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Session 1

Wednesday 20th

15.00-17.00

Poster 1

Using Visual Priming to Study Autism-related Visual Perceptual Anomalies in Rats

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1. SISSA

autism, rat model, visual processing, priming

Autism spectrum disorder is a heterogeneous group of syndromes defined by impairments in social reciprocity and language development, accompanied by highly restrictive interests and repetitive behaviors [1]. In addition, in the latest version of the DSM, disruptions in sensory processing have also been added as one of the core traits of autism [2]. Among many anomalies that characterize the visual perceptual phenotype of individuals on the spectrum, we have decided to focus particularly on (1) propensity to process local features at the expense of the global organization of visual patterns [3], (2) impairment to process patterns defined by second-order cues [4], and (3) deficit in invariant pattern recognition [5]. Rats have proven to serve as a valuable model for studying visual processing, especially since they allow probing cortical circuit-level dysfunctions, as well as application of gene editing methods and ultimately generation of genetic models. Therefore, in our study, visual perceptual abilities were first assessed on a group of 12 wildtype (WT) rats by means of a grating orientation discrimination task, integrated with a priming paradigm. These WT rats displayed a high degree of invariance to the transformation of phase and spatial frequency of oriented gratings, while they had difficulties perceiving second-order (i.e., texture-based) gratings as similar to the default (luminance-based) ones. Rats were also strongly sensitive to the orientation of the local elements of the hierarchical Navon-like stimuli, which appeared to have precedence over the global pattern. Perception of the global pattern of the hierarchical stimuli was nevertheless appreciable and its magnitude could be inferred from the interference with the orientation of the local elements. Our results demonstrate the suitability of the priming paradigm to assess autism-related visual perceptual anomalies, and we now plan to administer the same visual task to a batch of rats with a mutation on a high-confidence risk gene for autism.

1. State, M. W., & Sestan, N. (2012). The Emerging Biology of Autism Spectrum Disorders. *Science*, 337(6100), 1301–1303. <https://doi.org/10.1126/science.1224989>. 2. American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>. 3. Baron-Cohen, S., Ashwin, E., Ashwin, C., Tavassoli, T., & Chakrabarti, B. (2009). Talent in autism: Hyper-systemizing, hyper-attention to detail and sensory hypersensitivity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1522), 1377–1383. <https://doi.org/10.1098/rstb.2008.0337>. 4. Bertone, A., Mottron, L., Jelenic, P., & Faubert, J. (2005). Enhanced and diminished visuo-spatial information processing in autism depends on stimulus complexity. *Brain*, 128(10), 2430–2441. <https://doi.org/10.1093/brain/awh561>. 5. Hellendoorn, A., Wijnroks, L., & Leseman, P. P. M. (2015). Unraveling the nature of autism: Finding order amid change. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.00359>

Poster 2

A Universal Left-to-Right Bias in Number-Space Mapping across Ages and Cultures

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cognitive science, human behaviour, cross-cultural studies, space-number association, numerical cognition

Number and space are inherently related. For decades, authors have collected evidence showing that numbers are aligned to a so-called “mental number line”, which is malleable and affected by cultural factors. However, preverbal humans and non-human animals also map numerosities into space, in a consistent left-to-right direction. These contrasting pieces of evidence raise the question of whether Space Number Associations (SNA) are culturally or biologically determined. Here, we investigated Italian adults, Italian preschoolers, and Himba adults to determine whether cultural influences are necessary for SNA to emerge. We found that, when explicitly asked to order numerosities, only Italian adults showed a consistent left-to-right preference, while preschoolers and Himba adults did not have a consistent preference for one direction or the other. On the other hand, in a numerosity comparison task, all groups performed better when small numerosities were presented in the left hemispace. These results suggest that SNA is not a unique phenomenon, but rather is dissociable in two components: a universal one, biologically predisposed and left-to-right oriented, and an acquired one, culturally dependent and not fixed in orientation.

Poster 3

Exploring the adaptability of perceptual memory through One Back Task

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perception, memory, behavior, sensory processing, psychophysics

Perceptual memory is a thriving area of research in cognitive neuroscience. However, existing studies usually focus on behavioral findings from a single paradigm, raising the question of whether perceptual memories are governed by paradigm-specific mechanisms. To address this, our research group aims to develop a flexible framework capable of adapting to various behavioral tasks. In order to challenge this framework, we have created a new task called the One Back Memory task, which combines working memory and reference memory. Participants are presented with vibrotactile stimuli and are asked to judge whether the current stimulus is stronger or weaker than the stimulus of the previous trial. This task requires each percept to be used in dual functions: first it is judged in real-time and then it must be stored in memory and recalled as the reference for the subsequent trial.

The stimuli are delivered in a Markov sequence, comprising nine intensities with unpredictable shifts between high and low-intensity clouds. This design allows us to test our hypothesis of two buffers: a short-term buffer (STB) representing the memory of the preceding stimulus and a long-term buffer (LTB) formed from a longer sequence of past inputs. Our findings indicate that perception is influenced by the context formed by recent stimuli, biasing perception. However, this bias does not fundamentally alter the task's objective. Furthermore, our observations suggest a contraction bias toward the local means of the stimulus clouds.

To understand the dynamics of the two buffers, we utilized a model that assumes that the information stored in the STB is attracted toward the LTB with the time constant τ_{STB} while, simultaneously, the information stored in the LTB is attracted toward the STB with the time constant τ_{LTB} . We discovered that, when the model is optimized to predict the choices of human subjects, τ_{STB} has a mean of 12 seconds, while τ_{LTB} has a mean of 33 seconds.

While fMRI studies have investigated the updating of decision boundaries in visual binary classification tasks, little research has been conducted on vibrotactile tasks. Our goal is to explore the neural locus of the decision boundary and the interaction between the two buffers (LTB & STB) using EEG recordings. Previous studies have identified the anterior superior temporal gyrus (aSTG) as the neural locus for the boundary in visual classification tasks. We seek to determine if there is physiological evidence supporting the existence of bimodal means and to examine the higher-level areas' response when subjects transition between clouds and eventually the means.

