging activity during exposure but gradually increased feeding and time spent in the open area, both with and without noise, indicating habituation.

D5 Chretien Morgane : Emotional value of stimuli alters visual lateralization of *Cercopithecus neglectus*

Hemispheric specialization of emotion processing is explained by two theories. The right hemisphere theory indicates that all emotions are processed by the right hemisphere. The valence theory states that negative and positive emotions are respectively processed by the right and the left hemisphere. Our study examined eye use preference in nine de Brazza's monkeys (*Cercopithecus neglectus*) when they need to look at positive and negative visual stimuli through a hole. The use of one eye indicates that information is processed by the contralateral hemisphere. The emotional value of stimuli appeared to alter visual laterality. Subjects with a left eye bias showed a higher degree of right hemisphere's lateralization for negative stimuli. Some individuals even switched to the left hemisphere for positive stimuli. Subjects with a right eye bias showed a higher degree of left hemisphere's lateralization for positive stimuli. Our results seem consistent with the valence theory.

B51 Christine E Beardsworth : Using accelerometers to produce activity budgets in the pheasant

For a long time, manual observations have been the primary data collection method for monitoring animal behaviour. However this can be time consuming is often unable to acquire high resolutions of behavioural activity. As a consequence, monitoring and measuring behaviour through remote sensing technology has become more popular in recent years. Accelerometers in particular are proving a valuable technological advancement and have been used to detect behaviours in a wide range of species. In this study, we use tri-axial accelerometers to obtain high frequency acceleration data from captive individuals of the common pheasant (*Phasianus colchicus*). We used video footage to classify and ground truth the raw acceleration data before investigating the efficacy of a primitive machine learning algorithm, K-nearest neighbour, in correctly predicting behaviours and thus, activity budgets.

B1 Christine Evans : Fairywrens don't pair for song complexity: implications for offspring

Our knowledge of birdsong as a sexually-selected trait primarily stems from systems where only males sing, and males with complex songs are more successful at mate attraction and territorial defence. Female song has recently been discovered to be common and widespread in songbirds, yet currently little is known about its implications for mate choice and song learning. Males and females of the cooperatively-breeding superb fairy-wren (*Malurus cyaneus*) produce complex solo chatter song year-round for territorial defence. We investigated assortative pairing for song characteristics in a wild population, but found no evidence of pairing for element types or song complexity. These results suggest that male and female song complexity and the number of element types shared and unshared by social pairs are not driving factors for social mate choice in this species, but are important for the development of complex song in male and female offspring.

D14 Christine Scholtyssek : How do birds predict the value of novel objects?

Animals can effortlessly classify diverse objects by some shared value. Objects vary along multiple dimensions, (e.g. shape, size, and colour), some of which are relevant to decisions about whether a novel object belongs to say, a palatable or an unpalatable class, while others are irrelevant. We train young poultry chicks to discriminate rewarded from unrewarded stimuli, where the two classes are

specified by their position in a two dimensional colour space, but where only one dimension is relevant for classification. We then test how this training generalises to novel colours. This allows us to characterise the form of learning, and generalisation in an animal model where we have great control over their previous perceptual experience. The pattern of results obtained allows us to distinguish between a number of classical mathematical models of learning and generalisation in humans and non-human animals.

D29 Daiqin Li : Multimodal signalling in an ornamented jumping spider

Animal communication involves the use of multiple sensory modalities, with each either encoding the same information or serving different functions. Here we investigated multimodal signals function in the visual and seismic modalities of a jumping spider (*Cosmophasis umbratica*). Ultraviolet colouration plays an important role in courtship displays, but little is known about the role of seismic signals. We provided the first description of seismic signals produced by courting males. Using a fully crossed 2×2 mating design, with UV presence/absence and seismic signal present/absent, we investigated the relative importance of UV and seismic signals in mating success. Multimodal signalling environments resulted in the highest mating success, while unimodal environments had lower, and similar, mating success, suggesting that UV and seismic signals may act as efficacy backups. The presence of seismic signals resulted in significantly greater mating success, but the presence of UV signals did not, implying seismic dominance.

D15 Daniela S. Rivera : Andrographolide (ANDRO) restores cognitive performance in aged *Octodon degus*

The social *Octodon degus* is the only wild-type South American rodent to develop Alzheimer like pathology with age. We evaluate the effect of a natural drug (ANDRO) to prevent the cognitive decline in aged degus (56-month-old). We administrated ANDRO during 3 months. We have 2 control groups (young degus:12-month-old and aged degus:56-month-old) that were administrated with saline. We evaluated Cognitive Performance (CP) through behavioral tests. Additionally we performed functional and biochemical analyses to establish the mechanisms underlying CP associated with age. We found a decline in CP in aged degus when compared with young ones, whereas ANDRO treatment was able to recover the CP. Interestingly, the recovery in CP was related with protection in the synaptic functions and reduction of main hallmarks of Alzheimer Disease (AD). Our results suggest that ANDRO could be used to prevent the progression of AD.

C18 Deborah Dawson : Supporting UK researchers in molecular studies of our natural environment

The NERC Biomolecular Analysis Facility (NBAF) provides facilities and training to support UK researchers in genetic studies of the natural world, such as behavioural ecology and population structure. Researchers do not need to be NERC-funded to apply for support.

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C33 Denise Dalbosco Dell'Aglio : Could herbivore pressure drive diversification of plant leaf shape?

Visual cues are important for butterflies to find flowers and host plants, and diversity of leaf shape in *Passiflora* vines could be a result of negative frequency dependent selection driven by their herbivores. We tested the hypothesis that *Heliconius* use leaf shape as a cue to approach a host plant. First, we tested for ability to recognise shapes using food reward showing innate preference for flowers with three and five petals. However, when trained, visits increased to two petals flower. Next, we investigated shape learning in oviposition by conditioning females on artificial leaf shapes: their host plant, biflora, and a non-biflora leaf. Butterflies experienced with non-biflora leaves approached more non-biflora shape than biflora. *Heliconius* butterflies used shape as a cue for feeding and oviposition and could learn shape for flowers and leaves. This demonstrates *Heliconius* potential to drive selection on the leaf shape of their host plants.

D42 Doriane Muller : Adaptive value of learning under sexual selection in changing environment

The role of learning in mate choice has not yet been assessed in ecologically-relevant environments induced by climate change. Here we test whether learning of mate preference may lead to unsuitable mate choice and risk of population extinction. Mate choice in the butterfly *Bicyclus anynana* was shown to be modified by learning, namely by exposure during sexual maturation to males with distinct phenotypic traits. In nature, *B. anynana* displays seasonal polyphenism with alternated wet and dry seasonal forms adapted to tropical Africa. *B. anynana* development switches to wet or dry forms depending on late developmental temperature, and female fitness depends on mating with either forms. We hypothesized that:

Increasing unpredictability of climate during seasonal transitions may alter the proportions of seasonal forms;

Females learn mate preference based on polyphenic male secondary sexual traits;

Learning of female mate preference is based on the most abundant male phenotype in the environment.

A10 Dr.Sunil Prakash Kamble : 'Diurnal Behaviour of Zooplanktons in Panchaganga River Ecosystem India'

The Vertical distribution of the Zooplankton community showed a clear diurnal variation in water column of Panchaganga river near Ichalkaranji area M.S.India

The Zooplankton concentration was found to be higher at the surface layer during night hours with peak around the middle of the night and another peak was observed just before sunrise, followed by a rapid downfall after sunrise. Zooplankton can offset the loss of daytime foraging opportunity by moving up into the water column to feed at night, when predation by visual predators is greatly reduced and it attributes to light intensity which is responsible for vertical migration during the twenty four hour cycles.

C31 Dustin J. Penn : Male house mice regulate pheromone production according to social status

Male house mice (*Mus musculus*) produce pheromones that attract females influence their reproduction – but these compounds have been studied mainly in domesticated strains under artificial conditions. We investigated wild-derived mice living in large seminatural enclosures to test whether males regulate pheromone production according to their social status. We monitored the excretion of major urinary proteins (MUPs) using proteomic methods, and volatile pheromones using GC-MS. Dominant, territorial males produced higher concentrations of MUPs overall than subordinate males (and females), though not all MUPs were up-regulated. The intensity of 6-hydroxy-6-methyl-3heptanone (HMH) was elevated in dominant males, and only males produced 2,4-Di-tert-butyl phenol (SBT). Genetic paternity analyses showed that dominant males sired more offspring than subordinates. We are currently investigating how these sexually dimorphic and status-dependent

pheromones influence female preferences and male reproductive success.

A5 Eben Gering : Insights to feralisation derived from genomes and social media

Feral animals that escape cultivation experience radical shifts in social and natural selection, but their evolutionary responses are not well studied. Here, we test for evidence of adaptation in feral chickens (*Gallus gallus*). First, we tested for signatures of positive selection (selective sweeps) in feral *G. gallus* genomes. We found ~30 such sites, which span loci controlling sexual traits, behavior, and reproduction. Next, we used media uploaded to the Internet by tourists to quantify plumage, vocalizations, and demography. Certain traits (e.g. plumage coloration, timing of breeding) varied non-randomly in space and/or time, generating testable hypotheses concerning their evolutionary drivers. Our studies so far 1) confirm that feral animals continue to evolve after leaving us behind 2) support the hypothesis that social interactions (e.g. mate competition) are an important selection pressure, and 3) show how social media can illuminate evolutionary patterns within human-inhabited landscapes.

B5 Ebi Antony George : Variation and Regulation of Dance Activity in Individual Honeybee Foragers

The honeybee recruitment mechanism, the waggle dance, is unique amongst eusocial insects in that it contains both navigational information and motivational information linked to the food source. Individual variation in the motivational aspect of dance activity is not well studied. I looked at this variation by observing the dance activity groups of 8-12 foragers for 3-6 days. I found that the relative individual differences in dance activity is consistent (repeatability estimates ranged from 0.52-0.85). Individual dance activity is also affected by the group composition. The removal of more active dancers causes some of the others to increase their activity. I also looked at response thresholds as well as neuromodulator brain titers of these individuals, but neither of these correlate with their dance activity. Future experiments will focus on identifying the social interactions and molecular mechanisms that regulate dance activity in a foraging group.

D16 Elisa Frasnelli : Learning flights of bumblebee workers at feeder and nest sites.

Wasps and bees perform learning flights on leaving significant places, like their nest and feeding sites, to acquire information about the visual surroundings. Because *Bombus terrestris* nest in the ground and collect nectar from low plants, we compared the flights at the two goals when the visual surroundings of each goal were very similar. We recorded the learning flights of individual bees as they learnt both goals set 5m apart. Preliminary analysis revealed some structural similarities between flight manoeuvres at the two goals, but flights at the feeder were conspicuously shorter than those at the nest. Consistent with the extra time invested when leaving the nest, in unrewarded tests, bees were more persistent in searching for the nest than for the feeder. These differences may well be related to the permanence and uniqueness of a bee's nest compared with the more transient nature of flowers and their wider availability.

D17 Elizabeth A. Hoskins : Temperature, but not aggressiveness, influences learning rate in *Julidochromis ornatus*

Learning can be beneficial, but there is often variation in learning rate. Variation in personality may contribute to this. Carere & Locurto (2011) hypothesized that the speed at which proactive and reactive individuals learn is based on whether or not the task is novel; proactive individuals are expected to learn novel, but not non-novel, tasks more rapidly. We tested these predictions in *Julidochromis ornatus*. Fish used in this experiment had been acclimated to two different temperature treatments, and we used this variation opportunistically to also explore the role of

temperature on learning rate. Each fish was assayed for aggressiveness and performed a novel and non-novel learning task. We found no significant relationship between personality and the learning rate for either task. Fish in the high temperature treatment completed the non-novel learning task more quickly. We suggest that temperature influenced motivation to perform the food-related learning task.

B10 Elizabeth L. Bergen : Predictors of attack in a structured aggressive vocal display

Animals may reduce the costs of engaging in aggressive interactions by communicating information about aggressive motivation or ability. In acoustic displays of aggression, information may be encoded in the acoustic characteristics of produced sounds or in the order and timing in which sounds are produced. Male satin bowerbirds (*Ptilonorhynchus violaceus*) confront sexual competitors with a multimodal display in which the acoustic component is a structured song consisting of a series of various “warble-grunt” syllables and a terminal rattle, followed by physical attacks. We investigate whether the acoustic characteristics of warbled elements or the structure of warble-grunt songs better a) reflect contest escalation as represented by elapsed time from the start of mirror-elicited aggression and b) predict subsequent physical attacks (pecking) against the mirror. From analyses of three focal subjects, we suggest that aggressive information is more likely communicated through song structure and syntax than by acoustic characteristics.

D9 Emelie Jansson : Enrichment keeps chicks optimistic

Animal cognition can include biases, such as ‘cognitive judgement bias’, where positive overestimation of cues can describe optimism. We explore how environmental differences affect optimism in young fowl (*Gallus gallus* ssp.) and performed judgment bias tests before and after chicks were exposed to a battery of stressors. Chicks in enriched conditions showed higher resilience to stress by being more optimistic in the subsequent judgment bias test, compared to chicks in simple conditions. This suggests that environmental complexity early in life can buffer against negative responses to future stress, and that environmental conditions can influence optimism. In another experiment we explored how personality (i.e. consistent individual differences in behaviour) relates to variation in optimism. We observe that somewhat more nervous chicks were less optimistic. Taken together, these studies highlight factors explaining variation in optimism, with potential implications for studies on animal cognition, personality and welfare.

B15 Erick Greene : Encoding and decoding alarm calls in multispecies communication networks

Alarm calls about danger are used by conspecifics and heterospecifics in communication networks. We know little about which species participate in these networks, or how far and fast the information travels. We experimentally tested how alarm call communication networks operate in North American winter bird communities. To test how wild birds encode information about predators in their alarm calls, we presented robotic raptors to elicit high and low threat alarm calls. Each species responded, but they responded differently in call rate and call structure for different threat levels. To test how birds decode the alarm calls of others, we deployed microphone arrays to localize sounds. We played back high and low threat alarm calls and recorded acoustic responses. Our dynamic maps of alarm call communication networks show when and where species start alarm calling and how quickly birds communicate over large distances about a predator.

