Meeting of the NeuroLeman Network and Doctoral Schools 2026 (NLN'26)

ABSTRACT BOOK

September 4-5, 2026
Leysin

Unil. UNIVERSITÉ DE GENÈVE EPFL

Abstracts in alphabetical order

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Adamou Kabirou

Generation of human iPSC-derived retinal organoid models to study the physiological and pathophysiological role of FAM161A

Kabirou Adamou[1], Ning Chang[1], Mélissa Gilles[2], Vasiliki Kalatzis[2], Yvan Arsenijevic[3], Virginie Hamel[4], Corinne Kostic[1]

[1]Dpt of Ophthalmology, Hôpital Ophtalmique Jules Gonin, University of Lausanne, Fondation Asile des aveugles, [2]Institut des Neurosciences de Montpellier, Inserm1298, [3]Dpt of Biomedical Sciences, University of Lausanne, [4]Dpt of Molecular and Cellular Biology, University of Geneva

Retinitis pigmentosa (RP) is the most common inherited retinal degenerative disease presenting a rod-cone dystrophy causing night blindness, peripheral vision loss, and ultimately blindness. Mutations in FAM161A causes the subtype RP28. FAM161A is a microtubule-binding protein located in the inner scaffold of the connecting cilium (CC), essential for photoreceptors integrity. Loss-of-function mutations cause CC collapse and photoreceptors degeneration. We previously demonstrated gene therapy proof-of-concept by rescuing retinal structure and function in a Fam161a knockout mouse model using human long (HL) and short (HS) FAM161A isoforms. However, translation is complicated by limited sequence conservation between mouse and human protein, alongside isoform expression differences. To address this, we are characterizing FAM161A expression, localization, and function in healthy and knockout human retinal organoids (hROs). Using ACD's BaseScope™ in-situ hybridization, we analyzed the spatial and temporal dynamics of FAM161A transcripts. Preliminary results showed dynamic HL and HS transcript changes during hRO differentiation, with HL predominantly nuclear and HS largely cytoplasmic. Further studies will determine if this reflects distinct protein localization or function. In parallel, we generated FAM161A-KO iPSC lines using Cas9 nickase with sgRNAs targeting exon 3, which encodes part of the microtubule-binding domain. After clonal selection, sequencing and pluripotency confirmation, 2 clones were differentiated into hROs. By differentiation day (DD) 120, no obvious phenotype has been observed, which is consistent with the expected timing of photoreceptor maturation, as the CC and outer segments begin to develop only after approximately DD170. To translate gene therapy rescue from the KO mouse model to human cell model, we will deliver both isoforms of human FAM161A using AAV5 vectors to DD120 hROs. Then, treated and non-treated FAM161A-KO hROs will be monitored until DD250 to determine gene therapy effect. Overall, our models are crucial for revealing FAM161A disease mechanisms and translating this therapy into clinical trials.

Akhavan Sara

Longitudinal Trajectories of Interpersonal Motor Synchrony in Autistic Preschoolers Undergoing Early Intervention: A Markerless Pose Estimation Framework

Sara Akhavan[1], Nada Kojovic[1], Thibaut Chataing[1], Iliana Ilaridou[1], Thomas Maillart[1], Marie Schaer[1]

[1]University of Geneva

Interpersonal motor synchrony (IMS) has been proposed as a core component of social interaction and is reported to be reduced in autistic children. However, little is known about how IMS changes during early development or whether it is modified by intervention. In this longitudinal study, we investigate the evolution of IMS in preschool-aged autistic children participating in the Early Start Denver Model intervention programme. Using our previously validated computer vision pipeline, which combines identity tracking (SAM 2.1) with pose estimation (RTMPose), we extract movement trajectories from repeated intervention sessions and subsequent ADOS assessments. We then quantify child–assessor synchrony using Dynamic Time Warping. Specifically, we investigate whether IMS changes over the course of intervention, whether these changes are also reflected in subsequent ADOS assessments. By applying objective, markerless motion analysis to longitudinal data, this study aims to characterise developmental trajectories of IMS and explore whether IMS may serve as an objective marker of intervention-related change in autism.