Poster 4

Effect of Island isolation on Predator Recognition by Arctic Terns

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mobbing, antipredation behaviour, nest defence, behavioural ecology

Island populations often face a limited range of predators, which can lead to a loss of ability to respond adequately to predators after long-term isolation. Here, we studied a population of Arctic terns (*Sterna paradisaea*) breeding in the Svalbard archipelago, where a limited spectrum of predators is present. We monitored the intensity of antipredation behaviour using textile dummies placed near the nests of incubating terns. We compared the responses of populations from Svalbard and from the European continent (Varanger Peninsula, northern Norway), where, in contrast, a rich predator spectrum is found. We presented the following species: great black-backed gull (*Larus maritimus*) - a common predator of nests in both populations, common raven (*Corvus corax*) - a common predator of nests found only on the continent, peregrine falcon (*Falco peregrinus*) - a common predator of adults found only on the continent, common eider (*Somateria mollissima*) - a harmless species found in both locations. Responses to these species were compared with responses to a seated human figurant and a piece of wood of reasonable size. We evaluated several types of behaviour such as number of attacks on the dummy, time spent near the dummy, and time spent on the nest. The great black-backed gull dummy at both sites elicited a number of attacks and terns spent a lot of time in its vicinity. This suggests that Arctic terns consider the great black-backed gull a threat. The response of terns from both sites to the eider was also relatively strong, but weaker than to the gull. This is surprising and suggests that eiders may also pose a threat to tern nests. The reaction to both ravens and falcons was slightly stronger on the continent, which is probably due to the little experience of the Spitsbergen population with these species.

Poster 5

Real-time virtual physical deformations: a continuous design paradigm for interactive reasoning

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design, physical deformations, motor control, virtual reality

We developed a 3D virtual environment with realistic physical dynamics in which deformable objects must be continuously manipulated into a form which solves for task objectives. Based on preliminary experiments, we report that human participants intuitively engaged with minimal task training, adapted their behavior based on experience both within and across task conditions, and their performance was modulated according to task difficulty. In the future, we aim to develop this experimental paradigm further e.g. with augmented reality and hand-tracking. We suggest that such immersive experiences for complex naturalistic problem-solving with high-dimensional and continuous motor readouts may provide a robust and informative platform for tracing the complexities of internal reasoning processes.

Poster 6

Neurotic and Analytical: Is It The Best Duo When It Comes to Not Falling for Covid-19 Conspiracies? A Turkish Case

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conspiracy theories, covid-19, analytical thinking, intuitive thinking, big five

In this post-truth age, conspiracy theories and misinformation have the opportunity to spread rapidly and leave us in a world where there are no clear boundaries of what is right or wrong. Especially during and after the pandemic, we had the opportunity to observe how quickly false information spreads, its fatal consequences, and how many people it affected. In order to have a better understanding of dealing with these consequences, we examined people's thinking strategies in the spread of misinformation. Is it the intuitive or analytical thinking that increases the susceptibility to believing in conspiracy theories? In the literature, the dichotomy between Classical Reasoning Account and Motivated System 2 Reasoning Account remains. In our research, while focusing on analytical thinking/intuitive thinking, we also measured the effect of certain personality characteristics on conspiracy theory beliefs. The characteristics we examined were: openness, agreeableness, and neuroticism from the Big-5 Inventory. 140 Turkish citizens with evenly distributed ages from 18 to 92, participated in this study. Their analytical thinking was tested using Cognitive Reflection Tests, and, also, they were given Big Five Inventory, at the end, COVID-19 Conspiracy Theory Belief Test was given to assess their beliefs in conspiracy theories. Our results supported Classical Reasoning Account with analytical thinking decreasing the conspiracy theory belief susceptibility. Surprisingly, contrary to the literature, our results showed that neuroticism is associated with low conspiracy theory belief. We believe that our finding regarding neuroticism may be of particular interest, because this result may have arisen from political reasons. Especially, when we consider the period in which the research was conducted coincided with the Turkish Presidential Elections. Overall, as this study helps bringing clarity on the dichotomy of reasoning accounts, and raises new questions on the role of neuroticism, it also creates diversity in the literature with non-western data.

Poster 7

The Role Of Optic Tectum In Quantity Discrimination: A Biomolecular Approach In Zebrafish (*Danio Rerio*)

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zebrafish, numerosity, habituation, molecular biology, optic tectum

Zebrafish (*Danio rerio*), like many other vertebrates, is able to discriminate sets of items on the basis of their numerosity. However, little is known about the neural correlates of this ability. We addressed the issue using a habituation/dishabituation paradigm followed by a biomolecular analysis of IEGs expression. Zebrafish were habituated to groups of 3 or 9 small red dots for four consecutive days. During this phase, the dots changed in density, position and size, while maintaining their numerosness and overall surface area. During dishabituation, zebrafish faced a change (i) in number (from 3 to 9 dots or vice versa, with the same overall surface), or (ii) in shape (3 or 9 red squares instead of 3 or 9 dots with the same overall surface), or (iii) in size (with the same shape and number). A control group was tested with the same stimuli as the habituation. After thirty minutes, specimens were sacrificed and their brains were dissected to quantify the transcriptional levels of *c-fos* and *egr-1* by quantitative polymerase chain reaction. The results showed a numerosity-selective response in the external and internal layers of the optic tectum. A role of the external and internal layer and the periventricular grey zone of the optic tectum was observed in response to changes in size. No selective modulation of IEGs in response to the change in shape was noticed. In conclusion, our results suggest an early involvement of specific tectal subregions in the encoding of discrete and continuous quantity. Moreover, this study adds another piece of evidence to the hypothesis of a neural circuit for numerosity discrimination in zebrafish.

Poster 8

Humboldt Penguins (*Spheniscus humboldti*) living in the zoo: Effects of visitors' activity on penguins' behavior

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Humboldt penguin, animal behavior, captivity, animal welfare, visitors' effect

Zoos play an important role in the conservation of all animals in captivity, where it is imperative to guarantee that they have the best welfare possible. The presence of visitors is one of many elements that animals in zoos are daily exposed to, that may have an influence on their welfare. This influence can be seen as negative, since it can cause stress and lead to the performance of stereotyped behaviours; it can be seen as positive, since it can be considered a type of environmental enrichment, promoting an increase in behavioural diversity; or not have any influence at all. Thus, conducting animal behaviour studies in zoos is crucial to understand the influence that visitors can have on the animals, to ensure their welfare.

The Humboldt Penguins (*Spheniscus humboldti*), inhabitants of Zoo Santo Inácio, are the target of this study. Considered one of the main attractions of the Zoo, feeding sessions occur every day, attracting visitors. Therefore, this project aimed to study the behavioural responses of Humboldt Penguins to several visitor activities (proximity, levels of excitement, attempts to interact with the animals). An ethogram of the penguins was elaborated, as well as a visitor behaviour scale (of 1-5 from passively observing to actively attempting to gain the animals' attention). Observations of the penguin's behaviour were made in the presence and absence of visitors and at the time of the feeding sessions. An instantaneous scan sampling of the penguin group was done once every 30 seconds and the zone of the enclosure used was registered, using the Boris software. Results seem to indicate that the nature and intensity of the visitor interactions, enclosure location influence the penguin's response to visitors. Comprehending the importance of these factors allows us to understand which visitors' behaviours have a negative or positive impact on the penguins-visitor interactions, enabling to refine the management of visitor-penguin interactions in zoos.