A34 Ethan Clotfelter : Parasite tolerance and resistance in nestling and adult tree swallows

Animals use tolerance and resistance mechanisms to defend themselves against parasites. The relative importance of these defenses varies across host life cycles. We examined tolerance and

resistance to hematophagous blowfly (*Protocalliphora sialia*) larvae in nestling and adult tree swallows (*Tachycineta bicolor*) by experimentally removing blowflies from some nests. Parasitized nestlings lost blood to blowflies, but were tolerant of parasitism in terms of body condition and fledging success. Nestling tolerance may have been facilitated by compensatory feeding behavior by their parents, who themselves declined in body condition in an age-dependent manner in parasitized nests. Adult tree swallows demonstrated more robust resistance against blowfly larvae, in the form of antibodies, than did nestlings. These findings suggest that nestlings invest more in tolerance than resistance, and that parental behavior may contribute to nestling tolerance.

B16 Eva Líznařová : Stridulation prevents cannibalism in araneophagous spiders

Acoustic signalling is widespread in arthropods, but evidence for its use in arachnids is limited. Sounds have several functions and can be used in interspecific and intraspecific communication. In our study we investigated the intraspecific role of stridulation in araneophagous *Palpimanus* spider. These spiders are specialised in hunting other spiders and all ontogenetic stages and both sexes use stridulation. We hypothesised that stridulation is used as acoustic signalling to avoid cannibalism. We investigated the presence of cannibalism between individuals of a variable body size and the use of stridulation during interactions. We found that cannibalism occurred only when the body size difference of the two opponents was more than 200%. Then we paired unmanipulated individuals with *Palpimanus* spiders whose stridulatory organs were impaired and found that impaired spiders suffered significantly higher cannibalism than the unmanipulated spiders. Our study reveals the importance of acoustic communication in conspecific recognition of araneophagous spiders.

B38 Felicie Dhellemmes : Does personality reflect space use in wild juvenile lemon sharks?

Animal personality is defined as consistent individual behaviour, and inter-individual differences suggest different personality types. Surprisingly, in marine vertebrates the widespread application of telemetry has rarely explored this framework to explain variations in individual movement. Here, we tested if personality scores, derived from open-field tests, can be used as a proxy to predict space use in wild juvenile lemon sharks (*Negaprion brevirostris*). Across two years, 29 individuals (Pre-caudal length = 52.5 ± 1.7 cm) were repeatedly tested in a novel open-field. Upon release they were subsequently tracked with internal acoustic transmitters using active and passive methods. Results reveal a significant relationship between home-range size (kernel utilization distribution 50% and 95%) and personality in an open-field (Repeatability=0.51). Additionally, observed distance from shore was correlated to personality. These results emphasize the importance of multidisciplinary approaches to movement ecology and behaviour research in marine predators.

C30 Finlay Stewart : Sexually dimorphic colour induction in a tetrachromatic butterfly

The butterfly *Papilio xuthus* has tetrachromatic colour vision. It presumably processes colour information via spectrally opponent channels, but how these are organised is unknown. We investigated this question by using a novel four-colour projection system to train animals to feed from a grey disk against a black (control) or coloured background. We then challenged them to select between targets of various tints, in order to determine which colour was induced by simultaneous colour contrast with the background during training. In the control condition, males were biased towards blue-violet tints, and females to purple (red + blue/violet). In females, a green background during training induced blue and vice versa, suggesting that green and blue form an opponent pair. In males however, both green and blue induced red. Thus, the sexes may have evolved different colour opponency systems to suit their differing ecological requirements (e.g. mate location versus oviposition).

B17 Francesca Dawson Pell : Context-dependent trade-offs between personal and social information

Animals use both personal and social information to lessen uncertainty about their environment, but these sources of information have different benefits and costs. Personal information comes from direct experience, therefore is highly relevant but potentially costly; by contrast, social information is acquired from other individuals, and so can be less costly but also less reliable. Consequently, there should be context-dependent trade-offs between the use of personal and social information, but this has received little experimental testing. We performed field experiments on Australian magpies (*Cracticus tibicen*) to examine the relative use of personal and social information. Specifically, we manipulated visual information while broadcasting noisy miner (*Manorina melanocephala*) alarm calls to examine the use of personal vigilance and heterospecific alarms in assessing risk. We predicted that magpies would respond more strongly to social information when personal information was limited, and discuss the evolutionary and ecological consequences of this behavioural flexibility.

A11 Gabriella Ljungström : Effects of selective fishing on behaviors and life-history traits

Effects of harvesting on morphological and life-history traits have been widely studied and documented in exploited fish stocks, however, harvest-induced changes in behavior have received less attention. In recent years, an increase in growth rate and decrease in length-at-age has been observed in Norwegian spring-spawning (NSS) herring, changes that are commonly associated with fisheries-induced evolution. As harvesting of NSS herring targets schools of fish, it is however also likely to be behavior selective. In this study we will use a bioenergetics model to investigate: 1) Whether fishing may drive the phenotypic changes observed in NSS herring, 2) The effects of behaviour-selective fishing on foraging behavior and hence natural mortality of these fish. We expect overall harvesting intensity to explain the observed phenotypic changes and that school-targeted fishing favors bold individuals with a higher foraging activity but also an increased predation risk.

D2 Georgina L Glaser : Are foraging rufous hummingbirds 'irrational'?

When making decisions and choosing options, animals can either be economically 'rational' (where preference is independent of available options) or 'irrational' (where preference depends on the options available). While humans are frequently irrational in their decision making, it is less clear if and when animals are. To determine whether rufous hummingbirds (*Selasphorus rufus*) make irrational decisions when foraging, we first quantified their sucrose concentration preference with arrays of six options spanning 5% to 55% sucrose. We found that hummingbird foraging preferences peaked at 45%. But when faced with a choice of only 45% and 55% sucrose options, males were indifferent. When offered a choice among 5%, 45%, and 55%, however, hummingbirds again preferred 45% over 55%. Hummingbird foraging preferences, then, depend on the options available: foraging hummingbirds are irrational.

C8 Georgopoulou Dimitra : From individual to collective behaviours: tracking motion at different scales

We attempt to track and understand motion patterns of collective behaviour at different spatio-temporal scales, and present data from two contrasting study systems: human osteosarcoma cells (U2OS) and stickleback fish (*Gasterosteus aculeatus*). The methodology used to study both systems includes time-lapse recordings, image processing techniques, and development of stochastic models. For the U2OS cells, we study inheritance patterns of endosomes loaded with fluorescent nanoparticles; we observe a highly asymmetric redistribution of the fluorescent dose per cell across mitosis, a mechanism by which tumour cells can collectively bypass the effects of targeted drugs and become pharmacologically resistant. For the fish, by tracking individual motion within shoals, and

relating it to individual differences in physiology and behaviour, we can explain emergent properties and collective dynamics. Overall, by adopting tools from complex systems theory, we can describe common aspects of collective behaviours emerging from local interactions, in vastly different biological systems.

B44 Germain Marion : Lower settlement probability following an experimental translocation: non-breeding as a cost of dispersal in a wild passerine bird population?

Dispersal is a key life history trait. Yet, the fitness consequences of dispersal remain equivocal. The absence of clear differences between dispersing and philopatric individuals may result from ignoring possible trade-offs among fitness components within breeding events and/or potential impact of mate characteristics on fitness output. Here, we examined these issues by analysing breeding strategies following dispersal in a wild passerine population. We compared breeding decisions reflecting the timing of breeding, the investment in eggs and egg care, hatching success, fledging success and recruitment but also parents' body mass between dispersing and philopatric individuals, accounting for the dispersal status of their mate. Dispersing and philopatric individuals differed in most of the breeding decisions considered. However, the dispersal status most often interacted with phenotypic traits, suggesting that the balance between dispersal costs and benefits is not fixed, but rather partly depends the individual's and its mate's phenotype.

B3 Giulia Bastianelli : Species replacement along geographical gradients: interspecific aggressiveness vs habitat segregation

In tropical mountains interspecific interactions are important determinants of range margins. In temperate mountains few studies scrutinized this topic. We investigate abiotic and biotic drivers of geographical replacement in two pairs of congeneric passerines (Anthus: Tree pipit/Water pipit; Emberiza: Yellowhammer /Ortolan bunting) in Cantabrian Mountains (Spain). First we tested for interspecific aggression towards the congeneric species in replacement areas. Then, using bird census data, we attributed cooccurrence patterns to species interactions and environmental responses by a joint species distribution model. We did not find evidences of interspecific aggression in any species pair. In Anthus pair, the negative species cooccurrence was driven by different environmental requirements but also by indirect interspecific competition. In Emberiza pair, species shared environmental requirements and did not appear to compete. Environment appears to play a more crucial role than direct biotic interactions; however other factor as indirect competition and dispersal barriers may constrain species ranges.

C14 gönül arslan : The Activity Pattern of Testudo graeca in Cappadocia Region, Anatolia

This study was carried out within 2012-2014 activity seasons of Mediterranean Tortoises (*Testudo graeca*) in Nevsehir, Cappadocia Region in Anatolia. There were two active and two inactive seasons during the annual cycle. The activity was terminated with hibernation November -March; and was lessen with aestivation May-September. The first mating period was in spring shortly after hibernation, and the second one was in autumn shortly before hibernation.

I recorded that the females still in hibernaculum were forced to copulate by active males and that just woke up females with mud remnant on their shells laid eggs after a few hours from mating in spring. Both early egg laying and/or autumn mating can be explained with the existence of sperm storage. Females lay one or two clutches between April and June.

In conclusion, the data described here extend our knowledge about *Testudo graeca* to a new area.

A35 Hanna Granroth-Wilding : Predicting disease impacts in natural populations under anthropogenic environmental variability

Parasites and disease are ubiquitous influences on the behaviour and fitness of their hosts, yet our understanding of how infection affects demographic processes in wild populations remains poorly parameterized. This prevents accurate predictions of how infection will contribute to regulating structured natural populations as environments become less predictable. Here, we present ongoing work quantifying how seasonal variation in the composition and size of populations of free-ranging wild three-spined stickleback (*Gasterosteus aculeatus*), sampled from paired sites representing naturally stable or fluctuating thermal profiles at three separate locations, is linked with prevalence of the parasitic cestode *Schistocephalus solidus*. In this natural experiment, systematic differences between sampling sites in temporal trends in parasite prevalence and population structure will allow us to infer how more variable temperatures affect infection intensity across all components of the population. We discuss the potential demographic consequences of these effects for wild populations experiencing increasingly changeable environments.

B18 Heidi M. Thomsen : Vocal cues and flock decisions in orange-fronted conures

During the non-breeding season, orange-fronted conures live in a fission-fusion social system, characterized by frequent changes in flock composition. During encounters between flocks, the conures exchange contact calls prior to decisions about flock fusion. The information available to both interactants and eavesdroppers, during these interactions, may thus be important in the choice-making process. Here we present the results of a playback experiment, in which orange-fronted conures are offered a choice between the follower and leader of a simulated vocal interaction. The experiment was conducted on wild flocks in Costa Rica and by using a four speaker design. The results showed, that orange-fronted conures are capable of extracting information about follower-leader roles of individuals by listening to a simulated vocal interaction and that they use this cue in their choice-making process when confronted with a choice of flock fusion.

C34 Hiromi Nagaya : Visual leaf selection in butterfly oviposition

Do *Papilio* butterflies select particular leaves in a Citrus tree they oviposit? We let *Papilio* lay eggs on a tree for 15 minutes and counted the number of eggs on each leaf. We found that butterflies preferentially laid eggs on particular leaves and this preference persisted across different individuals. Butterflies selected the leaves from a distance when approaching, indicating that they visually selected the leaves rather than olfactory. But we have found no significant differences in visual properties of leaves, such as the angle, curvature, roundness or reflectance spectra between “favored” and “unfavored” leaves. Leaf orientation, which alters polarization angle of light reflected from leaves, might be important for stable landing on the leaves in ovipositing. The polarization angle depends on the relative position of the viewer and objects. Thus, we have started to investigate in greater detail the relationship between flight trajectory and visual information.

C23 Hye-Kyoung Moon : Genetic profile of geographic populations in a habitat generalist bird

How species exploit diverse habitats is a long-lasting question in evolutionary biology. Species of habitat generalist may achieve this through genetic adaptation to local habitats or alternatively through behavioral plasticity without genetic modification. The former may predict some degree of genetic differentiation between populations occupying different habitats while the latter may be not. To test these alternative hypotheses, we investigate the genetic structure of a habitat generalist bird, the vinous-throated parrotbill, *Paradoxornis webbianus*. Specifically, we compared genetic profiles of 15 populations occupying three different habitats (reedbed, mixed, mountain). Haplotype network of mtDNA (COI, Cytb) showed frequent genetic mixtures between populations with different habitat types. Our overall results imply that behavioral plasticity may be a primary strategy for parrotbills to

exploit various types of habitats. Further studies with other markers such as microsatellite loci would be needed to verify our results.

C32 Ian Z.W. Chan : Quantifying Morphological Patterns in Animals

Animals display a variety of morphological colour patterns (e.g. leopard spots) that are involved in many phenomena, including camouflage, aposematism, and communication. However, most studies focus on the 'colour' in colour patterns, disregarding the potentially equally-important characteristics of the 'pattern' itself. Consequently the study of patterns (minus colouration) is poorly-developed, and lacks an established definition and quantitative measurement techniques. To address this, we surveyed the literature to formulate (1) a robust definition for animal patterns: "arrangements of elements into markings which are repeated on animal surfaces"; and (2) a framework of seven pattern properties (shape, size, contrast, distribution, complexity, randomness and directionality) with metrics and computer programs to quantify them. Finally, we applied the framework to two case studies to demonstrate its utility. This work enables researchers to synthesise 'colour' data with 'pattern' data, contributing to a greater understanding of morphological colour patterns.

