UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE

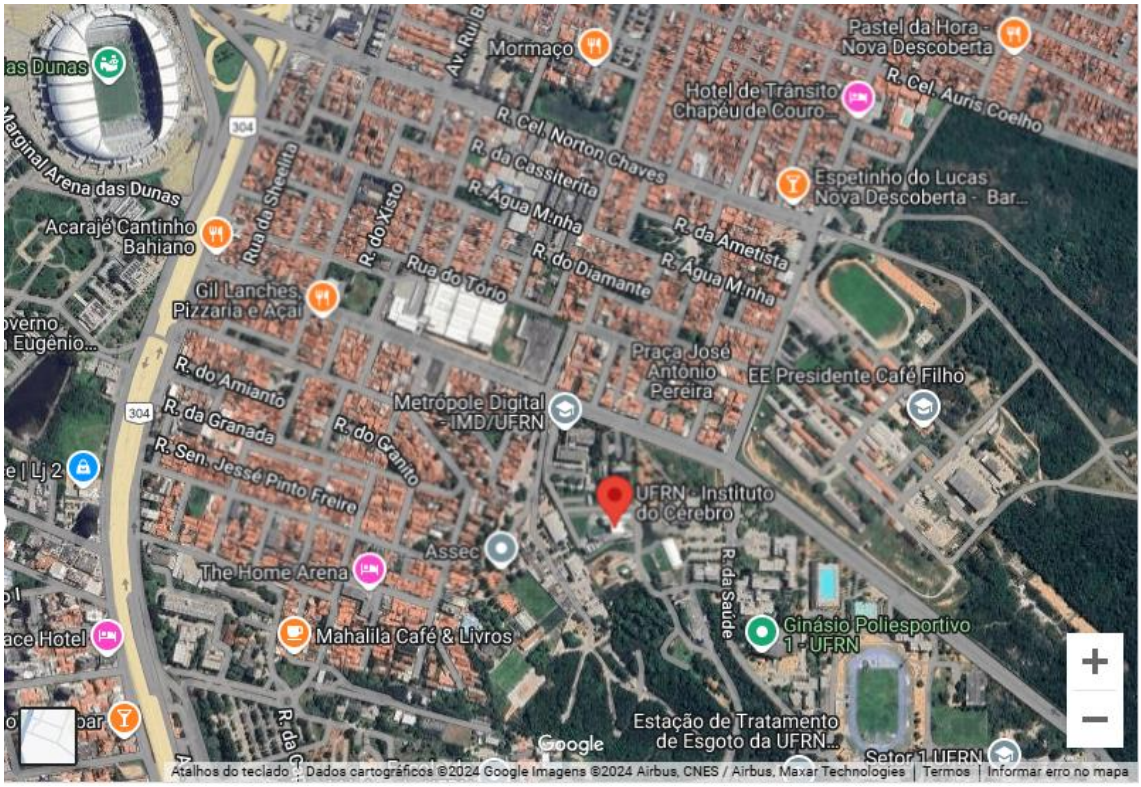
INSTITUTO DO CÉREBRO



UFRN CAMPUS

NATAL
December 05-06, 2024

Venue: Brain Institute/UFRN, Auditorium, Natal – RN
https://neuro.ufrn.br/



Program at a glance

THURSDAY, DECEMBER 5nd

08:00	Welcome/Registration
08:30	Opening words **Sergio on behalf of the Organizing committee**

Topic 1 – The sensing brain
Chair: Tarciso Velho

09:00	Stability and Adaptation of Visual Cortical Circuits after Acute Exposure to β-amyloid Oligomer (Aβ) **Taíla Fialho**
09:30	A visual pororoca: Probing the lateral geniculate activity in humans **Sergio Neuenschwander**
10:00	Student flash talks **Chair: Katarina Leão**
10:45	**Coffee Break & Poster Session**
11:30	Low-dose Sevoflurane inhibits layer 5 pyramidal neurons subtype-specifically in the primary auditory cortex of mice **Katarina Leão**
12:00	***Lunch break***

Topic 2 – The Vocalizing brain
Chair: Emanuelly Araújo

14:00	How do birds learn? **Tarciso Velho**
14:30	Atypical vocal behavior in rodents prenatally exposed to the inhibition of histone deacetylases **Rodrigo Pereira**
15:00	Fatores de variabilidade nas vocalizações de saguis em campo **Ricardo de Carvalho**
15:15	Atividades neuronais dos gânglios da base na comunicação vocal de primatas **Anna Gabriely de Sá**

15:30	**Coffee Break & Poster Session**

Topic 3 – The innovating brain
Chair: Richardson Leão

16:00	MESA REDONDA: Propriedade intelectual: da pesquisa ao mercado **Rochelle Barbosa – Assessora de Propriedade Intelectual da Agência de Inovação da UFRN** Development strategies for thermoplastic polymer blends and nanocomposites applied to specific engineering products **Edson Ito – Professor do Departamento de Engenharia de Materiais (DEMat-UFRN)**
17:00	Por que robôs não falam: o conceito de autonomia biológica e suas implicações na IA **Sergio Neuenschwander – Vislab, Instituto do Cérebro-UFRN**

FRIDAY, DECEMBER 6th

Topic 4 – The psychedelic brain
Chair: Catherine Mesquita

08:00	Welcome/Registration
08:30	**Student flash talks**
09:00	Ayahuasca: Effects on Perception, Thinking, and Neural Activity **Isabel Wiessner**
09:30	Mindfulness-Based Interventions applied to mental health **Geovan Menezes de Sousa Júnior**
10:00	Minor phytocannabinoids, major impact? Unraveling their role in acute seizure dynamics **Claudio Queiroz**
10:30	**Coffee Break & Poster Session**

Topic 5 – The oscillating brain
Chair: Elis Duarte

11:00	Spatiotemporal Encoding of Task Variables Across the Mouse Brain **Lucas Caiã de Souza Tavares**

11:30	Respiratory modulation of frontal brain signals during rat social interactions **Joseph Alves**
12:00	Sleep and Learning in octopus Insularis **Mizziara de Paiva**
12:30	***Lunch break***

Topic 6 – The developing brain
Chair: Laura Koren

14:00	Importância da neuromonitorização na UTI neonatal **Anna Cristina Barreto – Maternidade Escola Januário Cicco da UFRN**
14:30	The beginning of the functioning of the glymphatic system closes the susceptibility window for Zika virus-derived malformations **Eduardo Sequerra**
15:00	NeuroNatalogy: a holistic platform for neonatal neuroprotective care **Richardson Leão**
15:30	**Coffee Break & Poster Session**

Topic 7 – The machine and the brain
Chair: Sergio Neuenschwander

16:00	INTERVIEW/CONVERSATION **Martin Vinck – ESI/Max Planck**
17:00	***Closing Remarks & Happy Hour at Mormaço***

ORAL PRESENTATIONS

OR01 - LOW-DOSE SEVOFLURANE INHIBITS LAYER 5 PYRAMIDAL NEURONS SUBTYPE-SPECIFICALLY IN THE PRIMARY AUDITORY CORTEX OF MICE

Araújo AS [1], Silva SRB[1], Treptow W[2], Leão KE[1*]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, RN, Brazil
[2]Laboratório de Biologia Teórica e Computacional, Departamento de Biologia Celular, Universidade de Brasília, DF 70910-900, Brasília, Brazil
*katarina.leao@ufrn.br

General anesthetics are ubiquitous in medical practice yet cellular mechanisms of specific anesthetics are still poorly understood. The electrophysiological effects of volatile anesthetics such as sevoflurane are especially hard to study in in vitro preparations, yet, biophysical models predict stabilization of the open-state of the low-threshold voltage-gated K+ channels 1.2 (Kv1.2). To investigate the effect of sevoflurane on cortical pyramidal neuron (PNs) membrane properties we did whole-cell patch clamp recordings of layer 5 (L5) PNs of the primary auditory cortex of adult mice. The functional concentration of sevoflurane was quantified by gas chromatography-mass spectrometry to approximately 22 µM. In our analysis, L5 PN were subdivided into type A and B PNs based on responses to a depolarizing and a hyperpolarizing current step, since type A and type B L5 PNs display subtle differences in membrane properties that might be modulated by sevoflurane. We found that application of sevoflurane robustly decreased firing frequency for both cell types at current steps ≥150pA ($p < 0.001$). Interestingly, sevoflurane significantly depolarized the resting membrane potential of type A PNs ($p = 0.02$) while increasing input resistance of type B PNs ($p = 0.003$) while also depolarizing the AP threshold of both cell types (type A $p = 3.44e-6$; type B $p = 5e-4$) making cells have onset type firing properties. Sevofluran significantly also decreased the minimum current to generate action potentials ($p = 0.045$) as well as increased AP half-width of type B PNs ($p = 0.007$). Application of rTityustoxin-Kα (100nM), a Kv1.2 channel antagonist, could partially restore firing frequency in the presence of sevoflurane, an effect more pronounced in type A PNs as seen by voltage-clamp recordings in response to subthreshold voltage steps. Thereby sevoflurane decreases the firing frequency of both types of L5 PNs, partially due to opening of Kv1.2 channels. This work contributes to a better understanding of the mechanistic action of the volatile anesthetic sevoflurane.

Funding: CAPES

OR02 - SPATIOTEMPORAL ENCODING OF TASK VARIABLES ACROSS THE MOUSE BRAIN

Lucas C. S. Tavares[1]*, Adriano B. L. Tort[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, RN, Brazil
*lucascstavares@neuro.ufrn.br

Neural activity underlying decision-making processes is presumed to be distributed across time and space in the brain. We leveraged a dataset of 547 Neuropixels probe insertions from 267 brain regions in 115 mice performing a decision-making task with probabilistic trial blocks to investigate the temporal and spatial encoding of task variables. Using logistic regression for decoding, we identified brain regions involved in encoding choice, feedback, visual stimulus, and contrast across time. Decoding accuracies ranged from 50–95%, varying by task variable and brain region. Temporal analysis revealed a peak in choice-related decodability near movement onset, while feedback decoding remained stable over time and regions encoding visual information showed delayed decodability. Cross-session comparisons and manifold consistency analyses suggest encoding patterns that are robust across insertions and animals. These

findings advance our understanding of the spatial and temporal distribution of decision-making processes and highlight region-specific neural dynamics underlying perception.

Funding: CAPES

OR03 - NEUROSCIENCE OF ADVANCED MATHEMATICS: HOW THE MATHEMATICIAN'S BRAIN WORKS

Thales Bruno da Silva Oliveira[1*]
[1]Federal University of Rio Grande do Norte, Natal, RN, Brazil
*thalesbrunooliveira@gmail.com

This study explores the neural networks involved in advanced mathematics, examining the origins of mathematical abilities and comparing specific neural networks with those of general semantic knowledge. Using functional magnetic resonance imaging (fMRI), the brains of mathematicians and non-mathematicians were scanned while they reflected on mathematical and general statements.