Asadi Saina

Microstructure basis of structure-function coupling across human resting state networks

Saina Asadi[1], Arthur Spencer[1], Jasmine Nguyen-Duc[1], Yasser Alemán-Gómez[1], Juanli Zhang[2], Michael Chan[3], Alexandre Cionca[3], Dimitri Van De Ville[4], Patric Hagmann[1], Ileana Jelescu[1]

[1]Lausanne University Hospital (CHUV), University of Lausanne, [2]Geneva University Hospital, University of Geneva, [3]École Polytechnique Fédérale de Lausanne (EPFL), [4]École Polytechnique Fédérale de Lausanne (EPFL), University of Geneva

Introduction: Functional signal efficiency is physically constrained by white matter (WM) microstructure, including axon morphology and myelination1,2. Because macroscale streamline counts (NoS) lack biological specificity, they fail to explain transmodal decoupling3. Therefore, we aim to investigate the biophysical basis of structure-function (SC-FC) coupling. By modeling partial correlation functional connectivity (pcFC) as a function of Standard Model parameters4, we assess the microstructural constraints governing distinct resting-state networks (RSNs), hypothesizing they exhibit unique microstructural profiles reflecting specific physiological and computational demands. Methods: 66 subjects (age 22–36 years, 29 males) from the Human Connectome Project (HCP) were included, utilizing T1-weighted images, high-resolution DWI data and resting-state fMRI preprocessed via standard HCP pipelines. Tractography data was obtained from MultiConn Scale 4 atlas5 with 472 regions of interest. Standard Model4 microstructure parameters (axon water fraction (f), intra/extra-axonal diffusivities (Da, De,∥ and De,⊥), fiber alignment (p2)) were averaged along probabilistic streamlines. NoS served as a macroscale baseline and mean fiber length was extracted as a spatial covariate. SCs were averaged across subjects. Direct functional coupling was estimated using a Tikhonov-regularized precision matrix (partial correlation; pcFC) applied to low-pass filtered resting-state BOLD signals. Matrices were Fisher z-transformed and group-averaged. Node-wise dominance for SC-FC coupling was assessed using a competitive linear regression, modeling each region's pcFC profile using the structural metrics. After controlling for fiber length, the metric yielding the maximum standardized ß was defined as that node's "dominant driver." Binomial tests evaluated whether specific parameters significantly dominated a given Yeo-7 RSN6 above chance level (16.7%). Results: Regions dominated by NoS appeared dispersed across the brain, lacking a clear spatial pattern. In contrast, regions driven by microstructural parameters showed spatial clustering consistent with functional anatomy, notably with diffusivity-driven nodes aggregating in posterior sensory regions and density-driven nodes clustering in motor and control areas. Binomial tests revealed significant network-specific heterogeneity, identifying three distinct profiles: f was the significant dominant predictor the Somatomotor network (52% of regions; $p < 10\text{-}8$), Ventral Attention (38%; $p < 10\text{-}3$), and Default Mode Networks (36%; $p < 10\text{-}4$), indicating that coupling in these networks is primarily predicted by axon density or axonal packing. Conversely, Visual network (41%; $p < 10\text{-}5$), Dorsal Attention network (42%; $p < 10\text{-}4$), and subcortical regions (50%; $p < 10\text{-}4$) were primarily driven by De,∥. The Limbic network was uniquely driven by p2 (43%; $p < 0.005$), while the Fronto-Parietal network exhibited a heterogeneous reliance on multiple features without a single dominant driver above chance. Conclusions: These findings demonstrate that SC-FC coupling is spatially heterogeneous and constrained by specific WM microstructure properties rather than macroscale topology alone. By integrating microstructural imaging with direct functional coupling, we identify a distinct microstructural hierarchy across the human cortex: action and integration networks are constrained by axonal packing, sensory and attention networks by extra-axonal diffusivity, and limbic circuits by fiber alignment. These findings suggest that the human brain optimizes different biophysical properties of the WM scaffold, to meet regional computational demands.