D37 Ines Fürtbauer : Social conformity in a non-social marine invertebrate (*Carcinus maenas*)

In gregarious animals, social conformity occurs when individuals alter their own behaviour to the level of a certain behaviour displayed by another individual or a group. Social conformity may be beneficial for predator avoidance and/or resource acquisition, but it is unclear whether similar conformity effects exist in non-social species and, if so, whether changes in behaviour are dependent on individuals' personality. We studied the effects of social context on shore crab (*Carcinus maenas*) behaviour, using video tracking. Individuals differed consistently in their activity and were significantly more active in a non-social compared to social contexts. Dyad partners were more similar in their activity when tested together compared to when tested alone. Furthermore, more active individuals decreased their activity to a greater extent when with a conspecific. Overall, our results indicate social conformity effects in a non-social organism that are comparable to those found in gregarious species.

C35 Inon Scharf : Wormlions like it dark: Habitat choice in an ambush predator

Habitat choice is an important decision with consequences for survival and reproduction. We examined habitat choice by wormlions, sand-dwelling insects that construct pit-traps to capture prey. We first tested whether wormlions prefer shaded vs. lit, deep vs. shallow and surface-obstructed vs. clear microhabitats. The first of each pair was highly preferred. Next, we sought to determine whether the choice is additive (taking more than a single factor into account), hierarchical (ranking the factors according to an order of preference), or based on a threshold rule (accepting a microhabitat which crosses a quality threshold). Combining shade with one of the three disturbances, surface obstacles, shallow sand or high conspecific density, led to fewer wormlions choosing shade. A combination of shade and any disturbance was no longer preferred over light and disturbance-free microhabitats. We conclude that wormlions' choice is additive, taking more than one factor into account.

D18 Isabel Damas Moreira : Invasive lizards: do they conquer through learning?

Invasive species have become a significant conservation issue, and their effects are often exacerbated by the increasing mobility of people and cargo. For example, the lizard *Podarcis sicula* has rapidly expanded its range largely due to human action. Nevertheless, as with most invasive species, what determines its success is still unclear and of great interest. One hypothesis is their behavioural flexibility – an ability to rapidly adjust to novel stimuli. This has rarely been addressed and we are studying if behavioural flexibility is correlated with invasions, using *P. sicula* (invasive) and *P. bocagei*

(non-invasive). We are testing for behavioural flexibility, by analysing learning ability in multiple cognitive dimensions, for social learning and will present preliminary results.

This is important in understanding how species can cope with future changes and if it might impact other species. Ultimately it will hopefully help us understand how management efforts should operate following successful introductions.

B41 James C Makinson : Chasing liquid gold: trapline formation in nectar foraging bumblebees

Flowers present a dilemma for central place foragers such as bumblebees. While each flower provides a replenishing nectar source, the small volumes produced necessitate visiting multiple flowers during each foraging trip. Both Lab and field studies have demonstrated that bumblebees are able to converge upon optimal repeatable circuits (traplines) between forage sources over time. We used harmonic radar to track the first 50 bouts of bumblebee foragers presented with a trapezoidal array of 5 artificial 'flowers'. Our study is the first to continuously track every consecutive foraging bout of a bumblebee as it develops a trapline between floral resources. We found that foragers converge on more similar and efficient traplines over time, but never reached the optimal foraging route. Foraging bumblebees also frequently went on long exploratory flights between forage sources, these deviations frequently caused the total distance flown on a foraging trip to greatly exceed the optimal path length.

C15 James Rapkin : Macronutrient effects on male mating success through cuticular hydrocarbon expression

Condition-dependent male sexual traits play a central role in sexual selection theory. Most empirical studies focus on conspicuous sexual traits with relatively little known about the condition-dependence of chemical signals. We used Nutritional Geometry to determine the effects of protein (P) and carbohydrate (C) intake on male cuticular hydrocarbon (CHC) expression and mating success in *Gryllodes sigillatus*. Nutrient intake has clear effects on CHC expression and mating success with males regulating nutrient intake to optimize mating success. Multivariate selection analysis showed that female choice exerts linear and quadratic forms of sexual selection on CHC expression while structural equation modelling revealed that the effect of nutrients on mating success is not mediated exclusively through CHCs meaning that other trait(s) must also be important. Our results suggest that the complex interplay between nutrient intake, CHC expression and mating success is important in the operation of sexual selection in *Gsigillatus*.

C1 Javier I. Borráz-León : Resource Holding Potential in Human Males: Testosterone, Personality and Benefits

Resource Holding Potential is the ability to win an all-out contest, however it could be modulated by biosocial factors. The study aimed to investigate whether the decision of a man to get involved in a contest, depends on his testosterone levels, personality, and the quality of the benefits. We expected that men with the highest levels of testosterone and personality traits will decide to compete with the most dominant man when the benefits of the competition are high (a date with an attractive woman). 120 men chose a competitor according to their visual evaluation, donated two saliva samples to measure testosterone and answered three personality questionnaires. Our results suggest that high testosterone levels and high scores of self-esteem influenced the decision to compete with a dominant man only when the benefit is high. Also, we observed an increase of testosterone in individuals with high competitiveness and self-esteem.

D1 Jelmer M. Samplonius : Competitor phenology as a social cue in in habitat selection

On arrival from the wintering grounds, many migratory animals must rapidly choose the best possible breeding territory. To achieve this they partly rely on personal information, but also on public information indicating habitat quality including the density and success of competitors. However, the role of competitor phenology – a potential indicator of habitat quality – in habitat selection remains unexplored. Here we show that females of the migrant pied flycatcher *Ficedula hypoleuca* avoid males in forest patches with two experimentally delayed resident tit species. This effect acted specifically through females that had access to heterospecific timing information. Our results show that apart from the regularly tested spatial and density components, social information has temporal aspects. We argue that females match the habitat assessment of males with their own perception on arrival, and we introduce an information match-mismatch framework that may be used by females in choosing a mate.

C36 Jennifer Easley : Bitter taste perception and colour biases in domestic chickens

Prey animals that have evolved chemical defences advertise their unpalatability with bright and conspicuous warning signals. Known as aposematism, most research focuses on predator responses to the visual signals. In contrast few studies investigate predator perception of the chemical defences. This is despite the fact that many aposematic prey possess a diversity of chemicals, and predators learn to avoid multiple chemicals faster than single defences. Whether birds perceive chemical defences as distinct tastes is unknown. Here I present the results of a study that investigated the colour biases of domestic chickens when they were presented with a range of chemicals that activate different bitter taste receptors. These chemicals have the potential to be perceived as distinct tastes, and elicit different biases. This is the first study to identify the range of concentrations of bitter tastants that elicit biases, and whether diverse chemicals cause different biases against warning colours.

D25 Jennifer Morinay : Heritability of social information use and role of past experience

Social information use for habitat selection is considered as an important behaviour structuring multi-guild populations. Social information use probably depends on environmental conditions, but we also expect individuals to consistently differ in their use of social information and social information use to be heritable. We experimentally estimated the heritability of heterospecific social information use in collared flycatchers, by creating an apparent preference from their main competitors (great tits) for a novel nest site characteristic and recording whether flycatchers copied this apparent preference by settling in nest boxes with the same characteristic. The level of heritability of this copying behaviour was 0.06 [95% CI: 0;0.19]. In the following year, individuals tended to switch their choice, especially if they copied the tit preference in the past season. Social information use therefore appears weakly heritable but is also greatly influenced by the individual's copying history.

C5 Jenny York : Testosterone is not correlated with song in a subtropical songbird

Circulating testosterone (T) has been widely championed for its putative role in enforcing the honesty of sexual signals such as male song. Indeed, compelling experimental evidence demonstrates that T affects song, coupled with lines of evidence that T exerts inhibitory pleiotropic actions on other traits. However, surprisingly few studies have directly investigated whether natural variation in male song production is correlated with circulating levels of T; a relationship that is fundamental to the immunocompetence handicap hypothesis. Here, we investigate whether song and circulating T are correlated in wild white-browed sparrow weavers (*Plocepasser mahali*); a social sub-tropical songbird. Our findings suggest that natural variation in song output may be achieved through mechanisms other than variation in circulating T in this species. More widely, there is a need for behavioural ecologists to

incorporate advances in endocrine and neuroendocrine mechanisms into our understanding of signalling behaviour in an ecological context.

B54 Jessica Mitchell : Odour cues advertise parasitic infection status in the banded mongoose

Showy ornaments provide honest indicators of quality because only individuals in good condition, such as low parasite load, are able to maintain them. However, we have limited knowledge on the potential of olfactory ornaments to advertise quality. Here we investigate the interplay between parasite load and scent-marking behaviour in a wild population of the banded mongoose, *Mungos mungo*.

Using focal observations we show that banded mongooses who engage in intensive scent-marking have lower loads of a costly protozoan parasite, genus *Isospora*. We then use odour presentations to demonstrate that banded mongooses mark less in response to odours of opposite-sexed individuals with high *Isospora* loads. Results suggest that, in the banded mongoose, the *Isospora* parasite can affect the frequency of marking behaviour but is also detectable via scent. This provides support for scent to act as an important ornament and mechanism for advertising infection status within mammals.

A12 Jin hwan Choi : Effects of Flock size and Heterospecifics on Goose Behaviours

We investigated the effects of flock size and presence of heterospecifics on behaviours of wintering Bean Geese *Anser fabalis* and Greater White-fronted Geese *Anser albifrons* in rice fields around Hangang River Estuary, one of the major wintering grounds of waterbirds in Korea, in 2013-2014. In general, several hypotheses concerning relationship between group size and predation risk suggest that individual vigilance declines with increasing group size. However, vigilance level of one species may vary according to the presence or absence of other species in the vicinity, especially when these two species share similar ecological niche. We examined the behavioural patterns of two similar-sized goose species, Bean Geese and Greater White-fronted Geese, foraging in flocks of varying size in rice fields, under sympatric and allopatric situations. Consequently, our results showed that they seemed to assess predation risk and adjust their behaviour by the density of conspecifics and heterospecifics.

D11 Joah Madden : The quick are the dead

Cognitive abilities likely evolve through natural selection, with exaggerated abilities bringing fitness benefits. We assayed 204 pheasants *Phasianus colchicus* with tests of information acquisition and reversal learning and followed their fates after release. Birds that were slow to reverse learned associations, indicating poor flexibility or inhibitory control, were more likely to be alive at four months old. This result was consistent over two different years and when two different cue sets were used (colour and spatial location). Acquisition speed, tested using the same cue sets did not predict survival. Benefits of inflexibility or poor inhibitory control are not intuitive. Perhaps flexibility is traded off against other, untested cognitive abilities which in turn bring benefits. Alternatively, inflexibility means that the bird is less likely to encounter predators, or more likely to stay at established feeding sites. Selection may retard particular cognitive processes, explaining why there is no proliferation of flexible individuals.

D6 Jonathan L C England : Looking with my left eye? Or my right? Fish perspective

Most vertebrates tend to preferentially use a certain side of their body to manipulate objects or get information from their environment (i.e. laterality). Presence of this asymmetry is partly explained by the ability to increase the brain's efficiency (e.g. shorter reaction time, increased tasks performance). However, in a population, not all individuals are always lateralised and this variation is proving

challenging to explain. Evidence suggest that differences in how fast individuals explore their environment might reflect different strategies in acquiring, processing, storing and using information (i.e. cognitive styles). Fast and slow exploration strategies differ in their probabilities of meeting rewards or risks and are therefore not under the same constraints. Using a wild population of three-spined sticklebacks we tested the hypothesis that slow and fast explorers (in a novel environment) differ in their levels of laterality to achieve different cognitive abilities, that reflect different strategies.

A19 Jorge Fernando Saraiva de Menezes : Risk of predation increases variance in patch use

Animals decrease patch use when facing high risk of predation, yet predation risk might also influence the variance in patch use. In one such case, risk increased patch use variance in uniform landscapes for voles. However, theoretical models suggested uniformity is not necessary. We tested whether this pattern also holds for non-uniform environments. We studied the Neotropical rodent *Thrichomys pachyurus* in the Pantanal wetlands of Brazil. In this system, we set artificial patches of 20.5g of peanuts mixed in 200 ml of sand. The giving-up density, i.e. remaining food, represented the amount of time spent on patch. Following that, the deviation from mean represented variance. Canopy cover at each patch was a proxy to predation risk. Thus, its deviation from the mean correlates with patch use variance. We corroborated our hypothesis. Predation risk decreases absolute patch use, but increased its variance irrespective of its uniformity.

A8 Jorge S. Gutierrez : Climatic niche and mammalian invasion success at the global scale

A major goal of ecology is to understand why certain species are more invasive than others when introduced into novel environments. The 'niche breadth' hypothesis suggests that species that have broad tolerances of environmental factors are more successful at colonizing novel environments than less tolerant species. The relationship between invasion success and climatic niche breadth, however, remains poorly explored. Using phylogenetic comparative methods and the largest dataset of mammalian introductions, we show that higher introduction effort and wider climatic niches (the range of temperature and precipitation conditions across the species' range) promote success at establishment. Among established species, however, only introduction effort increases the likelihood of spread. Our results indicate that mammalian species with wider climatic niches are more likely to establish in novel environments most likely because these facilitate climate matching. Future studies should investigate whether climatic matching is facilitated by plasticity and/or adaptation to diverse local conditions.

D31 Joseph B. Barrant : The ontogeny and repeatability of exploration in red knots

Many individual differences are likely to originate during development, but a century of work on individual variation has, until recently, largely neglected this suggestion. We investigated how a behavioural trait, a physiological trait, and their covariation develop with age in red knots (*Calidris canutus islandica*). We used different diet types to experimentally manipulate gizzard mass in wild-caught juvenile (n = 44) and adult (44) individuals and subsequently measured exploration in a novel environment. Our results show that although diet manipulations induced changes in gizzard mass (always) and exploration (sometimes), repeatability of both traits was higher in adults. Furthermore, at the individual level, there was a significant positive covariation between gizzard mass and exploration in adults, but not in juveniles. These results suggest an important role of cumulative experience in shaping the integration between behavioural and physiological traits in red knots, and support further effort in the study of ontogenetic processes.