OR04 - AN IMMERSIVE HUMAN-MACHINE INTERFACE TO RESTORE UPPER-LIMB MOVEMENTS

André Felipe Correia de Oliveira[1*]
[1]Instituto Internacional de Neurociências Edmond e Lily Safra
* afelip.co@gmail.com

Upper-limb impairments in individuals with cervical and thoracic spinal cord injury (SCI) greatly limit the independence and quality of life. In response to the pressing demand looking for effective and personalized rehabilitation strategies, this MSc degree project proposes to explore here the benefit of using a multi-modal approach based in a Motor Imagery (MI) Electroencephalography (EEG) based Brain-Computer Interface (BCI), employing Functional Electrical Stimulation (FES) and Virtual Reality (VR). The project aims to build a MI-based BCI to assist bilaterally voluntary upper-limb movements by using FES, and enhance neuroplasticity. For this purpose, a virtual environment is being developed for upper-limb motor training, getting as a reference the MI EEG data classification outputs and brain rhythms, in order to trigger synchronously both FES and avatar movement end-effectors, and produce a neurofeedback. As materials, a commercial VR headset, an actiCHamp EEG amplifier and acticap with active electrodes are used here. Furthermore, two-in-house FES wireless systems composed of 4 independent channels each are used to assist upper limb movements, such as hand opening and closing in our approach. A novel multi-channel EEG visual neurofeedback is proposed in the VR scenario through a bottle that is gradually deformed while the subject performs MI to command the grasping movement of an avatar. This feedback is provided by considering the relative power modulation of both mu (8-12 Hz) and beta (18-24 Hz) rhythms over EEG locations covering the hand primary motor cortex, specifically around C3 and C4, according to the 10-20 system. The assessment of the sense of presence, usability, and any adverse effects within the VR environment will be evaluated by using a standardized questionnaires called System Usability Scale. The BCI performance will be assessed by using metrics of the classifier. The cortical effect of our system will be tested in tetraplegic SCI individuals with severe motor impairments, using quantitative EEG analysis. The BCI classifier's offline training achieved average accuracy of 87.28% and 76.34% for right and left hands, respectively, F1 scores of 0.88 and 0.88. However, real-time application averaged accuracy 45%. Volunteers rated the system's usability as excellent (81.25), indicating its potential for real-world application.

OR05 - ACUTE EFFECTS OF INTRACORTICAL INJECTION OF BETA-AMYLOID (AB42) ON NEURONAL FIRING ACTIVITY IN THE PRIMARY VISUAL CORTEX

Taíla M.A. Fialho.[1,2]*, Marcos R. Costa[4], Lucas M. Lira[3], Sergio Neuenschwander[3], Kerstin E. Schmidt[1]
[1]Neurobiology of Vision Laboratory, Brain Institute, Federal University of Rio Grande do Norte, Natal, Brazil
[2]Bioinformatics Multidisciplinary Environment, Federal University of Rio Grande do Norte, Natal, Brazil
[3]Vislab, Brain Institute, Federal University of Rio Grande do Norte, Natal, Brazil
[4]Univ. Lille, Inserm, CHU Lille, Institut Pasteur de Lille, France
*taila.fialho@neuro.ufrn.br

Alzheimer's Disease (AD) affects more than 50 million people worldwide, with projections indicating this number may double by 2030 (WHO). AD is characterized by progressive memory decline and other cognitive impairments. Neuroimaging studies reveal neuronal loss and atrophy in the hippocampus and neocortical regions. According to the amyloid hypothesis, the pathophysiological cascade of AD is triggered by the oligomeric isoform beta-amyloid 1-42 (Aβ42), a neurotoxic agent with high aggregation propensity. This process results in the formation of extracellular senile plaques and Tau protein hyperphosphorylation, leading to intraneuronal neurofibrillary tangles—both key pathological hallmarks driving functional deficits in AD. Transgenic models suggest that Aβ42 disrupts the excitation/inhibition (E/I) balance, causing episodes of neuronal silencing and subsequent hyperactivity, contributing to sensory disintegration and behavioral deficits. Unlike rodents, commonly used to study AD, aged cats can develop Cognitive Dysfunction Syndrome, a condition resembling human AD, characterized by senile plaques, neurofibrillary tangles, and neurodegeneration in multiple cortical areas, including the visual cortex. We aim to introduce the primary visual cortex of domestic cats (Felis catus) as a translational model for AD, due to the presence of periodic cortical maps and circuits homologous to those in primates. We investigated the impact of acute exposure to Aβ42 oligomers on the activity of single-unit neurons (SUA) within the intact visual cortex. Two 4x4 microelectrode arrays (250 µm spacing) were implanted bilaterally in homologous areas 17 or 18 of anesthetized cats (n=5). Visual stimuli consisted of moving gratings presented in 16 directions at 2 Hz and spatial frequencies of 0.5 cycles/degree (area 17) or 0.15 cycles/degree (area 18). Experiments were conducted at the Brain Institute of UFRN. We tracked 192 significantly responsive and orientation selectivity (orientation selectivity index>0.15) single-unit neurons before and 50 minutes after intracortical injection of Aβ42 oligomers. Mean evoked firing rates significantly decreased following Aβ42 injection (Wilcoxon, $Z=-4.2$, $p<0.0001$, $n=127$), but not with vehicle solution ($Z=-0.762$, $p=0.45$, $n=65$). Orientation selectivity indices were also reduced (Aβ42, $p=0.0065$; vehicle, $p=0.02$). Post-injection, neurons adapted more rapidly to visual stimuli. Our findings suggest that the acute effects of Aβ42 exposure in an intact visual cortical circuit lead to a depressive response and disrupt neuronal dynamics, causing synaptic dysfunction and a disrupted excitatory/inhibitory (E/I) balance.

Funding: CNPq; CAPES; Institute Pasteur de Lille

OR06 - RESPIRATORY MODULATION OF FRONTAL BRAIN SIGNALS DURING RAT SOCIAL INTERACTIONS

Joseph A. Belo[1]*, Annara M. Soares[1], Davi Drieskens[1], Ana L. A. Dias[1], Elis H. Duarte[1], Adriano B. L. Tort[1], Diego A. Laplagne[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, RN, Brazil
*joseph@neuro.ufrn.br

Breathing is not only vital for cellular respiration but also plays a critical role in modulating neural and behavioral processes. The rhythmic patterns of respiration have been linked to sensory integration and emotional regulation, suggesting a dynamic interaction between the brain, breathing, and behavior. Here, we discuss how the breathing cycle shapes neural and behavioral dynamics in rats during social

interactions. Using a behavioral apparatus designed for spontaneous exploration of social stimuli, we simultaneously recorded intranasal pressure and frontal brain electrical activity. Our findings show that during social interactions, rats exhibit high respiratory rates (> 5 Hz), characteristic of active sniffing, while engaging in behaviors such as olfactory investigation, whisker-mediated touch, and vocalizations. Coherence analysis of local field potentials revealed that respiratory-coupled oscillations (RCOs) in the olfactory bulb and prefrontal regions, including the medial-orbital, pre-limbic, and anterior cingulate cortices, were rhythmically aligned with the breathing cycle. Our results highlight the functional coupling of breathing with frontal brain networks involved in emotional and cognitive processes during social interactions. This work underscores the relevance of RCOs in bridging physiological rhythms with complex behaviors, offering novel insights into how respiration influences brain function in socially relevant scenarios.

Funding: CAPES

OR07 - INVESTIGATION OF EGR-1 EXPRESSION IN THE BASAL GANGLIA DURING VOCAL PRODUCTION AND PERCEPTION IN PERCEPTION IN CALLITHRIX JACCHUS

Anna Gabriely Barroso de Sá[1]*, Cristiano Soares Simões[1], Sidarta Tollendal Gomes Ribeiro[1]
Daniel Yasumasa Takahashi[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, RN, Brazil
*agabrielybsa@outlook.com

A fundamental aspect of human communication is flexible speech, which has long been believed to be exclusive to humans among primates. However, recent findings suggest that some non-human primates, such as marmosets, also exhibit vocal plasticity. Investigating the neural correlates of vocal flexibility in marmosets may provide insight into its origins in humans due to brain homologies. Among the brain areas related to vocal behavior, much is known about cortical contributions, but the function of subcortical regions is much less known. In particular, the basal ganglia are related to the choice/initiation of actions, fine motor control and the learning of motor sequences; therefore, it is likely that they are relevant to vocal flexibility. Here, using previously collected histological data and stereological methods, we tested the hypothesis that the caudate nucleus and putamen in the basal ganglia are activated during vocal communication and used the expression of the immediate early gene egr-1 to map their activation in three groups of marmosets. The first group did not vocalize during the test (C), the second group heard playback vocalizations but did not vocalize (H/O), and the third group heard playback calls and vocalized (H/V). We observed an increase in erg-1 expression in both areas in the H/O condition compared to the C condition and an even more significant increase in erg-1 expression in the same areas in the H/V condition compared to the H/O condition. To ensure the specificity of the changes observed, we compared the cells expressing erg-1 in the primary sensory and motor areas, finding no significant difference between the three conditions. In addition, we quantified locomotion during the hour before the end point of the experiment to rule out movement discrepancies as an explanation for the differences observed between the groups in erg-1 expression, without finding a correlation between locomotion and expression variation. Our results indicate activation of the basal ganglia during hearing and vocalization production, independently of other brain areas and body movements, which corroborates our hypothesis. The relevance of the basal ganglia in vocal learning in songbirds, together with our findings in marmosets, suggests their importance in understanding the evolution of vocal learning.

POSTER SESSION

P01 - THE INHIBITION OF THE GLYMPHATIC SYSTEM REOPENS THE SUSCEPTIBILITY WINDOW FOR BRAIN INFECTION BY ZIKV IN POSTNATAL DAY 14 MICE

Emanuelly K. C. Chaves[1,2*], Leocádio, L. G. S. C.[1], Vivian Becker[1], Jhulimar Doerl[1,2], Eduardo B. Sequerra[1,2]
[1]Brain Institute, Federal University of Rio Grande do Norte, University Campus, 59056-450, Natal, RN, Brazil
[2]Graduate Program in Neurosciences, Federal University of Rio Grande do Norte, University Campus, 59056-450, Natal, RN, Brazil
*emanuelly.cchaves@gmail.com

The injection of zika virus (ZIKV) in the mouse postnatal brain leads to a severe infection that, depending on the quantity of injected viruses, can lead to death. However, after the animals reach the second week, their suscetibility decreases substantially. During the second week, the glymphatic system beggins to work. Here, we hypothesize that the functional glymphatic system reduces new infections after ZIKV is released from infected cells, by draining the intersticial fluid. In this study, we aimed to test if the inhibition of the glymphatic system after P14 rescues the susceptibility to ZIKV infection observed in younger animals. To do that, we are going to use the drug SR49059, a competitive antagonist of the vasopressin receptor 1a that also reduces Aqp4 expression. We divided C57/Bl6 mice with 14 postnatal days (P14) into four groups: ZIKV, Saline Control, Drug Only, and ZIKV + Drug. The solution was injected into the right lateral ventricle. To monitor the progression of the disease, the average health score (HS) of the animals during the experiment was analyzed; the score ranges from 0-5, with 0 meaning healthy, 1- weight loss, 2- hunchback, 3- difficulty for moving, 4- limb paralysis, and 5- moribund or found dead. To analyze the circulation of fluorescent tracers between the CSF and brain parenchyma, 5 microliters of 2% 10,000 MW Fluorescein-Dextran and 70,000 MW Ovalbumin 488 were injected in the cisterna magna. After 30 minutes, the animal was euthanized and their brains fixed by immersion. The animals injected with ZIKV have a similar HS to saline-injected and drug-injected controls. However, the combination of glymphatic system inhibition and ZIKV significantly worsens the HS. Our preliminary data indicates that ZIKV plus drug-injected animals have a decrease in CSF tracer circulation in the brain parenchyma. Therefore, our data suggests that the beggining of the glymphatic system functioning participates in the closure of the suscetibility window for brain infection by ZIKV, what occurs during the third trimester in humans.