Poster 9

Humans and mice integrate sensory evidence and priors in similar ways when making decisions about when to act

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human behaviour, mouse behaviour, decision-making, priors, temporal expectation

Animals process a constant flow of sensory input and combine it with prior knowledge to make choices. When relevant sensory events occur around particular times, animals become capable of expecting the timing of upcoming events. Here, we investigated how humans and mice use uncertain sensory information to decide when to act, and how their decisions are influenced by their temporal expectations, by comparing the performance and strategies of humans and mice carrying out an identical behavioural task.

We adapted a visual change detection task previously developed for mice [1]. 15 humans (7 male & 8 female, 21-40 years old) were instructed to observe a drifting grating that constantly fluctuated in speed every 50 ms and to press a keyboard when they detected a sustained change in the drifting speed (temporal frequency: TF). We varied the magnitude and timing of the changes in each trial, and when the changes happened in blocks: 3-8 (early) or 10-15 seconds (late) after trial onset. At the end of each trial, participants were asked to report their confidence about whether a change had happened. We compared human behaviour to that of five mice performing the same task.

We found humans and mice had similar psychometric curves and reaction times. While humans had fewer early reports (reporting before a change), both species had an increase in report-triggered TF averages ~ 0.5 seconds before early reports, suggesting they continuously monitor noisy sensory evidence in similar ways. Humans were less confident when they made early reports compared to rewarded reports. In both species, early reports happened earlier in early blocks, and both species adapted to new blocks within ~ 20 trials. This implies humans and mice combine priors about temporal expectation with sensory evidence to decide when to act in similar ways.

1. Orsolich, I., Rio, M., Mrsic-Flogel, T. D., & Znamenskiy, P. (2021). Mesoscale cortical dynamics reflect the interaction of sensory evidence and temporal expectation during perceptual decision-making. *Neuron*, 109(11), 1861–1875.e10. <https://doi.org/10.1016/j.neuron.2021.03.031>

Poster 10

Acting or reacting? Developing a behavioral task to study Cued vs Self-paced initiations in a Parkinson's disease animal model

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Parkinson's disease, movement initiation, dopamine, self-paced and cued

Survival relies on the ability to initiate movement at the right time and with the right vigour. Despite this, patients with Parkinson's disease (PD) struggle to initiate movement in a self-paced manner, and even when successful, it tends to be less vigorous. On the other side, PD patients seem to be less impaired when movement initiation is triggered by an external cue which lead to the aphorism that these patients "react better than they act".

In this project we want to investigate the neural circuit dynamics that underly the beneficial effect of cues for movement initiation in PD. To this end, we developed a head-fixed behavioral task, where mice can initiate forward locomotion either in a self-paced manner, or upon an auditory cue. Three-dimensional postural, gait and kinematic parameters are extracted using deep learning based markerless tracking.

To model PD, we have injected D1/D2 antagonists in mice leading to the development of acute movement initiation impairments, after the behavior has been stabilized. What we show is that although mice behavior is similar in both self-paced and cued initiations, when injected with antagonists they show a decrease in self-paced but not cued movement initiations and speed.

Having established a behavioral ask, we will assess and manipulate the activity of different neuronal circuits involved in self-paced and cued movement initiation before and after mice develop a parkinsonian phenotype. Our ultimate goal is to identify what is the change that cues elicit in motor control circuits and use this information to rescue self-paced movement initiation impairments.

Poster 11

The hidden rhythms of freezing: Muscle activity during optogenetic activation of freezing in *Drosophila*

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defensive behaviour, neuroscience, freezing, *drosophila*, muscles

When faced with a potential danger, animals are confronted with a split-second decision: to flee or to freeze (remain immobile but alert to avoid detection). During freezing skeletal muscles maintain a rigid posture, sometimes in atypical positions for many minutes at a time. Calcium imaging to visualise *Drosophila* muscle activity during freezing has revealed striking novel patterns of muscle activation in the distal tibia. Two modes of muscle activity were apparent; pulsing continuously throughout freezing “continuous”, or an initial period of quiescence before ramping up activation prior to movement onset, “delayed”. This intriguingly suggests that freezing comprises multiple immobility states. The balance between these two states has been shown to be modulated by changing threat salience, with delayed pulsing being associated with increased threat salience. A pair of descending neurons, DNp09, have been implicated in freezing behaviour. Genetic silencing of DNp09 descending neurons disrupts freezing yet does not prevent fleeing. Optogenetic activation of both DNp09 neurons induces running and freezing in a state-dependent manner. Here we investigate muscle activity during optogenetic activation of DNp09, and show that the delayed pulsing state predominates. These findings lend support to a model where different freezing states are controlled by distinct neuronal pathways, and muscle activation patterns can serve as a valuable readout of internal information.

Poster 12

Development of a System for Tastant Delivery During Feeding Behaviour Experiments

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feeding behaviour, tastant delivery, peristaltic pumps, arduino, MRI-compatible

Administration of gustatory stimuli in human feeding behaviour studies has been aided by the development of devices known as gustometers. Compared to manual presentation, this constitutes an automated and more controlled approach that can easily be synchronized with computerized tasks. Here, we present a portable system for precise administration of liquid solutions during decision-making tasks, aimed at investigating decisions for prospective food rewards at a trial-by-trial level. Specifically, this constitutes an adaptation of a gustometer design based on peristaltic pumps as integral components [1], optimised for delivery of large volumes of yogurt-based solutions. The system's control module includes an Arduino UNO board with a custom-made pluggable circuit board, necessary for operating the pumps. Delivery of liquid solutions to the subject's mouth takes place through plastic tubes that are then coupled to a disposable 3D printed pacifier-shaped mouthpiece [2], which we re-designed for delivery of water and multiple yogurt-based solutions, while producing equivalent oral sensations and minimizing cross-contamination. To ascertain this, we are optimizing a 3 alternative forced choice test to understand if subjects can discriminate between different flavors delivered with our system. Open-source Python and Arduino scripts were developed to perform triggered administration of the liquid solutions, as well as adjust delivery duration. Importantly, the tubes and mouthpiece are MRI-compatible, allowing for replication of behavioral tasks while performing functional imaging, by keeping the pumps outside the MRI suite. Overall, this prototype system provides a precise and customisable method for investigating feeding decisions in humans.