D26 Justa Heinen-Kay : Predicting multifarious behavioral divergence in the wild

Environmental variation can drive divergent selection on complex behaviors, but how predictably behaviors evolve in response to particular environmental agents remains unclear. We tested a priori predictions for the five primary behavioral components of animal personality in Bahamas mosquitofish (*Gambusia hubbsi*) inhabiting blue holes differing in predation risk using a combination of field and lab studies. Low-predation mosquitofish exhibited reduced sociability and greater exploration of a novel environment compared to high-predation counterparts. Meanwhile, only females exhibited greater boldness, and only males displayed reduced aggressiveness in low-predation populations. Activity levels did not differ between predation regimes. Regarding exploration, all populations exhibited a behavioral syndrome characteristic of proactive versus reactive stress-coping styles. We confirmed that exploratory behaviors have a genetic basis and exhibit significant within-individual repeatability. Our results suggest that variation in predation risk can lead to repeatable, and often predictable, changes in multifarious animal behavior.

A30 Katie Dunkley : Multi-species cleaning stations influence Caribbean cleaner-client interactions

Through the removal of parasites, dead skin and mucus from the bodies of visiting reef fish (clients), cleaner fish can have an important impact on the ecology of coral reefs. However, the role of multiple cleaner species sharing the same resource is not well understood. The predominant Caribbean cleaner species, the sharknose goby (*Elacatinus evelynae*), can share cleaning stations with juvenile French angelfish (*Pomacanthus paru*). Between 2010-2015, cleaner-client interactions were observed at single and multi-species cleaning stations in Tobago. The cleaning behaviour of both cleaner species was recorded to investigate the impact of this multi-species mutualism, in terms of creating variation in cleaner-client interactions. The presence of a French angelfish at a cleaning station influenced both the diversity of visiting clients and the duration of cleaning events by sharknose gobies. This suggests that the occurrence of additional cleaner species can influence cleaner-client interaction dynamics.

B13 Katie Hall : Foraging ranges of Eastern honeybees, *Apis cerana*, in South India

Social bees deliver essential ecosystem services by pollinating crops and wild plants. They have been widely studied in temperate geographic regions, but in Asian tropical bee-plant systems there is a distinct lack of knowledge on the behaviour and ecology of social bees. We investigated the foraging behaviour of the Eastern honeybee, *Apis cerana*, an abundant species that is managed and distributed for honey production, asking how foragers distribute in the landscape. We have recorded waggle dances and collected pollen loads in colonies located in four different habitats, in the Western Ghats of South India. Returning foragers recruit nest mates through these dances communicating the distance and direction from the hive for a newly discovered or particularly rich food source. We analyse how emerging spatial patterns and locations of food-source clusters are linked to landscape features and the occurrence of major pollen sources within the foraging range.

C9 Kendra Smyth : Maternal traits mediate offspring health in wild meerkats

Androgens underlie a well-known tradeoff between reproductive benefits versus health costs in males. Despite substantial variation in female androgen production and the potential for transgenerational effects, this tradeoff is underappreciated in females and their offspring. In the cooperatively breeding meerkat (*Suricata suricatta*), dominant females benefit from raised androgens through increased competitiveness but suffer from androgen-mediated immunosuppression (Smyth and Drea 2016; Smyth et al. 2016). Here, we ask if exposure to raised prenatal androgens produces a comparable trade-off in meerkat pups. From 2012-15, we measured innate immune responses in pups derived from dominant and subordinate control dams, and from dominant dams treated with an androgen-receptor blocker. We found stronger immune responses in pups from dominant versus subordinate dams; however, blocking prenatal androgens improved the pups' innate immunity. Thus,

an 'inherited,' androgen-mediated immunohandicap may be offset by the social benefits accrued to pups of dominant females.

C3 Kenyon Mobley : The effect of synthetic estrogen exposure on stickleback behavior

Synthetic estrogen (17 α -ethinyl estradiol, EE2) is a persistent anthropogenic endocrine-disrupting contaminant present in many aquatic environments. We tested the effect of EE2 on nest-building behavior and gene expression patterns in three-spined stickleback (*Gasterosteus aculeatus*). Mature, lab-bred sticklebacks from five families were exposed to 30ng/l of EE2 or a solvent control for 30 days. Males were then placed in individual 16l tanks and allowed to build nests. Similar numbers of males built nests in each treatment. However, EE2 exposed males built significantly higher quality nests and had more red throat coloration after 10 days of exposure. Expression levels of gonadotropin were similar between the sexes and treatments while vitellogenin was over expressed in the liver of males compared to females. Our results demonstrate that EE2 affects male nest-building behavior and expression of sexual ornamentation. Whether this affect translates into mating success remains unknown.

B6 Koichi Ito : Evolution of floral honest signal about reward for pollinators

Some empirical studies reported that the floral plants often change their floral color or volatile after finishing the production of rewards. In these cases, pollinators can distinguish between nectar-full and nectar-less flowers from their colors or volatiles without visiting them. However, such honest signal about existence of rewards seems to be non-beneficial for flowers because pollinators will avoid visiting nectar-less flowers. In order to explain the evolution of honest signal of reward, we theoretically investigated the evolution of floral age, duration of reward production and floral signal about the existence of reward. In the results, we found that the variation of the recognizing ability of floral signal in pollinators is an important factor for the evolution of honest signal. This suggests that the evolution of floral color change or other signals about rewards can be explained by the variation of ability in pollinator community.

B32 Kozue Shiomi : Spatiotemporal constraints on homeward movements of seabirds

Timing of movements is crucial for animals to optimize foraging, travelling and breeding in spatiotemporally heterogeneous environments. During chick-rearing, some shearwater species are away from the breeding island during daytime and return to the nest only at night. This diurnal pattern has been attributed to avoidance of diurnal predators on land. In addition, they depart the colony within several hours before sunset and finish foraging trips within several hours after sunset, independent of distances of foraging areas to the island. In this study, we explored reasons for the characteristic distributions of departure and arrival times in shearwaters by analyzing GPS tracks. Results indicated that the birds avoided nocturnal offshore travelling by adjusting the onset time of homing and the proportion of flight duration to on-water duration. Thus, concentration of the departure and arrival times appeared to derive from their preference of diurnal travelling as well as predator avoidance.

B12 Krzysztof Deonizak : Song thrushes (*Turdus philomelos*) sing differently in town and forest

We recorded males of song thrush in comparable forest-like habitats within- and outside-city in Western Poland, which differed in ambient anthropogenic noise level. We analysed 1000 subsequent syllables for each male which were assigned to individual types and two fundamental categories (whistles and twitters). Whistles were pure toned, loud syllables with lower frequency. Twitters had a broader frequency band with more harmonics and were more quiet. Birds from urban forests had

significantly larger repertoires of syllables, whistled less and twittered more than birds from adjacent forest population. This study provides the first evidence for differences in song thrush song characteristics between urban and natural forest populations. Those differences can be a regulation in which males adjust to conditions present in the cities, e.g. increased level of background noise, therefore further research is needed. (Financial Support: National Science Center, Poland, 2013/09/N/NZ8/03204).

D19 Laurin McDowall : Does ink exposure tell cuttlefish embryos about future threat?

Environmental cues in juvenile stages can alter developmental trajectories to suit predicted adult conditions (anticipatory plasticity). For example, cuttlefish embryos can learn about prey availability, which changes their later food preference, and predator presence, altering investment in camouflage. Adult cuttlefish produce ink as an anti-predator defence, which could also signal danger to eavesdropping conspecifics. We investigated whether embryos can use ink as a visual and/or chemical signal of potential danger and alter their behaviour in response. We measured ventilation rate and movements in *Sepia officinalis* embryos exposed to an ink stimulus or saltwater control. Movement of the embryo was increased by ink exposure. After hatching we also tested juvenile camouflage ability and found a trend for ink-exposed embryos to be quicker to match uniform backgrounds. Our data suggest both that embryos can detect and immediately respond to ink, and that this may affect their juvenile behaviour.

C37 Liisa Hämäläinen : Bitter taste perception not affecting avoidance learning in great tits

Many prey species contain defensive chemicals that often taste bitter. Bitter taste perception is therefore presumed to be important for predators in order to detect and learn to avoid toxic prey. However, it is not known how much bitter taste perception varies between individuals, or if this affects how fast predators acquire avoidance of novel unpalatable prey. We investigated this in wild-caught great tits (*Parus major*), by first measuring their behavioural response to drinking water of increasing bitterness, and found that individuals differed considerably in their bitter taste detection threshold. We then conducted an avoidance-learning test using novel prey. Greater taste discrimination could speed learning, but we did not find that individuals with good bitter taste sensitivity learned to avoid unpalatable prey faster than less sensitive individuals. Therefore, while predators may vary in their bitter taste perception, this may not influence how quickly novel bitter prey are avoided.

C7 Lindsay J. Henderson : Hormone regulation of food hoarding in a passerine bird

The hormonal control of food hoarding in mammals is well characterised. But the hormones that regulate food hoarding in birds have not been identified. To investigate this we injected wild caught coal tits (*Periparus ater*) with ghrelin, leptin and a saline control in the laboratory. We then measured hoarding activity and mass gain, as a proxy of food consumption, for two hours post injection. Both ghrelin and leptin injection significantly reduced hoarding and mass gain compared to controls. These results are consistent with previous findings from birds that show both leptin and ghrelin cause a reduction in consumption. Furthermore, unlike hoarding mammal species, where ghrelin promotes hoarding and leptin reduces hoarding; our results provide the first evidence that hoarding behaviour is reduced by both leptin and ghrelin in a passerine bird. These findings suggest that the hormonal control of consumption and hoarding in avian species differs from that in mammals.

B47 Lisa Gill : Determining wild jackdaw call types and contexts via microphone backpacks

Studying the vocal behaviour of individual animals moving naturally in their habitat remains a

challenge to date. Recent technological developments (microphone backpacks) now allow recording vocalisations even of small, freely behaving animals. However, field studies remain rare because devices need to be lightweight, especially in birds, limiting the amount of data they can collect next to vocalisations.

We thus aim to tap the full potential of on-bird microphones by determining different acoustic contexts, such as movement and background sounds, in addition to individual vocalisations of group-living songbirds in the field.

To investigate this, we placed microphone backpacks on wild and captive jackdaws, and use video-validated, human-coded and machine-learned annotations of bird movements and background sounds, along with acoustic call-type classification.

We find different acoustic contexts (e.g. flight, vocalising conspecifics) and call types, and discuss the potential of such methodology for future behavioural research.

D28 Lorenzo R. S. Zanette : The cost of being bold - personalities in a queenless ant

The apparent ubiquity of personalities has led to a reappraisal of the importance of individual variations. Although consistent individual differences are a defining trait of eusocial insects, research has focused on differences between morphological castes. Using the queenless ant *Dinoponera quadricaps* (17 colonies; 282 ants) we investigate the effect of personalities on the establishment of rank in colonies of morphologically totipotent individuals and test if environmental conditions favour specific personalities. Behavioural consistency was found in all environments. Ants from unpredictable environments were more exploratory but less bold than ants from predictable environments. Higher rank ants were not consistently bold or aggressive ($R < 0.18$, $P > 0.11$). In contrast, lower rank ants were highly consistent in both of these traits ($R > 0.56$, $P = 0.001$). Our findings indicate that environmental conditions may select for certain personalities and that behavioural flexibility may be important to achieve a high rank.

A31 Lou Yingqiang : male vigilance is important for female in Chinese Grouse

In some monogamous avian species, males invest more time in vigilance than females, especially during the pre-incubation period. As behaviors are energetically costly, there is a trade-off between vigilance and feeding behavior. Chinese Grouse is the smallest grouse species in the world, and the behavior ecology during the pre-incubation period was unpublished. Our results indicated that paired Chinese Grouse males spend more time in vigilance than unpaired males and paired females and could alter their activity budgets in response to the social context and an experimental encounter with an important predator. We can concluded that male investment through vigilance behavior should play an important role in promoting the survival and probably the reproduction success of their mates. The proportion of time allocated for vigilance by males and foraging by females of Chinese Grouse during the pre-incubation period was the highest recorded among monogamous grouse species.

B45 Louise Riotte-Lambert : Population-level consequences of memory-based movement behaviour

How individual movement behaviour impacts population-scale ecological dynamics is still largely unknown. In particular, as memory use leads to energetically advantageous recursive movement, it should have ecological consequences, but no study has yet investigated this question.

We develop a spatially-explicit individual-based model where reproduction and death depend on individual foraging efficiency, and compare the population dynamics of memory users and non-memory users. We show that memory use leads to strong differences between the intensities of competition averaged over the entire population vs locally experienced by individuals. It also leads to diverging shapes of density-dependence response curves, to a stronger depletion of the environment

and to higher population size equilibrium.

These results call to more systematically take into account individual movement behaviour when studying population dynamics, and provide new insights into how the emergence of an advantageous behavioural strategy can result in population-level ecological changes.

B24 Lucy Magoolagan : Structure and Function of Male and Female Song in Dippers

Female song is rare in birds and relatively little is known about how it compares with that of conspecific males, especially in non-duetting species. I describe the song of male and female Dippers (*Cinclus cinclus*), a territorial songbird. Unpaired males sang longer, more complex songs than males that were paired up and nest building or whose partners were incubating. Males seeking a female put the most energy into song production, providing evidence for male song used for mate attraction. Female song was structurally similar to males, with individuals using a similarly sized syllable repertoire to unpaired males. However, females were more likely to sing with a partner than alone, suggesting that mate attraction is not the primary function. Females rarely sang after they had begun laying, and song may help to coordinate breeding activities. Singing in order to defend the territory appears to be shared by males and females.

A26 Lucy Nevard : Foraging behaviour of social bees in the South Asian tropics

Social bees are the most abundant and significant group of pollinators in the Asian tropics, but little is known about their behaviour. Two key species are *Apis cerana* (Eastern honeybee) and *Trigona iridipennis* (Indian stingless bee); both are eusocial. We studied their behaviour in the Western Ghats of South India, a biodiversity hotspot in which much of the landscape is dominated by agriculture. Differences in size, physiology and social organisation lead us to hypothesise differences in foraging and resource utilisation. In field experiments we investigated their responses to an artificial feeder at various distances from the hive. The results indicate that the stingless bee has a shorter foraging range than *A. cerana*. Daily activity patterns were recorded, including the proportion of foraging effort dedicated to pollen collection. Furthermore, we collected pollen to assess the differential utilisation of plant resources. Preliminary analysis reveals species differences that may impact on pollination services.