P02 - LOUD NOISE EXPOSURE ALTERS CALCIUM DYNAMICS OF LAYER 5 PYRAMIDAL CELLS OF THE AUDITORY CORTEX OF MICE

Gabriel M. de Queiroz[1*], Jéssica Winne[1,2]
[1]Hearing and neuronal activity lab, Brain Institute, Federal University of Rio Grande do Norte, postal box 1524, Campus Universitário, Lagoa Nova, CEP 59078-970, Natal/RN, Brazil
[2]Neurodynamics lab, Brain Institute, Federal University of Rio Grande do Norte, postal box 1524, Campus Universitário, Lagoa Nova, CEP 59078-970, Natal/RN, Brazil
*gabriel.queiroz.712@ufrn.edu.br

How the brain processes and responds to external stimuli such as loud noise exposure can be studied behaviorally and electrophysiologically. However, investigating intrinsic experiences like phantom sound perception (tinnitus) poses a significant challenge. Since tinnitus is to 99% a subjective auditory experience, the direct quantification of its neuronal correlates in mice is still a challenge. To address this, we applied calcium imaging to analyze auditory cortex activity of mice before and after loud noise overexposure (4-18kHz, 90dB, 1.5 hr followed by 1.5 hr in silence). One month old mice

(n=3) were injected with viral vectors carrying CamKII2a-GCaMP6f, ten days later implanted with a GRIN-Prism lens complex in the vicinity of the auditory cortex and a baseplate fastened to the skull with dental acrylate. The sound protocol consisted of 30s long tones of 12 different frequencies intermingled by 30s of silence for each frequency. Three weeks later, a miniature microendoscope ('miniscopes', UCLA V3) was used to record calcium signals of individual layer 5 pyramidal neurons (n=422) in the primary auditory cortex. Our results first show that it was possible to identify the same neurons before and one week after the noise overexposure (n=172 neurons) by filtering the center of mass positions of each neuron between sessions doing cartesian adjustments. Next we quantified the change in neuronal activity and found 50.6% (85/172) of cells increased neuronal activity while 49.4% (87/172) decreased activity. Interestingly,preliminary data shows an increase in activity during silent periods 17.54% (30/172) of neurons were more active during 'silence' after the noise overexposure session. Neuronal activity patterns were clustered using K-means and the closest means showed 3 main activity patterns. This might reflect the two populations of L5 pyramidal neurons having shown bidirectional changes after noise overexposure in vitro. This study is a first attempt to describe, quantify and visualize how an acoustic trauma inflicts long-term changes in neuronal activity that may be part of the mechanisms leading to noise-induced tinnitus.

P03 - COMMUNICATION SUBSPACE DYNAMICS OF THE CANONICAL OLFACTORY PATHWAY

Joaquin Gonzalez[1,3*], Pablo Torterolo[1], Kevin Bolding[2], Adriano Tort[3]
[1]Universidad de la Republica, Uruguay
[2]Monell Chemical Senses Center, Philadelphia, PA 19104, USA
[3]Brain Institute, UFRN, Natal, Brazil
*joaqgonzar@gmail.com

Understanding how different brain areas communicate is crucial for elucidating the mechanisms underlying cognition. A possible way for neural populations to interact is through a communication subspace, a specific region in the state-space enabling the transmission of behaviorally relevant spiking patterns. In the olfactory system, it remains unclear if different populations employ such a mechanism. Our study reveals that neuronal ensembles in the main olfactory pathway (olfactory bulb to olfactory cortex) interact through a communication subspace, which is driven by nasal respiration and allows feedforward and feedback transmission to occur segregated along the sniffing cycle. Moreover, our results demonstrate that subspace communication depends causally on the activity of both areas, is hindered during anesthesia, and transmits a low-dimensional representation of odor.

P04 - EARLY MATERNAL DEPRIVATION AND BDNF REGULATION IN SENSORY AREAS

Adriano Junio Moreira de Souza[1]*, Elizabeth Giestal-de-Araujo[2]
[1]Universidade Federal do Tocantins (UFT)
[2]Universidade Federal Fluminense (UFF)
*junio.adriano@hotmail.com

Introduction: Exposure to stressful events during the neonatal period is associated with an increased risk of psychopathologies in adulthood due to alterations in neuroendocrine maturation and levels of neurotrophic factors, such as brain-derived neurotrophic factor (BDNF). The maternal deprivation animal model has been widely used to investigate these changes, showing significant effects on limbic and sensory regions. However, the impacts on sensory tissues, such as the retina, remain underexplored. This study evaluated BDNF levels in the retina of rats subjected to maternal deprivation, identifying a significant increase, suggesting that neonatal stress also influences the developing visual system. Materials and Methods: Lister Hooded pups (P2–P9) were used and kept under controlled temperature, humidity, and a 12-hour

light-dark cycle with free access to food and water. The experimental protocol was approved by the Ethics Committee (CEPA #00196-10). For the maternal deprivation procedure, eight pups (four males and four females) were separated from their mothers for 360 minutes/day from P1 to P8, maintained at 30°C in an environment similar to the control group, which remained with their mothers. On P9, 24 hours after the last deprivation period, the animals were sacrificed, and the retinas were collected. Proteins from the retinas were extracted and quantified by Western Blotting, using 15% polyacrylamide gel and an anti-BDNF primary antibody (1:5000). Detection was performed via enhanced chemiluminescence (ECL), and band intensity was analyzed using Scion Image software and normalized to an internal standard protein. Statistical analysis was conducted using Student's t-test for unpaired data, considering significance at $p<0.05$. Results are expressed as mean ± standard error of the mean (SEM) and analyzed using GraphPad Prism 5.01 software. Results: Maternal deprivation increased retinal BDNF levels by 44% at P9 ($P=0.0285$), confirmed by western blot. Discussion: Our findings demonstrate that early maternal deprivation increases BDNF levels in the retina, potentially influencing its maturation. This increase aligns with studies highlighting sensory stimulation effects on BDNF. Considering the retina's role in visual processing and its association with mood disorders, these alterations may reflect developmental imprints with profound long-term implications for visual and emotional health. Conclusion: Early maternal deprivation alters BDNF levels in the retina, suggesting the need for studies on its long-term implications.

Funding: CNPq

P05 - EFFECT OF THE MENSTRUAL CYCLE ON THE BETA RHYTHM OF ELECTROENCEPHALOGRAPHY DURING A MOTOR COORDINATION TASK

Danielle Lima[1]*, Luana Borges[1], Rafaela Faustino[1], Maria Bernardete Sousa[1]
[1]Program in Neuroscience, Federal University of Rio Grande do Norte, 59078-970, Brazil
*daniellecdelima@gmail.com

The hormones estrogen and progesterone, which are essential for female reproductive function, exhibit a rhythmic pattern of fluctuation throughout the menstrual cycle. Due to their lipid solubility, these hormones are capable of traversing the blood-brain barrier and exerting influence upon the functionality of the central nervous system. This research examines the impact of these hormones on cerebral cortex activity, with a particular focus on the beta rhythm (15–30 Hz) during a motor coordination task. A total of 30 women between the ages of 18 and 30 with regular menstrual cycles participated in the study. Each volunteer participated in three experimental sessions, which were conducted during different phases of their menstrual cycle: menstrual, follicular, and luteal. During each session, the participants completed the Finger Tapping Test, which included both simple and sequential tasks performed with both their right and left hands. The findings indicated that there was no statistically significant main effect of menstrual cycle phase on cortical activity during the task. However, a significant interaction effect was observed between the cycle phase, brain hemisphere, and hand laterality in the frontal cortex based on beta rhythm measurements. These results indicate that female sex hormones affect interhemispheric communication in the frontal brain region associated with movement planning. This area interacts with the basal ganglia, a critical structure for motor coordination. In less demanding tasks, higher progesterone levels were linked to reduced cortical asymmetry, whereas more complex tasks showed the opposite trend.

Funding: CNPq; CAPES; UFRN

P06 - ELECTROENCEPHALOGRAPHIC STUDY OF THE GO AND NO-GO RESPONSE DURING THE PHASES OF THE MENSTRUAL CYCLE

Luana Adalice Borges de Araujo Lima[1]*, Danielle Costa de Lima[1], Rafaela Faustino Lacerda de Souza[1], Maria Bernardete Cordeiro de Sousa[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Rio Grande do Norte, Brazil
*luanaborges@neuro.ufrn.br

Motor behavior involves the adaptive control of movement, relying on perception and cognition to plan and execute somatic actions, both innate and learned. Steroid hormones act as transcription factors in signaling pathways, modulating neural functions, including motor control. Evidence shows that sex steroids influence neurotransmission in the central nervous system, impacting women's motor performance during the menstrual cycle and emphasizing the role of inhibition in motor control. This study examined cortical activity and voluntary motor variables across three ovarian cycle phases (menstrual: low estradiol and progesterone; follicular: high estradiol; luteal: high estradiol and progesterone) in 30 young women using a Go/No-Go protocol. The protocol included auditory stimulus pairs (S1 and S2) organized into two tasks: S1-centered, where the decision occurred after S1, and motor execution or inhibition followed S2; and S2-centered, where decision-making and motor actions occurred after S2. EEG recorded cortical activity, analyzing alpha (8–13 Hz), beta (15–30 Hz), and beta-1 (15–23 Hz) rhythms in the medial frontal region (Fz) and central electrodes (C3 and C4). Relationships between EEG data, Go/No-Go outcomes, and ERSPs were evaluated. Changes in brain activity, with the generation of beta-ERS during movement initiation in the medial frontal region, indicated a likely increase in the control of motor inhibition associated with decreased levels of sex steroids as was found in the menstrual phase. Beta and alpha oscillations in the left central region were more pronounced in the follicular and luteal phases, suggesting modulation by higher estradiol and progesterone levels, either independently or combined, in motor task processing. Overall, this study highlights variations in motor cognition throughout the menstrual cycle in Go/No-Go tasks. These findings may guide strategies to optimize women's motor performance during the reproductive period and inform future research and clinical interventions.

Funding: CAPES; UFRN

P07 - THE EMBRYONIC OLFACTORY EPITHELIUM AS A POSSIBLE ENTRY POINT FOR ZIKV INTO THE BRAIN

Leocádio LGSC[1*], Marcelino BLM[1], Sequerra EB[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, University Campus, 59056-450, Natal, RN, Brazil
*lc1215574@gmail.com

Microcephalic patients with congenital zika virus (ZIKV) syndrome always develop malformations of prosencephalic structures while caudal regions, like the cerebellum and spinal cord, can be normal. The existence of higher odds to develop anterior malformations led us to hypothesize that ZIKV enters the embryonic brain through an axis formed by the placenta, the amniotic fluid, the olfactory nerve and the olfactory bulb, the most anterior region of the brain. To test it, we injected 1 microliter containing 10>5 PFU of ZIKV in the amniotic fluid of E15 mice embryos. We observe ZIKV+ neurons (Dcx+) and cells in the olfactory epithelium (OE) in 3 days post infection (dpi). We also observe the brain infection beggining in regions where differentiating neurons are, as the cortical plate and the retinal ganglion cell layer. Our temporal analysis, indicates that ZIKV infects anterior structures first, like the olfactory bulb and cortex and the rhombencephalon after. We are now testing strategies to prevent ZIKV brain entrance through the OE. We started to test if methimazole, an antithyroid drug that is toxic for the OE in adults, can ablate the embryonic OE through injections in the mother. Our preliminary data indicate that part of the embryos in 90 and 120 mg/ kg-treated females display a degeneration of olfactory nerve, while embryos of 75 mg/ kg-tretaed females do not show any degeneration. Our next step will be to test if we can

prevent or reduce the embryonic brain ZIKV infection with the ablation of the OE with 120 mg/ kg methimazole.

