

# Conference Schedule

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Wednesday, 4<sup>th</sup> September 2019

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20.00 – 22.00 *Informal ice breaker*

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Thursday, 5<sup>th</sup> September 2019

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08.15 – 09.00 *Registration*

09.00 – 09.30 *Welcome of the authorities and announcements*

09.30 – 10.30 **Plenary talk**  
**Tomer Czaczkes: Value perception & cognition in social insects**

10.30 – 11.00 *Coffee break*

11.00 – 12.30 **Talk session 1: biological bases of behaviour**

11.00 – 11.15 **Angela Andreella**  
 A statistical approach to the alignment of fMRI data

11.15 – 11.30 **Livia Cosentino**  
 Male mice carrying dysfunctional methyl-CpG binding protein 2 are vulnerable to traumas

11.30 – 11.45 **Anastasia Morandi Raikova**  
 The effect of eye occlusion on the hippocampal representation of environmental novelty in domestic chicks (*Gallus gallus*)

11.45 – 12.00 **Nicola Meda**  
 Place learning can be assessed by changes in locomotor velocity in *Drosophila melanogaster*

12.00 – 12.15 **Simone Gastaldon**  
 Do I produce to predict? Brain oscillations in language anticipation in fluent speech and stuttering

12.15 – 12.30 **Nela Novakova**  
 Does behaviour of cranes mirror their phylogenetic relationships?

12.30 – 14.00 *Lunch on your own*

14.00 – 15.00 **Plenary talk**  
**Anna Wilkinson: Cold-blooded cognition**

15.00 – 16.00 **Poster Session A**

16.00 – 17.30 **Talk session 2: cognition**

16.00 – 16.15 **Giovanni Frighetto**  
 Action-based attention in *Drosophila melanogaster*

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16.15 – 16.30	<b>Jim McGertick</b> Dogs' responses in inequity paradigms may be driven by perceptions of reward attainability
16.30 – 16.45	<b>Silvia Guerra</b> Goal-directed actions in plants: a kinematical approach
16.45 – 17.00	<b>Alessandra Pecunioso</b> Anisotropy of perceived numerosity: Evidence for a horizontal-vertical numerosity illusion
17.00 – 17.15	<b>Maria Bortot</b> Abstract numerical representation in honeybees ( <i>Apis mellifera</i> )
17.15 – 17.30	<b>Giulia Montalbano</b> Individual differences in inhibitory control in a teleost fish
17.30 – 18.15	<b>Round-table discussion</b> <b>Gianmarco Altoè: Good research practices</b>
20.00 – 22.00	<i>Conference Dinner at "Pizzeria Marechiaro" (p.7)</i>

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## Friday, 6<sup>th</sup> September 2019

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09.00 – 09.30	<i>Announcements</i>
09.30 – 10.30	<b>Plenary talk</b> <b>Cinzia Chiandetti: Cognition in the poultry yard</b>
10.30 – 11.00	<i>Coffee break</i>
11.00 – 12.30	<b>Talk session 3: social interactions</b>
11.00 – 11.15	<b>Zsofia Bogнар</b> Look into my eyes, I will reward you – Head shape, sex and age affects dogs' visual communication
11.15 – 11.30	<b>Gwen Wirobski</b> Hand raised, pack-living dogs' and wolves' urinary oxytocin levels following interactions with human partners
11.30 – 11.45	<b>Paula Perez-fraga</b> Who looks for human assistance? A comparative study of pigs' and dogs' performance in an unsolvable task paradigm
11.45 – 12.00	<b>Marianne Wondrak</b> Who is a happy pig? - Does social status influence decision making in a cognitive bias task?
12.00 – 12.15	<b>Vedrana Slipogor</b> Cognitive aspects of 'group personality' in common marmosets ( <i>Callithrix jacchus</i> ): does social environment affect the individual variation in learning?

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12.15 – 12.30	<b>Katarina Wenig</b> Let's play - an ontogenetic study on play contagion in ravens
12.30 – 14.00	<i>Lunch on your own</i>
14.00 – 15.00	<b>Talk session 4: ethology</b>
14.00 – 14.15	<b>Chayan Munshi</b> Quantification of self-grooming behavior of a semi-transparent prawn, <i>Macrobrachium lamarrei</i> , by applying video-based posture detection method
14.15 – 14.30	<b>Viviana Di Pietro</b> Copulatory wounding inflicted by a female genital structure in males of a damselfly?
14.30 – 14.45	<b>Anna Zanolì</b> Dimorphic phrase structure of the indris' song ( <i>Indri indri</i> ) and its potential for sex discrimination
14.45 – 15.00	<b>Katarzyna Ostrowska</b> Human behaviour in the specific conditions on the basis of the literary reportage „Wielki przyptływ” of Jarosław Mikołajewski
15.00 – 16.00	<b>Poster session B</b>
16.00 – 16.45	<b>Round-table discussion</b> <b>Lucia Regolin: Ethics in animal research</b>
16.45 – 17.45	<i>Acknowledgments, farewell and prizes</i>
19.00 – 21.00	<i>Happy hour! At ZùBar (p.7)</i>

## Saturday, 7<sup>th</sup> September 2019

9.00 – 11.00	<i>Tour in Esapolis or Orto Botanico – first round</i>
11.30 – 13.30	<i>Tour in Esapolis or Orto Botanico – second round</i>

# Poster sessions

## Session A – 5<sup>th</sup> September

Anita Szabò	Do Azure-winged magpies ( <i>Cyanopica cyanus</i> ) recognize themselves in mirrors?	1
Barbara Csibra	Measuring attention deficit, hyperactivity and impulsivity in dogs: Developing a human analogue ADHD questionnaire	2
Bianca Bonato	Silent reading and writing: the influence of language processing on motor response (and viceversa)	3
Carlos Daniel Corrales Parada	Neural basis of familiar and unfamiliar conspecifics recognition in domestic chicks	4
Carmen Schwarzl	Influence of migration behaviour and habitat affiliation on the eye size of birds: a case study from the Pacific lowlands of Costa Rica	5
Cecylia Watrobska	Does metabolic rate affect learning, memory and personality in chickens?	6
Cémentine Mitoyen	Differential role of courtship sensory modalities on the female response in the ring dove ( <i>Streptopelia risoria</i> )	7
Chiara urbinati	Metformin treatment rescues aberrant mitochondrial activity and oxidative stress status in the brain of female mouse model of Rett syndrome	8
Daniela Cardillo	Dog's sense of smell to help people with Food Allergies: a pilot study	9
Daniele Carlesso	Spontaneous quantity discrimination in crickets	10
Elena Gobbo	Personality of a dog and its owner and their attachment styles play a role in dog aggression	11
Elisa Tedaldi	Chicks on the right side: Young chicks' numerical discrimination is affected by spatial disposition of numerosities	12
Enrica Aguzzoli	Test-retest validation of a short battery of test for the behavioural assessment of ageing pet dogs	13
Eva Simoncicova	Altered hippocampal synaptic structure in male rat offspring after pre-gestational stress exposure and antidepressant treatment	14
Fabiana Festucci	A new paradigm for Prosocial Behavior and Reciprocity, assessed in WT and HET rats for the DAT gene	15
Giorgio Piazza	Speakers of Veneto-dialect and Italian: can these people be considered bilinguals? Evidence from Picture-Word Interference.	16
Huba Eleőd	Parallel analysis of EEG, ECG, and respiratory signal during sleep in dogs	17
Janet Louisa Wijaya	Spider See, Spider Do: Observational Learning in Jumping Spider	18
Justina Polomova	Are sexually naive zebra finch females able to discriminate between different male songs?	19
Judith Janisch	Motor skill learning in an elaborate courtship display	20

Session B – 6<sup>th</sup> September

Karel Novák	Behavioural and Physiological Changes in Dogs during Search for Missing Persons	21
Katarina Prikrylova	Visual individual recognition in African grey parrots ( <i>Psittacus erithacus</i> )	22
Klara Grethen	Effects of inequity on negotiation strategies of ravens ( <i>Corvus corax</i> ) in a cooperation task	23
Lisa Poncet	Do dogs reciprocate help received from a human?	24
Maria Cristina Talamo	Pharmacological inhibition of p21-Activated Kinase rescues the behavioural phenotype in a female mouse model of CDKL5 Deficiency Disorder	25
Martina Morová	The effect of prenatal and early postnatal exposure to a phthalate mixture on sociability, anxiety-like behaviour and testosterone production in rats	26
Michaela Piešová	Impact of gestational hypoxia on development and behavior of the rat offspring	27
Rita Lenkei	Separation related behaviour in dogs: the effect of fear and frustration	28
Sabrina Karl	Who do you prefer? Investigating the human-dog attachment system in pet dogs	29
Silvia Damini	Spontaneous differences in how male and female tortoises interact with conspecifics	30
Sofija Perovic	Assessing behavioural flexibility in domestic chicks through a serial reversal learning task	31
Valentine Comin	Figure-ground segmentation in <i>Phidippus regius</i>	32
Vivien Reicher	Effects of different training styles on learning performance and neural activity (sleep EEG) in dogs	33
Weronica Młodzikowska	Using a second language within sexual and romantic relationship	34
Zuzana Skalná	Does tickling evoke positive experience in laying hens?	35
Alexandra Koch	Comparing Ants With Humans? - A Comparative Psychology Approach	36
Mattia Pellas	Systemic treatment with Rimonabant, a CB1 receptor antagonist, improves behavioural alterations in a mouse model of Rett syndrome	37
Federico Ferrante	Spiders in the box: associative learning in <i>Phidippus regius</i>	38
Camilla Marossi	Animal art-ivity: the sense of beauty in bowerbirds	39
Gaia Pegarin	Slime mold: minimal cognition	40

# Getting around

## The venue

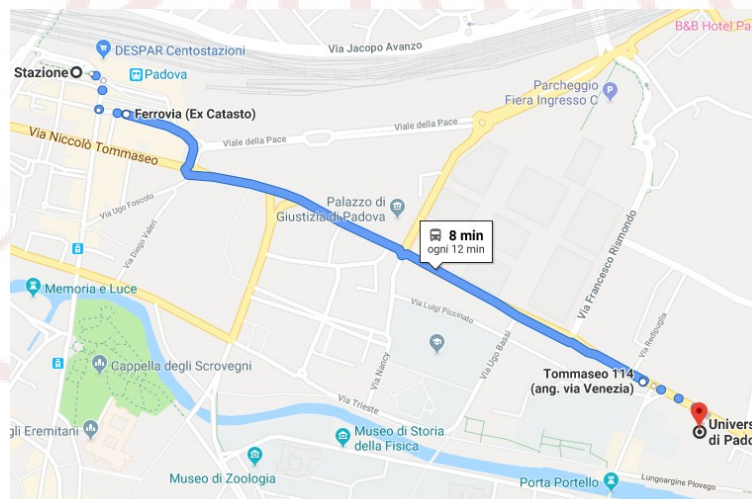
Università degli Studi di Padova - Centro Linguistico di Ateneo, Via Venezia 16 (other entrance in Via Venezia 8), 35131, Padua

From Via Venezia 16, you will get into a complex with 5 buildings. The conference will be held in building 4 (Centro Linguistico di Ateneo, CLA), while the poster sessions, registration and coffee breaks will be held under the colonnade on the building directly in front.



## Reaching the venue from the railway station

from the city station, get to the opposite side of the road and take either line DP, 7 or 10. The bus stop nearest to the venue is "Tommaseo 114 (ang. Via Venezia)". If you prefer to walk, it will take just around 20 minutes.