1. Canna A, Prinster A, Fratello M, et al. A low-cost open-architecture taste delivery system for gustatory fMRI and BCI experiments. *J Neurosci Methods*. 2019;311:1-12. doi:10.1016/j.jneumeth.2018.10.003.
2. Munoz Tord D, Coppin G, Pool ER, et al. 3D-Printed Pacifier-Shaped Mouthpiece for fMRI-Compatible Gustometers. *eNeuro*. 2021;8(5):ENEURO.0208-21.2021. Published 2021 Oct 6. doi:10.1523/ENEURO.0208-21.2021

Poster 13

Comparative Analysis of the Alarm Calls of *Corvidae*

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bioacoustics, antipredatory behaviour, behavioral ecology

Birds usually produce alarm calls in the presence of a predator. The warning can be picked up by both conspecific and heterospecific individuals. Birds are well known for the diversity of their vocal expressions and alarm calls also vary considerably across the species spectrum. The reasons why individuals respond even to heterospecific alarm calls may vary as well. If species inhabit the same environment and also share predators, it is clearly advantageous for individuals to recognize and respond appropriately to heterospecific alarm calls. However, some studies suggest that individuals may also respond to calls of species they have never come into contact with. In these cases, the response is probably triggered by acoustic similarity of the unfamiliar calls to the familiar ones. Previous studies conducted on ravens and carrion crows have shown that both species' response to alarm calls produced by other corvids was stronger than to alarm calls by species in other families, even if they could not have had any direct previous experience with the tested corvids' alarm calls. Based on these results, the authors suggest that ravens might share certain characteristic elements in their alarm vocalizations across continents. We conducted a comparative bioacoustic analysis of their alarm calls. The sources of the alarm calls were the open-access database Xeno-Canto and our own recordings. These recordings contain a provoked response to a dummy avian predator. The bioacoustic programs Raven Pro 1.6 and Luscinia were used for the acoustic analysis. Selected spectrotemporal parameters were measured on each call to quantify the variability and similarity of warning calls between corvid species. The results suggest that the similarity of alarm calls to each other is influenced not only by phylogenetic relationships but also by body size or the type of habitat in which the species occurs.

Poster 14

Identifying Motor Neurons Involved in Pulsatile Muscle Activity Signalling

Mariana Franco¹, Anna Hobbiss^{1,2}, Marta Moita¹

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2. CEDOC

drosophila melanogaster, pulsatile muscle activity, motor neuron, movement resumption

The motor system is associated to movement. But, whenever you move a specific body part, you suppress everything else. From a static state, an animal also needs to be able to restart movement in a coordinated manner. In the Lab, we study this active stillness in *Drosophila melanogaster* using defensive freezing.

Unpublished results from our team identified an unexpected pulsatile muscle activity in the distal tibia while flies adopt a freezing posture, which is hypothesized to be a preparedness state for movement resumption and to be responsible for tissues nourishment and oxygenation.

In the project, we aimed to identify the motor neurons carrying such pulsatile signal to innervate the pulsing muscle. To do so, we targeted specific subsets of cells using *Drosophila* genetic tools: one fly line labelling the pulsing muscle; and other lines labelling motor neurons. Then, we optogenetically activated the selected muscle or neurons, while analysing flies' muscle activity (using GCaMP fluorescence).

We found that the muscle spontaneously varies between a high-sustained-state and low-pulsing-state. Furthermore, our results showed that the activation of two motor neuron lines led to muscle activity changes. One line caused transient muscle activation, making this a strong candidate to be the motor neuron for the pulsing muscle. The other caused striking muscle inhibition. Our results will be crucial for identifying the pulsing circuit.

Poster 15

Characterisation of the Acoustic Fish Communities in the Professor Luis Saldanha Marine Park (Portugal)

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fish acoustics, Professor Luis Saldanha Marine Park, fish sound catalogue, marine soundscapes

Sounds produced by teleost fish are an important component of marine soundscapes, making passive acoustic monitoring (PAM) a cost-effective non-intrusive method to assess the dynamics of an environment. This study aims to catalogue fish sound types recorded in the Professor Luis Saldanha Marine Park (PLSMP), and determine their potential sources. Based on comparison with literature 21 vocal species and 79 potential vocal species are found within the PLSMP. From the acoustics recording made in-situ during March 2021- September 2022, a total of 2542 putative fish sounds were detected, spread over 32 sound types, from which seven sound types had more than 100 detections: sound types #15(N=651), #4(N=568), #3(N=382), #14(N=172), #6(N=143), and #8(N=147). By comparing these putative sound types with previously reported sound types, potential sources were identified. Specifically, four sound types are potentially produced by *Chromis sp.*, *Scorpaena sp.*, *Cynoscion regalis*, and *Triglidae sp.*, and two sound types produced in tandem appear to be produced by *Seranus Cabrilla*. The use of Baited Remote Underwater Videos (BRUVS) further aided in identifying potential sound sources. Sound type #3 was associated with *Diplodus sargus*, *Trachurus sp.* or *Coris julis*, while #6 with *Coris julis* or *Centrolabris exoletus*. This study presents the first comprehensive catalogue for the PLSMP, laying the groundwork for future acoustic investigations in the area. Such knowledge may pave the way in the study, monitoring and management of soniferous single-fish species and coastal fish communities in Portugal.

Poster 16

Monkeys Integrate Facial Expressions and Direct Gaze to Modulate Gaze-following Behavior

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gaze-following, facial expression, gaze perception, primate behavior, social cognition

The eyes of primates are salient cues that make important contributions to the interpretation of facial expressions. Moreover, the other's gaze – given by the eye axis – identifies their object of attention. The process of identifying where the other has their attention directed is known as gaze-following. Gaze-following may be initiated by the other first gazing at the observer (direct gaze), in a way inviting the observer to subsequently follow gaze. In humans, direct gaze has been shown to facilitate subsequent gaze-following (1). In monkeys, it is known that facial expressions can encourage gaze-following (2,3) but the role of direct gaze remains unknown. In order to explore the influence of direct gaze on gaze-following and its possible interaction with facial expressions in monkeys, we trained 3 *rhesus macaques* on a gaze-following task in which the head orientation of a portrait monkey with the eyes straight relative to the head identified a spatial target from a set of 4. Prior to showing the spatial cues, we presented a 'distractor' stimulus – a monkey portrait with the same identity as the subsequent head gaze stimulus. The distractor monkey portrait could either gaze straight at the observing monkey with his eyes open, thereby establishing eye contact or have his eyes closed. Independent of whether eyes were open or closed the portrait displayed a neutral, threatening or fearful expression. We found that direct gaze, in the absence of facial expressions is unable to modulate the latency of a subsequent gaze-following response, unlike in humans. However, in combination with the expression of threat – but not with fear – direct gaze elicited faster gaze-following than when the eyes were closed. This result suggests a particular role of the other's eyes in the perception of threat and, moreover, an ecological advantage of tracking the focus of attention of an adversary.