P08 - COCOA BIOACTIVES IN THE GUT-BRAIN AXIS: ADVANCES AND CHALLENGES FOR MANAGING ADHD AND BINGE EATING DISORDER

David Marte Coimbra do Nascimento Silva
davidmartenutri@gmail.com

INTRODUCTION: The gut-brain axis plays a central role in the pathophysiology of neuropsychiatric disorders such as ADHD and binge eating disorder. Dopaminergic dysfunctions, alterations in the gut microbiome, and systemic inflammation are critical associated factors. Cocoa bioactives, including theobromine and flavonoids, have shown promising results in modulating these systems, enhancing neural plasticity, attentional competence, and better regulation of the gut-brain axis, with low toxicity (Svedlund et al., 2017; Reyes et al., 2019). OBJECTIVE: To explore advances and challenges in the use of theobromine and flavonoids as modulators of the gut-brain axis in neuropsychiatric disorders. METHODS: A narrative literature review was conducted through PubMed, Scopus, and Cochrane Library databases. Studies published between 2015 and 2022 were considered, including controlled clinical trials in adults, systematic reviews, and in vitro or in vivo animal studies. Exclusion criteria included studies involving children, letters, and commentary articles. RESULTS AND DISCUSSION: Theobromine acts as an antagonist of A2a adenosine receptors, regulating dopamine and contributing to behavioral benefits such as improved impulse control and decision-making (Valada et al., 2022). Flavonoids, such as catechins and quercetin, inhibit MAO and COMT enzymes, prolonging dopaminergic signaling in the prefrontal cortex, a region associated with attentional competence (Rebas et al., 2020). These bioactive compounds also reduce systemic and neuroinflammation by regulating intestinal permeability, alleviating ADHD symptoms and optimizing the bioavailability of essential neurotransmitters (Reyes et al., 2019). The modulation of the gut microbiota reduces inflammatory markers, positively impacting neuropsychiatric parameters (Reyes et al., 2019). With low-cost properties and easy integration into adult dietary habits, these non-pharmacological strategies, if validated through clinical trials, could become viable tools for the nutritional management of ADHD and associated binge eating disorder (Svedlund et al., 2017; Reyes et al., 2019). CONCLUSION: Cocoa bioactives offer significant advances for managing ADHD and binge eating disorder, with positive impacts on neuroprotection and gut modulation. Future studies should prioritize human clinical trials to validate their efficacy and establish practical therapeutic guidelines.

P08 - COMPARATIVE CORTICAL MESOCONNECTOME ANALYSIS BASED ON ELECTROPHYSIOLOGICAL DATA: A STUDY OF DIFFERENT SPECIES

Jaime B. Cirne[1]*, Dardo N. Ferreiro[1], Sergio A. Conde-Ocazionez[1], João H.N. Patriota[1], Sergio Neuenschwander[1], Kerstin E. Schmidt[1]
[1]Brain Institute, UFRN, Natal, Brazil
*jaime.cirne@neuro.ufrn.br

In the last two decades, neurophysiological data of both high temporal and spatial resolution from up to hundreds of simultaneously recorded intracortical channels have become increasingly available, thanks to technical advancements such as the higher packing density of microelectrodes, miniaturization of headstages and amplifiers, higher sampling frequencies, and improved signal-to-noise ratios of individual electrodes (e.g., Chen et al., 2022). However, classical analysis techniques often remain focused on serial, single-unit firing rate-based metrics (e.g., Conde-Ocazionez et al., 2017a) or paired measures such as coherence between channels, thereby largely ignoring the high dimensionality of mutual interactions in datasets from multiple parallel channels recorded under the same experimental conditions. This issue has been partially addressed by computing spike statistics based on neuronal assemblies (e.g.,

Conde-Ocazionez et al., 2017b), where activity across multiple channels within the same time window is aggregated into population events, partially sacrificing spatial information about electrode distribution within recording matrices with spatial design.
A solution developed to build human brain connectivity maps from diffusion tensor or functional magnetic resonance imaging with datasets offering high spatial but poor temporal resolution, is graph-based analysis of the connectome derived from all functional or anatomical links between defined nodes such as cortical areas (for review, Sporns, 2015). This technique, however, has been sparsely applied to mesoconnectomic data obtained from extracellular recordings of spatially distributed cortical electrodes (e.g., Dann et al., 2016). The correct interpretation of the results and accurate modeling of underlying circuits also heavily rely on effective data visualization. To address this, we developed a computational tool to model and interactively visualize brain mesoconnectomes derived from preprocessed electrophysiological data, such as interelectrode spike-spike or spike-field coherence measures (NES platform by SN and chronux toolbox by Bokil et al., 2010). The application utilizes graph theory and machine learning techniques to characterize neural connectivity and the identification of functional and structural differences between visual cortical connectomes of species with distinct evolutionary and behavioral traits. We used metadata from two animal models: the domestic cat (Felis catus), a predator with periodic cortical maps similar to those of primates, and the agouti (Dasyprocta leporina), a diurnal herbivore and highly visual rodent with a cortex size comparable to the cat but featuring a rodent-typical salt-and-pepper map. Both species were studied under identical experimental conditions (Ferreiro et al., 2021). The interface processes tabular neural connectivity data derived from multiple parallel electrophysiological recordings to model connectomes representing brain activity under different functional contexts. Distinct patterns were observed, confirming higher clustering of connections in the predator's visual cortex and a more dispersed connectivity pattern in the herbivore. The tool also facilitates navigation in big datasets because it enables interactive network visualization, exploratory analysis and deeper interpretation of the neurophysiological data.

P09 - VALIDATION OF AN ETHOLOGICAL ASSESSMENT PROTOCOL FOR CHRONIC PAIN: A MULTIFACTORIAL ANALYSIS

Laura Koren[1], Claudio Queiroz[1]
[1]Brain Institute, UFRN, Natal, Brazil
*laura.koren.o88@ufrn.edu.br

Pain is a multidimensional physiological process that signals threats for the organism, and is studied from three main perspectives: the sensory-discriminative (intensity, location, quality, duration), the affective-emotional (discomfort and behavioral responses), and the cognitive-evaluative (cultural values, context, and cognitive states). Often, each dimension is evaluated independently in animal models of pain, providing a fragmented description of the pain experienced by non-verbal animals and making more difficult translational applications. We propose that repeated measures of a diversity of tests associated with multifactorial analysis can integrate behavioral and physiological parameters into a statistic model, capable of highlighting complex phenotypes in a neuropathic pain mouse model. We hypothesized that his approach would increase the sensitivity and accuracy of pain assessment in animal models. For the sensory-discriminative domain, we will investigate mechanical hyperalgesia, through Von Frey Test, and thermic allodynia, with both cold (Cold Plate and Acetone Tests) and hot stimuli (Hot Plate and Tail Flick Tests). For the affective-emotional domain, we will study Ultra Sonic Vocalizations frequencies, the Grimace Scale, for facial expressions of pain, and Burrowing and Building Nest tests. For the cognitive-evaluative domain, we will analyze motivation to explore (spaces [open field arena], objects, and conspecifics), to consume sucrose solution, and to exercise with a Running Wheel. We also added a fourth domain related to the animal's general well-being, including body weight monitoring, assessment of spontaneous locomotor activity, and

Rotarod and Grip Force to assess motor functions such as balance, strength and motor coordination. Before collecting the data, we used published and theoretical data to demonstrate the potential of this experimental design and statistical approach, while testing for potential limitations and constraints. This new approach agrees with the principles of the 3Rs (replacement, reduction, and refinement) and therefore, advances the ethical alternatives for pain animal research.

Funding: CNPq

P10 - ACTIVATION OF NEURONAL CIRCUITS DURING PTZ-INDUCED SEIZURES: A TRAP2 MICE STUDY

Antonio Jhones Rocha[1]*, Ana Augusta Rangel [1], Pierre-Hervé Luppi[2], Claudio Queiroz[1]
[1]Brain Institute, Universidade Federal do Rio Grande do Norte, Natal - Brazil
[2]INSERM, U1028; CNRS, UMR5292, Lyon Neuroscience Research Center, Lyon - France
*jhones@neuro.ufrn.br

Recent advances in genetic tools and high-throughput imaging techniques have provided novel opportunities to address key questions in epilepsy research. One such question is whether two seizures, spaced in time, activate the same neuronal populations throughout the brain. To explore this, we used TRAP2 (Targeted Recombination in Active Populations, double heterozygous Fos2A-iCreER;R26Ai14) mice, which enable the tamoxifen-dependent labeling of neurons active during a specific time window. In our experiments, cFos-expressing neurons were labeled two hours after PTZ-induced seizures (20 mg/kg or 60 mg/kg, N=2 and 5, respectively, s.c.). One week later, the protocol was repeated with all animals receiving 60 mg/kg PTZ (N=7, s.c.), followed by transcardiac perfusion 2 hours post-injection. The brain was collected, stored and immunohistochemistry for cFos was later performed on 30 µm thick coronal sections. Images were acquired using DAPI, c-Fos (Alexa-488), and tdTomato (tdT) fluorescence channels. Exposure times were calibrated to optimize signal distribution across 16-bit grayscale images (>20% gray values). For each section, five mosaics were captured (5-µm z-steps) and projected into a single plane using the Zen software (version 3.1) wavelet depth-of-focus function. Quantification was performed by importing raw images into Aligning Big Brains & Atlases (ABBA) and QuPath, two open-source platforms. ABBA enabled rapid alignment of brain sections to the Allen Mouse Brain Atlas, with subsequent coronal segmentation and projection of labeled neurons onto brain structure boundaries. QuPath performed the visualization and quantification of tdT+ and cFos+ neurons, considering a neuron labeled when it exhibited clear cytoplasmic (tdT) or nuclear (cFos) staining, using optimized thresholding parameters (pixel size = 0.5 µm; nucleus minimum area = 10 μm^2 and nucleus intensity threshold of 100x for each fluorescent channel). Ongoing analyses revealed that (i) spasms or myoclonia do not result in significant activation of the hippocampal formation, whereas limbic seizures robustly activate the dentate gyrus after PTZ injection, and (ii) limited reactivation of limbic structures was observed when limbic seizures were absent, but strong reactivation occurred in the dentate gyrus, amygdalar formation, retrosplenial cortex, and piriform cortex during seizure episodes. These findings demonstrate that behavioral expression of seizures is associated with the activation of specific neuronal networks. While weaker ictal expressions, such as spasms and myoclonia, are associated with diffuse and less region-specific activation, limbic seizures engage robust, localized activation patterns in key brain regions. This approach provides a deeper understanding of the dynamics of seizure expression within neuronal networks and may offer valuable perspectives for developing targeted therapies.