### Reaching “Pizzeria Marechiaro” 🍷 from the venue 🎓

Via Daniele Manin, 37, 35122 Padua

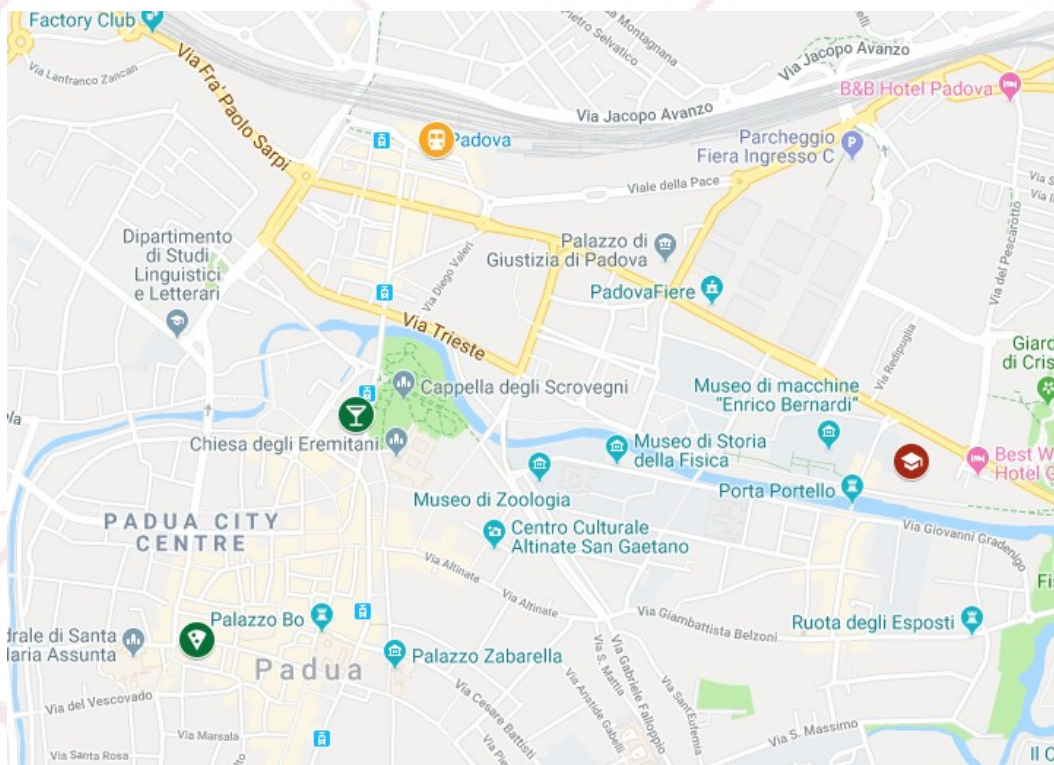
You have different options to get to the pizzeria:

- You can take any bus that will take you back to the city station (DP, 7, 10). From there take the tram line (direction “capolinea sud”) and stop at “ponti romani”. From there is a 5 minutes walk to the pizzeria.
- Bus DP will stop almost in front of the pizzeria. Stop at “Piazza delle Erbe” and then is just a 1 minute walk
- If you can, and especially if your accommodation is in the city centre, consider walking to the pizzeria! The city is lovely and it is most of the time more convenient to walk rather than taking the bus when staying in the centre.

### Reaching “ZùBar” 🍷 from the venue 🎓

Corso Giuseppe Garibaldi, 33, 35137 Padua

all the info given for the bus to reach the pizzeria are more or less identical to reach ZùBar, you just have to stop at “Eremitani”. As before, walking there may still be the best option!



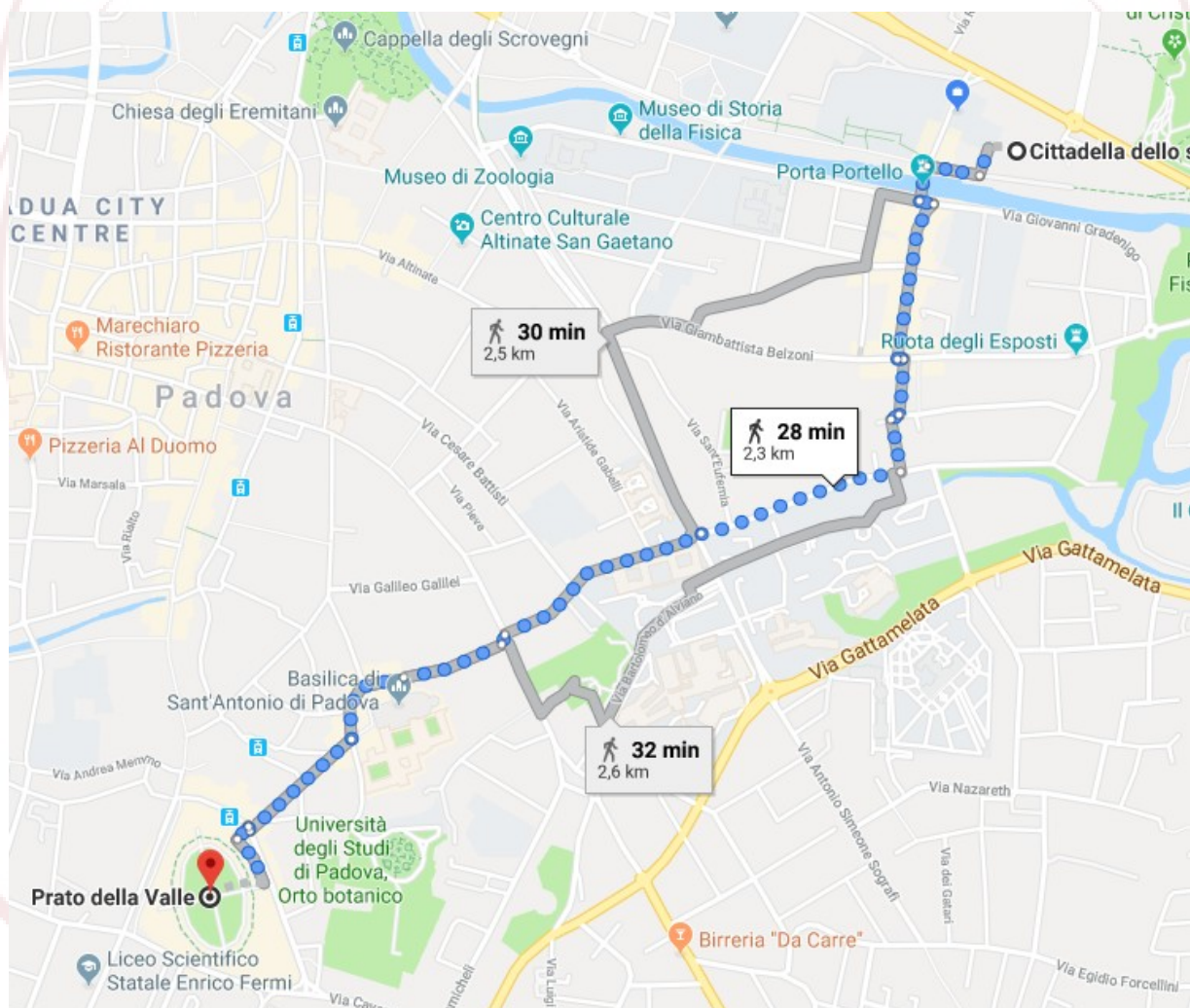
## Tours

We will reach both Esapolis and the Botanical Garden together. The appointment will be at 8:30 in "Prato della Valle", where who is going to visit Esapolis will take the bus (the ticket will cost 1.30 € each way), while who is going to visit the Botanical Garden will just walk there. For whom have chosen both tours, after the visits are finished we will meet back at Prato della Valle and we will swap places.

### Reaching Prato della Valle from the venue

To reach Prato della Valle from the venue by bus, you will have to go back to the city station with any bus (DP, 7, 10), then take the tram and stop at "Prato della Valle". Bus tickets in Padua last for 90 minutes after being validated, so you will be able to use the same ticket to get to Esapolis if you are going there.

Especially if you are staying in the city centre, walking there may be better than taking the bus. From the venue and surroundings, it's a half an hour walk.





# Book of Abstracts

## Students talks - Session 1

### **A Statistical approach to the alignment of fMRI data**

Andreella A<sup>1</sup>, Ma F<sup>2</sup>, Halchenko Y<sup>2</sup>, Van Loan Haxby J<sup>2</sup>, Finos L<sup>3</sup>

1 - Department of Statistical Sciences, University of Padua, Italy

2 - Department of Psychological and Brain Sciences, Dartmouth College, NH, United States

3- Department of Developmental Psychology and Socialisation, University of Padua, Italy

Multi-subject functional Magnetic Resonance Image (fMRI) studies are critical to test the validity of findings across subjects. However, the anatomical and functional structure varies across subjects, hence the image alignment is a fundamental step. One anatomical alignment is the Talairach Atlas, thus, it doesn't account for functional topography. For that, Haxby et al. (2011) developed a functional approach called Hyperalignment, using sequential Procrustes orthogonal transformations. The inter-subject classification of functional response improved. However, any constraint has been imposed on the transformation, losing the interpretability of the results. In this contribution, we tackle the functional alignment with a statistical perspective. A probabilistic model for the data generating process is defined. The maximum likelihood estimates of the rotation parameters result to be the Generalized Procrustes Problem solution, improving the Hyperalignment in terms of residuals sum of squares. The statistical framework allows assuming a prior distribution for the orthogonal transformation parameter, as the matrix Fisher Von Mises distribution. It embeds the anatomical information in the estimation of the parameters, i.e. penalizing the combination of spatially distant voxels. The application to several datasets shows that the proposed method improves the classification accuracy of task-related images compared to the anatomical alignment and the Hyperalignment methods.

### **Male mice carrying dysfunctional methyl-CpG binding protein 2 are vulnerable to traumas**

Cosentino L<sup>1,2</sup>, Vigli D<sup>1</sup>, Medici V<sup>1</sup>, Flor H<sup>3</sup>, Lucarelli M<sup>4,5</sup>, Fuso A<sup>4</sup>, De Filippis B<sup>1</sup>

1 - Center for Behavioral Sciences and Mental Health, Istituto Superiore di Sanità, Rome, Italy;

2 - PhD program in Behavioral Neuroscience, Sapienza University of Rome, Italy

3 - Department of Cognitive and Clinical Neuroscience, Central Institute of Mental Health, Medical Faculty Mannheim, Ruprecht-Karls-University Heidelberg, Mannheim, Germany;

4 - Department of Experimental Medicine, Sapienza University of Rome, Italy;

5 - Pasteur Institute Cenci Bolognetti Foundation, Sapienza University of Rome, Italy;

Post-traumatic stress disorder (PTSD) is a mental disorder characterized by persistent anxiety symptoms arising after trauma exposure. Stress susceptibility, due to gene-

environment interactions, plays a major role in the etiology, although the underlying biology is not clear. We hypothesized that hypofunctionality of methyl-CpG binding protein 2 (MECP2), an epigenetic modulator, confers susceptibility to develop PTSD-like symptomatology. Male mice expressing truncated MeCP2 (MeCP2-308) were exposed to intense footshocks, mimicking a trauma. The onset of PTSD-like symptoms was assessed in trauma-exposed MeCP2-308 mice and compared to wild type and MeCP2-308 mice subjected to a mild stressor. The effects of fluoxetine, a prime pharmacological treatment for PTSD, were also explored. Trauma-exposed MeCP2-308 mice showed long-lasting fear in response to both correct and incorrect predictors of the trauma and persistent increased avoidance of trauma-related cues. Traumatized MeCP2-308 mice also displayed abnormal post-traumatic plasma levels of corticosterone and altered peripheral gene expression mirroring that of patients. Chronic administration of fluoxetine improved PTSD-like symptoms. These findings provide evidence that MeCP2 dysfunction results in increased susceptibility to develop PTSD-like symptoms after exposure to traumatic events, and identify trauma-exposed MeCP2-308 mice as a new tool to investigate the molecular underpinnings of PTSD vulnerability.

## **The effect of eye occlusion on the hippocampal representation of environmental novelty in domestic chicks (*Gallus gallus*)**

Morandi Raikova A<sup>1</sup>, Mayer U<sup>1</sup>

*1 - CIMeC, University of Trento, Italy*

Hippocampus in birds, like in mammals, is particularly sensitive to exposure to novel environments, a function that is based on visual input. Chicks' eyes are placed laterally, determining a wide monocular visual field and the optic fibers coming from each eye show an almost complete decussation at the level of the optic chiasm, thus projecting mainly to the contralateral brain hemisphere. Moreover, birds lack a corpus callosum. Thus, monocular occlusion has been frequently used in chicks to document functional specialization of the two hemispheres. However, it has never been directly tested if monocular occlusion has an impact on the activity of hippocampus. The aim of the present work was to verify whether eye occlusion influences hippocampal activation. In order to induce hippocampal activation, three groups of chicks (left eye occluded, right eye occluded or binocular vision) were exposed to a novel environment. Their hippocampal expression of c-Fos (neural activity marker) was compared to a baseline control group that remained in a familiar environment. Interestingly, while the hippocampal c-Fos expression in two monocular groups was not different from each other and also not from the baseline control group, c-Fos expression was significantly higher in the binocular group exposed to the novel environment. We conclude that representation of environmental novelty in the hippocampus of domestic chicks requires the integration of the information from both eyes.