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Session 2

Thursday 21st

09.00-10.40

Poster 17

Chronic oxygen loss but not warming increase dishonesty in cleaner wrasses

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deoxygenation, *Labroides dimidiatus*, climate change, cleaning mutualisms

Anthropogenic emissions are driving several challenges to marine life such as oxygen loss and ocean warming. Yet evidence for repercussions on mutualistic interactions is limited. In coral reefs, cleaning mutualisms are crucial for ecosystem health by removing parasites and dead skin from their client fish. However, a major conflict arises as cleaner wrasses prefer eating the protective mucus from their clients instead of parasites, which constitutes cheating and challenges the stability of this mutualism. Here we aimed to address the effects of oxygen loss and ocean warming on cleaning mutualism stability. To do so, we exposed cleaner wrasses (*Labroides dimidiatus*) and their clients (*Naso elegans*) to predicted future scenarios of ocean deoxygenation, warming, and a combination of both stressors for 20 days. We then assessed the resilience of the mutualistic interaction using social interaction tests and cooperativeness tests. Our results showed that cleaners exposed to deoxygenation, but not warming, were more motivated to initiate interactions (+17%) and were more dishonest (+169%), but their ability to learn to feed cooperatively remained unaffected. This suggests that under lower oxygen conditions, the decrease in cleaners' honesty is not due to cognitive impairments (i.e. disruptions in the ability to learn cooperative rules) but rather a decrease in inhibition. Our findings suggest that impending oxygen loss could affect the honesty of mutualistic interactions, which could lead to mutualism breakdown and significantly impact coral reef ecosystems.

Poster 18

Social Distancing in Cleaning Interactions: effects of sickness behaviour

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2. DBA-FCUL

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Labroides dimidiatus, immunostimulation, sickness behaviour, social preference, disease.

In the aftermath of the recent COVID-19 pandemic, in which social distancing proven to be a reliable strategy to prevent disease spread, it's fundamental to address the relationship between infectious diseases and social behaviour, namely how interspecific interactions may be affected by diseases. In the cleaning mutualism, the cleaner wrasse *Labroides dimidiatus* engages in interactions with other reef fish (who will be referred as clients) from whom he removes ectoparasites, dead skin and mucus. Due to the significant amount of daily interactions cleaners engage in, going up to 2300 daily interactions, they have recently been considered to potentially super-spreaders. In order to determine if both cleaner and client engage in social distancing or adjust their behaviour during cleaning interactions, that occur in the context of an infection, cleaner were injected with lipopolysaccharides (LPS) to induce a pathogen-like response. After being immune stimulated, cleaners were tested in terms of social preference, interaction and ability to adjust their behaviour when observed (bystander test), clients social preference was also tested. Even though "sick" cleaners do not demonstrate either social preference nor social avoidance, their activity levels were lower suggesting lethargy associated with sickness behaviour. Also, "sick" cleaners interacted less, despite clients still demonstrated availability to interact. And in cooperation-dependent cognitive test (bystander test) immune stimulated cleaners didn't adjust their behaviour to demonstrate cooperativeness. By adding all these results, and despite the passive self-isolation secondary to the lethargy, cleaning mutualisms are negatively affected by sickness behaviour, and due to clients maintaining their interest in interacting, cleaning interactions that occur in infectious context may have the potential to significantly increase disease spread.

Poster 19

Group size discrimination in zebrafish: A study of the role of visual dynamic features

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1. University of Trento

zebrafish, behaviour, group size, motion

Zebrafish are social animals, they live in groups to protect themselves from predators and to access information about food. Costs and benefits vary with group size and zebrafish can discriminate shoals of different sizes. Also, when socially isolated they prefer to join larger groups. However, this preference disappears when the largest of the two groups of fish is less active, i.e. slower. Several studies have investigated the influence of types of motion - e.g., biological motion - on the social drive as well as the ability to discriminate the number of static stimuli or live conspecifics. However, the role of motion in the assessment of group size has not been dissociated from other variables, such as the density or the number of elements. In this study, I investigated the influence of different visual dynamic features on shoal size preferences. In order to do so, I modeled artificial visual stimuli (dots) that could simulate a shoal and could elicit social preferences in fish. Between groups, stimuli varied in the number of elements, in the total amount of displacement and in the coherence of movement. In this way, I could study in a controlled way the role of different physical features for group size assessment. Individual fish were isolated in a tank and presented with two different streams of visual stimuli, varying only in one physical property. Time spent close to either stimulus was used as a measure of fish preference. Some initial results will be presented.

Poster 20

Characterization of daily patterns of fish sound production in Madeira Archipelago (Portugal)

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5. ARDITI
6. Faculty of Life Sciences (University of Madeira)

passive acoustic monitoring, madeira archipelago, fish sounds, daily vocal patterns

Information related to fish vocal behavior in natural environments can be gained by applying passive acoustic monitoring (PAM). PAM technique can support long-term field studies and has been shown to be a useful tool in the conservation and management of sound producing species. The principal aim of this research was to characterize the fish acoustic community in Madeira Archipelago (Portugal). For that the first checklist and descriptive reference of the vocal fish species was made, as well as the first catalogue of sound types produced by fish and the first assessment of diel patterns of soniferous fishes. Audio files from June and September 2021, in two locations (Garajau Partial Nature Reserve and Desertas Islands Nature Reserve) were analyzed. A total of 101 potentially vocal and 36 vocal fish species were identified, and 43 different sound types were recognized. Higher vocal activity and types of putative fish sounds were found in Garajau reserve, and lower abundance and richness was generally found in night time in respect to other times of the day at both Garajau and Desertas Islands reserves in the Madeira Archipelago. We show that vocal activity allows a clear distinction between a diurnal and a nocturnal group of fishes. *Pomacentridae* species were proposed as candidates for some of the most dominant sound types detected during the day, while *Scorpaena sp.* were proposed to some of the most dominant nocturnal fish sounds. This study provides important information about this community acoustic behavior and is a valuable steppingstone for a future noninvasive, cost-effective monitoring programs in Madeira.

Poster 21

Assessment of spatial and temporal patterns of nearshore fish communities through passive acoustic monitoring in a Marine Protected Area

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soundscape, fish communication, MPA, Portugal, bioacoustics

Passive Acoustic Monitoring (PAM) is a cost-effective, non-invasive technique with potential applications for long-term monitoring of biodiversity, species behaviour, habitat health and noise pollution at wide temporal and spatial scales.