Funding: CAPES; CNPq; FAPERN (Brazil); CNRS (France)

P11 - MULTISENSORY ACTIVITIES AND SLEEP TO OVERCOME LETTER REVERSAL: A SCALABLE PROTOCOL TO IMPROVE LITERACY

Flora Sousa[1]*, David Oliveira[1], Gabriel Farias[1], Carolina França[1], João Patriota[2], Felipe Pegado[3], Sidarta Ribeiro[1, 4]
[1]Laboratory of Memory, Sleep and Dreams, Brain Institute, Federal University of Rio Grande do Norte, Av. Nascimento de Castro 2155, Natal 59056-450, Brazil
[2]Brain and Cognition, Dept. of Psychology, University of Amsterdam, Amsterdam, The Netherlands
[3]Laboratory of Cognitive Psychology, Institute for Language Communication and the Brain, CNRS and Aix-Marseille University- 3 place Victor Hugo, Marseille 13331, France
[4]Ficoruz Center of Strategic Studies, Av. Brasil, 4036, Prédio da Expansão, Manguinhos, 21040-361, Rio de Janeiro, Brazil
*floraassaf_@hotmail.com

Mirror invariance is a visual mechanism that has been hypothesized to be causally linked to letter reversal – a common struggle among children going through literacy acquisition - when letters are read and/or written backwards. Interventions using multisensory-motor activities have been shown to inhibit letter reversal and improve reading fluency. Our study applied for the first time in large scale a scientifically grounded intervention for 1st grade students, combining multisensory-motor activities with post-training sleep. The intervention was implemented in six public schools across four cities in RN, Brazil, and conducted by their teachers. The protocol consisted of three weeks of 20 to 30 minutes activities targeting the motor and sensory system, followed by up to 2 hours of napping after lunch, designed to test its impact on learning consolidation. Each session used one of three pairs of symmetrical letters: 'b'/'d', 'p'/'q', and 's'/'z'. Therefore, teachers were offered instructions on the intervention and given a thorough checklist for each step of the activities. All sessions were recorded on video. Experimental groups received a 30-minute lesson on lowercase letters a week before the intervention. This ensured all children were familiar with this alphabet form, which is not commonly taught in Brazilian 1st-grade classrooms. The schools were divided in two groups: training, in which students participated in all activities; and control, in which students participated in the lowercase letters activity, but not the multisensory ones. To measure the prevalence of letter reversal, we applied a same-different visual task and a writing task where children were asked to reproduce letters on paper with pencil. We collected this data in two different points: baseline, short-term (the following two weeks after the intervention). Preliminary results indicate that students in two out of three training schools reduced their letter reversal errors in both tasks. Preliminary supervised video analysis showed that all teachers were too reliant on reading the items from the checklist on the first week, which suggests training should be improved. The three teachers also reported that children felt tired or bored during the activities after the first week, a problem that could be solved by spreading the training sessions over five weeks instead of three. For the first time, we replicate the initial results into a large cohort of schools. Importantly, this represents a low-cost scalable possibility to facilitate literacy acquisition, a prevalent problem in Brazil and worldwide.

P12 - BEYOND THE RACINE SCALE: AN ETHOLOGICAL CHARACTERIZATION OF PENTYLENETETRAZOL-INDUCED SEIZURE IN MICE

Ana Augusta Rangel[1], Antonio Jhones Rocha[1], Claudio Marcos Queiroz[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, University Campus, 59056-450, Natal, RN, Brazil
*anaaugustacrangel@gmail.com

Seizures are stereotyped behavioral manifestations arising from abnormal, hypersynchronous, and transient neuronal excitability. Pharmacological agents that enhance neuronal excitation or reduce synaptic inhibition, such as GABAa receptor antagonists, can induce seizures in a dose-dependent manner. The behavioral expression of those seizures varies and it is assumed they reflect the neural circuits involved in paroxysmal activity. Despite this complexity, most rodent studies rely on

the Racine scale to assess seizure severity and frequency, often neglecting the specificity of the inducing drug, propagation dynamics, and the regions engaged during seizures. To address these gaps, we developed a novel ethological coding methodology to characterize behaviors associated with seizures induced by pentylenetetrazol (PTZ). Male C57BL/6 mice (3 months old, 25–30 g) were administered varying doses of PTZ and observed for 1 hour post-injection using video monitoring. Behaviors, including spasms, myoclonus, and limbic seizures, were classified using "Solomon Coder," while ambulation was tracked via "MouseLabTrack" (MATLAB toolbox). Electrophysiological recordings from hippocampal and retrosplenial cortex electrodes validated the ictal behaviors in a subset of animals. Our results highlight spasms and myoclonus as critical ictal behaviors, improving the behavioral characterization of drug-induced seizures beyond the Racine scale. We propose this methodology can assist in experimental protocols designed for new drug screening and seizure genesis in animal models of seizure and epilepsy.

P13 - ELECTROPHYSIOLOGICAL AND BEHAVIORAL SYNCHRONIZATION DURING LEARNED FEAR EXPRESSION IN MARMOSETS (CALLITHRIX JACCHUS)

Ingrid Gomes Queiroz[1], Joseph Andrews Belo Alves[1], Gabriele Rocha de Carvalho[1*], Andressa Radiske[1]
[1]Instituto Internacional de Neurociências Edmond e Lily Safra (IIN-ELS)
*gabriele.carvalho@edu.isd.org.br

Anxiety related disorders are primarily treated with exposure therapies based on fear memory extinction. However, this process does not eliminate the original fear memory, often leading to relapse of symptoms. Understanding the neural mechanisms underlying fear memory relapse may help optimize therapeutic responses. This study aims to characterize the electrophysiological activity of the anterior and posterior medial cingulate cortices and hippocampal regions (CA1 and CA3) of marmosets (Callithrix jacchus) during fear memory recall. To investigate the relationship between neural activity and fear behavior, we developed a synchronization software called "Marmosync". This software interfaces with an Arduino board that controls a polarized door, alternating between transparent and opaque states. When transparent, the door allows the animal to view either a neutral stimulus or an aversive stimulus (e.g., a plastic snake). Marmosync also synchronizes two cameras and sends TTL signals to the electrophysiological data acquisition system (Open Ephys), ensuring alignment of recorded data with video capture and stimulus presentation. Preliminary results show that the Marmosync system effectively controls stimulus presentation and synchronizes behavioral and electrophysiological recordings, enabling a comprehensive analysis of the data. Our findings also reveal that aversive stimuli trigger fear responses, including increased vigilance and altered locomotion, while neutral stimuli do not evoke defensive behaviors compared to baseline levels. This integrated approach may help elucidate the neural dynamics of fear learning and relapse, contributing to the development of long-lasting and effective interventions for trauma and phobias.

Funding: CAPES

P14 - IDENTIFICATION AND QUANTIFICATION OF BEHAVIORAL PATTERNS CORRELATED TO EXPOSURE TO LOUD NOISE AND NOISE-INDUCED TINNITUS

Emilly Louanny Lima Sales[1], Gabriel Mendonça de Queiroz[1], Rêmullo Brenno Galvão de Miranda Costa[1], Richardson Menezes[1], Helton Maia[1], Emelie Katarina Svahn Leão[1]
[1]Brain Institute, UFRN, Natal, Brazil
*emilly.lima.713@ufrn.br

Tinnitus can be defined as the unilateral or bilateral perception of sound in the absence of an external stimulus. This condition significantly impacts psychosocial well-being and is associated with comorbidities such as stress disorders, depression, and anxiety.

Current research indicates that tinnitus is closely linked to the limbic system, particularly the basolateral amygdala (BLA), demonstrating alterations in activity and connectivity between the auditory and limbic systems. The amygdala functions as a primary gateway for processing external stimuli and maintains connections with various regions of the hippocampus. While auditory induced fear memory is well-characterized as amygdala-mediated processes, the precise relationship between the amygdala and tinnitus, as well as its correlation with anxiety, remains less understood. Here we investigate the relationship between noise-induced tinnitus and anxiety, and aim to identify and quantify behavioral patterns related to loud noise and tinnitus. Advanced computational tools, including neural networks and artificial intelligence, are employed to refine the quantification of behavioral metrics such as "head dips" (the intention to explore). In locomotion tracking of videos of animals in the round open field and elevated plus maze we will analyze number of entries into regions of interest (ROIs), time spent in these ROIs (in seconds), distance traveled within the arena (in centimeters), and locomotion speed (in centimeters per second). Preliminary data show noise exposure not to generate general anxiety, but to alter certain parameters best detected with computational tools. Thereby, quantitative studies provide an important framework for investigating interaction between tinnitus, anxiety and limbic system dynamics.

Funding: PIBIC-UFRN

P15 - INHALED DMT INCREASES LUCID DREAMING RECALL FREQUENCY

Maia M[1], Wießner I[1], Falchi M[1], Palhano-Fontes F[1], Ruschi S[1], Bolcont R[1], Lima TZ[1], Ribeiro S[1], Mota-Rolim S[1]*, Araújo DB[1]
[1]Brain Institute, UFRN, Natal, Brazil
*sergioarthuro@neuro.ufrn.br

Introduction: Dreams and psychedelic states share many similarities, such as visual mental imagery, emotion activation, and fear memory extinction. Psychedelic states are closer to lucid dreams (LD), when subjects know they are dreaming and may control the oneiric content. Objective: To analyze how inhaled DMT influences LD recall frequency. Methods: This is an open-label, single-ascending, fixed order, dose-response study to assess the feasibility of inhaled DMT in healthy volunteers. On D0, a smaller first dose was used, followed by a second larger dose 2 hours later. We applied questionaries about sleep, dreams, LD and nightmares on four different times: D0 = dosing day, D1 = one day, D14 = fourteen days, and D28 = twenty-eight days afterwards. With the exception of D1, when questions referred to the previous night, the other three questionnaires (D0, D14 and D28) referred to the past two weeks. Results: Our sample comprised 25 volunteers (including 13 men and 12 women), being mainly white, single adults, with completed higher education, employed, without a defined religion, but with spirituality. In a first descriptive analysis, comparing data between D0 and D28, we found that the percentage of LD increased by 23%. Using a generalized linear mixed model with Poison distribution and logarithmic link for LD count (Wald test), we observed that LD decreased at D14 ($p = 0.03$) and D28 ($p = 0.01$) among the subjects treated with the lowest DMT dose (5-20 mg), comparing to baseline (D0). In contrast, participants subjected to the highest dose (15-60 mg) experienced LD frequency far superior at D14 ($p = 0.003$) and D28 ($p = 0.006$) as compared to the baseline (D0). Conclusion: LD recall frequency depends on the dose of inhaled DMT: the lowest dose elicited a reduction of LD, while the highest dose promoted an increasing of LD.