## **Place learning can be assessed by changes in locomotor velocity in *Drosophila melanogaster***

Meda N<sup>1</sup>, Frighetto G<sup>2</sup>, Zordan MA<sup>3</sup>, Megighian A<sup>4</sup>

1 - Dep of Biomed. Sci. and Padova Neurosci. Ctr.

2 - Dep of Gen. Psychology

3 - Dep of Biol. and Padova Neurosci. Ctr., Univ. of Padova

4 - Dep of Biomedical Sciences and Padova Neurosci. Ctr., Univ. of Padova

Animals, through instrumental conditioning, learn the outcomes of their behaviours. Pain-relief learning is a type of instrumental conditioning that takes place whenever a certain action weakens or abolishes a noxious stimulus. When relief is provided by a specific zone in space, place learning is the mechanism that guarantees the localization of the "safe" zone. If an animal expects a specific outcome according to its spatial position (i.e. pain-relief), it should alter its locomotor kinetics in anticipation of the expected outcome.

Young adult *D. melanogaster* males expressing a transgene for blue-light sensitive ChannelRhodopsin2 in bitter-sensing neurons were tested in a transparent plexiglass arena. Around the arena, LED panels were used to display two vertical green stripes. PC-controlled blue-emitting LEDs were used to activate ChR2 according to fly position. During a training session, whenever the fly entered a virtual safe area in proximity to one of the two stripes, optogenetic stimulation automatically stopped. During probe session there was no relief from bitter-taste because optogenetic stimulation was always on.

Optogenetic activation of bitter-sensing neurons guide relief-based place learning in fruit flies. In particular, flies show a progressively increasing expectation of pain-relief, as attested by a reduction on locomotor velocity in the proximity of the ""safe"" zone. This is also seen during the probe session, when relief is not provided.

## **Do I produce to predict? Brain oscillations in language anticipation in fluent speech and stuttering**

Gastaldon S<sup>1</sup>, Arcara G<sup>2</sup>, Navarrete E<sup>1</sup>, Natarelli G<sup>3</sup>, Busan P<sup>2</sup>, Peressotti F<sup>1</sup>

1 - Department of Developmental and Social Psychology (DPSS), University of Padova

2 - MEG and Neurophysiology Lab, IRCCS Fondazione Ospedale San Camillo

3 - Progetto Now SCS

Suppose somebody is speaking to you and says "Before sleeping I'm going to read a...". Even before hearing it, you can predict that the word completing the sentence is most likely "book". This makes communication faster and more efficient. In this sense, language comprehension does not simply entails the passive integration of information, but involves the interplay with predictions based on background knowledge and sentence meaning. Some models propose that these predictions are generated in the same way as when speakers generate motor-to-sensory predictions to monitor their own utterances. In order to test this hypothesis, we carried out an EEG study with 40 fluent adults to study

both comprehension and production processes while manipulating the predictability of a target word, with specific focus on the beta frequencies (13-30Hz). Results show an effect of predictability in both tasks, specifically a pre-target beta suppression. Correlations of beta suppression between tasks show overlap in areas involved in speech planning and internal modelling and contextual updating. We are currently collecting data on adults with stuttering, which is a fluency disorder characterized by the impaired realization of motor programs associated to linguistic sequences. Within- and between-group contrasts will clarify whether prediction in comprehension involves motor-to-sensory transformation in addition to allowing a deeper understanding of preparation processes in people with stuttering.

## **Does behaviour of cranes mirror their phylogenetic relationships?**

Nováková N<sup>1</sup>, Robovský J<sup>1</sup>

*1 – Zoology, University of South Bohemia in České Budějovice*

Every species has its own specific behavioural repertoire – our knowledge about it vary according to particular taxa, but complete sociograms are already available for many species. Nevertheless, only few studies aim to analyse a connection between behaviour (repertoire) and phylogeny of species. For our first study, we chose cranes (family Gruidae) due to several factors. This group is a small, monophyletic, diversified a long time ago and most importantly with existing complete sociogram (Ellis et al. 1993) and well-corroborated phylogenetic hypothesis on the species-level relationships. Cranes exhibit more than a hundred of behavioral displays. In the present project we attempt: 1) detect phylogenetic signal for particular behavioral taxa, 2) estimate the ancestral behavioral repertoires for recognized clades, specifically based on available genetic data for Gruidae (all 15 species) and limpkin (*Aramus guarauna*) with purple swamphen (*Porphyrio porphyrio*) as the outgroups and using TnT (Goloboff et al. 2008) for analyses. Visualization was performed in RStudio (© 2009-2018 RStudio, Inc). We found out that more than half of analyzed traits carry a significant phylogenetic signal. Genera *Grus* could be considered as the most derived clade from the behavioral point of view. These results suggest non-random distribution of behavioral display at least in cranes and provide new point of view on behavior in context of phylogeny.

## Students talks - Session 2

### **Action-based attention in *Drosophila melanogaster***

Frighetto G<sup>1,2</sup>, Zordan MA<sup>3,4</sup>, Castiello U<sup>1</sup>, Megighian A<sup>2,4</sup>

1 - Department of General Psychology, University of Padova, Padova, Italy.

2 - Department of Biomedical Sciences, University of Padova, Padova, Italy.

3 - Department of Biology, University of Padova, Padova, Italy.

4 - Padova Neuroscience Center, University of Padova, Padova, Italy.

The mechanism of action selection is a widely shared fundamental process required by animals to interact with the environment and adapt to it. A key step in this process is the filtering of the “distracting” sensory inputs which may disturb action selection. Because it has been suggested that, in principle, action selection may also be processed by shared circuits in vertebrate and invertebrates we wondered whether invertebrates showed the ability to filter out “distracting” stimuli during a goal-directed action, as seen in vertebrates. In this experiment action selection was studied in wild-type *Drosophila melanogaster*, by investigating their reaction to the abrupt appearance of a visual distractor during an ongoing locomotor action directed to a visual target. We found that when the distractor was present, flies tended to shift the original trajectory towards it, thus acknowledging its presence, but they did not fully commit to it, suggesting that an inhibition process took place in order to continue the unfolding of the planned goal-directed action. To some extent flies appeared to take into account and represent motorically the distractor, but they did not engage in a complete change of their initial motor program in favour of the distractor.

These results provide interesting insights into the selection-for-action mechanism, in a context requiring action-centred attention which might have appeared rather early in the course of evolution.

### **Dogs' responses in inequity paradigms may be driven by perceptions of reward attainability**

McGetrick J<sup>1</sup>, Korath ADJ<sup>1</sup>, Feitsch R<sup>1</sup>, Siegmann S<sup>1</sup>, Range F<sup>1</sup>.

1 - Domestication Lab, Konrad Lorenz Institute of Ethology, University of Veterinary Medicine, Vienna, Savoyenstraße 1a, 1160 Vienna, Austria

Inequity aversion, the negative response to inequitable reward distributions, has been shown in dogs across a number of “paw task” studies. In the paw task, dogs stop giving their paw to an experimenter if they are unrewarded but a familiar partner is rewarded for performing the same task. In contrast, dogs typically work for longer in a crucial control condition in which they are unrewarded for giving the paw but no partner is present. However, in this control condition, a reward is moved by the experimenter on each trial, as though feeding a partner dog, introducing a potential confound. It has been hypothesised that this aimless movement of the food might lead to subjects perceiving the rewards as

attainable, and may, consequently, lure them into working longer. To test this hypothesis, we performed the paw task with naive dogs and included a novel asocial control condition in which subjects were unrewarded but rewards were moved into a box on each trial. In the subset of dogs that responded negatively to inequity, responses in the asocial control condition with the box, and the inequity condition, did not differ. Furthermore, these dogs gave their paw significantly fewer times in these two conditions than in the original asocial control without a box. Overall, our results suggest that dogs' responses to inequity in such studies are driven, at least partly, by perceptions of reward attainability.

## **Goal-directed actions in plants: a kinematical approach**

Guerra S<sup>1</sup>, Peressotti A<sup>2</sup>, Peressotti F<sup>3</sup>, Bulgheroni M<sup>4</sup>, Ceccarini F<sup>1</sup>, Castiello U<sup>1</sup>

1 - Dipartimento di Psicologia Generale, Università degli studi di Padova, Padova, Italy.

2 - Dipartimento di Scienze Agroalimentari, Ambientali e Animali, Università degli studi di Udine, Udine, Italy.

3 - Dipartimento di Psicologia dello Sviluppo e della Socializzazione, Università degli studi di Padova, Padova, Italy

4 - Ab.Acus S.r.l., Milano, Italy

Given that plants are rooted into the ground and they lack of visible movement, they are commonly conceived as still organisms. However, plants are capable of a variety of movements which allow them to sense a wide range of environmental elements and to behave properly in order to meet their needs and increase their chances of survival. The purpose of the present study is to investigate if plants have the ability to detect environmental stimuli and, if they do, how they plan and execute movements towards them. To do this, we characterized the kinematical features of pea plants' wrapping movements towards a wooden stick of various dimensions by means of a 3-Dimensional (3D) kinematical analysis. Results revealed that the kinematics of the pea plants' movement were scaled depending on stimulus size. These findings demonstrated, for the first time, that plants are able to perceive a stimulus into the environment, code its structural dimension and put in place purposeful, anticipatory behavior

## **Anisotropy of perceived numerosity: Evidence for a horizontal–vertical numerosity illusion**

Pecunioso A<sup>1</sup>, Miletto Petrazzini ME<sup>2</sup> & Agrillo C<sup>1</sup>

1 - Department of General Psychology, University of Padova, Italy

2 - School of Biological and Chemical Science, Queen Mary University of London, UK

Many studies have investigated whether numerical and spatial abilities share similar cognitive systems. A novel approach to this issue consists of investigating whether the same perceptual biases underlying size illusions can be identified in numerical estimation tasks. In this study, we required adult participants to estimate the number of white dots in

arrays made of white and black dots arranged in such a way as to generate horizontal–vertical illusions with inverted T and L configurations. In agreement with previous literature, we found that participants tended to underestimate the target numbers. However, in the presence of the illusory patterns, participants were less inclined to underestimate the number of vertically aligned white dots. This reflects the perceptual biases underlying horizontal–vertical illusions. In addition, we identified an enhanced illusory effect when participants observed vertically aligned white dots in the T shape compared to the L shape, a result that resembles the length bisection bias reported in the spatial domain. Overall, we found the first evidence that numerical estimation differs as a function of the vertical or horizontal displacement of the stimuli. In addition, the involvement of the same perceptual biases observed in spatial tasks supports the idea that spatial and numerical abilities share similar cognitive processes.

## **Abstract numerical representation in honeybees (*Apis mellifera*)**

Bortot M<sup>1,2</sup>, Agrillo C<sup>3</sup>, Avarguès-Weber A<sup>2</sup>, Bisazza A<sup>3</sup>, Miletto Petrazzini ME<sup>4</sup>, Giurfa M<sup>2,5</sup>

1 - Center for Mind/Brain Sciences, University of Trento, 38068 Rovereto, Italy;

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During the last decade, rudimentary numerical abilities have been found in non-human species as mammals, birds and fish. Recently, researchers have started to focus their attention to invertebrates too. In particular, honeybees were found to have numerical abilities that partially resemble those of vertebrates. In the present study we investigated whether honeybees spontaneously prefer to use an absolute or a relative numerical rule in a numerical discrimination task. The absolute rule implies the selection of the array containing a specific number of items, whereas the relative rule implies the choice of the set containing the larger/smaller quantity of items regardless of the specific number. In this case, subjects should be able to order numerosities and to judge whether they are equal or different. Two groups of bees were trained to select either the larger array in a 2 vs. 3 contrast or the smaller array in a 3 vs. 4 contrast. Subjects were then tested with a contrast pairing the previous rewarded quantity (3) with a novel numerosity (respectively, 4 or 2). In contrast to what previously found in vertebrates, the results showed that bees successfully chose the trained numerosity (3) when compared with the novel numerosity, showing evidence of a spontaneous use of the absolute rule. This study demonstrated the ability of bees to learn a specific quantity and associate it with a positive reinforcement, suggesting an underlying ability of forming a concept of number.