Awada Jade

A Longitudinal and Reproducible Anti-coactivation Pattern Between the Cerebellum and the Ventral Tegmental Area Relates to Apathy in Schizophrenia

Jade Awada[1], Farnaz Delavari[1], Thomas Bolton[1], Fares Alouf[1], Fabien Carruzzo[1], Noémie Kuenzi[1], Mariia Kaliuzhna [1], Tal Geffen[2], Terresa Katthagen[2], Florian Schlagenhauf[2], Dimitri Van De Ville[3], Stephen Eliez[1], Stefan Kaiser[4], Indrit Bègue[1]

[1]University of Geneva, [2]University of Berlin, Center Charité, [3]Ecole polytechnique de Lausanne, [4]Hopitaux Universitaires de Genève

Background Negative symptoms of schizophrenia lack effective treatments. Anomalies in the reward system and cerebellum have been linked to these symptoms. The cerebellum modulates reward circuitry via the ventral tegmental area (VTA). The "cognitive dysmetria theory" posits that reduced cerebellar inhibition in schizophrenia may underlie striatal hyperdopaminergia. However, the role of cerebellum-VTA connectivity in negative symptoms remains unclear. Methods From 427 individuals screened, 146 were recruited: 90 with schizophrenia (SZ) and 56 healthy controls (HC). At 3 months (T2), 65 individuals (36 SZ, 29 HC) completed follow-up. SZ participants were invited for clinical interviews at 9 months (T3; 33 SZ). After quality check, 105 participants were retained at T1, 41 at T2, and 21 at T3. A validation cohort included 53 individuals (28 SZ, 25 HC). The Brief Negative Symptom Scale quantified negative symptoms. Dynamic functional connectivity of the cerebellum and VTA was analyzed using coactivation patterns analysis. Results A reproducible cerebellum-VTA anti-coactivation pattern was found across T1 and T2 ($r = 0.98$) in bilateral paravermal Crus I/II. Anti-coactivation emergence at T1 correlated negatively with apathy, particularly asociality and avolition. At T2, anti-coactivation persistence related negatively to apathy, especially anhedonia, and to anhedonia at T3. Similarly, reduced emergence at T2 was linked to worse asociality at T3. In the validation cohort, we replicated the pattern ($r = 0.93$), and its emergence negatively correlated with apathy, particularly asociality. Conclusion Reduced cerebellum-VTA anti-coactivation is a reproducible neural marker of apathy in schizophrenia, highlighting its potential as a therapeutic target.

Badina Aurelien

Spatial multi-omics identifies a plaque-distant white-matter-like inflammatory field in Alzheimer's disease hippocampus

Aurélien Badina[1], Eleonore Raveloson[1], Quentin Amossé[2], Philippe Millet[1], Benjamin Tournier[1]