Funding: CAPES; CNPq

P16 - RESPIRATION-COUPLED BRAIN OSCILLATIONS APPEAR DURING FREEZING BEHAVIOR IN RATS

Duarte EH[1]*, Silva AN[1], Laplagne DA[1], Tort AB[1]

[1]Brain Institute, UFRN, Natal, Brazil
*elis.duarte.121@ufrn.edu.br

We know that breathing is fundamental to life. However, breathing is responsible for much more than gas exchange, including being able to modulate our emotions. In 1942, Lord Adrian discovered an oscillatory rhythm that synchronizes with nasal respiration, which became known as respiration-coupled oscillations (RCOs). Several lines of evidence suggest that these oscillations are initiated by the activation of neurons in the nasal epithelium. After reaching the olfactory bulb, RCOs are transmitted throughout the brain, in regions such as the amygdala, hippocampus, and prefrontal cortex, among others. Recent studies show that a strong 4-Hz oscillation appears during freezing, an expression of fear behavior in rodents. During freezing, rodents can emit ultrasonic vocalizations, which are coupled to the exhalation phase of the respiratory cycle. Here we propose simultaneously recording freezing behavior, ultrasonic vocalizations and electrophysiological signals from the medial prefrontal cortex in a cue-driven fear conditioning paradigm. Our main hypothesis is that RCOs occur during freezing and are differentially expressed during the emission of ultrasonic vocalizations. Furthermore, we hypothesize that ultrasonic vocalization activity produces a natural disturbance in the sniffing cycle that is also observed in RCOs.

Funding: CNPq; CAPES

P17 - PSYCHOPHYSICAL STUDY OF VISUAL INTERHEMISPHERIC CONNECTIVITY IN HEALTHY YOUNG AND OLDER ADULTS

Carlos Emmanuel Sousa de Andrade Cabral[1]*, Alyson M. de Carvalho Souza[2], Kerstin E. Schmidt[1]
[1]Neurobiology of Vision Laboratory, Brain Institute, UFRN, Natal, Brazil
[2]Metropole Digital Institute, UFRN, Natal, Brazil
*carlos-emmanuel10@hotmail.com

As the global population ages, understanding the physiological changes in sensory perception, particularly those related to vision, have become increasingly significant. This study investigates the inter- and intrahemispheric connectivity of the visual cortex in healthy young and elderly individuals using psychophysical paradigms. The key focus is on perceptual grouping mechanisms that integrate visual stimuli into coherent shapes, thought to be mediated by receptive field responses to contour orientations and motion directions in the primary visual cortex (V1). At the center of gaze, visual percepts from the two halves of the visual field have to be integrated by connections through the posterior, visual part of the corpus callosum, (VCC). This integration enables the perception of horizontal information crossing the visual field's vertical midline. To examine perceptual processes through the VCC, the present study uses a modified version of the Motion Quartet (MQT), a bistable illusion where two circular images alternate, creating ambiguous perceptions of vertical or horizontal motion. Variations of the MQT are applied, incorporating congruent and non-congruent configurations with stimuli such as Gabor patches and three-dimensional shapes. The project hypothesizes that aging alters neural circuits responsible for visual interhemispheric connectivity, impacting collinear facilitation and leading to perceptual asymmetries. Eye-tracking methods are used to analyze visuomotor functions and fixation fidelity, offering insights into age-related changes in reaction times, motion perception biases, and perceptual grouping across the visual midline. By identifying behavioral markers of age-related visual processing changes, this research seeks to establish pre-clinical diagnostic methods for cognitive decline and age-related conditions such as Alzheimer's disease (AD). Ultimately, the findings aim to deepen our understanding of how aging impacts visual perception and to inform future studies on neurodegenerative and psychiatric disorders.

Funding: CAPES; CNPq

P18 - SHINING LIGHT ON RETINAL NEURAL DYNAMICS: INSIGHTS FROM FLICKERING STIMULI

Lucas Lira[1]*, Claudio de Oliveira[2], Jerome Baron[3], Kerstin Schmidt[1], Sergio Neuenschwander[1]
[1]Vislab, Instituto do Cérebro, UFRN
[2]Departamento de Ciências Naturais, UFSJ
[3]Departamento de Fisiologia e Biofísica, UFMG
*lucasdemlira@gmail.com

Gamma oscillations have been proposed as a key mechanism for large-scale interactions within the retina's inner plexiform layer (IPL) (Neuenschwander & Singer, 1996; Roy et al., 2017). These fast signals were shown to be transmitted to the LGN and cortex and thought to be relevant for visual binding (Castelo-Branco et al., 1998; Storchi et al., 2017). However, recent studies in cats have challenged this hypothesis, revealing that these oscillatory processes are induced by halothane anesthesia and absent in awake states (Neuenschwander et al., 2023). Consistent with these findings, recordings from the LGN in non-anesthetized, conscious humans (Self et al., 2024) have shown no evidence of oscillatory signals originating from retinal activity. Here, we used flickering stimuli to evaluate the dynamics of synchronous spiking activity in the LGN of ketamine-anesthetized cats (N = 2). We designed tripartite stimuli consisting of concentric circles to investigate how spatial and temporal properties influence synchronization. These allowed us to vary flicker frequency independently across the center, intermediate annulus, and peripheral annulus of the stimulus. Stimuli were delivered using a computer screen (CRT, 2 recording sites, RS) and a custom-built LED array device (1 RS). Our findings show that individual cells could follow high temporal frequencies beyond predictions based on classical temporal frequency tuning curves (up to 16 Hz for X- and ~30 Hz for Y-cells, Lehmkuhle et al., 1980). Notably, the ability to follow high-frequency flicker (60 Hz with a CRT) critically depended on the spatial continuity and extent of the stimulus. Discontinuities, such as an annulus separating the center from the periphery, disrupted the cell's entrainment. In LED-based experiments, the entrainment of central regions at higher frequencies (e.g., 30 Hz) could be abolished by frequencies applied to the peripheral region (10 Hz) distinct from those of the center. These results suggest that a synchronization mechanism coordinates responses across large retinal distances. Future studies will explore whether this synchronization dynamic operates actively by comparing synchronization strength in LGN cells receiving input from the same versus different eyes, using simultaneous recordings across the two hemispheres. Additionally, we plan to examine whether this synchronization mechanism is selective for specific cell types (X vs. Y) and polarities (ON vs. OFF). This work holds promise for advancing our understanding of the mechanisms underlying temporal coding in the retina and their role in processing rapid visual events.

P19 - MATURATION OF THE CEREBRAL GABAERGIC SYSTEM WITH ZIKA VIRUS INTERFERENCE

Bruna Lorena de Melo Marcelino[1]*, Vivian Antonielly Becker dos Santos[1], Richardson Naves Leao[1], Emelie Katarina Svahn Leao[1], Eduardo Bouth Sequerra[1]
[1]Brain Institute, UFRN, Natal, Brazil
*brunalorena@neuro.ufrn.br

Brazil has thousands of patients with neurological consequences resulting from Congenital Zika Virus Syndrome (CZVS). One of the outcomes of CZVS is the occurrence of epileptic seizures in some patients, which increase over time and are resistant to medication. During the perinatal period, the expression of chloride importers (NKCC1) and exporters (KCC2) regulates the reversal of chloride potential in cells, transforming gamma-aminobutyric acid (GABA) from an excitatory to an inhibitory neurotransmitter. Developmental disturbances can disrupt this reversal, resulting in pathological neuronal activity in the central nervous system. In this project, we hypothesize that Zika virus

(ZIKV) infection interferes with the development of intracellular chloride concentrations in hippocampal neurons. We injected 1 µl of 0.9% saline solution (CTRL) or a solution containing 1,000 ZIKV particles into the lateral ventricle of mice on the first day after birth. We conducted current clamp experiments between postnatal days 7 and 16. This technique allows for measuring the membrane potential of cells and observing basic firing properties, such as their response to different stimuli, by measuring ionic currents and generating current-voltage curves to analyze conductance, capacitance, and the kinetics of ion channel opening and closing, providing insights into the ionic behavior of cells with or without ZIKV infection. Our preliminary data indicate that after 15 days of infection, the parameters observed in the patch clamp such as the resting potential and the membrane capacitance remain unchanged compared to the control group. We observed that mice in the ZIKV group showed behavioral decline and weight loss starting on the 11th day. Therefore, beginning on the 10th postnatal day, we initiated treatment with bumetanide (BUM), an NKCC1 inhibitor, in half of the infected animals and the control group until the 15th day. The results indicated that untreated ZIKV-infected animals experienced greater weight loss and reduced reflexes, whereas animals treated with BUM showed milder reflex impairments and better weight preservation in the ZIKV+BUM and control groups. The survival rate in the untreated ZIKV group was 54.5%, compared to 72.7% in the ZIKV+BUM group. In conclusion, our data suggest that treatment with BUM reduces the severity of the consequences of ZIKV infection.

Funding: CAPES

P20 - USE OF ESSENTIAL OILS IN THE PREVENTION OF POSTPARTUM DEPRESSION IN MOTHERS WITH NEWBORN INFANTS IN THE NEONATAL ICU: A STUDY IN A PUBLIC MATERNITY IN NATAL/RN

Palloma Nunes Andrade dos Santos[1]*, Maria Bernardete Cordeiro de Sousa[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, Brazil
*pallomanunesasantos@gmail.com

During pregnancy, significant hormonal changes occur, including an increase in sex steroids like estrogen and, most prominently, progesterone, along with elevated cortisol levels—a steroid critical for fetal maturation and energy regulation. Cortisol peaks at the end of the third trimester but decreases substantially following childbirth. These hormonal fluctuations, combined with psychosocial and genetic factors, are believed to play a role in triggering postpartum depression (PPD). One of the pressing challenges today is identifying effective interventions, both pharmacological and behavioral, to address PPD. Additionally, alternative therapies, such as the use of essential oils, have shown promising results in treating various physical and mental health conditions. This approach aligns with the integrative practices recognized by Brazil's Unified Health System (SUS) since March 2018.This project seeks to examine the impact of a blend of sweet orange (Citrus sinensis) and lavender (Lavandula angustifolia) essential oils in preventing postpartum depression among mothers whose newborns require care in a Neonatal Intensive Care Unit (NICU). The study will employ a randomized, single-blind (mothers), descriptive, and quantitative design to assess the effectiveness of this essential oil blend in 40 postpartum women recruited at Maternidade Januário Cicco (MEJC). Participants will be divided into two groups: (1) control (n=20, placebo) and (2) experimental (n=20, essential oils).Data collection will include a sociodemographic questionnaire and psychometric evaluations to measure stress, anxiety, depression, and sleep quality. Psychological support will also be offered through therapeutic group sessions. Statistical analyses, both parametric and non-parametric, will be conducted, with significance set at $p < 0.05$. This study aims to contribute to the prevention of mood disturbances in postpartum women, promoting their biopsychosocial well-being and enhancing care for mothers coping with the NICU experience, as well as improving the mother infant bond.