## **Individual differences in inhibitory control in a teleost fish Individuals of many species consistently differ in their ability to perform certain cognitive tasks.**

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In humans, large individual differences have been reported for tasks requiring inhibitory control, a cognitive process that allows blocking behaviours and responses. We studied individual differences in inhibitory control in a teleost fish, the guppy *Poecilia reticulata*. In experiment 1, we tested a set of guppies in two inhibitory tasks, the cylinder task and the tube task. In the cylinder task, guppies had to enter a transparent cylinder from the lateral, open side to obtain a piece of food; this required guppies to inhibit the tendency of swimming directly towards the food. In the tube task, guppies were exposed to live prey sealed inside a glass tube and had to inhibit their foraging behaviour. We found positive correlation between the performance in the two tasks, suggesting that some individuals were consistently better than the others in inhibiting behaviour. In experiment 2, we investigated a possible cause of the variability in inhibitory control. We tested a set of guppies with the tube task, to measure inhibitory control, and with a personality test, the open field test. Guppies that more efficiently inhibited behaviour in the tube task behaved boldly in the personality test, showing high activity. Overall, this study evidences individual differences in inhibitory control in guppies and suggests that this variability might be related to individuals' personality.

## **Students talks - Session 3**

### **Look into my eyes, I will reward you – Head shape, sex and age affects dogs' visual communication**

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Recognizing a partner's attention is important for successful communication. Eye contact (EC) is the most common way humans use to signal the intention to communicate. Pet dogs are also prone to make EC with humans and pay attention to such human visual communication (VC) signals.

We investigated whether cephalic index (CI, an indicator of retinal ganglion density), sex and age affect dogs' ability to establish EC with humans. Previous results suggest that (1) selective breeding for different head shapes (different CI) affect visual acuity (i.e. shorter-headed dogs' visual acuity is better) and hence VC ability, (2) primate females pay more attention to their partner's VC signals which might be a general trait in mammals, and (3) older dogs are less responsive to their environment in general.



We tested 129 dogs (64 males, 2.5-14.5 years old, different breeds) in a test where dogs were rewarded for repeatedly making EC with an unfamiliar experimenter. We measured the first 15 latencies from eating the food until making the next EC.

Preliminary results supported our hypotheses, showing that dogs with shorter heads (higher CI;  $p=0.005$ ), females ( $p=0.049$ ) and younger dogs ( $p=0.058$ ) established EC sooner. Dog females seem to be more social. CI value positively affects the VC ability, while age decreases it. To our knowledge, this is the first study examining dogs' tendency to make EC based on CI and sex.

## **Hand raised, pack-living dogs' and wolves' urinary oxytocin levels following interactions with human partners**

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Several domestication hypotheses suggest that dogs are able to establish special bonds with humans, and involvement of the oxytocin (OT) system has been proposed. OT levels of pet dogs and captive wolves have been studied before, but no study has compared subjects raised and kept under comparable conditions. To address this, we investigated how interactions with humans of different bonds correlate with urinary OT levels in hand raised, pack-living dogs and wolves with similar previous human experiences. We predicted more interactions and a greater OT increase following human contact (regardless of relationship) in dogs than wolves. Wolves were predicted to prefer the closer bonded partner and show higher OT levels with the bonded than the familiar humans. Ten wolves and eleven dogs were tested 1) with a bonded and 2) a familiar human, 3) in a baseline condition, and 4) after food delivery without physical contact ("food only"). Urine samples were collected within 60-90 minutes and analysed using an Enzyme Immunoassay. Behaviourally both species showed a preference for the bonded over the familiar human ( $p<0.0001$ ), however, in contrast to the social conditions, "food only" led to the greatest OT increase ( $p=0.017$ ). No effect of species ( $p=0.062$ ) but an effect of sex ( $p=0.031$ , males > females) emerged. Our results suggest that, although both species are more willing to interact with the bonded partner, no corresponding rise in OT is evident following social interactions.

## **Who Looks For Human Assistance? A Comparative Study Of Pigs' And Dogs' Performance In An Unsolvable Task Paradigm**

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A key element of human communication necessary for establishing joint attention is the looking behaviour (i.e. gaze orientation), which has also been explored in animals and deeply in dogs. In problem solving contexts dogs were found to look at the human partner and perform gaze-alternation between the human and the target, which is interpreted as an act aimed at seeking assistance.

Our aim was to explore the emergence of human-oriented communicative behaviour in the domestic pig and to compare that with dogs' similar behaviour. In controlled laboratory setting we tested dogs and miniature pigs, both socialized and living in human families. We used the validated solvable/unsolvable task paradigm, in which the animal is exposed to a solvable problem (interacting with an apparatus) that after several trials becomes unsolvable. We hypothesized that pigs would show human-oriented behaviours in the unsolvable trial, but they would perform them less frequently and for a shorter time than dogs. We also expected pigs to spend more time trying to solve the task (i.e. be more persistent).

Our results show that pigs were more persistent than dogs ( $P=0.0004$ ), and, although they performed gaze-alternation between the human and the apparatus, dogs performed more ( $P=0.003$ ) and they also looked sooner to the human ( $P=0.028$ ). These differences between dogs' and pigs' performance could be partly based on their different domestication history and species-specific motivational states.

## **Who is a happy pig? - Does social status influence decision making in a cognitive bias task?**

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The inner state of animals is influenced by many factors including environment like housing conditions or experiences prior to testing. Introducing social factors in a cognitive bias task is novel in most animal species, especially in pigs, while the question of inner state and its relation to welfare is of big importance for any species in human care. In this study, we hypothesized that rank and centrality will influence the cognitive choice of 20 free-ranging Kune Kune pigs (10m/10f) chosen from a stable herd of 39 individuals of which we beforehand assessed the social structure. We predicted that high

ranking as well as central individuals will choose optimistic-like, while loners and low ranking individuals will choose pessimistic-like. All pigs were trained in a spatial Go-No-Go task until their response was distinct, before the ambiguous cues were interspersed in the known positive and negative cues. Female pigs chose more optimistic the higher their centrality index and more pessimistic the higher their rank ( $p < 0.001$ ). Contrary to that, male pigs chose more pessimistic the higher their centrality index and more optimistic the higher their rank ( $p < 0.001$ ). These findings fit into the behavior patterns of wild boar, where females live socially together and rely on cohesiveness of the group especially while raising their young. Males disperse from the group to live as loners and join the groups only during breeding season, conspecifics might be seen more as competitors.

### **Cognitive aspects of 'group personality' in common marmosets (*Callithrix jacchus*): does social environment affect the individual variation in learning?**

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Animal personality has recently been described in common marmosets (*Callithrix jacchus*), using a set of personality tests and observations. In particular, consistent inter-individual variation was found to be smaller between individuals of the same group as compared to the variation among individuals of different groups. Marmosets are apt learners and they have also been reported to display substantial inter-individual variation in the learning tasks. However, no study to date asked whether and how inter-individual variation in exploration and boldness-shyness affects marmosets' propensity for individual learning, and if this is also dependent on their social environment. We tested 27 common marmosets in standard personality tests (general activity, novel food, novel object, foraging under risk, predator) and a series of cognitive tasks, divided in simple motor tasks (novel room, scale, target) and discrimination learning tasks (feature discrimination, size discrimination). We found that i) marmosets show individual consistency in learning across different tasks, but that the speed of learning differs between the family groups, and ii) marmoset personality affects the speed of individually mediated learning. In sum, it seems that both personality and the social environment of an individual are important factors linked to the individual variation in information processing, possibly also influencing the likelihood of subsequent social information transmission in the group.

## Let's play - an ontogenetic study on play contagion in ravens

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Perceiving, evaluating and reacting towards conspecifics' emotional states are important competences for social group living. Emotional contagion describes an alignment of emotional states through behavioural synchronisation, leading to an affective state similar to the demonstrator's. In the past, behavioral synchronization has been widely studied while only a few studies addressed potential transmissions of emotional states in non-human animals. In the present study, we assessed play as a potential context for emotional contagion in 10 juvenile common ravens (*Corvus corax*). Play behaviour of ravens includes a wide range of species-specific motor patterns that can be categorised in object, social, and locomotion play and its (potentially emotional) contagiousness has been noted. We provided objects to elicit play in a standardised experimental set-up and tested if the specific play behavior of one individual leads to play behavior in conspecific bystanders. We were particularly interested in the type of play bystanders would show - object play (like demonstrated) or social and/or locomotion play. In the former case, we could argue for behavioral contagion, whereas in the latter case we could argue for a general transfer of a playful mood and therefore emotional play contagion. Our results support the latter scenario, but also highlight the importance of taking into account developmental trajectories of emotional play contagion.

## Students talks - Session 4

### Quantification of self-grooming behavior of a semi-transparent prawn, *Macrobrachium lamarrei*, by applying video-based posture detection method

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Self-grooming is a neurophenotypic behavior in animals, which defines the body cleaning activity. Grooming has been established as a behavioral biomarker to evaluate stress and several neurotic disorders in mammals. We aim to establish this behavior as a sensitivity marker in aquatic invertebrates.

*Macrobrachium lamarrei*, is a common native freshwater prawn species in India, shows robust self-grooming behavior and effectively involves the first and fifth thoracic

appendages to clean several body parts. Assessment of microscopic structures on the grooming appendages, indicated prominent adaptive modifications. Detailed analysis of self-grooming activity in this species implied a complex patterning. The organism makes prominent postures of the body while cleaning different body parts. Depending on these specific postures, we have classified the grooming activity into two major groups; anterior and posterior body grooming.

We have used a high-resolution video camera to record the behavior. The method of posture detection was applied to identify self-grooming activity in a video and the quantification was done in terms of time spent for each activity. A pilot experiment was conducted to record self-grooming in two different aquatic conditions (clean tap water and dirty pond water) where results show significant difference in grooming activity. Our ultimate focus is to use this method to evaluate stress induced alteration of self-grooming in these invertebrates.

## **Copulatory wounding inflicted by a female genital structure in males of a damselfly?**

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In the damselfly *Enallagma cyathigerum*, females have a vulvar spine on the 8th abdominal segment. Although it is a structure present in some damselflies of the family of Coenagrionidae, its function is currently unknown, as it has never been studied. In this study, our aim was to determine the possible functions of the vulvar spine. We hypothesized that this spine could facilitate oviposition, stimulate the male to release more sperm (because the spine contacts with the male seminal vesicle during copulation) or inflict damage to the male to reduce copulation duration (assuming this is favorable to females). Our results did not clearly support any of the three hypothesized functions. However, SEM analysis of the seminal vesicle of males showed a series of fold structures in the ventral tegument of the vesicle, more or less sharpened depending on the degree of maturation of the male. Similar fold structures were also found in other species of Coenagrionids whose females have vulvar spine, but not in damselflies of the same family that do not have a vulvar spine. This led us to think that the folds are a counteradaptation to a copulatory wounding inflicted by females to males. Future research should be focused on a comparative analysis of the size of the vulvar spine in other damselflies, to test if this is related to the shape of the seminal vesicle, which is expected if the spine produces a copulatory wound.

## **Dimorphic phrase structure of the indris' song (*Indri indri*) and its potential for sex discrimination**

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When seen in comparison with humans, animals showed a limited combinatory ability to concatenate vocal emissions in phrases, at least in the acoustic domain. Few investigations on primate vocal sequences are currently available, and none of them is evaluating the stereotypy of song structure between sexes using easily comparable methods. The Levenshtein distance (LD), used to quantify the difference between two strings of data, calculates the minimum number of necessary changes to transform one string into another. We investigated the phrase structure of the indris' song (*Indri indri*) and its potential for sex discrimination. We hypothesized that song structure varied between males and females showing that sex differences should also reflect in the combination of song phrases. To understand whether there were differences in song structure between sexes, using the LD, we investigated the descending phrases combinatorics in each contribution. We found an apparent sex dimorphism in phrase structure, also showing that female between-individual variability was much higher than males' one. In agreement with previous studies that reported sexual dimorphism in the timing, repertoire size, frequency modulation, duration and rhythm, we found that sexes indris also differed in the phrase combinatorics of their songs. This result is in line with the hypothesis that song structure varied between sexes suggesting that songs may play a role in finding a partner and mediate pair formation.