A13 Marisol Dominguez : SONG SIMILARITY BETWEEN PARENTAL SPECIES IN AN HYBRID ZONE

The Yellow Cardinal (*Gubernatrix cristata*) is an endangered bird endemic of South America that hybridizes with the related Common Diuca (*Diuca diuca minor*). Hybridization in the wild only occurs in one region where both species live in sympatry during breeding season. Yellow cardinal males are scarce because they are captured to commercialize them as cage birds. In this study, we investigated cardinals' song variation in allopatry and within the hybrid zone with Common Diuca. We found greater similarity between songs of yellow cardinals and diucas where hybridization takes place. Common Diuca's acoustic characteristics along its distribution allow us to discard the possibility of convergent adaptation to the environment. We suggest that interspecific learning due to the low presence of Yellow Cardinal males might contribute to song convergence in the southern population, where young individuals copy Common Diuca song features. Thus, cultural introgression could be affecting vocal variation of yellow cardinals.

C29 Mark Laidre : Evolutionary transition from social to antisocial in largest terrestrial invertebrate

Many organisms come together to exchange resources. However, if the need for such exchange is eliminated, removing the benefits of socializing, then organisms may transition from social to anti-social behavior. Here I experimentally tested whether such an evolutionary transition has occurred in

the world's largest terrestrial invertebrate, the coconut crab (*Birgus latro*). Unlike its closest evolutionary relatives the terrestrial hermit crabs (*Coenobita* sp.), which must socialize to exchange shells, coconut crabs cease needing shells as adults and hence do not benefit from exchange. I therefore tested both coconut crabs' and sympatric terrestrial hermit crabs' interest in socializing by creating simulated social aggregations and examined how attracted others were. While terrestrial hermit crabs were highly attracted to conspecifics, consistent with their need to exchange shells, coconut crabs showed no such attraction and instead avoided conspecifics. These results show sociality is contingent upon the need to exchange resources.

D30 Marlis Dumke : Social foraging and behavioural types: larger groups contain more scroungers

In groups of socially foraging animals, feeding behaviour may change with group size in response to varying cost–benefit trade-offs. Numerous studies have described group-size effects on group-average feeding behaviour, particularly emphasizing an increase in scrounging incidence for larger groups, where individuals (scroungers) feed from the food sources others (producers) discovered. However, individual variation in feeding behaviour remains unconsidered in the vast majority of these studies even though theoretical models predict individuals to specialize in feeding tactic and anticipate higher scrounger-type frequencies in larger groups. We combined group-level and individual-level analyses of group-size effects on social foraging in the subsocial spider *Australomisidia ergandros*. Lending novel experimental support to model predictions, we found that individuals specialize in feeding tactic and that higher scrounging and lower producing incidence in larger groups were mediated through shifts in the ratio of behavioural types.

C38 Matteo Santon : Active photolocation helps small fish to spot cryptic predators

“Active photolocation” is defined as emitting light with the goal of inducing and spotting reflections in other organisms. We claim that this process is used among diurnal fishes to enhance their regular visual ability. The principle assumes the presence of reflective eyes in many organisms, which will appear to blink from the perspective of an observer that has a light-emitting area in or near the eye. We present evidence that active photolocation can be used to detect cryptic sit-and-wait predators. We manipulated the ability of triplefins (*Trypterigion delaisi*) to emit light or not by gluing a shading or transparent hat onto their heads. When visually exposed to a scorpionfish, *Scorpaena porcus*, fishes with an opaque hat spent more time close to the predator than control-treated fish. This hints at a new form of visual interaction between predator and prey.

B31 Matthew B. Petelle : Fine-scale movement data reveals personality in a wild canid

Consistent individual differences in behavior, or animal personality, has become an important research topic in behavioral ecology because of its potential ecological and evolutionary consequences. In wild carnivores personality type could influence individual hunting success, and thus profoundly impact individual fitness. Activity levels and movement patterns are indicative of exploration, yet few researchers have used long-term, fine-scale movement data to understand personality differences in wild carnivore populations. Here, we use fine-scale movement data (906 focal hours) of a habituated population of bat-eared foxes (*Otocyon megalotis*) to identify potential individual differences in exploration and activity. Using three metrics: total distance moved, movement tortuosity, and percent of home range explored per night, we found individual differences (across 20 individuals) only in percent explored. Individuals remained consistent regardless of time of night and ambient light levels, but did vary seasonally, with less exploration occurring in winter.

C27 Matthew Shawkey : What gloss is and why it matters to animal coloration?

Most studies of animal coloration consider its chromatic components and in some cases iridescence. However, colors of many taxa have shiny appearances that are analogous to highly polished surfaces. This gloss is optically described as a high ratio of specular to diffuse reflectance. However, almost nothing is known either about how gloss is created or its significance to signaling. Here, through optical and nanoscale morphological analyses, we show that gloss can be produced by 1) a weakly ordered array of melanin-containing organelles around the edge of barbules or 2) smooth, flattened barbs in combination with carotenoids. Pigments therefore produce the base hue and nanostructures enhance specular reflection. Angle-resolved spectrophotometry reveals that these colors maintain their brightness over a wider range of viewing angles than matte colors. Gloss may thus be a mechanism for enhancing visibility, and may be selected for either separately or in conjunction with pigments.

C16 Matthew Symonds : Bill size mediates thermoregulatory behaviour in birds

Bird bills show well-documented adaptations in size and shape according to foraging ecologies. However, as significant areas of heat loss, bills are also under selection with respect to thermoregulation, yet the adaptive consequences of this function have been poorly studied. We predicted that birds should behave to minimise heat loss through their bills at lower ambient temperatures, and that such behaviour should be more frequent in species with larger bills, as they will be more prone to heat loss. Using field observations of shorebirds and broader phylogenetic comparative studies we demonstrate both these predictions to be correct. First, the placement of the bill within the plumage while roosting, which insulates the bill, becomes more frequent at cooler temperatures. Second, larger-billed species tend to use this behaviour more frequently. We therefore provide clear evidence that bill morphology influences behavioural adaptations to prevailing climatic conditions.

A24 Maya Saar : Repeatability in foraging behavior of two related Messor ant species

Animal personality is defined as a correlated suite of traits that is repeatable through time and across contexts. Repeatability, at least for some time, is a pre-condition to personality. We compared repeatability of foraging behavior in two related harvester ant species (*Messor ebeninus* and *Messor arenarius*), under field conditions. First, foraging colonies were presented with three seed types in different treatments, to test preference. Second, foraging colonies were presented with the preferred seeds, in different treatments, over three days. Both species were consistent in foraging behavior, under different treatments, over part or all days tested. However, *M. ebeninus* was generally more consistent in behavior than *M. arenarius*. This may be explained by different foraging strategies: The group forager, *M. ebeninus*, may be more consistent owing to a stable trail leading to food patches, whereas the individual forager, *M. arenarius*, might be less consistent, while searching individually for scattered patches.

A6 Melanie Chan : Fine-scale Habitat Heterogeneity Effects on Urban Bird Habitat Selection

As an alternative to the long standing theory of a positive linear relationship between habitat heterogeneity and diversity, it has recently been proposed that there may be an area-heterogeneity tradeoff. High heterogeneity can potentially exert a neutral or negative effect on patch species richness by micro-fragmentation of specialist habitats or intrinsic differences in the adaptability of species to heterogeneous environments. We tested this hypothesis at the individual habitat selection level using urban bird communities in Hong Kong as a model system. Monthly point counts were

carried out in 16 urban parks of comparable size (between 5 and 15ha) from January to April 2016. We found a positive but weak relationship between heterogeneity and species richness – inconsistent with the area-heterogeneity hypothesis. Further analyses, including analysis of species traits (e.g. invasive vs. native species) and multiple measures of habitat heterogeneity, will be conducted to further test this hypothesis.

D33 Melinda Weaver : Variation in house finch novelty response across an urban gradient

To survive in human environments, animals must adapt to the presence of anthropogenic structures, noises, vegetation, and introduced species. Thus, urban individuals may be more willing to approach novel objects and novel species than their rural counterparts. Studies on risk taking and neotolerance in urban areas have produced conflicting results, however, as some species tend to be more exploratory in urban areas while others show the opposite trend. Many of these studies test one specific object or situation rather than combining several novel situations that may more closely mimic an urban environment. We tested exploratory behavior of house finches (*Haemorhous mexicanus*) in a novel structural environment, with novel objects, in the presence of novel noises, with novel food and in the presence of novel bird species. We predict that urban birds will approach novel structures/species more quickly and spend more time feeding from novel structures.

A17 Michał Bogdziewicz : Nitrogen fertilization affects seed dispersal by rodents

Human-driven deposition of organic nitrogen alters functioning of ecosystems worldwide. However, effects of this global change on conditional mutualism are poorly known. We used the long-term ecological experiment (established 1988) at Harvard Forest to evaluate the effects of nitrogen deposition on rodent dispersal of red oak acorns. We predicted that fertilization would alter size and tannin concentration of acorns, and indirectly influence foraging decisions of scatter-hoarders. We analyzed chemical composition of acorns, conducted seed tracking and seedling establishment experiments to compare quality of rodent acorn dispersal. Nitrogen fertilization did not affect acorn size, but caused a decrease in tannin concentration. Rodents dispersed fewer fertilized than control acorns. Seedling establishment from caches was 3-times higher in control than in fertilized acorns. These changes reduced the effectiveness of acorn dispersal by rodents. Similar alterations of plant-disperser interactions might operate in other systems affected by anthropogenic nitrogen deposition.

A33 Michel B. C. Sokolowski : Foraging for toxic nectar in the honey bee

Honey bee may encounter fermented nectar when foraging. The goal of our experiment was to study the effect of various ethanol concentrations (1% or 2.5%) and to test the effect of resource abundance (100% or only 33% of flowers containing nectar) on bee nectar gathering efficiency. The experimental protocol was controlled with the help of automated self-administration conditioning chambers. The main dependent variable was the nectar flow entering inside the colony.

When all the flowers contain nectar, we show that only the 2.5% EtOH concentration has an effect: the nectar flow entering inside the hive is reduced. However, when the resource is less abundant, we show that the 1% EtOH concentration produces now a similar reduction in the nectar flow.

We conclude that the effects of a toxic nectar on foraging behavior of honey bees may depend on the abundance of the resource.

D27 Michelle L Hall : Animal personality and mating strategies

Research on mating systems usually investigates differences among species and populations in order to better understand optimal mating strategies. Variation among individuals that deviate from the population-level optimum is often regarded as sub-optimal, and little is known about what underpins

such variation. Recent work on behavioural variation among individuals has suggested that optima may differ among individuals, depending for example, on differences in pace-of-life. Furthermore, suites of behavioural traits linked to the pursuit of a particular life-history strategy may be correlated. We investigated mating strategies in a cooperatively breeding bird with high rates of extra-pair paternity to determine (i) whether there are consistent differences among individuals in mating strategies, and (ii) whether certain behavioural types are more or less likely to engage in extra-pair mating. We quantified extra-pair paternity superb fairy-wrens (*Malurus cyaneus*) to address these questions for females and males.

B9 Miya Warrington : Abundance, diversity and acoustic behaviours of Grenadian birds

Grenada is host to many species of passerine birds, but few studies have examined the abundance, distribution and acoustic behaviours of these birds. There is great need to establish baseline population monitoring in endemic birds in Grenada, especially as the country is undergoing rapid building and development. Monitoring of avian species involves identifying individual visually and aurally and aural identification in Grenada can be challenging because there are very few recordings of Grenadian species. Additionally, acoustic and behavioural observations allow for assessing the potential to use vocalisations for remote detection and monitoring of species and determining the impact of human presence on behaviours, such as mate-attraction, competition and dispersal patterns. Here, I describe newly started research examining the diversity of avian acoustic signals in Grenadian avifauna using a system of an automatic recording devices and hand-held ground truth recordings.

C10 Nicole Greaney : Currents and Contraceptives: ethinylestradiol turns the tide on mummichog boldness

Endocrine disrupting chemicals, such as ethinylestradiol (EE2), are released into the aquatic environment from various sources and are prevalent and persistent worldwide. A variety of species exposed to these chemicals experience morphological and behavioral changes, yet the effects of exposure on behaviors beyond courtship and aggression are understudied. To address this, mummichogs (*Fundulus heteroclitus*) experienced different amounts of EE2 and their boldness was examined in four different assays (Empty Tank, Novel Environment, Shoaling, Foraging) once a week for four weeks (pre-, 1, 2, and 3 weeks of exposure). Chronic exposure to EE2 resulted in a change in overall levels of boldness and the relationship of behavior in different assays. Since exposure impacts behaviors that are related to fitness, this may cause evolutionary consequences. The results show that exposure alters behavior and highlights the importance of studying behavioral effects of unintentional pharmaceutical exposure in multiple contexts and at multiple exposure levels.

C6 Nikolaus von Engelhardt : Females coping with social challenges – transgenerational consequences and physiological mechanisms

Even though maternal effects of the social environment may strongly affect adaptation and evolution, underlying mechanisms and consequences are still not well understood. Japanese quail (*Coturnix japonica*) housed in groups laid fewer eggs than when in pairs, suggesting increased competition. Unexpectedly, plasma testosterone and corticosterone levels were lower in groups, possibly due to less stimulation by the male. Egg weight and yolk testosterone were not affected, but offspring growth was modulated: weight of chicks from groups was less affected by their egg weight even though all chicks were housed identically. Offspring behaviour and hormones were not affected. Maternal and grand-maternal social environments again modulated how egg weight affected chick weight, suggesting that both anticipated and experienced conditions influence maternal physiology and offspring developmental processes. Since yolk testosterone was apparently not involved, other

egg components (hormones, antibodies, carotenoids) should be considered.