Funding: OWN RESOURCES

P21 - ADJUNCTIVE EFFECT OF A 12-WEEK MINDFULNESS-BASED PROGRAM + ESCITALOPRAM ON DEPRESSIVE SYMPTOMS

Sousa GM[1]*, Araújo-Riordan GLL[1], Tavares VDO[1], Sousa MBC[1], Galvão-Coelho NL[1]
[1]Federal University of Rio Grande do Norte, University Campus, 59056-450, Natal, RN, Brazil
*geovanjr1@gmail.com

Major Depressive Disorder (MDD) is a multifactorial disorder that affects more than 290 million people worldwide, and 10.8% of the Brazilian population. Despite pharmacotherapy being a primary treatment, antidepressants alone may not fully address the complex symptoms of depression and can have undesirable side effects. Evidence has shown that mindfulness training may enhance mental health and reduce depressive symptoms. However, few studies have investigated the complementary effect of mindfulness to pharmacotherapy to treat MDD. Therefore, this study explored whether a combined mindfulness-based program with escitalopram is more effective than escitalopram as a stand-alone. Sixty-two participants, students and staff from the Federal University of Rio Grande do Norte who were experiencing depressive symptoms, were included. Participants were allocated to either the Escitalopram treatment group (ESC, n=33, women = 25), or the Mindfulness + Escitalopram treatment group (MT, n=29, women = 22), both with a 12-week duration. The mindfulness program included weekly online sessions (1h) and a thrice-a-week guided home practice. Depressive symptoms were assessed at Baseline (B), Week 5 (W5), and Week 12 (W12), using a self-reported (Patient Health Questionnaire 9, PHQ-9) and a clinical-reported (Montgomery-Åsberg Depression Rating Scale, MADRS) instruments. The effect of interventions on depressive symptoms were analysed employing a generalised linear model, using the Poisson distribution and the identity link function, adjusted for age, sex, and dose of escitalopram. It was found an interaction between time and treatment ($\chi 2(3) = 9.84$, $p = 0.020$) for self-reported depressive symptoms, where both groups reduced PHQ-9 (Cohen's d: B-W5: ESC = -1.68, MT = -2.37; B-W12: ESC = -1.84, MT = -2.67, all p-values<0.001; W5-W12: ESC = -0.81, p = 0.393, MT = -0.38, p<0.001), however, those who received the mindfulness intervention plus escitalopram scored lower at the end of treatment (Cohen's d = -0.58, p = 0.023), as compared with those taking the escitalopram only. Only an effect of time ($x2(2) = 752.82$, $p < 0.001$) was found for clinical-reported depressive symptoms, where both groups equally reduced MADRS. In summary, this study showed a positive adjuvant effect of mindfulness to escitalopram on self-perceived depressive symptoms independently of the clinically assessed outcome. These results suggest that the mindfulness training may modify the relationship of the individual with their symptoms, which may positively impact on relapse prevention, for instance.

Funding: CAPES

P22 - CAN ZEBRAFISH MODEL DEPRESSIVE-LIKE BEHAVIOR? INSIGHTS FROM THE NOVEL TANK TEST

Lariça Alves de Souza[1]*, Paulo Sidney Bezerra da Silva[1], Priscila Fernandes Silva[1], Romério Oliveira Lima Filho[1], Ana Carolina Luchiari[1]
[1]FishLab, PPG Psychobiology, Department of Physiology and Behavior, Center of Biological Sciences, Federal University of Rio Grande do Norte. Natal-RN, Brazil
*laricaalves97@gmail.com

Depression is a prevalent and complex mental health disorder, and its neurophysiological mechanisms remain incompletely understood. Animal models, such as zebrafish (Danio rerio), are invaluable tools for advancing our understanding of depression. This study aimed to evaluate the effectiveness of different protocols in

inducing depressive-like states in zebrafish. Animals were divided into 4 experimental groups: Unpredictable chronic stress (UCS) (n=15), hydrocortisone exposure (n=15), reserpine exposure (n=15), and control (n=15). UCS involved exposing animals to two different stressors at random times each day for 15 days. The stressors included water level reduction, increased and decreased temperatures, predator presence, confinement, social isolation, crowding, and exposure to increased light (500 lux). The hydrocortisone group was maintained at a concentration of 2.7 µL/L (50 µM solution) for 15 days, 24 h/day. The reserpine group was exposed to 40 µg/L of the drug for 20 minutes, seven days before the experimental test. The control group was untreated. After 15 days of treatment, the animals were filmed individually in the novel tank test (6min) and encephalon were collected for gene expression analysis. The results revealed no significant differences between the groups for locomotion parameters, including average speed, total distance traveled, and immobility ($p > 0.05$). However, for vertical exploration, the treated groups spent more time in the lower zone of the tank ($p< 0.05$), indicating increased anxiety. The UCS and hydrocortisone groups also showed shorter distance from the bottom compared to the control group ($p< 0.05$). The UCS group also exhibited less exploration of the tank than the other groups ($p < 0.005$). The UCS and reserpine groups exhibited greater latency to reach the top of the tank ($p< 0.05$). Genes related to tryptophan hydroxylase in the central nervous system, the serotonin receptor HTR1A, and the BDNF gene were downregulated. These findings suggest that all treatments induced effects related to stress and anxiety responses. However, UCS and reserpine induced more pronounced behavioral changes, highlighting their effectiveness for modelling depressive-like behavior in zebrafish. Hydrocortisone is a novel model for zebrafish, also elicited anxiety-related behaviors, suggesting its potential for further exploration in these animals. Together, these treatments lay the groundwork for further investigation into biochemical (cortisol) and molecular markers involved in the neurophysiology of depression, as well as testing potential alternative treatments.

Funding: CAPES

P23 - CHEMOGENETIC STRATEGY TO ELECTROPHYSIOLOGICALLY VALIDATE THE ROLE OF THE BASOLATERAL AMYGDALA IN PROCESSING LOUD SOUND

Catherine Mesquita[1]*, Emelie Katarina Leão[1]
[1]Brain Institute, UFRN, Natal, Brazil
*catherine.mesquita.323@ufrn.edu.br

Recently, a non-canonical auditory pathway, the reticular-limbic auditory pathway, shed light on the role of the limbic system in auditory processing of aversive sounds. Loud broadband sounds can take a shortcut from the cochlear nucleus to medial septum, reaching the entorhinal cortex and rapidly relaying salient signals to the hippocampus for memory retrieval or storage, without the participation of the auditory cortex. A previous study from our lab showed acceleration and decrease in hippocampal theta power during locomotion, in the presence of a loud noise. The basolateral amygdala (BLA) is a limbic structure part of the amygdaloid complex, known to modulate hippocampal activity. Moreover, BLA receives monosynaptic inputs from the entorhinal cortex, specifically from its lateral part (known to participate in auditory-sensory integration) and from hippocampal CA1, that sends back monosynaptic projections to BLA. The direct connectivity between BLA, entorhinal cortex and hippocampus raises the possibility that BLA can modulate the activity of the reticular-limbic auditory pathway, in the presence of aversive sounds. The advances in transcriptomics and use of genetic-based tools allowed precise identification of cell populations and helped to better understand their connectivity and function. For many years, BLA activity has been associated with the expression of fear and anxiety behaviors. Now, based on genetic markers, different populations of neurons have been identified and an unexpected anxiolytic role of some BLA neurons have been observed. Also, distinct neuronal populations in BLA were identified by their valence encoding

and/or projections targets. Here, we bring an actualized morpho-functional characterization of BLA, and based on that, we aim to use chemogenetics to manipulate the activity of specific BLA neuronal populations and possibly find their role in acceleration of hippocampal theta oscillations during loud noise exposure.

P24 - TOWARDS AN UNIVERSAL NEONATAL NEUROLOGICAL MONITORING: EXTRACTING AEEG FROM CONVENTIONAL EEG

Aline Elvina Rodrigues Fernandes[1]*, Richardson Naves Leão[1]
[1]Brain Institute, UFRN, Natal, Brazil
*aline.fernandeselv@gmail.com

Neurological disorders are the leading cause of disabling diseases worldwide, with premature neonates being the most vulnerable population. The electroencephalography (EEG), performed using the modified international electrode placement system, is widely recognized as the gold standard for the diagnosis of neonatal seizures. However, the use of EEG in many neonatal intensive care units is limited by the complex setup process for continuous monitoring and the shortage of trained professionals. For that reason a simplified form of EEG known as amplitude-integrated EEG (aEEG) presents a more accessible technique that that can be used by non-specialists for neuromonitoring, especially for the detection of neonatal hypoxic-ischemic encephalopathy. Nevertheless, when compared to EEG, the diagnostic power of aEEG is hindered by the lack of comprehensive studies and databases. In other to improve the diagnostic output of aEEG, we plan to use the vast amount of conventional EEG data repositories to model aEEG form modified international electrode placement system. Using numerical analysis and finite element modelling, we aim to extrapolate aEEG from normal and pathological neonatal EEG from available databases. In a second phase, we will use machine learning techniques to classify aEEG modelled signals in order to test the predictability of EEG abnormalities. Using numerical and machine learning techniques, our project aims to enhance the diagnostic power of aEEG, making it a more reliable tool for neonatal neuromonitoring. This could significantly improve early detection and intervention for neurological disorders in premature neonates.

P25 - TAKING THE RED PILL: EEG CORRELATES OF LUCID DREAMING DURING LIGHT SLEEP (STAGE 2) - PRELIMINARY ANALYSIS

Eric Amaral[1], Eder Xavier[1], Natalia Mota[2], Sergio Mota-Rolim[1]*, Sidarta Ribeiro[1]
1 Brain Institute - Federal University of Rio Grande do Norte, Brazil
2 Psychiatry Institute - Federal University of Rio de Janeiro, Brazil
*sergioarthuro@neuro.ufrn.br

Introduction: Lucid dreaming (LD) is a state of consciousness during which the dreamer becomes aware of the oneiric state, and may be able to control the dream content. LD is predominantly associated with REM sleep, and is objectively verified by the pre-agreed eye movement technique, in which subjects perform voluntary eye signals as they become lucid. During REM sleep, LD is correlated with enhanced activity and connectivity in frontal regions and temporo-parietal areas, including precuneus. LD can also happen during sleep onset (stage 1) and light sleep (stage 2), however, little is known about the neural correlates of LD during these other sleep stages. Objective: In the present work, we aimed to investigate LD correlates during light sleep (stage 2). Methods: We analyzed data from a case report of eye signaled verified LD, after a intermittent nap protocol, recorded by 64 electroencephalogram (EEG), 4 electrooculogram (EOG), and 3 electromyogram (EMG) channels. We first performed the preprocessing by removing eye signals artifacts over the frontal cortex using independent component analysis (ICA). Next, we will stage sleep epochs, and compare the main EEG oscillations (delta = 1-3Hz, teta = 4-7Hz, alpha = 8-12Hz, beta = 13-20Hz and gama = 21-50Hz) in power, connectivity and coherence analysis. Expected Results: We hypothesize that LD during light (stage 2) sleep has increased activity in frontal and

temporo-parietal regions, but in a less pronounced way than those found for LD during REM sleep.