This study describes an application of Passive acoustic monitoring (PAM) at the Marine Protected Area (MPA) Professor Manuel Saldanha (PMPLS) in Portugal. Three acoustic recorders (with a continuous duty cycle at a sampling rate of 48kHz) were deployed from June 2021 to September 2022 in the three protection zones within the marine park: Buffer Area (BA), Partial Protected Area (PPA), and Full Protected Area (FPA). Recordings were analysed for putative fish sounds and boat sounds. Sound were classified in different sound types and quantified, and analysed for temporal patterns (seasonal, lunar, and diel). We compared the sound type abundance and biodiversity indices (Richness, Shannon, Simpson and Evenness) at the different spatiotemporal scales. A purpose-built Baited Remote Underwater Video (BRUV) system was used to potentially identify the source of the different sound types.

Results show an increment in fish sound production and higher diversity indices at sunset and night, with no distinct seasonal or lunar patterns. Total abundance and diversity of sounds were higher in BA compared to FPA. There were no significant spatial or temporal differences observed in the number of boats or their duration in the three areas. Boat passage detection highlights PAM as an invaluable tool for monitoring domain usage within MPAs and providing insight that can redirect compliance decisions. These findings also underline the potential of PAM as an innovative tool for monitoring and conservation efforts in the marine environment, serving as a foundation for future acoustic studies in the PMPLS.

Poster 22

The relationship between mirror neuron dysfunction and social deficits in kids with autism spectrum disorder

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mirror neuron system, autism, cognition, social behavior

Autism spectrum disorder (ASD) is a neurodevelopmental disorder in which deficit in a brain development plays a key role in its etiology. Autistic people have social cognition disorder, which is usually caused impaired the social and behavioral problem . However, the exact role of Motor Neuron System (MSN) in the development of autism and its relationship With the treatment not yet known, our aim is to investigate this hypothesis and try to identify the relationship between MSN and behaviour and social cognition in clients with autism. Search method: This is a systematic review that was designed with the PRISMA checklist. for data gathering we used Scopus, PubMed, Science Direct and Google Scholar search engine without time frame, and the the words Mirror Neuron System, Mirror Neuron Dysfunction, Autism, Action Observation Network were selected were used for our search

Findings: First According to the inclusion and exclusion criteria, 30 articles were used in this study.

Damage to Mirror Neuron could cause variety of social and behavioral difficulties . Cortical thinning in regions involved in emotion recognition and social cognition correlates with severity of ASD symptoms. Neuroimaging techniques reveal the involvement of the MNS is responsible for action perception and imitative behavior. But some suggest that emotional expression disorder is not just MNS disorder. An example claims that MNS does not have an independent role in imitation and action observation, but cooperation between MNS and other brain networks can have huge impact on social communication.

Conclusion: Damage to MNS causes wide range of cognitive and social damage. It is better to perform brain examination at a young age along with blood tests.

Poster 23

Imaging Purkinje cell complex spikes during locomotor coordination and learning

Ana Gonçalves¹, Hugo Marques¹, Alice Geminiani¹, Francesco Costantino¹, Jorge Ramirez-Butirica¹, Megan Carey¹

1. Champalimaud Foundation

behavior, motor adaptation, calcium imaging, locomotion

Motor adaptation is an essential part of behavior that involves the continuous refinement of movement in response to external perturbations. Previous work has shown that this form of supervised learning depends on the cerebellum, where sensorimotor inputs converge at the level of Purkinje cells. In general, instructive signals for cerebellar learning are thought to be carried by climbing fibers from the inferior olive, but for locomotion, the nature of climbing fiber signaling is still elusive. To better understand how climbing fibers and the 'complex spikes' they elicit from cerebellar Purkinje cells contribute to locomotor coordination and learning, we performed calcium imaging from Purkinje cell dendrites in unrestrained mice walking on a motorized, split-belt treadmill. This was achieved through the use of head-mounted microendoscopes in mice expressing the fluorescent calcium indicator GCaMP6f selectively in Purkinje cells. Imaging during walking on a split-belt treadmill allows us to measure neural activity while animals are walking in both tied- and split-belt conditions across a range of speeds, as well as during locomotor learning experiments, in which prolonged exposure to mismatched speeds on the right and left side of the body leads to learned changes in locomotor symmetry. We observe widespread correlated activity along parasagittal axes within the dorsomedial/ intermediate cerebellum. This organization is consistent with the existence of cerebellar microzones that result from anatomical connections between climbing fibers and Purkinje cells. Ongoing work aims to understand the nature of locomotor signals represented by this activity, and how it evolves during the course of learning.

Poster 24

The impact of Aquacultures in Madeira Island, Portugal, on the population of Mediterranean monk seals (*Monachus monachus*)

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2. Parque Natural de Santa Maria

monk seal, aquaculture, behavior, impacts, acoustic deterrent device

The Mediterranean monk seal (*Monachus monachus*) is one of the most threatened species in the marine environment, with few individuals distributed throughout the Mediterranean Sea and the Atlantic Ocean, due to various exposed threats. In Madeira Island, their population has been decreasing over time due to commercial exploitation and the loss of their natural habitat caused by fishing activities. Recently, Aquaculture in the region has become a new threat, as its structures attract predators like the sea lion, causing issues for both the sea lion and the Aquaculture industry. To try to control these interactions, an Acoustic Deterrent Device (ADD) was used with the aim of deterring the sea lion from Aquaculture areas, and its behavior was monitored based on Aquaculture activities. When the ADD was activated, it was observed that the sea lion spent most of its time at the surface but did not move away from the location. Additionally, behavior monitoring indicates that the sea lion appears and approaches the boat whenever the fish feeding machine in the Aquaculture starts working, and it remains nearby, swimming around the boat and cages during feeding. Although these results are preliminary, the sea lion's behavior suggests that it is well adapted to human presence and activities in Aquaculture areas. With the projected expansion of Aquaculture in the region, this habituation to human presence, driven by easy access to food, could have significant long-term impacts on Aquaculture and, consequently, on the well-being of the sea lion due to increased exposure to human activity.

Poster 25

How does context familiarity modulate freezing behavior in *Drosophila*?