## **Human behaviour in the specific conditions on the basis of the literary reportage „Wielki przyływ” of Jarosław Mikołajewski**

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In my talk presentation I would be pleased to present results of the research connected with the way of human behaviour presented in the literary reportage „Wielki przyływ” of Jarosław Mikołajewski. A genre of the literary reportage is a very interesting field of science as it combines literariness with documentality. The author shows place called Lampedusa where every day many emigrants try to get through. There are many people that help them like: doctor, nurse, historian, rector. The reporter describes pain, exhaustion, moral dilemmas and social problem that seems to be unweighted by the world. There are two elementary targets of this paper. Firstly, presenting the definition of the concepts like: „behaviour” and „literary reportage”. Secondly, describing the situation on the Lampedusa and human behaviour on the basis of the Jarosław Mikołajewski's

book. In this report I accept the artistic model of Vladimir Zaika divided into: reality, narrator and national language. What is more, I use Polish reportage researchers' texts (for example Jadwiga Litwin, Czesław Niedzielski and Janusz Sławiński). As a result proposed report will be interesting from the linguistic, literary and philosophical point of view.

## Poster – Session A

### **Do Azure-winged magpies (*Cyanopica cyanus*) recognize themselves in mirrors?**

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Mirror self-recognition (MSR) has commonly been tested with the Mirror-Mark test and used as an indicator for having a concept of self. Typically, animals show a similar string of behaviours when responding to mirrors, namely social reactions and mirror-exploration, followed by contingent behaviour and in some species self-directed behaviour. Species that pass the mark test (e.g. apes, elephants) commonly share characteristics when it comes to living in complex social systems, possessing advanced cognitive skills and a high encephalization index. These characteristics can also be found in corvids, which have further been proven able of perspective taking, making them likely candidates for MSR. The azure-winged magpie (*Cyanopica cyanus*), a cooperatively breeding corvid species, is particularly interesting to study in this aspect due to their prosocial tendencies and social system. Therefore, in the present study we exposed 10 azure-winged magpies to mirrors and non-reflective surfaces and measured their responses before conducting a Mirror-Mark test. Preliminary results show that more than half of the birds spent more time in front of the mirror than in front of the non-reflective controls and some exhibited the same string of behaviours in front of the mirror as it has been shown in other species. However, none of the so far tested magpies exhibited signs of mirror self-recognition.

### **Measuring attention deficit, hyperactivity and impulsivity in dogs: Developing a human analogue ADHD questionnaire**

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The family dog, in its natural environment, exhibits neuropsychological deficits redolent of human psychiatric disorders, including behaviours that are similar to human Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms.

In humans, questionnaires are efficient tools to assess ADHD symptoms and are the basis for diagnosis. A 13-item questionnaire has already been developed for dogs to measure two ADHD symptom dimensions (inattention and hyperactivity/impulsivity). However, owners reported that some questions were difficult to answer and scores did not distribute symmetrically. Moreover, in modern human questionnaires, activity and impulsivity are separately measured factors.

Based on standard assessment methods in humans, we aimed to (1) review the old questionnaire, (2) develop and validate a better-detailed, psychometrically improved tool to assess owners' views on relevant dog behaviours, and to (3) add questions that allow for separate analysis of impulsivity as well as of functional impairment.

We collected data online, from >1000 owners for the different validation steps and involved trainers, similarly to the human procedure, where teachers complete the questionnaires as an experienced control. With this new tool, we could determine all three symptom dimensions in dogs, assess the effects of breed, age and training, and gain better insight into the ADHD phenotype in dogs.

## **Silent reading and writing: the influence of language processing on motor response (and viceversa)**

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Language production necessarily requires both linguistic and motor processes, and the two are traditionally seen as informationally encapsulated. In this experiment, we probed the interplay between language and motor processing by comparing EEG oscillatory power in the beta-frequency range across silent reading and typing, and by using emotional and neutral words in order to manipulate the semantic content of the stimuli. Reading and typing share stages of lexical-semantic processing, whereas motor processes uniquely characterize typing. Consistently, both tasks display an early beta desynchronization surfacing 300 – 500 ms after stimulus presentation and arguably related to language processing, whereas a later one surfaces only in typing during response execution. The comparison between tasks thus suggests that beta-band desynchronization might provide separate functional EEG landmarks of linguistic and motor processing. However, a semantic variable such as the emotional connotation of words affects the early desynchronization in reading, and the late motor-related desynchronization in typing. This latter result may point against a strict functional segregation between language and motor processing and towards a more interactive architecture featuring functional overlap.



## **Neural basis of familiar and unfamiliar conspecifics recognition in domestic chicks**

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Most birds are highly social animals. Behavioural studies have demonstrated that domestic chickens (*Gallus gallus*) are as socially complex as other mammals and birds. An important feature of the social groups of the domestic chicken is the presence of a very well established hierarchy. This requires individuals to be able to recognize and to distinguish between different members of their social group. Indeed behavioural studies demonstrated that chicks are able to distinguish familiar from unfamiliar conspecifics, however the neuronal mechanisms mediating this behaviour are almost unknown. To fill this gap in the present experiment, chicks were housed in pairs for one week. During the test one of the two chicks was taken out of the cage for one minute and either exchanged by an unfamiliar individual (experimental group) or the familiar individual was placed back in its original cage (control group). The interactions of the chicks were recorded for 20 minutes (10 minutes before and 10 minutes after the test) and several behavioural parameters related to social interaction were coded. One hour after the test chicks were sacrificed. We analysed chicks' neuronal activity in different brain areas of the 'social behaviour network' by visualizing the immediately early gene product c-Fos with an immunohistochemical procedure. In this poster I will present the preliminary data obtained in this study.

## **Influence of migration behaviour and habitat affiliation on the eye size of birds: a case study from the Pacific lowlands of Costa Rica**

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The lowland rainforests of Costa Rica harbour an incredible diversity of bird species, characterized by various habitat preferences and different migratory status. This study assessed to what extent these factors are capable to explain interspecific differences in eye size of bird species mist-netted in the lowlands of Costa Rica. Migratory birds from higher latitudes raise their young during a period of expanded day lengths in habitats less dense than the understory of tropical forest. Hence, they may be less limited by ambient light conditions during foraging and consequently may invest less in eye size than tropical resident birds. Furthermore, we expect that bird species occurring in openland habitats are characterized by smaller eyes than forest specialists due to latter species facing significant light constraints in the understory. Relative eye size (residuals of linear regression of eye diameter on body size) of bird species was used to assess interspecific differences. Migratory behaviour proved having the strongest effect with residents having

significantly larger eyes than migrants. Furthermore, eye size of forest specialists was found being larger than of forest generalists and open land species. Another investigated factor, feeding guild affiliation, did not show any significant effect on eye size. Hence, both migratory status and habitat affiliation appear contributing to shape the visual system of birds.

## **Does metabolic rate affect learning, memory and personality in chickens?**

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Energy is broadly considered the currency of life. Metabolic rate determines life processes and physiological requirements of an individual and has recently also been implicated as a driver of inter-individual variation in behaviour and personality, with positive correlations with boldness, aggressive behaviour and dominance recorded. While the link between metabolism and personality has been explored, little is known about the influence of metabolism on learning and memory.

We used young hens (*Gallus gallus domesticus*; n=12) to investigate the relationships between metabolic rate, personality and learning and memory. We measured resting metabolic rates (RMR) of the chicks over a six-week period and assayed learning and working memory using an analogue of the radial arm maze. We also measured exploration of a novel environment and novel object, as well as dominance within the group, both before and after learning experiments, and concurrently with RMR measurements.

Results are still being analysed, but we predict that chicks which have higher RMR will show higher exploratory traits due to having higher energetic requirements necessitating greater exploration. Similarly, individuals with high metabolic rates may show decreased use of working memory due to the already high metabolic demands associated with a bolder and potentially more dominant personality. This poses the question whether there is a three-way trade-off between metabolism, personality and learning capacity.

## **Differential role of courtship sensory modalities on the female response in the ring dove (*Streptopelia risoria*)**

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1 - University of Vienna

Most courtship displays are complex and the courting sex often uses signals simultaneously occurring in more than one sensory modality. Empirical research has so far mainly focused on studying information coming from one sensory channel without taking the sensory complexity of courtship into account. Recent technological developments in video and audio recordings, as well as in computer-based video

analysis, now allow the study of visual and auditory stimuli at a previously impossible precision and scale. In the ring dove, males court females with a stereotypical visual bowing display and a coo-call. We developed a recording system to synchronously record the visual and auditory components of the male courtship display, as well as the female behavioural response. In a cross-over experiment with 10 males and 10 females, we recorded 300 male-female courtship interactions. We then used a deep learning algorithm to automatically track male movements. We assessed whether male courtship parameters (auditory: frequency and duration of coo-calls; visual: amplitude, velocity and duration of bows) influence female behaviour. We found that the structure of the courtship (length and number of bouts) did not have any influence on female behaviour. Rather, the spectral parameters of the calls (minimum and maximum pitch) but not temporal ones (duration or rate) seem to increase female preference.

## **Metformin treatment rescues aberrant mitochondrial activity and oxidative stress status in the brain of female mouse model of Rett syndrome**

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Rett syndrome (RTT) is a neurologic disorder, due to mutations in the X-linked methyl-CpG-binding protein 2 (MECP2) gene. No cure is available. Besides mental and physical decline, RTT patients and mouse models have disrupted energy homeostasis, increased oxidative stress and insulin resistance. We provide the first evidence that activation of the adenosine-5-monophosphate-activated protein kinase (AMPK), a regulator of energy balance and anti-oxidant defense, is impaired in the brain of two RTT mouse models, suggesting that treatments targeting AMPK may represent innovative therapeutic strategies for RTT. Based on this, we evaluated whether mitochondrial alterations and oxidative stress in RTT mouse brain are rescued by metformin, a well-established modulator of AMPK and a FDA-approved drug used for the treatment of type 2 diabetes, even in children. Treatment with metformin (25, 50, 100 mg/kg, i.p. injections for 10 consecutive days) led to a dose-dependent activation of defective AMPK in the brain of fully symptomatic MeCP2-308 female mice, a validated RTT model. Together with the two-fold increase in AMPK activation, the 100 mg/Kg dose of metformin induced a normalization of mitochondrial ATP production and ATP whole brain levels and a reduction of the oxidative stress status in RTT mouse brain. These results demonstrate that metformin rescues brain metabolic alterations in a RTT mouse model, suggesting that it could be a new potential therapy for this disorder.

## **Dog's sense of smell to help people with Food Allergies: a pilot study**

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1 - Università di Parma

2 - TICE Live and Learn

**Purpose:** Assistance dogs worldwide are trained to support humans with disabilities on a daily basis. This pilot study was to evaluate if one family dog could learn recognize an allergen in food samples and learn to alert the human companion using Positive Reinforcement Training (PRT).

**Procedure:** A 3yo female dog was chosen. The independent variable was a procedure based on olfactory stimulus control (allergen) followed by an operant response of the dog, maintained with an edible positive reinforcer. The dog was taught to alert when sniffing a contaminated food with the emission of the signal-behavior (sit) in the presence of the target odor (peanuts). An experimental design (ABCDEDEFA) was used to evaluate the effects of dog's learning process using PRT & Clicker Training, under 3 different experimental conditions. The dependent variables were the percentages of correct behaviors showed by the dog when contaminated food was presented.

**Results:** Through the collection of data it was possible to evaluate the olfactory discrimination learning process to discriminate and alert the presence of the target odor in different samples of food (background). The mastery level of 100% correct trials for 2 consecutive sessions has been performed within short training period (2 weeks). Findings suggest that dogs specifically trained with PRT may be able to discriminate an allergen presented in different food and alert with a signal-behaviour with significant speed, precision and stability.