B43 Noa Katz : The effect of biotic & abiotic factors on wormlion spatial pattern

Various biotic and abiotic factors influence the spatial pattern of organisms, and it is indicative of an animal's interactions with conspecifics and abiotic traits. Intraspecific interactions are important for territorial animals and affect their spatial pattern, usually producing a regular pattern that conduces to a reduction in competition by maximizing nearest-neighbor distances. We examined which factors influence the spatial pattern of a trap-building predator, the wormlion. Wormlions are pit-building predators that ambush small arthropods. They inhabit fine sand in shaded habitats. We found that density and body mass to be positively correlated with the wormlions' spatial pattern, producing a more regular one than that affected by abiotic factors, such as sand particle size and illumination conditions, which had a mixed effect. In conclusion, similar to other territorial organisms, biotic factors related to competition with conspecifics exert a greater effect than abiotic factors on the spatial pattern.

B19 Noori Choi : Verification of Functional Hypotheses of Anuran Acoustic Chorus

Various frog species organize acoustic choruses around their breeding sites. Various hypotheses about the function of acoustic chorus have been suggested: predator avoidance, local-group competition, and byproduct of inter-male competition.

According to the predator avoidance hypothesis, acoustic chorus has been evolved as a defense mechanism by calling with their neighbors. The local-group competition hypothesis maintains that a group of males call together for more attractive call characters such as longer duty cycle or higher amplitude while competing with other local-groups over females. The byproduct hypothesis argues that the collective behavior is an artefact of inter-male competition for leading role among neighbors. To verify the hypotheses, we used a multi-channel recording using a network of microphones and a visualization software. We investigated (a) time scaling among neighboring males' call, and (b) a calling pattern in a chorus.

B27 Oded Berger-Tal : Not going around in circles: a recursive movement generalized framework

Recursive movement, i.e., returns to previously visited areas, is a widespread phenomenon that has been investigated in a large range of species at different spatial scales. Nevertheless, the wide scope and generality of this phenomenon may be still considerably underestimated, because recursive movement behavior has been studied in several different lines of research which have been developed in parallel, using different methodologies and terms to analyze and describe the same phenomenon, with almost no cross-referencing among them. We constructed a conceptual model for recursive movement behavior across species and spatio-temporal scales. The emergence and complexity of recursive movement patterns are determined by the rate of resource recovery, environmental heterogeneity, the predictability of resource recovery, and the animal's cognitive capabilities. Our synthesis can be used to generate predictions and promote the sharing of knowledge and methodologies gained in different ecological sub-fields.

B52 Patrick Scherler : Factors affecting prospecting patterns of juvenile red kites (*Milvus milvus*)

Life-history theory suggests that dispersing juvenile animals invest considerable effort in prospecting potential locations before they settle at site of first reproduction. It is likely that this prospecting behaviour varies in relation to intrinsic and extrinsic factors balancing costs and benefits of the behaviour. We investigate the effect of body condition and natal environmental factors on prospecting behaviour during the first period of natal dispersal by tagging a cohort of 44 juvenile red

kites (*Milvus milvus*) with GPS-loggers. We found that towards the range margin individuals of high body condition and individuals originating from sites of low breeding density areas show wide range prospecting movements, whilst distant from the range margin dispersing individuals show small scale prospecting patterns irrespective of their fledging condition. These results suggest that natal habitat characteristics are key factors affecting the information gathered and available for future settlement decisions and thus, natal dispersal distances.

B7 Pavel Linhart : Acoustic identity signalling in perspective of the Tinbergen's questions

Social behaviour is often conditioned by seemingly simple fact that animals recognize and remember other individuals. Animals use visual, acoustic, and olfactory cues to recognize other individuals. Signalling identity through vocalizations represents well studied component of individual recognition regarding the number of available studies, yet understanding of identity signalling was formerly found insufficient. We reviewed over 100 studies on individual variation in vocalizations of vertebrates and asked whether we can answer the four Tinbergen's questions for the identity signalling phenomenon. Majority of the studies were mere reports of individual variation in vocalizations, but only few studies systematically answered important questions: Were certain vocalizations selected to signal identity? Which vocal characteristics are suitable for identity signalling and why? How identity signalling changes over life-time and over generations? We will give examples of the best studies and suggest opportunities for future research.

A7 Paweł Podkova : The importance of illumination in avian nest site choice

Results of recent surveys suggest that light positively influences many aspects of physiology and development of avian embryos and nestlings. We may therefore expect that adults use illumination level as a cue in nest site choice. Light regime may be especially important for hole nesting birds because of the especially dim conditions. We tested this idea experimentally on a Great Tit population breeding in two types of nest-boxes: "bright" - fitted with semi-transparent windows and "dark" – without this modification. Bright boxes were used approximately twice as often as dark boxes, however there was no light effect on timing of occupation. Moreover, nests built in brighter nest-boxes were lower than those in the dark analogue. Our results provide the first support for the hypothesis that birds assess light conditions during nest site selection. In addition, the nest height may be use as a mechanism regulating illumination within cavities.

D8 Peter Schausberger : Proximate variation of early learning in foraging predatory mites

Learning ability is ubiquitous but the performance in learning varies largely, both constitutively and proximately, among individuals and populations. Constitutive variation is due to selection, proximate variation depends on the immediate behavioral and ecological contexts. We demonstrate cue-, diet- and attention-related causes of proximate variation in early learning by foraging predatory mites. We scrutinized which prey cues are learned, compared the underlying learning mechanisms (non-associative/associative), investigated the influence of maternal and immediate diets, and looked at trade-offs in bi-contextual learning (social/foraging). The predators foraged more efficiently following experience with prey traces, prey contact and prey feeding. External prey cues paired with a feeding reward produced stronger learning effects than mere prey contact without reinforcement. Maternal pollen diet and pollen availability during early life interfered with learning. Learning of prey interfered with social familiarization. Our study represents a key example for variation in learning performance.

D23 Petri T. Niemelä : Trustworthiness of beer ratings as a source of social information

Key question in social information use is how accurate it is because behavioural traits might often

vary among information producers. We addressed this question by using human beer ratings posted on internet, which people use as a source of social information. We analyzed repeated measures dataset of >130 000 beer ratings collected by 490 individuals. We decomposed variation in social information (i.e. ratings) into components attributable to characteristics of the beer (beer identity, beer style, brewery, country of brewery, alcohol content), characteristics of the individual rating the beer, and residual variation. Beer characteristics explained >60% of variation while inaccuracy in beer ratings due to individuality (10.6%) was much lower than expected based on meta-analytical reviews. Our findings thus demonstrate that beer ratings represent an unbiased source of social information. We also present unbiased “rankings” for different beer styles and countries where beers are brewed.

B46 Philip M Harrison : Inter-individual variation in depth use and diel depth plasticity

Partial diel migration, a facultative form of partial migration, has only recently been investigated, and the possibility that inter-individual differences play a role in structuring this migration, has not been investigated. Here we test the hypothesis that long-term individual differences in depth use and diel depth plasticity explain a proportion of variance in a partial diel migration. Specifically, we use hierarchical behavioural reaction norms to estimate the repeatability of depth use and diel depth plasticity, across multiple time scales, in a group of 47 burbot (*Lota lota*) tagged with acoustic telemetry transmitters. Our results, based on 373,439 depth measurements, show that while depth use and diel depth plasticity were primarily a proximate response to daily conditions, long-term inter-individual variation was also apparent. These findings highlight the important, yet previously unrecognised role inter-individual variation plays in structuring the vertical distribution of aquatic species.

D24 Philipp Sprau : Adaptations to multi-dimensional environmental factors in great tits

Urbanisation constitutes a unique setting to assess adaptive micro-evolutionary processes of human-induced rapid environmental change. Urbanisation has mostly been investigated by comparing urban to rural populations or by quantifying the effects of single environmental factors that might cause differences in phenotypic traits along urban gradients. Yet the multidimensionality of environmental factors that shape urban habitats has mostly been neglected. To test how environmental variation between urban and rural populations as well as along urban gradients may shape life history and behaviour of *Parus major* we quantified multiple environmental factors. Data from the first two breeding seasons imply that differences in phenotypic traits between urban and rural areas stem from spatial variation that is not induced by the environment. Within urban habitats, however, birds adapt to their environment both on between and on within individual levels. These findings provide new insights in micro-evolutionary effects of urbanisation.

B35 Pim Edelaar : “Selection of the environment”: a distinct behavioural driver of adaptation

We argue conceptually and empirically that movement caused by behavioural “selection of the environment” is a driver of adaptation that is distinct from natural selection. We present a novel framework to understand the mechanisms of adaptation, acknowledging that individuals as well as environments can be changed. Applying this in nature, we show that ground-perching grasshoppers colonising novel street pavements surprisingly maintain their camouflage, because individuals select those pavements that are similar to their own colouration. Habitat use changes adaptively after individual colouration is experimentally altered. This results in a marked adaptive, genetic microgeographic population structure, and enhanced scope for assortative mating. Our results demonstrate that evolutionary theory needs to incorporate that individuals are not only targets of selection (by the environment), but also agents of selection (of the environment). Realising that individuals can evolve their own populations through their behaviour allows for a richer understanding

of the evolutionary process.

D22 R. Ian Etheredge : In *Gambusia affinis*, active females and social males learn better

Identifying behavioral correlates of learning holds promise for better understanding of how individual differences in cognitive ability arise. The behavioral diversity amongst Poeciliids make them particularly suited for such investigations. Here we use *Gambusia affinis* to ask how individual performance in a numerical discrimination task (numerosity) correlates with independent measures of activity, anxiety, exploration, sociability, and mate choice. Using canonical discriminant analysis and linear mixed-effect models we identify a sex by sociability interaction in predicting learning performance. Furthermore, we identified significant behavioral differences as well as sex-dependent behavioral correlates related to learning. In females, learners are differentiated by higher activity levels; while in males, sociability is the best predictor of performance. Taken together, male and female learners converge on learning performance but differentiate themselves from non-learners in sex-dependent ways.

B8 Rachel Olzer : Male preference for calling song in Pacific field crickets

Satellite behavior involves non-signaling males that eavesdrop on signaling males and intercept approaching females. The evolutionary loss of a sexual signal in populations of *T. oceanicus* provides a unique opportunity to examine this alternative mating strategy. While previous work shows the importance of calling song in female mate choice, unknown still is how non-calling males might increase their fitness by exhibiting a preference while engaging in satellite behavior. In this study we conducted playback experiments to ask how males determine which calling males to orbit while engaging in satellite behavior? To test this, we placed adult males in a linear arena with a speaker playing varying song qualities on one end. We measured both the latency to touch the speaker and the distance from the speaker that each male settled. Our results illustrate the importance of understanding how selection differentially acts in males and females.

B39 Rafael Mares : Comparative foraging strategies in frugivores: Big brains via 'smart foraging'?

How do species with relatively large brains for their body size afford such energetically expensive organs? In non-human primates, a leading hypothesis is that larger brains allow individuals to use more complex foraging strategies and thus extract resources more efficiently. Empirical support for this hypothesis is lacking, however, in part because the comparative data required to test whether large-brained primates forage more efficiently than non-primates are not available. Here, we compare foraging patterns across four sympatric frugivore species: spider monkey, capuchin monkey, coati and kinkajou. We combine high-resolution GPS tracking data from 20 animals with a photo mosaic of our entire rainforest study site (Barro Colorado Island, Panama) that identifies all fruiting trees of their primary resource. Our results suggest that primates and non-primates differ in their ability to integrate information about what resources are available, where they are located, and when they are ripe.

A3 Raïssa de Boer : Inbreeding x Environment interactions early in life: causes and consequences

The effects of inbreeding are often enhanced under stressful environmental conditions, and such inbreeding-environment interaction effects may be most relevant early in life, because individuals are particularly sensitive during early development, and because changes during early development have often long-lasting consequences. Here, we reared inbred and outbred birds under experimentally manipulated pre- and post-natal conditions, allowing us to study the interactive effects of inbreeding and environmental conditions at different developmental stages. Our results suggest that inbreeding -

environment interactions are most probably caused by the fact that birds lose direct competition with outbred birds. In addition, we still observed differences in oxidative balance between inbred and outbred birds at adulthood, which depended on the early life conditions birds had experienced. This indicates that inbreeding – early life environment interactions may have long-lasting physiological consequences with the potential to affect the sensitivity to environmental conditions later in life.

C4 Rebecca J. Wilson : Investigating temporal patterns of neurohormones associated with foraging in spiders

While it is widely assumed that circadian rhythms benefit organisms by allowing them to anticipate changing conditions, only a few studies have directly tested this. Being both predator and prey, orb-weaving spiders offer a novel, tractable model system to test whether circadian rhythms are adaptive due to their variety of temporal foraging strategies across species. Previous work suggests that spiders modulate their aggression/wariness over the 24-cycle and that aggression and wariness are modulated by biogenic amines. In this study, we analyzed temporal changes in catecholamine levels in three orb-weaving species with differing temporal foraging strategies. After an entrainment period, spider cephalothoraxes and haemolymph were collected at 4 different time points over a 24-hour cycle and neurohormone levels were measured using HPLC-ED. Levels of catecholamine neurohormones did change over the 24-hour period with all three species, however the patterns found were not uniform.

A23 Rebecca Stutz : Borrowed plant defences: browser response to a forestry by-product

Browsers can cause significant damage to preferred tree species. Damage may be reduced using the defensive chemicals produced by other plants. We tested the potential of birch bark extract to protect Scots pine seedlings from browsing by moose and red deer. We quantified their responses to extract treatment as a function of both inter-plant distance and treatment pattern. Both species consumed significantly fewer treated than untreated seedlings, but responses differed when only alternate seedlings were treated. At inter-plant distances equivalent to those used in forestry, untreated seedlings with treated neighbours were more likely to be browsed by red deer, and less likely to be browsed by moose, relative to the control treatment. This reflects the scale at which these herbivores make browsing decisions. Chemical defences extracted from forestry byproducts could effectively reduce browsing of preferred trees, particularly when their application considers the scale of selection by dominant browsers.