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drosophila melanogaster, rutabaga, learning, freezing behavior

When faced with a predatory threat, animals display different defensive behaviors: freeze, flight or fight. Exploration familiarizes the animal with the surrounding environment and helps to guide its behavioral choices. In our experiments, when flies are exposed to an inescapable threat, the more they explore the environment, the more they freeze. Conversely, when flies perceive a threat in a novel and unexplored environment, they prefer fleeing over freezing. This suggests that freezing is selected when flies perceive that escape is not available. But how do flies learn about their external context and escape availability? To investigate how context familiarity modulates the selection of defensive behaviors, we expose flies to a looming stimulus in an inescapable arena, while manipulating the expression of the learning gene *rutabaga* (*rut*). Our results show that *rut* mutants display more escapes than freezing, which is in accordance with our hypothesis that flies only freeze once they learn that escape is not possible. Upon *rut* downregulation in the mushroom body (MB), and in R2/R4m neurons of the ellipsoid body, we observed that flies froze less, suggesting that *rut* expression in these neurons is required for this learning process. We were able to rescue the freezing levels observed in *rut* mutants by overexpressing *rut* throughout the brain. However, overexpression of *rut* only in MB or in R2/R4m neurons was not sufficient to rescue freezing. Our findings strongly support the hypothesis that context familiarity modulates freezing in flies, and that expression of *rut* in MB and in ellipsoid body is required for the underlying neuronal mechanism.

Poster 26

Neuronal activation patterns in high and normal trait anxiety subjects following mild hypercapnia

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anxiety, hypercapnia, interoception, mouse model

Emotions are influenced by one's internal state of bodily arousal via interoception. It is reported that interoception is altered in anxiety disorders, the most prevalent psychiatric disorders with approximately 25% of the population being affected during their lifetime. It is known that the physiological responses to CO₂ inhalation are elevated in subjects with high-trait anxiety compared to those with normal anxiety[1]. Yet, although altered interoception is increasingly recognized as an important component of anxiety-related disorders, its underlying neural mechanisms remain insufficiently understood. In the present study, we aimed to elucidate whether differences in trait anxiety levels determine the engagement of the anxiety network in response to the CO₂ challenge.

Mice selectively bred for high (HAB) and normal (NAB) anxiety-related behavior of both sexes were habituated to the test arena and exposed for 10min to either CO₂-enriched (10%) or synthetic air on the following day. The activity and anxiety-related behavioral parameters were analyzed during the test period. Using immunohistochemistry, neuronal activation patterns were assessed by mapping the expression of the immediate early genes c-Fos and Zif268 in the cortex, hypothalamus, and amygdala.

Relative to chamber or air control conditions, CO₂ reduced locomotor activity and increased anxiety-related parameters in the test arena. These behavioral effects were associated with altered expression of c-Fos and/or Zif268 in the central and basolateral amygdala, key brain areas of the anxiety neurocircuitry. Moreover, HAB mice displayed behavioral hyperresponsivity to the test challenge and increased neuronal activation of hypothalamic nuclei. Sex differences in behavior and neuronal activation patterns were also revealed.

These data support the translational value of the paradigm in assessing negative valence. The observed greater effect of CO₂ on behavioral responses in the HAB mice is in line with human studies showing that anxious individuals are hypersensitive to CO₂.

Supported by the Austrian Science Fund FWF FG 18-B.

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Poster 27

The Evolution of Beauty: How Birds of Paradise evolved their stunning Dances

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Birds-of-Paradise, ethogram, display behaviour, courtship, ancestral reconstruction

Birds of Paradise (*Paradisaeidae*) are often described as the most extraordinary and beautiful bird species around the world and always fascinated people. Within most species of the *Paradisaeidae* there is an astonishing sexual dimorphism, best shown in the colourful nuptial plumage and elaborate courtship behaviours of adult males. This dimorphism most probably resulted from sexual selection. Although Birds of Paradise have always attracted the attention of researchers, comparative studies of courtship among all 45 species of the *Paradisaeidae* are still lacking, as well as studies focusing on the evolutionary origin of these behaviours. We therefore aimed to create an ethogram using common terminology across the different species to allow comparison between them. For this, descriptions from existing literature were used and complemented with courtship behaviours observable in videos of courting males. Additionally, we carried out an ancestral state reconstruction of display behaviours. Therefore, functionally analogous behaviours within the created ethogram were analyzed in a character matrix using R to test whether these represent independently evolved traits within single species, or convergently evolved ones. This was done to unravel the most probable pattern of courtship display evolution within the radiation of the Birds of Paradise.

Poster 28

Fear from the heart

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1. Champalimaud Foundation

heart-brain interaction, freezing, cardiac activity, crustacean cardioactive peptide, defensive behaviors

Animals are subjected to changes in the environment and adopt different strategies to properly adapt to them. Upon threat, animals from most species engage in three different defensive behaviors - flee, fight and freeze - accompanied by changes in the physiological state that help the organism to adapt to the specific needs. A wealth of studies has shown, in a wide range of species, that fleeing, and fighting are accompanied by heart acceleration, while freezing is accompanied by heart deceleration. In the lab, we have recently shown in the fruit fly similar changes in cardiac activity as flies freeze or flee in response to a threat. Furthermore, we found that basal heart activity is predictive of the total time freezing displayed upon threat. These data suggest a bidirectional brain-heart axis of communication. The afferent and the efferent connections of the *Drosophila* heart are still poorly understood. Here, we aim to analyze the role of CCAP (crustacean cardioactive peptide) during defensive states. We have downregulated the expression of CCAP receptors in cardiomyocytes, using RNAi. The impact of this manipulation both on cardiac activity changes triggered by threat and on the defensive behavior of flies will be discussed. We hope the results obtained will shed light on the efferent neuronal control of the heart and in turn its influence on the behavior.

Poster 29

Follow the Leader - Propagation and Resolution of Incomplete Social Cues in Insects

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neuroethology, navigation, honeybees, decision-making, polarized light

Animals living in social groups need to interpret and convey complex signals regularly when interacting with conspecifics[1]. However, socially-acquired information is often incomplete and may be both uncertain and ambiguous. How does this incomplete information affect the individual decisions within the group, and the behaviour of social groups as a whole?

Insects[2] can perceive and use the polarized light pattern in the sky for course control[3], path integration[4] and sun-compass navigation[5-6]. Polarized light is characterised by two properties: the angle of polarization and the degree of polarization. The angle of polarization can be described as an directional component and the degree of polarization as a measure of signal strength[3]. As uncertainty[3,9] and ambiguity[7] are inherent properties of polarized light, social animals that use polarized light for navigation are excellent models for investigating how incomplete information propagates through social groups.