## **Spontaneous quantity discrimination in crickets**

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The ability to discriminate quantities to make adaptive decision is no more considered as a prerogative of vertebrates. Ants, bees, spiders, and cuttlefish can discriminate among quantities in context such as mate choice, competition, and foraging. Although many evidences of a proto-counting system have been reported in invertebrates, more control experiments are necessary to confirm this ability. Here we propose a new method to investigate quantity discrimination in invertebrates that allows to control for discrete (e.g., number of objects) and continuous quantities (e.g., size of the objects). We investigated the quantitative abilities of the cricket *Acheta domesticus* by exploiting its natural shelter-seeking behavior in a dangerous context. To study discrete quantities

discrimination ability, we presented subjects with a dichotomous choice between sets of same-sized geometrical shapes differing in number of items. The majority of crickets chose the larger sets up to 2 vs. 3 items. In a second experiment we investigated the role of continuous variables by presenting a 2 vs 3 discrimination controlling for the convex hull and the cumulative surface area. Crickets did not show a preference for one set, suggesting that subjects attended to more types of information when making quantity discrimination decision. In a further experiment, we showed that crickets attended to the width but not to the height of the stimuli to discriminate between shape sizes.

## **Personality of a dog and its owner and their attachment styles play a role in dog aggression**

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A dog's aggressive behaviour can be influenced by external and internal factors, including its psychological profile. In the present study, we investigated the association between personality traits, attachment styles, and dogs' aggression towards humans (strangers, owners) and animals (dogs and other animals). Forty Slovenian owners and their dogs of different breeds and aggression history, sorted into three groups (non-aggressive dogs, dogs aggressive towards humans and dogs aggressive towards animals), participated. The owners filled out three separate questionnaires that assessed owner-reported dog aggression history towards different targets, owners' personality (using Big Five factor taxonomy) and owners' attachment styles (anxiety and avoidance attachment). Then the dogs' personality was tested using a standardized Dog Mentality Assessment test, during which the dog was exposed to nine tasks, performed outside, and scored based on behavioural manifestation. The results indicate that dogs aggressive towards humans were less sociable than non-aggressive dogs, and associated with higher neuroticism scores of their owners. We also found that owners of dogs aggressive towards strangers had lower scores for anxiety attachment and owners of dogs aggressive towards owners had higher scores for avoidance attachment. These results imply that both, dog and owner psychological profiles can influence dog aggression.

## **Chicks on the right side: Young chicks' numerical discrimination is affected by spatial disposition of numerosities**

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Young domestic chicks can discriminate different numerosities and show a spontaneous preference for larger groups of familiar stimuli. In the classical discrimination paradigm, however, numerosities are presented on two different sides of an arena (left vs. right), which can result in spatial biases affecting animals' performance. Here we reanalysed data from a previous study on numerical discrimination, to investigate the presence of a

side bias. In Exp.1 newborn chicks were reared with 7 tri-dimensional red plastic balls and tested in a spontaneous choice task using a triangular arena: one vertex constituted the chick's starting point, while on the two opposite vertices there were either 5 or 9 stimuli, identical to the rearing ones. In Exp.2 we maintained the same paradigm as Exp.1 but modified the stimuli numerosity (rearing=8; testing=6vs.10). The position of the small and large numerosity was randomized during trials. We registered the time spent near each group of stimuli for 6 minutes as an index of preference. Interestingly, chicks spent more time near the larger group only when it was placed on the right side of the arena and chose randomly when it was on the left side. These data are consistent with previous studies that highlighted a rightward bias in chicks in similar discrimination tasks and may represent an interesting starting point for the study of number-space mapping in animals.

## **Test-retest validation of a short battery of test for the behavioural assessment of ageing pet dogs**

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\* These authors have contributed equally to the project

We recently developed a set of behavioural tests to detect age-related behaviour differences in a large population (N > 150) of dogs (*Canis familiaris*) kept as pets. The current study assessed test-retest reliability of some tests from the battery. These measured dogs' tendency to explore a new environment, interaction and playfulness with strangers and objects, persistence, short-term memory, reactivity towards ambiguous stimuli. The tasks relied on motivation towards food, animated and unanimated objects, and social interaction.

We tested 26 dogs: 'young dogs' (N = 13, age range 2-5 years) and 'old dogs' (N = 13, age range 10-15.5 years). Each dog was tested twice (test-retest delay range = 7-18 days). Preliminary regression analysis of 4 variables (exploration, play, persistence, memory) indicated trends towards an age effect and no effect of re-test in the exploration (Age group: effect  $\pm$  SE = 0.92  $\pm$  0.51, p = 0.068; Re-test: effect  $\pm$  SE = 0.29  $\pm$  0.47, p = 0.528) and memory (Age group: effect  $\pm$  SE = 1.37  $\pm$  0.22, p = 0.048; Re-test: effect  $\pm$  SE = 1.00  $\pm$  0.15, p = 0.9663) but not the other measures.

The study appears currently underpowered, thus additional data collection is required. However, our results suggest that some of our tests might reliably measure age-related behaviour differences in dogs without carry-over effects.

## **Altered hippocampal synaptic structure in male rat offspring after pre-gestational stress exposure and antidepressant treatment**

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Over the last decades depression during perinatal period has become a serious problem with almost 20% of pregnant women suffering from this condition. Accordingly, several studies reported a significant increase in the antidepressant use during gestation and lactation. Although clinical and preclinical research suggest an impact of antidepressant treatment on the developing brain, more research is needed to determine the effects on brain neuroplasticity. Following up on these findings we decided to investigate the effects of 2 newer antidepressants with different mechanisms of action – venlafaxine (SNRI) and bupropion (NDRI), on synaptophysin density and number of immature neurons in the hippocampus of rat offspring. To do this, female Wistar rats were subjected to chronic unpredictable stress prior to gestation. Venlafaxine (10mg/kg/day) or bupropion (30mg/kg/day) were administered from 10 day of gestation to 20 day after birth. Subsequently, we studied 4 groups of offspring: non-stress+vehicle, non-stress+antidepressant, stress+vehicle and stress+antidepressant. Preliminary findings showed that pre-gestational stress, regardless of antidepressant treatment, negatively affected the number of immature neurons in dentatus gyrus of the offspring. Similar outcomes with markers of synaptogenesis have been shown. A greater understanding of gestational stress and antidepressant treatment impact on neural plasticity could hold the key toward more effective treatment of depression.

## **A new paradigm for Prosocial Behavior and Reciprocity, assessed in WT and HET rats for the DAT gene**

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Most behavioral studies on animals focus on observation of individual subjects. Current paradigms set aside the social-operant dimension, i.e. acting in favor of another conspecific. We focus on prosocial behavior and reciprocity of male, adult Wild-Type (WT) and heterozygous (HET) rats for the dopamine-transporter (DAT) gene.

Method - During training, rats were introduced individually into an apparatus hosting a suspended syringe, where they learnt to push to obtain food therein. Then, we introduced

two rats separated by a grid in the same structure: each subject had the opportunity to donate and receive donations of food. Firstly, we tested cagemates, then unfamiliar pairs with same genotype, then pairs with different genotype. Eventually, we replaced food reward with polystyrene pieces, to understand if they pushed for actual reward or like a habit.

Results - HET rats pushed more with same-genotype cagemates. In all other cases, WT rats had better performance ( $p=0,02$ ), regardless of reward, than HET ones ( $p=0,06$ ). When we crossed rats' genotype (WT-HET pairs), WT rats pushed at peak levels, regardless of food received back: in fact, HET companions pushed less. WT rats achieved better results than HET ones even when polystyrene, instead of food, was used.

In short, "genotype" has great significance ( $p=0,004$ ): WT rats performed better than HET ones, but like a habit. HET rats represent a good model for studies on altruistic behavior, to understand impaired social mechanisms.

## **Speakers of Veneto-dialect and Italian: can these people be considered bilinguals? Evidence from Picture-Word Interference.**

Piazza G<sup>1</sup>

1 - *University of Padua*

Most people in Padova speak Veneto dialect in addition to Italian. Can these people be considered bilinguals? We explore this issue by investigating lexical selection during single word production. It was shown that the activation of semantically related words in L2 slows down production in L1. Such interference effect turns into facilitation if the L2 word is the equivalent translation of the name of the picture. This is consistent with the idea that in bilingual speakers lexical competition occurs only within each language and not between languages. We asked whether the same conclusion can be drawn in the case of Italian-Veneto bilinguals. Participants were asked to name a picture in Italian while hearing a distractor word in Veneto. The dialectal distractor could be a) translation of target b) categorically related word or c) unrelated word. Distractor words in Veneto varied also for frequency. We obtained the interference effect in the case of semantically related distractors; however, we did not obtain any difference between translations and unrelated words (no facilitation effect). Frequency modulated picture naming so that high-frequency distractors elicited faster responses than low frequency distractors. This pattern can be interpreted as crosslinguistic influence in bilinguals. Our findings are not conclusive and need further investigation, but the present results suggest that Veneto dialect-Italian is not a typical case of bilingualism.



## Parallel analysis of EEG, ECG, and respiratory signal during sleep in dogs

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The sleeping activity of family dogs have been studied increasingly in the previous years. They have been proposed to be a model for studying some aspects of the evolution of human cognition, due to their adaptation to the human environment and the human-analogue socio-cognitive skills they developed during this process.

However, there has not been yet performed an analytic study describing the major physiological features related to sleep on non-anesthetized family dogs, which would pose as a basis for further experiments.

In this study we examined the recordings of 30 dogs sleeping for 3 hours during the afternoon in a lab. We measured their EEG, EOG, ECG and respiratory signals, and compared the data of the different sleep-wake phases (wakefulness, drowsiness, REM, NREM) and looked for associations with the dogs' age and size.

We have found significant differences between the sleep-wake phases in the mean heart rate and two time domain HRV parameters: RMSSD and pNN50. However, we have found no differences between the sleep-wake phases in a third HRV parameter: SDNN and the mean respiratory rate of dogs. We also did not find associations between weight, age, sex, and neuter status.....

This study represents an in-depth analysis on the different neurophysiological features, serving as a potential basis for comparisons with human findings, as well as further dog studies.

## Spider See, Spider Do: Observational Learning in Jumping Spider

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Learning is an essential skill for survival. In fact, all animals do show a continuous change in their behaviour as a result of their interaction with the environment. However, learning is not always without risk: every unknown experience can potentially cost your

life. A way to deal with this problem is to learn from the bad outcomes of your conspecifics, avoiding the same mistakes. Researchers named this behaviour observational learning. Although it has been extensively studied in vertebrates, invertebrates have received less consideration. Nevertheless, some species of this group are able to perform behaviour with a complexity comparable to the vertebrates' one. Among invertebrates, jumping spiders are known to have excellent eyesight and although they are mostly solitary, they still seek out other individuals and they have been shown to be exceptional learners. To test the presence of observational learning in jumping spiders, we will train subjects to discriminate between palatable and unpalatable drops based on their colours. Afterwards, we will let other individuals observe the trained subjects and see if the colour preference is transferred. Thus, we would be able to see whether they could learn from observation. These findings could shed light on the phylogeny of observational learning. Data is currently being collected and will be presented during the conference.

## **Are sexually naive zebra finch females able to discriminate between different male songs?**

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Female zebra finches (*Taeniopygia guttata*) do not sing but they learn song of their fathers during sensitive period of their lives and respond to it more than to other songs. Females can discriminate also between undirected songs sang for practice and directed courtship songs, where the latter is preferred. Females without song experience do not demonstrate this preference. Here we take an advantage of these abilities of females and we investigate the biological importance of a brain nucleus called Area X that controls song performance in males. Males with an injury within this nucleus sing faster songs and they can contain an increased syllable repetition. If the females discriminate between the two types of songs (normal vs. "injured"), we also want to know which songs they prefer and if they generalize the comprehension of father's song that contains or does not contain a syllable repetition. First we performed a proof-of-principle study and tested females (n=12) discrimination between songs of their father and different males in callback assays. We confirmed that the females were able to distinguish the father's song among 7 other songs. The results regarding the discrimination of the songs before and after Area X injury are in progress. We expect that females will choose the pre-operation songs because such songs are natural. In addition, we expect to find out if females can generalize the comprehension of the father's song. The study was supported by grant APVV-15-0077.

## Motor skill learning in an elaborate courtship display

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Very few studies have investigated how animals cope with sudden disruptions in their mating displays and how flexible they are in such behaviour. In our experiment, we tested how male golden-collared manakins (*Manacus vitellinus*) adapted their display after an obstructing object was introduced into their courtship arena. Each male had a little arena containing 3 to 7 saplings on the forest floor. The elaborate display consisted of a rapid sequence of jumps within their arena. Every jump included a wingsnap (clapping wings together behind their back which produces a loud sound) in mid-air and a beard-up posture towards the centre of the arena after landing on a sapling. A display always ended at the same sapling, the so called mating sapling. On the mating sapling the males performed a last cartwheel – like jump to the ground, as an invitation for the females to mate and a jump back up. We placed the obstructing object at the mating sapling. For the analysis we focused on the jumping sequence and found that males had a very precise jumping routine that was rigid before testing, and that males needed time to learn a new sequence within their courtship arena during testing to successfully perform a full display including the last jump to the ground. Our findings are one of the first to show motor learning in an elaborate courtship display.