B20 Renato C. Nali : Environment, genetics or sexual selection? Communication in a Brazilian treefrog

Variation among animal populations is common, yet studies rarely combine various traits and mechanisms to address adaptive and neutral patterns of differentiation. We compared morphology and calls of a treefrog with complex reproductive behaviors, and examined the roles of sexual selection, genetic drift, and acoustic adaptation to the environment (AAH) on call differentiation. Calls varied more than morphology, suggesting stronger selection on acoustic variables, and variables related to individual discrimination or female attraction showed significant population differentiation. Genetic drift and AAH were unrelated to call divergence, and two acoustic variables opposite to AAH indicated a role for male competition. Thus, individual recognition and female preferences may have shaped call differentiation, while intermale competition appears as an underlying mechanism (inter and intrasexual selection). Female choosiness and male territoriality observed for this species support our results. We showed that a multitrait and multimechanism approach can elucidate intricate processes leading to behavioral differences.

B2 Richard K. Simpson : The evolution of hummingbird coloration and courtship displays

Animals display an incredible diversity of exaggerated traits used for communication. The sensory drive hypothesis states that selection will favor signaling traits than can be effectively transmitted through the environment, and interact with each other to improve transmission efficacy. We are studying evolutionary interactions between colorful ornaments and display behaviors in order to understand diversity in these traits across bee hummingbirds. We filmed male courtship displays and plucked feathers for color measurement in several species. We used the display data to recreate each species' courtship displays in time and space and photographed the feathers as we moved them through the recreated display to measure perceived male coloration. We tested the relationships between species' plumage patch, display behavior, and perceived coloration. Our results indicate a potential negative relationship across species between patch size and display width. Additionally, our results demonstrate the importance of trait interactions when evaluating signal diversity and coevolution.

C11 Rodrigo A. Vasquez : The frequency distribution of behavior and integrative phenotypic assessment

Although intra-specific variability is the raw material on which natural selection acts to shape evolutionary change, few studies have assessed variability, least on several traits. Intra-specific variability can have important consequences, particularly since different phenotypes can be adaptive under different scenarios. We studied *Octodon degus*, a diurnal rodent that exhibits social foraging, bi-parental care, and communal living. We assessed exploratory behavior, burrowing, basal metabolism and plasma cortisol, and found that the population is characterized by having two different phenotypes, exploratory and non-exploratory animals, and that there is a large variability in burrowing behavior, sociality, and cortisol levels. Furthermore, we found that basal metabolism is lower among exploratory animals, in agreement with profiles of cortisol. These results have important neurobiological, ecological, and evolutionary implications, making the species an exciting model for the integrative study of behavior. (ICM-P05-002, PFB-23-CONICYT, FONDECYT 1140548)

B42 Roi Harel : How time, energy, risk, age and scale affect soaring flight?

Animals try to minimize time, energy and risk costs when performing movements. We examined variation in decision-making proxies related to soaring-gliding flights over several spatiotemporal scales. Long-range movements were compared to local ones, and at local scale inbound flights (to a roost) were compared to outbound flights (from a roost), using GPS and accelerometer data collected from Eurasian griffon vultures (*Gyps fulvus*). We found that both in long-range movements and inbound flights, individuals minimized time (moved forward more efficiently) and energy (less flapping) and maximized risk (steeper gliding), compared to local foraging movements and outbound flights. Thus, vultures balance time and energy trade-offs using similar rules at different scales, presumably due to similarity in the level of uncertainty about the movement outcomes. Older birds showed higher soaring-gliding efficiency, presumably due to their superior ability in utilizing drifted thermals compared to juveniles.

D38 Sabine Kraus : Born to be aggressive, curious or fearless? – Heritability of personality

Animal personality describes behavioural differences between individuals that are consistent across time and contexts. Especially the evolutionary mechanisms generating and maintaining individual differences are still under debate. Heritability, the transmission of the phenotypic variability within a population from generation to generation, is a key genetic parameter regarding whether natural selection is able to generate evolution on a trait or not.

We have developed a standardized test battery comprising three personality traits. We measured

aggression towards a mirror, exploration in a novel environment and fearlessness in a tonic immobility test in a captive population of wild-type zebra finches. We established bi-directional selection lines on each of these three traits to study their genetic and environmental causes. Preliminary parent-offspring regression analyses indicated heritability estimates between 0.12 and 0.44 after three generations of selection. We will report heritabilities obtained from four generations of selection using an animal model.

D21 Sajesh Vijayan : Ontogeny of orientation flights in the Eastern honey bee

Young honeybees undertake a series of short 'orientation flights' to learn the location of the hive relative to prominent landmarks around it. Earlier studies have indicated that physiological changes occur in the mushroom body and brain stem of orienting Western honeybees, suggesting that orientation flights are linked to learning. In *Apis cerana*, we investigate the age of onset and cessation of orientation flights, the number and duration of orientation flights, and the number of daily orientation flight 'bouts'. Results suggest that i) *A. cerana* colonies exhibit two orientation bouts per day, ii) individual bees undertake approximately four orientation flights prior to foraging and iii) individuals continue orienting after onset of foraging. Individual bees start orienting at 7 days and commence foraging at 12 days. A typical orientation flight is ~85 seconds, compared to ~200 s in *A. mellifera*, which might explain continued orientation after onset of foraging in *A. cerana*.

B30 Samantha C. Patrick : Personality predicts the way individual albatrosses search for food

Mobile foragers generally locate prey by increasing searching in specific key areas to optimise the tradeoff between effort and reward. However, where and when to intensify searching may differ among individuals, offering a mechanism to explain widely reported individual foraging strategies. Personality differences have been suggested to influence the exploitation of resources patches and here we test whether personality predicts the way individual albatrosses search for food. Using GPS tracking data from wandering albatrosses, during incubation, we show that the boldness predicts the scale at which individual search and the number of patches they use. This is one of the first studies in the wild to show that individual personality predicts searching strategy and suggests that optimal foraging behaviour may covary with personality itself.

C39 Sandra A. Allan : Wavelength-associated behavior of the Asian citrus psyllid

The Asian citrus psyllid, *Diaphorina citri*, the vector of the pathogen causing the devastating citrus disease, huanglongbing, resides primarily in citrus canopies with intermittent dispersal to new habitats. The impact of specific visual cues (such as hue) are poorly understood. In this study, laboratory assays were undertaken to specifically address the impact of different wavelengths on movement-associated behaviors in the psyllids. Ultraviolet and green light differentially affected klinotaxis with strong orientation towards ultraviolet light and little movement under green light. Additionally, age affected walking responses with older psyllids less mobile under green light. These results are related to movement of psyllids within tree canopies and between trees.

B25 Sarah M. Zala : Sex-dependent modulation of ultrasonic vocalizations in house mice

Mice communicate with complex ultrasonic vocalizations (USVs), and our goals were to determine whether USV emission depends upon the sex of the sender, receiver, or both. We recorded USVs of wild house mice (*Mus musculus musculus*) during same- and opposite-sex interactions, and we developed a method to automatically detect and quantify USV elements. We found that males emitted more vocalizations than females during interactions with females, and that females vocalized more for males than for females. We also found more vocalizations during opposite- than same-sex

interactions and that the frequencies of vocalizations of both sexes depended upon the sex of receiver. These results provide the first evidence that mice modulate the amount and frequency of their vocalizations depending upon the sex of the receiver.

A22 Sean A. Rands : Why show stop/start behaviour when moving to food?

When an animal has to leave a safe refuge to travel to a patch, it exposes itself to predation risk. In experimental systems, this travel behaviour may be slow and indirect, rather than a fast trip that would minimise exposure time.

I describe a stochastic dynamic program that models animals deciding to move from a refuge to a distant foraging site. The animals pay attention to their energetic reserves as they are metabolising energy, and can only increase reserves when they forage. If a predator appears, the animal turns and runs to shelter, with an enhanced risk of being killed by the predator.

Several optimal behavioural policies are discussed. Typically, an animal following these policies will spend a large amount of time waiting in the exposed region between the refuge and the foraging site, mirroring the slow 'dawdling' behaviour seen in many empirical systems when moving to a foraging site.

A32 Seongseop Park : Diving patterns of gentoo and chinstrap penguins on KingGeorge Island

Sympatric animal species may differentiate their foraging behaviors with the inter-specific competition. Also, breeding parents can increase the foraging effort to feed offspring after hatching. From December 2015 to January 2016 on KingGeorge Island, Antarctica, we deployed 25 TDRs and 58 GPS to chinstrap and gentoo penguins, which breed sympatrically, during the incubation and chick-rearing period. We aim to 1) compare their diving behaviors between the incubation period and the chick-rearing period, and 2) examine the differences between chinstrap and gentoo penguins. Our results showed that chinstrap and gentoo penguins segregated the foraging ranges and diving depth. In addition, both species performed deeper diving during the chick-rearing, compared with the incubation. These results suggest that the sympatric penguins may differentiate foraging niches, possibly due to the inter-specific competition, and adjust their foraging habitat with the breeding stages to satisfy the demand for food of offspring.

B26 Seth Bullock : Modelling communal boundary latrine formation in the badger, *Meles meles*

A simple, spatially explicit model of badger foraging and territoriality is replicated and extended to include defecation in order to better understand patterns of communal latrine formation in the European badger, *Meles meles*. We find that 1) communal latrines arise spontaneously at home range boundaries without the need for specific cognitive behavioural adaptations, e.g., spatial memory, recognition of individuals, or commuting to latrine sites; 2) both territorial and non-territorial (free-roaming) badgers achieve communal boundary latrines, suggesting that latrines may shape territoriality as well as vice versa; 3) simple "faecotaxis" and overmarking behaviours are both necessary positive feedbacks underpinning communal boundary latrine formation; and 4) lowering badger numbers results in less defecation overall, but does not tend to reduce the number of faecal deposit sites significantly, since lowering population density weakens the positive feedbacks underpinning latrine formation, thereby attenuating the badgers' ability to concentrate defecation in communal latrines.

D39 Sheri L. Johnson : Quantifying repeatability of personality traits in zebrafish

Between-individual differences in behaviour that persist through time (i.e., personality) are widespread among animals, and personality is now commonly explored in the fields of animal behaviour and behavioural ecology. The consistency of traits can be quantified through repeatability estimates. Yet, the majority of reported behavioural estimates originate from studies that are conducted over short temporal scales (i.e., within days). Here we use the model vertebrate, the zebrafish (*Danio rerio*), to quantify repeatability of a suite of traits over time (days to months), using behavioural analysis software, EthoVision XT. Zebrafish have been widely used as a model for anxiety and behavioural neuroscience, but studies rarely estimate repeatability. We aim to show that the five key personality traits (activity, exploration, aggressiveness, boldness, and sociability) are repeatable over time. Moreover, we assess sex differences and whether any behavioural syndromes exist.

A14 Sophia Whitlock : Passerine Prozac Prescriptions: antidepressants in the environment affect starling behaviour

Many pharmaceuticals, including antidepressants, survive wastewater treatment processes, entering the terrestrial environment via sewage sludge. They can then be taken up by invertebrates, including those living on wastewater treatment plants, which can be predated by wild birds. Although present in the environment at low concentrations, antidepressants are designed to change behaviour at low doses. Currently, little is known about the effects of this pharmaceutical contamination on birds. This project aims to use behavioural endpoints to assess the effects of exposure to environmentally relevant concentrations of the antidepressant fluoxetine in the Eurasian starling (*Sturnus vulgaris*). Anxiety related endpoints are employed in order to mirror the intended therapeutic action of fluoxetine, specifically: a) neophobia in the presence of a novel object and b) exploration of a novel environment. Changes in anxiety related behaviours are predicted to alter responses of wild birds to risks such as predators.

B55 Sophie C Bell : No short-term tag effects on Pied Flycatcher provisioning rate

The fitting of miniaturised location tags to small passerines is a rapidly expanding field of study. Here we test whether there are any short-term effects of fitting geolocators on reproductive effort and success, of the Pied Flycatcher *Ficedula hypoleuca*. We compare provisioning rates, nestling growth and nest success between nests where the adult male was fitted with a geocator, with control nests where males had the same capture history but were not tagged. We found no difference between treatments in provisioning effort by males or their associated female, or nestling growth, two days after fitting of the device, and no difference in subsequent brood reduction or nest success.

B11 Stephanie Doucet : It's not easy being yellow: anuran dynamic sexual dichromatism

Bright male colouration is a common secondary sex trait in animals. Such traits can benefit males in multiple contexts including male-male aggression, female mate choice, and sex recognition. However, bright colouration may also increase conspicuousness to predators. We used two model presentation experiments to test possible costs and benefits of bright colouration in explosively breeding neotropical yellow toads. These toads exhibit dynamic sexual dichromatism wherein males rapidly change from brown to bright lemon yellow for just a few hours during their brief mating period. In our first experiment, males preferentially amplexed brown models over yellow models, suggesting that the yellow colouration may serve as a signal of sex. In our second experiment, yellow models experienced predation attempts more often than brown models. Our findings help to explain why male yellow colouration fades rapidly after mating in some anurans, and highlight both costs and benefits of conspicuous colouration in animals.

D32 Stephen J. White : Maternal and Genetic influences on personality and Pace of Life.

Despite extensive study on animal personality in recent years our understanding of its mechanistic underpinnings are still lacking. Through covariance with life-history, the Pace of Life Syndrome (POLS) provides one possible route through which behavioural variation can be maintained. But in order to understand how life-history and personality evolve together we need to understand their relationship at the genetic level. To do this we used a quantitative genetics approach on a lab population of guppies to estimate the contributions of genetic and maternal effects on boldness, growth and their covariance. Our results indicate that all traits measured have a significant genetic basis, with some maternal effect; meaning that boldness and growth are able to respond to selection with maternal effects potentially altering this response. This highlights the need for an evolutionary approach to personality research, which, ultimately, will allow us to predict how populations will respond to selection.