Funding: CAPES; CNPq

P26 - CHEMICAL DIVERSITY, AFFINITY, AND PRODUCTION OF PHYTOCANNABINOIDS: THE CREATION OF THE LABORATÓRIO DE CULTIVO DE CANNABIS (LACCA-ICE)

Sérgio Ruschi[1]*, Igor Sales[1], Sidarta Ribeiro[1], Cláudio Queiroz[1]
[1]Brain Institute, UFRN, Natal, Brazil
*sergioruschi@neuro.ufrn.br

Cannabis, used for millennia in medicinal, religious, and recreational contexts, has garnered increasing scientific attention for its therapeutic potential. Its proven efficacy in managing treatment-resistant epilepsy has driven global research into its pharmacological properties, sparking debates about regulation and clinical applications in other pathologies. One of the plant's most intriguing aspects is its chemical diversity, which varies depending on strains and cultivation conditions. Cannabinoids such as d9-THC, CBD, CBG, and CBN, along with terpenes and flavonoids, make up the plant's chemical profile, generating distinct effects based on the proportion of these compounds. This variability requires precise extraction and characterization methods to ensure the safety and efficacy of therapeutic products and support robust scientific research. Analyses conducted at the Brain Institute on various samples received revealed chemical profiles consistent with findings from other countries. These studies underscore the importance of assessing how environmental and genetic factors influence the concentration of bioactive compounds, helping refine cultivation practices and expand knowledge of the plant. Another crucial point is the interaction of cannabinoids with the endocannabinoid system's receptors. Our meta-analysis revealed that THC and CBN share similar affinities for CB1 and CB2 receptors, while CBD and CBG exhibit binding affinities 10 to 100 times lower. Notably, statistical comparisons highlight significant differences between THC and CBD, with THC demonstrating affinities two orders of magnitude higher. We propose that the effects of CBD and CBG are mediated through interactions with non-canonical receptors such as GPR55, TRPV1, and TRPM8 rather than primary endocannabinoid receptors. Guided by these advancements, the Laboratório de Cultivo de Cannabis (LACCA-ICe) emerges as a facility for integrating research, development, and innovation in cannabis studies. With a focus on controlled cultivation, chemical characterization, and evaluation in pre-clinical models, LACCA aims to contribute to the safe and effective application of this ancient plant.

P27 - SPATIAL AND TEMPORAL FREQUENCY SELECTIVITY ACROSS THE VISUAL FIELD IN DIFFERENT SPECIES

Amanda D. Fonseca[1]*, Dardo N. Ferreiro[1], Sergio A. Conde-Ocazionez[1], João H. N. Patriota[1], Sergio Neuenschwander[1], Kerstin E. Schmidt[1]
[1]Neurobiology of Vision Laboratory, Brain Institute, UFRN, Natal, Brazil
*amandadomingues100@hotmail.com

In contrast to most frontal-eyed predators, rodents do not exhibit a fovea but a visual streak in their retinas. Agouti are large diurnal and highly visual South-American rodents which have much higher peak ganglion cell densities along their visual streak than other large rodents (Silveira et al., 1989). Accordingly, they also have small receptive fields (RFs) and exhibit moderate to high orientation selectivity in their primary visual cortex (Ferreiro et al., 2021). Our lab has previously shown, that despite of the good visual response properties, small RFs and large V1 size Agouti exhibit the order-specific trait of a salt-and-pepper map instead of a periodic pinwheel-like layout for orientation selectivity typical for carnivores and primates. Furthermore, as in small

rodents (Ayzenshtat et al., 2016; Pattadkal et al. 2018), orientation selectivity does not seem to be as stable across spatial and temporal frequency space in Agouti as it is in cats (Ferreiro et al., 2021). Therefore, we examined the distribution of spatial and temporal frequency selectivity of neurons with receptive fields at various eccentricities and elevations across the visual field from 9 agoutis and 5 cats using a visual stimulus void of orientations, the classical whole-field checkerboard. We computed the mean and preferred spiking activity recorded during visual stimulation with different temporal (TF, 2, 4 and 8 Hz) and spatial frequencies (SF, 0.04, 0.08, 0.16, 0.32, 0.64, 1.28, 2.56 cyc/deg) and related the distribution of SFs and TFs evoking the best response to the position of the neuron's RF in the visual field. Neurons with defined receptive fields and a significant response to one of the SF x TF combinations (n=106 agouti area17, n=48 cat area 17; n=42 cat area 18) were analyzed. As expected from a lower ganglion cell density in the peripheral upper and lower Agouti retina, we observe a slight but significant decrease of preferred SF (F-test; F=10.2, p=0.002), and a tendency to increase of preferred TF with increasing elevation of RFs. In agreement with similar densities along the visual streak we observe no variation in SF or TF preference up to 120deg eccentricity. Results are compared to cat RFs which confirm a rapid and significant increase in preferred TF towards larger eccentricities in both areas 17 (F=16.6, p=0.0002) and 18 (F=7.46, p=0.01) compatible with an increase of the y-x-ratio towards the peripheral retina. Our results imply that the Agouti exhibits moderate SF selectivity (median 0.32 cyc/deg) across most of its visual field.

P28 - ANALYSIS OF THE PRESENCE OF AUTOANTIBODIES AGAINST CENTRAL NERVOUS SYSTEM TARGETS IN MOTHER-CHILD PAIRS WITH CONGENITAL ZIKA VIRUS EXPOSURE

Vivian Becker[1]*, Samantha Cavalcante[1], Carolina Aguiar[2], Nívia Arrais[4], Selma Jerônimo[3], Eduardo Sequerra[1]
[1]Brain Institute, Federal University of Rio Grande do Norte, Natal, Brazil
[2]Scientifc Initiation Program, Empresa Brasileira de Serviços Hospitalares, Januario Cicco Maternity School, Natal, Brazil
[3]Tropical Medicine Institute, Federal University of Rio Grande do Norte, Natal, Brazil
[4]Pediatrics Hospital, University Hospital Onofre Lopes, Federal University of Rio Grande do Norte, Natal, Brazil
*vivian.becker.141@ufrn.edu.br

The infection of the fetal central nervous system (CNS) by Zika virus (ZIKV) causes malformations. However, it also causes inflammation. It is currently unknown to what extent the immune response can cause these malformations. To have a window of the immune response that occurred in the past, we decided to analyze the blood serum collected from pairs of mothers and children with ZIKV-derived microcephaly for the presence of neural autoimmune antibodies. The samples were collected when the children were approximately two years old (692 ± 87 days, standard deviation). We analyzed the serum samples in ELISA essays using adsorbed antigens to identify the patient's antibodies against it. The group of mothers had a higher expression of antibodies against ZIKV and the four dengue virus serotypes than their CZVS children, suggesting an immature response to viral by the fetuses. To test if the maternal immune system produced antibodies against the embryonic CNS and not against her own, we chose the protein ENGRAILED1. Few brainstem neurons express this homeobox transcription factor in adults, but it is highly expressed in the embryonic rhombencephalon and participates in its patterning. Data shows that mothers of patients with congenital Zika syndrome (CZVS) had higher levels of IgG and IgM against the ENGRAILED1 protein (ENG-1), while the children had only elevated ENG-1 IgM. To confirm the presence of neural autoantibodies in the blood of the mothers, we tested their sera with a commercial ELISA assay for the detection of autoantibodies against a basal ganglia antigen (typically used in patients with motor deficits and suspicious autoimmune encephalitis). Our results show that both mothers and CZVS patients have

a higher expression of auto IgG against the basal ganglia antigen. However, there is no correlation between the patients' ENG-1 IgG or IgM expression. These data suggest that part of the pairs of mothers-microcephalic children kept an immunological memory of the fetal CNS viral infection in the form of neural autoantigens.

Funding: CAPES, ICGEB, EBSERH

P29 - THE DEVELOPMENT OF SOCIAL GROOMING IN CALLITHRIX JACCHUS

Campos ACM[1], Santos SCL[1], Takahashi DY[1]
[1]Brain Institute, UFRN, Natal, Brazil

Among primates, social grooming serves both as a hygiene mechanism and as a tool for maintaining group cohesion and social bonds. Callithrix jacchus (common marmosets), are cooperative breeders, in which grooming is central to their social dynamics. Despite their relevance, the factors influencing the development of grooming behavior remain poorly understood. Our study aimed to investigate how grooming behaviors emerge and develop in infant marmosets, focusing on the influence of sex and genetic relatedness. We observed 10 captive infant marmosets (5 males, 5 females) from three different colonies (A, B, E) over 66 days, from 91 to 157 days of postnatal age. Behavioral data were collected using focal animal sampling, encompassing multiple behaviors. Here we emphasize solely active grooming (when the focal animal grooms another) and passive grooming (when the focal animal is groomed by another). Data were analyzed using Spearman correlations and hierarchical clustering to explore patterns in grooming trajectories. Our results revealed that sex significantly influenced passive grooming, with hierarchical clustering showing distinct trajectories for males and females. Meanwhile, active grooming did not show a clear association with sex or family structure, suggesting that a different mechanism might be involved in its development. While limited by a small sample size and captive conditions, our study sheds light on the ontogeny of grooming in C. jacchus, thus adding to the growing literature on the evolutionary origins of primate social behaviors.

P30 - DEVELOPMENT OF COMPUTER VISION PIPELINES FOR IDENTIFYING, TRACKING AND CLASSIFYING MARMOSET SOCIAL BEHAVIORS IN COMPLEX ENVIRONMENTS

Breno Oliveira[1]*, Daniel Yasumasa Takahashi[1]
[1]Brain Institute, UFRN, Natal, Brazil
*BrenoB99@Protonmail.com

The study of the social behavior of marmosets is a valuable means to examine and understand behavioral patterns in humans and other primates. This is primarily due to the notable similarities in their social organization and interactions. The research on the social behavior of primates has shown notable development due to the continuous evolution of advanced tracking and classification tools, alongside the sophisticated study of deep neural networks, to identify and monitor these behavioral patterns accurately. One significant challenge encountered in this research is the over-specialization of cutting-edge tools for few species, like rodents. While these tools are highly effective for their intended purposes, they are often poorly optimized for use in other species, like primates. To address this issue, our project is developing a comprehensive pipeline focused on tracking marmosets' social interaction. This pipeline utilizes technologies such as YOLO (You Only Look Once) with instance segmentation for precise identification of individuals, OpenCV for advanced image processing tasks, and deep learning frameworks like TensorFlow to accurately identify and classify behaviors. Currently, the project is in the model training phase for tracking instances of social interaction between marmosets. Our tracking model has already demonstrated high accuracy in detecting social itneraction, achieving between 88% and 90% precision when deployed in controlled environments.

P31 - AUTOMATED SOURCE CLASSIFICATION OF MARMOSET VOCALIZATIONS

Pedro A. Varela[1], José F. Rodrigues[1], Hjalmar K. Turesson[2], Daniel Y Takahashi[1]
[1]Brain Institute, UFRN, Natal, Brazil
[2]York Institute

Marmosets (Callithrix jacchus) exhibit remarkable vocal flexibility, a trait they share with humans, making them valuable models for studying the evolution of vocal communication. Their complex vocal communication and highly social nature provide insights into social behaviors and potential parallels to human speech evolution. Studying group-level vocal dynamics is essential for understanding vocal interactions within a group, as it offers deeper insights compared to studies focusing on dyadic interactions. However, identifying the source of each vocalization in a group context is challenging due to the complexity of calls and fast-paced exchanges, making manual labeling by specialists very difficult. To address this, the InceptionResNet V1 convolutional neural network, originally developed for facial recognition, was employed to automatically and accurately identify the source of each call. In this study, phee calls from nine marmosets, including four pairs of twins aged 8-84 days, were analyzed, with 85% of the data used for training and 15% for testing the model. The model achieved classification precision ranging from 86.73% to 92.59%, depending on the individual, with minimal confusion between twins (maximum misclassification rate of 5.14%) and demonstrated the ability to distinguish individuals during the early stages of vocal development.

ACKNOWLEDGMENTS



BRAIN INSTITUTE

9th HOUSE SYMPOSIUM

UFRN CAMPUS

NATAL

DECEMBER 05-06, 2024

https://neuro.ufrn.br/housesymposium/