## Poster – Session B

### Behavioural and Physiological Changes in Dogs during Search for Missing Persons

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The aim of my study is to determine relationships between physiological, locomotor activity and behavioural data in search-and-rescue dogs and to outline main factors influencing their success and welfare during search missions. Domestic dogs of both sexes, various age and breed and various housing conditions participate in the study. The educational and training backgrounds of each canine rescue team also vary since participating teams represent Czech Police, Mountain Rescue Service, Fire Brigade and volunteer canine brigades.

Data sampling takes place during simulated field sessions focusing on ground searching for missing persons on various localities of the Czech Republic. „Missing persons“ are ensured by assistants (figurants) from our research team.

Given to a complex nature of this study, we sample various data that can be classified as: i) physiological (heart rate variability, body temperature, thermography sampling and salivary cortisol), ii) behavioural (video records - analysis of dog's and handler's behaviour during play and during finding/marking of missing persons in the field), iii) locomotor activity and climatological data (GPS tracking of canine rescue teams - distance, speed, elevation, terrain. Climatological data – air temperature, humidity, wind conditions), and iv) questionnaires for dog handlers.

During spring/summer of 2019 I would like to present some of the first results and conclusions that originate from this study.

## **Visual individual recognition in African grey parrots (*Psittacus erithacus*)**

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Previous research on African grey parrots (*Psittacus erithacus*) has confirmed their ability to sort photographs based on the identity of the conspecific pictured, indicating the possibility of visual individual recognition (IR) in this species.

The aim of the research presented was to explore the role of specific body parts and visual traits in IR of this species.

Three subjects (1 female, 2 males) were tested using matching-to-sample tasks. Modified as well as non-modified photographs of familiar conspecifics were used as sample stimuli. Modifications were created in order to assess the effect that specific visual traits play in IR.

Overall, 16 different modifications were created. Visual traits we focused on: coloration and structure of plumage, body shape, level of detail, particular body parts – beak, eye, head, body, and their configuration. Specific attention was paid to visual modifications which influence facial recognition in humans - such as the negative effect of spatial inversion and color inversion.

Modifications that targeted structure and coloration of plumage significantly decreased IR in contrast to success rate in non-modified trials. Also, modifications that obscured conspecifics' shape or abdomen had a negative effect on IR. On the other hand, success rate in trials containing modifications that related to head and facial features was comparable to non-modified trials, suggesting that these features do not play a major role in IR of grey parrots.

## **Effects of inequity on negotiation strategies of ravens (*Corvus corax*) in a cooperation task**

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Working together to solve a problem comes naturally to humans. When cooperating, we utilize negotiation strategies, including sharing of the obtained resources or punishment of cheating, to prevent inequality. But cooperation is not unique to humans and has been demonstrated in several species ranging from apes to birds and even fish. Although some animals have shown a sensitivity for inequity, very few studies have investigated how inequity is dealt with while cooperating. Ravens, who live in highly complex social structures, have previously been shown to cooperate by simultaneously pulling at the ends of a string to access a reward, a task known as the loose-string paradigm. During these tests the birds ceased collaboration when being cheated by their partner. Therefore, we decided to use this set-up to investigate cooperation in situations of inequity. We baited the apparatus with different quality food items, which forced the dyads to choose who would get to work on which side. As we expected the dominant individual to monopolize the high-quality side, this created inequity. We assessed the effects of the situation on the cooperation and whether the dyads would use strategies to achieve a satisfactory outcome for both birds. Additionally, to uncover effects of social context, different relationships, i.e. siblings and couples, were compared. Here, we will present the results of this study and discuss their implications for avian negotiation strategies.

## **Do dogs reciprocate help received from a human?**

Poncet L<sup>1,2</sup>, McGetrick J<sup>1</sup>, Range F<sup>1</sup>

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Cooperation is a mutually beneficial interaction between individuals. One mechanism maintaining cooperation between unrelated partners is reciprocal altruism, whereby the partners alternate donor and recipient roles, helping each other in turn. Dogs are among the many non-human animal species found to reciprocate. They reciprocate help received from a conspecific and they discriminate between cooperators and cheaters. Moreover, due to their complex social relationship with humans, dogs are also interesting for studying interspecific interactions. While they cooperate during daily life with us, their ability to reciprocate help toward humans has not yet been studied. In the present study, we investigate whether dogs discriminate between a helpful and an unhelpful human

partner and reciprocate the help received by the former. We conducted an experiment in which dogs interacted with two humans: during the experience phase, dogs received food from their helpful partner whereas the unhelpful partner did not provide anything. Then, during the test phase, dogs had the opportunity to provide treats to each human by pressing a button. The preliminary results indicate that during the experience phase, dogs behave differently when faced with a helpful compared with an unhelpful human, showing many stress behaviours and frustration with the latter. However, it does not seem to impact their behaviour in the test phase, as they tend to provide food indiscriminately to the humans.

## **Pharmacological inhibition of p21-Activated Kinase rescues the behavioural phenotype in a female mouse model of CDKL5 Deficiency Disorder**

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**Aim** Cdkl5 Deficiency Disorder (CDD) is a rare neurodevelopmental condition due to mutations in X-linked cyclin-dependent kinase-like 5 (CDKL5) gene. No cure is available. It encodes for a kinase involved in several neurodevelopmental processes. Cdkl5-null male mice present brain overactivation of group I p21-activated kinases (PAKs), a family of Ser/Thr protein kinases involved in the spine morphogenesis and synapse formation, whose pharmacological inhibition rescues neurobehavioral defects in preclinical models of Fragile X and schizophrenia. The present study evaluated in a CDD mouse model the therapeutic efficacy of FRAX486, a brain penetrant inhibitor of group I PAKs.

**Methods** Symptomatic Cdkl5-Het female mice and wild-type littermate controls were treated with vehicle or FRAX486 for 5 days (20 mg/kg, daily s.c. injections). A battery of behavioral tests was performed to evaluate treatment efficacy.

**Results** Overactivation of group I PAKs was confirmed in the brain of symptomatic Cdkl5-Het mice, the condition which more closely recapitulates that of CDD patients. A 5-day long treatment with FRAX486 rescued the general health status of Cdkl5-Het mice and the social behavior in the Three-chamber social test, restoring wild type-like levels of sociability.

**Conclusion** Present results shows that systemic treatment with FRAX486 rescues some behavioral alterations in a CDD mouse model. Group I PAK inhibitors may represent an innovative therapy for this disorder.

## **The effect of prenatal and early postnatal exposure to a phthalate mixture on sociability, anxiety-like behaviour and testosterone production in rats**

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Phthalates (Pht) are chemicals negatively affecting testosterone (T) levels. T is important for brain development and there is concern of Pht having a role in the emergence of autism spectrum disorders (ASD).

We investigated the effect of prenatal and early postnatal exposure to a Pht mixture on sociability and anxiety-like behaviour in rats (at the time of weaning (W), puberty (P) and adulthood (A)) because problems in sociability and anxiety are often present in children with ASD. Plasma T levels in adult rats were measured to assess the long-term effect of prenatal and early postnatal Pht exposure.

Pregnant Wistar rats were divided into two groups: control (Ctrl) and exposed to the mixture of Pht – diethylhexyl, diisononyl, and dibutyl in dose of 4,5 mg/kg/day each, diluted in peanut oil and delivered to an animal orally from gestational day 15 to postnatal day 4. Social interaction test and elevated plus maze test were performed to assess sociability and anxiety-like behaviour respectively. T was measured by radioimmunoassay from plasma collected after the decapitation of animals.

Offspring from Pht group had decreased sociability in W, P and A, and increased anxiety-like behaviour in W and P when compared to Ctrl group. T levels were decreased in Pht group. These results suggest a possible role of Pht in decreasing T levels, which could lead to abnormalities in brain development, leading to changes in sociability and anxiety.

This work was supported by VEGA 2/0166/16

## **Impact of gestational hypoxia on development and behavior of the rat offspring**

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Maternal hypoxia during pregnancy may have a long-lasting or even a permanent effect on the health of the offspring. The aim of our study was to assess the effect of late gestational hypoxia on postnatal development and behavioral changes of the rat

offspring. We induced hypoxia (10,5% O<sub>2</sub>) to pregnant Wistar female rats on gestational day 19 and 20 for 8 h per day. This prenatal insult resulted in a significant delay of sensorimotor development of hypoxic pups compared to the control group. This delay was seen in air-righting ( $p < 0,01$ ) and startle reflex ( $p < 0,05$ ) test. The number of pups per litter was also decreased in the hypoxic group compared to normoxic pups from the postnatal day (PD) 8 ( $p < 0,05$ ), which may correspond to a delayed brain injury seen in other hypoxic models. Hypoxic pups also showed hypoactivity and lower anxiety-like behavior in the open field on PD 25 that was normalized in adulthood (PD 85). In conclusion, our study shows a deleterious impact of late maternal hypoxia on the early development of offspring and points out a possible existence of delayed postnatal compensatory mechanisms following prenatal injury. Supported by VEGA 2/0166/16.

## **Separation related behaviour in dogs: the effect of fear and frustration**

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Separation related disorder (SRD) is one of the most common behavioural problems in companion dogs, causing serious welfare problems for both the dog and its owners. SRD manifests itself in fairly well known signs in dogs being left alone (excessive vocalization, restlessness, destructive behaviour etc.) and there are many studies about its causes and risk factors. It is a multicausal problem; however, the connection between particular signs of SRD and the possible different emotional states – provoked by different causes – remained uninvestigated. We hypothesize that some dogs show more frustration-related, meanwhile others more fear-related behaviours during separation. To measure these personality traits we developed a questionnaire that contains questions about situations where the dog may show fearful or frustrated reactions. The results (N=376) were compared to the behaviour of the dog in a 3 min indoor separation situation. Our preliminary results (N=34) showed that dogs that prone to show more frustration-related behaviour in other (e.g.: food related) situations and dogs that are generally less relaxed in everyday situations move and vocalise more and start to vocalise sooner during the separation test. Dogs that are generally more fearful or have noise- or thunderstorm-phobia rather stand at the door and move less so they may have a different, less intense negative inner state during the absence of the owner.



## Who do you prefer? Investigating the human-dog attachment system in pet dogs

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Humans and dogs share a long period of close co-habitation, shaping each other's socio-affective behavior. Numerous studies have shown that the human-dog relationship resembles the human mother-child bond. Behavioral evidence suggests that dogs fulfill all human attachment-defining criteria. But is the dogs' brain network involved in attachment comparable to the one of the human mother-child bond? Do dogs prefer their attachment figure (AF) over other humans? We aimed to combine various methods to investigate the human-dog attachment system. Therefore, we conducted an fMRI study with 17 awake unrestrained dogs while perceiving visual stimuli. Additionally, we collected behavioral data in a two-choice task and in an eye-tracking study. During all studies, we presented dynamic face pictures of the AF and of other humans that the dogs were either familiar or unfamiliar with. Based on behavioral evidence we expected the dogs to show a preference for their AF. We predicted that the dogs would spend more time on the "AF's side" of the test arena in the explorative behavioral test. During the eye-tracker test we expected the dogs to show more fixations and revisits on the presented AF stimuli on the screen. For the fMRI study, we anticipated a stronger activation of e.g. the amygdala, hippocampus and several cortical brain areas related to attachment when perceiving visual stimuli of their AF. Data collection and analyses are still in progress and will be reported at the conference.