B34 Swetashree Kolay : Decision making during nest site selection in an Indian ant

During house hunting in social insects, individuals of a colony have to reach a consensus regarding a single nest among the multiple sites available and move as a cohesive unit. Usually, only a few members who have knowledge of the nesting sites are involved in decision making. We studied the process of decision making during relocation in an Indian ant, *Diacamma indicum*, and the effect of stress on this process. Relocations were conducted in the laboratory using 10 colonies where colonies were exposed to different stresses. Presence of a quorum at the new nest is not required for recruitment to the new nest to start. Moreover, increased stress causes more individuals to search for new nests resulting in faster decision making and faster relocation. This manner of response is bound to have a positive impact on colony survival and fitness.

B29 Sze-Wing Yiu : Landscape of Fear: To eat or to be vigilant?

The presence of predators affects their prey through a "Landscape of Fear," which causes behavioural adaptation in the prey in response to the perceived predation risk, ultimately affecting prey fitness. The impact could be substantial when long-extinct predators are reintroduced and the preys are naïve. We mapped predation risks by predicting the probability of occurrence of reintroduced lions, and compared the vigilance behaviour of zebra and blue wildebeest in areas with different predation risks. Time spent on intense vigilance behaviour (without chewing) by both species significantly increased with the level of predation risk (i.e. "fear") and risk of capture (small herd size, dense vegetation and greater distance between herd members), leading to a decrease in food processing time. Results therefore suggest a trade-off between vigilance and foraging, potentially effecting prey fitness in areas with high level of perceived predation risk.

C12 Takahiro Kato : Male embryo mortality biased offspring sex ratio in tree sparrows

Sex-specific mortality (SSM) of offspring is pervasive phenomenon in many animal taxa. In avian species, it has reported that male embryo mortality is higher than that of female. Although SSM is one of factors skewing offspring sex ratio after fertilization stage, ecological and physiological factor of SSM was little known. Here, I researched the correlation of SSM and breeding density and individual interaction as ecological factor for 5 years. In addition to this, I measured yolk hormone level as physiological factor. I showed that embryo development rate per a clutch was negatively associated with an increase of breeding density. Moreover, embryo mortality increased with increasing the frequency of nest visit by the con- and hetero-specific nest competitors. Furthermore, I suggested that corticosterone have negative effect on embryo development. As a consequence, high male embryo mortality by hormonal effect was biased secondary sex ratio in according to breeding environment.

C17 Tamsin Shepherd-Waring : Effects of developmental experience on behaviour and consistency

Many aquatic species rely on chemical information to determine predation risk, and adjust their behavioural responses based on current threats in their environment. In the pond snail, information collection starts early during embryonic development. However, it is not known if the impact of embryonic development lasts past the hatching stage or whether embryos respond in the same way to generalized or specific alarm cues. It is also not known how developmental experiences affects consistency of behaviour in this species over their life time. Although the picture is complex, this work goes some way to answering these questions. The results are discussed in terms of how the potential reliability of information received in embryonic stages can impact on the plasticity and consistency of behaviour throughout early life.

B4 Tan Morgan : Human presence affects signature whistle usage among bottlenose dolphins

Signature whistles are social cohesion calls produced by bottlenose dolphins (*Tursiops truncatus*) to identify themselves as individuals, but are difficult to study in wild populations. Dolphin Reef in Eilat, Israel is a lagoon inhabited by a family of five wild dolphins, encouraged to remain permanently by regular feeding. This semi-wild situation provides the opportunity to study the vocal behaviour of a dolphin community without the difficulties of following free-ranging animals. The Reef is also visited by tourists who come to view and interact with the resident dolphins. We examined the whistle repertoire of this pod to see whether their signature whistle use depends on the presence of humans and other disturbances. Among other findings, the proportion of signature whistles in the repertoire increases during interactions with tourists. These findings have important consequences for measuring the impact of humans upon the emotional states and social behaviour of wild dolphins.

B49 Thomas Bodey : Competition and opportunity interact to affect individual specialisation in gannets

Individual specialisations are important contributors to ecological processes. Experimental results and theoretical predictions suggest increasing specialisation occurs with increasing intraspecific competition; but in wild systems density interacts with environmental variation, potentially modulating this link. We investigated the interactions among intraspecific competition, foraging specialisations, and environmental heterogeneity in a colonial central-place forager, the Northern Gannet *Morus bassanus*, at six different sized colonies. We found that inter-individual dietary variation and spatial separation of dietary specialisms were generally higher at larger colonies. However, repeatability of movements did not vary with colony size, and environmental variation strongly moderated results through effects on foraging opportunities. Our findings demonstrate the range of ways in which intraspecific competition can affect the extent of individual specialisations within a single species in a wild context. They highlight the importance of variation in resource availability in the extent to which specialisations are manifested in a wild system.

A18 Thorben Müller : Host plant effects on behaviour and reproduction of a beetle

The question whether larval or adult host plant experiences are decisive for the adult phenotype is largely unexplored, especially in holometabolous insects in which both larvae and adults consume plants. We reared larvae and adults of the leaf beetle *Phaedon cochleariae* constantly on watercress (natural host) or on cabbage (nutritious crop) or switched them after metamorphosis (match-mismatch). The behavioural phenotype, feeding preferences and reproductive output were determined several times throughout lifetime. Adult behaviour differed mainly between sexes and over time, only weakly influenced by the host experience. In contrast, adult feeding preferences and reproduction were shaped by the current host experience, with significant preferences for the more

nutritious plant (cabbage) and a higher reproductive success on that food. Furthermore, adults could compensate for poor larval food conditions. Nutritious crop plants, which lead to a higher reproductive output and are preferred, may thus be readily exploited by herbivores.

D7 Timothy J Polnaszek : Tradeoffs associated with rapid responses: nectar foraging experiments with bumblebees

Individual differences in responsiveness, or sensitivity to change, potentially underlie differences in innovation and behavioral flexibility. Since responsiveness and flexibility are seemingly beneficial, what causes these differences and why do they persist? We examined whether responsiveness is similar across contexts, creating a tradeoff where individuals who respond quickly to potentially relevant cues are also more likely to be distracted by extraneous cues. Specifically, we measured changes in the foraging behavior of bumblebees (*Bombus impatiens*) in response to new flowers (relevant) and fake leaf litter (extraneous) to determine if responsiveness is general or context specific. We also tested whether responsiveness predicts performance in an assay of behavioral flexibility (a reversal learning task). The results show that bumblebees 'distracted' by leaf litter were also more likely to respond to new flowers. Responsiveness also predicted reversal learning performance, but this effect was small compared to the effects of color preferences and colony ID.

C25 Tom Langbehn : Photoperiodic implications on visual foraging in polar marine ecosystems

Trophic interactions are the key link between climate-driven environmental change and community processes defining ecosystem dynamics. The accelerated loss of Arctic sea ice constitutes a drastic change to the light regime of the pelagic realm with fundamental implications for the outcome of predator-prey interactions. We used mechanistic modelling of biological and physical components along a latitudinal gradient from open water to sea-ice covered seas to investigate light-modulated impacts on seasonal predator-prey interactions involving visual predators. Less sea ice means increased light which results in more efficient visual search. Phenology of sea ice and its relative timing to the solar photoperiod was found crucial for foraging. Melting sea ice will seasonally boost visual foraging of planktivorous fish and thus strengthen top-down control of the arctic pelagic food-web. Strongly non-linear responses in foraging will likely induce light-driven regime shifts in the pelagic realm.

C24 Topi K. Lehtonen : Familiar enemies are dearer to males than females

In order to manage the costs of aggression, whether confronted by conspecific or heterospecific intruders, animals commonly adjust aggression according to the perceived level of threat. Yet, we currently know surprisingly little about heterospecific interactions or sex differences with regard to adjustment of aggression, particularly in the context of the 'dear enemy' phenomenon in territorial animals. To address these knowledge gaps, we experimentally manipulated territorial intrusions in a biparental cichlid fish, the moga (*Hypsophrys nicaraguensis*), in their natural habitat. We found that both females and males quickly habituated to heterospecific intruder stimuli, with aggression decreasing quicker when the stimulus, sequentially presented to the focal fish, remained the same than when it did not. We also found a significant sex difference: males habituated faster. Such patterns of aggression adjustment can have important ecological consequences, affecting the reproductive success and coexistence of the interacting individuals and species.

B21 Troy G Murphy : Facultative status signaling in titmice when competition varies over time

When resources are unstable over time, the use of status signals to mediate competition may also vary over the same time scale. We studied status signaling among male black-crested titmice

(*Baeolophus atricristatus*) at supplemental feeders in Texas. Using Radio Frequency Identification technology at feeders, we tested the relationship between the size of the prominent head-crest and foraging success of males across seasons, and also after feeders were experimentally reduced. Males with longer crests were more successful at maintaining access to feeders both during the competitive time of year and when feeders were reduced, but no relationship was detected when competition was naturally low at feeders. These results suggest that the crest functions as a status signal during periods of high competition, and that the potential for status signaling persists between seasons, even though such signaling may not be overtly present or detectable during periods of low competition.

A25 Ulrika A Bergvall : Directional associational plant defence from red deer foraging decisions

Herbivore feeding behaviour can result in associational plant defence. For instance, an unpalatable plant might protect its neighbours from grazing. We have investigated the new but similar question of whether a part of a plant, e.g. top or bottom, can protect other parts. In experiments we used 1 m high artificial trees, made from aspen branches, and measured red deer browsing from the top (above 0.5m) and the bottom (below 0.5m), with the application of condensed tannin to top or bottom as a proxy for plant part unpalatability. There were four treatments where either none, both, or one part (top or bottom) of the artificial trees had tannin applied. We found that a defended top protected an undefended bottom, but we found no evidence for the opposite relationship. The explanation could be that red deer prefer to start their feeding from the top of the plants.

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B22 Victoria E. Lee : Contact call discrimination in a social corvid

In complex social environments, an ability to recognise other group members and associate individual cues with past experience is likely to be beneficial in mediating social interactions. Under these conditions, strong selection for individual discrimination and learning of conspecific vocalisations is expected. Here, I tested the ability of jackdaws (*Corvus monedula*) to discriminate between contact calls of different individuals. Jackdaws are members of the large-brained corvid family and form long-term monogamous pair bonds, nesting in small colonies during the breeding season. Incubating females were presented with contact call playbacks from their partner, a male from a neighbouring nest, and an unfamiliar male. The behavioural response of females following playback differed significantly according to the identity of the caller, suggesting that jackdaws are able to discriminate between contact calls of different conspecifics and that this discrimination extends beyond the pair bond.

A15 Victoria Franks : Social behaviour and learning in young hihi (*Notiomystis cincta*)

To survive in a changing world, animals can update behaviour using information. This may come from personal experience and/or via social information, but both come with costs and benefits, and sources

of information may conflict. How do juveniles in particular, with little personal experience, cope with information conflict? Here, I use field experiments with an endemic New Zealand passerine, the hihi/stitchbird to show that social relationships change during their first few months of independent life, changing their access to social information. I also show that when learning a new behaviour, juveniles associate novel cues with a food reward more slowly than adults. These results suggest that social interactions in young hihi may play a role in determining how they learn as adults. For this endangered bird, determining how social relationships affect survival in changing environments will be particularly relevant for improving the success of translocations for their conservation.

C19 Victoria Yolanda Lourenco de Souza : Can activity period influences on defensive behaviour of neotropical harvestmen?

In this paper were provided an experimental study about some of the differences on defensive behaviour of *Pseudopucroliia discrepans* (Roewer, 1943), harvestmen which commonly occurs in the northeast Brazilian Atlantic Forest. We tested the hypothesis that harvestmen possess differences defensive strategies depend on the activity period. Upon disturbance, they may exhibit four behavioural acts: as fled, tanatosis pinch with the apophysis of the femur and coxa IV and can also release a repugnatory liquid upon manipulation. Experiments were performed in 30 individuals of an Atlantic Forest fragment in the Brazilian northeast by manipulating the defensive behaviours during daylight and night and between male (n=15) and females (n=15). There are no significant differences between males and females behaviours. The most used defensive action is fled. The field study suggests that fleeing is the most effective defensive behaviour but the others are important and deserve more focus to research.

D10 Wouter van der Bijl : Brain size varies with predation in birds

The widespread variation of brain size and cognitive ability begs the question which selection pressures have driven the evolution of these traits. Several recent papers have highlighted predation as a possible driver of brain size evolution through study of mortality in semi-natural settings as well as study of anti-predator behavior, but it remains mostly unknown how brain size affects predation outcomes in the field. Since current theory concerns predation pressure and predation level data is more often available, we first present a simple model to aid in our predictions. This model predicts a positive relationship between effective predation rate and brain size, if predation drives brain size evolution. We tested this prediction on 83 bird species. Indeed, brain size was positively related to predation rate. These results add to the growing body of evidence supporting predation as a widespread driver of the evolution of larger brains.

C13 Yashada Kulkarni : Identifying male sex pheromones of a butterfly using behavioral assay

Pheromones elicit a behavioural or physiological response in another individual of the same species. Most studies identifying pheromones in lepidoptera focus on electrophysiological response elicited by the supposed pheromone, but rarely on behavioral changes in the receiver. Here, we use simple behavioral studies to identify male sex pheromone in a tropical swallowtail butterfly instead of following the physiological approach.

Males of the tailed jay (*Graphium agamenon*) possess scent pouches. Behavioral changes in females subjected to sprays of extracts of volatile substances from male scent pouches were studied. Females responded positively to samples from middle-aged males compared to those of younger and older ones. Gas chromatographic and mass spectrometric analysis confirmed variation in composition of volatile substances with male age. Major individual compounds from male scent pouch extracts were synthesized and behavioral assays repeated and pheromones identified.

A2 Ye Eun Kim : Comparison of antipredator behavior between *Hyla japonica* and *Hyla suweonensis*

Hyla japonica and *Hyla suweonensis* are cryptic species. Morphologically similar, the most noticeable characteristic is the difference in mating call. Currently, *H. suweonensis* is considered an endangered species, while *H. japonica* is a common species. One hypothesis is that these two species originally evolved in different natural habitats but as these natural habitats are no longer available, both are competing in a common habitat, the rice paddy. This study tries to observe this difference in evolutionary background through differences in antipredator behavior.