Honeybees communicate the location of a food source to their nest-mates through the waggle dance[8]. When only visual cues, e.g. polarized light are available, the information conveyed through the waggle dance can be manipulated by altering the directional component[9] and the signal strength[5] of an artificial polarized light stimulus. Even when presented with uncertain and ambiguous information, a dancing bee will still dance the location to a food source according to her own estimate. However, little is known about how this incomplete information propagates to her nest-mates. Here, we investigate how honeybees interpret and make navigational decisions using uncertain and ambiguous information from their peers by manipulating the waggle dance using an artificial polarized light stimulus.

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Poster 30

Long-Lasting Neurobehavioral Effects of Early-Life Stress: The Role of MeCP2

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early-life events, anxiety, epigenetics, maternal separation, Rett syndrome

Methyl-CpG binding protein 2 (MeCP2) is an epigenetic reader. It binds to methylated DNA to modulate the expression of genes such as brain-derived neurotrophic factor (Bdnf) and corticotropin-releasing hormone (Crh), which are implicated in synaptic plasticity and in response to stress, respectively.

The early postnatal development encompasses periods of high brain plasticity that promote the acquisition of critical sensory and cognitive skills. Adverse events at this stage leave epigenetic marks, affecting the predisposition for the development of anxiety disorders. Particularly, early-life stress (ELS) may lead to changes in the methylation pattern of DNA, thus changing the modulation of gene expression by MeCP2. Previously, we found that *Mecp2* deficiency per se recapitulates the anxiety-like behavior observed in mice subjected to maternal separation (MS), establishing a correlation between MeCP2 and anxiety-like behavior.

Mutations in the *MECP2* gene are the primary cause of Rett syndrome (RTT) and, to a lesser extent, of other neurodevelopmental disorders. In RTT and other *MECP2*-related disorders, anxiety is a comorbidity, yet largely under investigated.

Here, we aim to investigate how ELS and MeCP2 interact in the construction of the anxiety neurocircuitry. Using wild-type mice and MS as a model of ELS, we found sex-dependent changes in anxiety-like behavior. Specifically, female animals submitted to MS showed heightened anxiety levels, with no alterations in corticosterone levels. Maternal behavior was also monitored in dams from naive and MS pups to control for potential long-lasting effects on pup's anxiety behavior. Of relevance, MS induced changes in the levels of MeCP2 expression and activation in anxiety-related brain regions in females. Moreover, we found a reduction of both BDNF and TrkB levels specifically in the hippocampus of female MS animals, when compared with non-stressed animals.

Our data suggests hippocampal MeCP2-BDNF as one molecular mechanism mediating the effects of ELS on anxiety later in life.

Poster 31

Red-backed shrike (*Lanius collurio*) versus common cuckoo (*Cuculus canorus*): An example of ineffective cuckoo–hawk mimicry

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brood parasitism, cuckoo–hawk mimicry, nest defense, red-backed shrike

The red-backed shrike (*Lanius collurio*) used to be one of the most common hosts of the common cuckoo (*Cuculus canorus*). Nevertheless, during the last 30 years, there is increasing evidence from Central Europe that the occurrence of cuckoo chicks in shrike nests has become scarcer, and that in some locations they have disappeared completely. Multiple hypotheses have been suggested to explain this abandonment. Here, we test the hypothesis that shrikes vigorously attack adult cuckoos, potentially resulting in ineffective parasitism. Adult common cuckoos resemble in appearance the Eurasian sparrowhawk (*Accipiter nisus*), a common predator of small passerines. One hypothesis presumes that the cuckoo has evolved this mimicry to avoid attack by small passerines when searching for their nests. Our results show that shrikes defending their nests attacked cuckoos very vigorously, more often, and more intensively than they did sparrowhawks. In the presence of a sparrowhawk dummy, parent shrikes only produced alarm calls and flew over the dummy. This suggests that cuckoo–hawk mimicry is ineffective in the case of shrikes and that they attack them much more often than they do any other presented intruder. Therefore, this activity could possibly result in the abandonment of shrikes as potential hosts for cuckoos.

Poster 32

Intestinal parasites in captive reptiles

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parasitology, zoohygiene, phylogenetics, epidemiology

Reptiles are popular captive animals and, like all captive animals, suffer from an increased incidence of monoxenous parasites. Parasites with indirect life cycles such as tapeworms or flukes are very rare in reptile breeds, occurring especially in animals imported from the wild, and due to the absence of a suitable intermediate host, these infections do not spread further.

The most common parasites in captive reptiles are pinworms (Nematoda: *Oxyurida*) with a prevalence of more than 60 %, followed by representatives of the protistan *phylum Apicomplexa – coccidia* (prevalence 25 %) and *cryptosporidia* (prevalence only 8 %, but high mortality). Other representatives of nematodes parasitising reptile breeds are roundworms (*Ascaridida*) and hookworms (*Strongylida*). Of the other protists, microsporidia, ciliates, and giardia are of importance.

The distribution and diversity of parasites in captivity is influenced by the limited space in which the animals are kept, by the number of individuals per housing unit, and also by the level of zoohygiene in individual farms. The pet trade also plays an important role, with huge numbers of animals travelling with their parasites between continents and potentially spreading infection around the world.

Although in nature these infections are primarily asymptomatic, in captivity the increased parasitaemia can lead to severe clinical symptoms such as apathy, inappetence, diarrhoea, intestinal obstruction or perforation, and many others including the host death.

Poster 33

Cellular encoding of passive limb movement in mouse forepaw primary somatosensory and motor cortex

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cortex, mouse, proprioception, neurobiology, electrophysiology

Proprioception is a fundamental sense and underpins coordinated motor control. Mouse forelimb primary somatosensory (fS1) and motor (fM1) cortex are both involved in representing passive movements of the forelimb (1), but differences in cellular encoding of limb movement sensory components and their origins in primary sensory afferent neurons are unclear. Here we address these questions using extracellular laminar probe electrophysiology recordings in isoflurane anesthetized mice during directional horizontal movements of the forelimb, comparable to classic centre-out directional movement paradigms. To assess the afferent inputs driving these responses, we went on to test the responses of cortical cells to different frequencies of vibrotactile stimulation tuned to activate tactile and proprioceptive afferents. We further examined cortical encoding in proprioceptor-specific knockout mice using the *Pvalb-Cre;Piezo2cKO* mouse (2). Ongoing analysis shows differences between fS1 and fM1 neurons in their tuning to directional limb movements as well as to vibrotactile stimulation. Together, our data suggests afferent-specific input differences to fS1 and fM1. Use of single unit recordings in combination with intersectional transgenics in mice promises advances in the understanding of circuit and cellular mechanisms of proprioception.

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Funding:

European Research Council (ERC-2015-CoG-682422), Deutsche Forschungsgemeinschaft (FOR 2143, SFB1315), Helmholtz Society, HFSP (LT000359/2018)