## Spontaneous differences in how male and female tortoises interact with conspecifics

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Individual recognition is the ability to identify an organism through its specific characteristics. It is an adaptation for the modulation of social interactions. Since it has been studied mainly in social species, it is considered an adaptation for social life. To gain a deeper understanding of this ability, it is interesting to test it also in non-social species, such as tortoises. In a previous study we observed that tortoise's hatchlings of

different species can discriminate between familiar and unfamiliar individuals. In this study we explore the individual recognition capabilities of adult tortoises (*Testudo hermanni*). The experimental subjects were raised in captivity in close contact with conspecifics of the same sex, and then tested in a novel arena, once with a familiar conspecific and once with an unfamiliar one. We analyzed the distance kept between conspecifics in the two conditions. Our data did not show any behavioral difference between the familiar and the unfamiliar conditions, but differences were found between males and females, regardless of familiarity. Males kept a much closer distance than females, and the average distance decreased during the test. Females instead showed an interest in approaching the conspecifics at the beginning of the test but subsequently lose interest in the other individual. These spontaneous differences in the interaction with conspecifics should be further explored to clarify their perceptual and physiological basis.

## **Assessing behavioural flexibility in domestic chicks through a serial reversal learning task**

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Intelligence can be broadly defined as a property of an individual to interact with its environment, the ability to profit with respect to some objective and to adapt to new situations. Such definition implies that a wide variety of animal species do exhibit intelligent behaviour. In particular, convincing evidence has been accumulating that cognitive abilities of some avian species are comparable to those of primates. However, inter-species variability and the use of different tasks has made it difficult to measure and quantitatively compare birds' performance. To overcome the species-specific constraints such as differences in motor, visual and other systems, the use of serial reversal learning task has been put forward. This task requires inhibitory and excitatory conditioning, the ability to inhibit the previous responses and to learn the general rule which makes it suitable for measuring the construct of behavioural flexibility with a real strength in a comparative perspective. Here in the attempt to validate this paradigm in young chicks, we tested 4 male domestic chicks (*Gallus gallus*) from 3 to 10 days old in a series up to 10 reversals. Preliminary data suggest that chicks make more errors in the first reversals and reach a very low error rate in the last two. Overall, in spite of their early age, domestic chicks seem to outperform other avian species, such as adult pigeons and even adult corvids, which data are reported in previous literature.

## Figure-ground segmentation in *Phidippus regius*

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Jumping spiders (Salticidae) are active visual hunters, known for their outstanding visual system composed of two principal eyes and three pairs of secondary eyes. While the forward-facing principal eyes have an excellent spatial resolution and colour vision, the secondary eyes are specialized in motion detection. Noticing a possible prey will prompt the spider to turn towards the stimulus to get a closer look with its principal eyes.

However, the spider's hunting ability does not depend only on motion detection, but also the ability to tell apart prey from the background. Figure-ground segmentation can be shown in humans with the famous Rubin's vase that shows that it is possible to see a vase in the foreground and two faces in the background, but not both at the same time. However, figure-ground segmentation becomes more difficult when the two components are similar.

In the absence of literature on this ability in spiders, we assessed 27 jumping spiders (*Phidippus regius*) on a figure-ground segmentation test. Each spider was harmlessly restrained in front of two monitors and given a polystyrene ball to hold. Each stimulus was composed of a black and white grating background and on one of the monitors, a white and black grating circle as moving from posterior to anterior. We manipulated the orientation of the circle's gratings to see how similar to the background the object can be and still be recognized as a moving prey by the spider. More assessments are yet to be carried out.

## Effects of different training styles on learning performance and neural activity (sleep EEG) in dogs

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It has been argued that dogs can be used to non-invasively study neuro-cognition, including sleep-related cognitive functioning. In dogs, similarly to humans, learning and emotional experience (e.g. stress level) influence the sleep pattern. The efficiency of learning is affected by the training methods used and the stress level involved. Numerous studies reported detrimental effects of punishment-based training in dogs. However, most studies investigating the effects of stress and training style on performance are questionnaire-based and owners' reports might be biased by their beliefs on optimal methods.

In our study our twofold aim was to investigate directly the effect of supportive vs. controlling style of training on the memory performance and the sleep pattern of family dogs.

Dogs (N=15) participated in the test on three occasions: first in an adaptation sleep, using our non-invasive polysomnographic method. The next two occasions started with the learning phase (within subject design, conditions in counterbalanced order) followed by the sleep measurement. Directly after the sleeps, we retested the dogs' performances.

Based on our previous results we assumed that, due to the higher stress level, in the controlling condition 1) dogs would show more stress-related behaviours during the training, 2) their REM sleep duration would be larger, and 3) their performance in the retest session would be worse.

Our preliminary results will be presented at the conference.

## **Using a second language within sexual and romantic relationship**

Mlodzikowska W<sup>1</sup>

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In my presentation I would like to bring the attention to the needed area of research within human's behaviour and cognition: an influence of a language on human sexuality and my personal approach to study the concept.

As Sapir and Whorf presented in their ground breaking language determinism theory, our cognition is affected by the language we use. And therefore, so is our behaviour. As many studies have shown our personality and how we see the world can be vastly influenced by the language we speak and its cultural connections (Ramírez-Esparza et al. 2006). There are also studies which suggest that what also change in using a second language is our emotional response – its magnitude (Hsu et al. 2015) or its timing (Opitz and Degner, 2012).

We also know that personality (for example level of extraversion) is connected to sexual promiscuity (Schmitt, 2004).

Based on that evidence it seems almost unbelievable that within modern world where more and more people are engaged in multilingual and multicultural intimate and sexual relationships, we as scientists can't tell exactly how using a second language within such relationship can affect it.

Currently, we can only hypothesise that on one hand it can lead to reduced emotional response where at the same time it can increase chances of communicating needs and desires.

In the speech I would like to present my master thesis and research which I devoted to that complex aspect of human cognition, behaviour and functioning.

## **Does tickling evoke positive experience in laying hens?**

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The brains of birds and mammals share many functional similarities. Although birds do not have cortex, the neuronal circuitry of its avian homologue pallium explains cognitive abilities of birds. Despite the fact that domestic chickens are often perceived by general public only as commodity, they are intelligent animals with individual personalities. Inspired by works on rats, we tested, whether tactile stimulation could induce positive affective states also in laying hens. To assess the affective states induced by tickling in hens, we used our custom-built Skinner box and judgement bias task. Sixteen hens were trained to discriminate between positive stimulus (PS, white or dark grey circle, rewarded by mealworm) and refraining to peck at negative stimulus (NS, circle of opposite color, punished by white noise). They were divided into 2 groups. Half of them was handled (H), and the other half tickled (T) for 30 sec in afternoon sessions, while discrimination training took time in the morning. The hens were subjected to cognitive bias test, in which their responses to PS, NS and additional ambiguous stimulus (AS, shade of grey between PS and NS) were recorded. Although we have not seen any difference in mean proportion of responses to AS between tickled and handled hens, tickled hens reacted to AS with longer latencies than handled hens indicating, that tickling at this age and with this treatment duration was not perceived by hens as positive experience.

## **Comparing Ants With Humans? - A Comparative Psychology Approach**

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Living in a multivariate environment demands focussing on essential tasks. Voluntary task switching is an important paradigm for testing cognitive flexibility and spontaneous decision-making when competing tasks are present. Task switching has been studied in the light of reward, which might be the most commonly used tool to shape individual behaviour. A study by Fröber and Dreisbach (2016) demonstrated that it is not reward level per se, but reward change, which most strongly affects switching behaviour in humans: Task switching was lowest when reward remained high, intermediate when reward remained low but highest when reward is changed (increase or decrease). We replicated their experiment on individual foragers of the ant species *Lasius niger*, using an adapted spontaneous alternation task. We found that ants responded in the

qualitatively same pattern as humans in the matter of reward sequence. In a second experiment we showed that this behaviour can be explained by cue change, rather than rewards. However, patterns exist in the data which cannot be explained by cue change. This undeniable resemblance in the behaviour of the two species raises the question how reward shapes behavioural flexibility and stability in humans.

## **Systemic treatment with Rimonabant, a CB1 receptor antagonist, improves behavioural alterations in a mouse model of Rett syndrome**

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Rett syndrome (RTT) is a rare neurodevelopmental disorder, characterized by severe behavioural and physiological symptoms. RTT is caused by mutations in the methyl-CpG-binding protein 2 (MeCP2) gene in about 95% of cases. The endocannabinoid system regulates several physiological processes and behavioural responses that are impaired in RTT and its deregulation has been associated with numerous neurodevelopmental disorders. In particular, the blockade of the cannabinoid receptors CB1 (CB1R) normalizes some behavioural alterations in a mouse model of Fragile X. The present study evaluated the potential therapeutic efficacy for RTT of a systemic treatment with the CB1R antagonist Rimonabant in a mouse model at a symptomatic stage. MeCP2-308 heterozygous female mice and wild-type littermate controls were treated daily for 4 consecutive days with vehicle or Rimonabant at a low dose (0.3 mg/kg, i.p.). A battery of behavioural tests was applied to test treatment efficacy. Treatment with Rimonabant rescued the motor coordination defects and normalized the abnormal locomotory activity of RTT mice. Vehicle-treated RTT mice showed reduced sociability, which was increased by the CB1R antagonist. Present results demonstrate that a 4-day long systemic treatment with Rimonabant improves some behavioural alterations in a RTT mouse model, suggesting CB1R blockade as a novel potential therapeutic strategy for this severe disorder.

## **Spiders in the box: associative learning in *Phidippus regius***

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The ability to understand the relationship between events in the environment is an essential mechanism to survive in the animal kingdom. This mechanism, defined associative learning, has been studied in several species, from mammals to invertebrate organisms. Here, we tested this ability in the jumping spider *Phidippus regius*. These

animals are excellent models for the study of invertebrate cognition: they have been shown to possess abilities like spatial navigation, visual discrimination and learning. However, training spiders in learning tests presents difficulties. These are mainly related to the selection of suitable reward modalities for spiders and individual differences in learning performances. To overcome these problems, we designed a skinner box with automated reinforcement schedules. Spiders were first trained to familiarize with a drop of sucrose solution and then to activate a photosensor to obtain the reward. Our results support the presence of associative learning mechanisms in *Phidippus regius*, and also introduces an innovative paradigm to study invertebrate cognition using automated reinforcement schedules.

## **Animal art-ivity: the sense of beauty in bowerbirds**

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In our work, we discuss the bowerbird's behaviour in relation to animal aesthetics. The male bowerbird creates a unique, multifaceted and peculiar bower with objects from its environment like flowers, shells and rods. This kind of courtships (that differs both individually and geographically) should attract females. In the past, the Darwinian approach to animal aesthetics issue explains this pre-copulatory behavior with the sexual selection theory. But, is it only a simple sexual selection or does it also imply some aesthetic abilities? To answer this question, we argue that the bowerbird's discrimination of the beauty of the whole courtship ritual cannot be explained simply by referring to a straightforward sexual instinct: it is connected with aesthetic appreciation, which is inevitably linked to a notion of judgment. Actually, males create sophisticated and elaborated courting specifically to impress females and females choose one male rather than another based on aesthetic discernment. These behaviors depend on the coevolution of males' and females' sense of beauty. Furthermore, it is possible that human aesthetic ability has developed from non-human animal aesthetic ability, along a continuum. In line with our discussion, we suggest further studies about animal aesthetics, supported neither by the sexual selection nor by anthropocentric perspectives as it has been so far.

## **Slime mold: minimal cognition**

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Is having a brain crucial to process information? Is the Central Nervous System (CNS) a prerequisite for complex behaviour, such as cognition? We want to introduce you in the tiny world of the slime mold *Physarum Polycephalum*, a unicellular organism without a CNS, which nonetheless displays complex behaviour. In the last two decades researchers had shown that the slime mold is capable of finding the shortest path through a maze,

constructs networks as efficient as those designed by humans, anticipate periodic events, compares the relative qualities of multiple options, shows habituation and it even makes irrational decisions. However, some of these behaviors could be explained by simple biological mechanisms like chemotaxis: *P. polycephalum* leaves behind a thin mat of extracellular slime as it moves through the environment, and use it to avoid areas previously explored. Nonetheless, other evidence sustains that brainless slime mold has the capacity to learn about the environment and regulate its behavior accordingly, thus exhibiting same kind of learning (both associative and non-associative). Traditionally, lower organism without neurons or brains were considered to be able at most of simple stimulus-response behavior, but these evidences suggest a form of primitive or minimal cognition that does not requires a neuron-based architecture. Further research on the exact mechanisms of primitive cognition could help us to better understand the phylogenesis of cognitive abilities and if the fundamental elements for more complex information processing are contain by other brainless life forms.