[1]Université de Genève, [2]Université de Lausanne

Alzheimer's disease (AD) is defined by amyloid-β (Aβ) plaques and tau tangles accumulation, and neuroinflammation thought to damage neurons. But these lesions do not fully explain when and where inflammatory pathology emerges in human hippocampus. Here, we characterize AD-associated glial activation and inflammation relative to plaque location. We analyzed human postmortem hippocampus using 10x Visium spatial transcriptomics with Aβ plaque annotation (control n=7, AD n=9; Braak I-VI), bulk DIA proteomics (control n=6, early AD n=12, late AD n=13; Braak II-VI), public single-nucleus reference deconvolution, and an independent immunohistochemistry cohort spanning young, Aβ-negative control, Aβ-positive non-demented, early AD, and late AD cases (n=54). Spatial models were run within histology-defined grey-matter-like (GML) and white-matter-like (WML) hippocampal compartments, preventing plaque distance from acting as a proxy for compartment identity. Aβ plaques were much more present in neuron-rich compartments. 8.10% of GML spots were plaque-positive versus 1.27% of WML spots, a 6.4-fold difference. In contrast, inflammation was stronger in WML, far from neuron-rich compartments. A pre-specified 49-module inflammatory taxonomy identified a plaque-distant WML field enriched for reactive-glial, extracellular-matrix remodeling, iron-handling, complement, AGE-RAGE/NF-κB, glymphatic, and ferroptosis-related programs. Thirteen modules showed the WML-far/GML-near pattern, with slide-level directional concordance across compartment and diagnosis cells. In proteomics, six field modules increased with continuous Braak stage after adjustment for age, sex, and postmortem delay, and a composite FrontIndex tracked Braak severity. Cell-type deconvolution attributed the field mainly to astrocytes, microglia, and a glio-vascular axis; nine of ten pre-specified cellular predictions were recovered. In the IHC cohort, Aβ-positive non-demented cases retained low IBA1 signal whereas early AD showed marked microglial activation, supporting plaque insufficiency as an explanation for inflammatory state. These data indicate that AD hippocampus contains a plaque-distant, WML-enriched inflammatory field that is glial, temporally progressive, and oxidative/carbonyl-stress-compatible. Rather than treating neuroinflammation as only a local response to plaques, this framework identifies WML glial and glio-vascular biology as a candidate driver or amplifier of disease progression. Inflammation thus seems to start far from Aβ plaques, and progress inwards neurons with the disease.

Baldoni Valerio

Acute-phase inflammatory markers are associated with long-term emotion recognition following SARS-CoV-2 infection

Valerio Baldoni[1], Anthony Nuber-Champier[1], Gautier Breville[2,3], Léonardo Céravolo[1], Katja Schlegel[3], Philippe Voruz[1,3], Isabele Harumi Jacot De Alcantara[1,2], Patrice Lalive[2,4], Frédéric Assal[2,4], Julie Péron[1,2]

[1]University of Geneva, [2]University of Pennsylvania Health System, [3]University of Bern, [4]University Hospital of Geneva

Abstract Background: SARS-CoV-2 infection induces a strong acute inflammatory response, but its long-term impact on socio-emotional cognition remains unclear. Objective: To determine whether inflammatory markers measured at hospital admission are associated with later multimodal emotion recognition performance. Methods: In a post-COVID cohort, leukocyte and cytokine levels measured during acute infection were related to emotion recognition performance assessed ~6 months later using a validated multimodal task. Associations were tested using generalized linear mixed models adjusted for age and sex, with false discovery rate correction. Emotion recognition performance was compared exploratorily with an independent control group. Results: As we have had to repeat the analyses for statistical and methodological reasons, the results will be available shortly. Conclusions: Acute-phase peripheral inflammation is associated with long-term multimodal emotion recognition, supporting a link between early immune activation and socio-emotional abilities after COVID-19.

Born Maren

Seeing Myself Sick: Embodying an Infected Virtual Face Alters Behavioral and Immune Responses

Maren Born[1], Gioele Crespi[2], Georgia Papadopoulou[3], Sara Trabanelli[3], Camilla Jandus[3], Andrea Serino[1]

[1]University of Lausanne, [2]IMT School for Advanced Studies Lucca, [3]University of Geneva

The immune system must discriminate between self and non-self. While external agents may pose threats, the self requires continuous monitoring and protection. Previous work has shown that approaching infectious virtual avatars elicit anticipatory immune responses, suggesting that disease cues prepare the immune system before infection occurs. However, it remains unknown whether these responses change when disease cues are experienced on a face perceived as one's own. Because self-representations are flexible and can be altered through multisensory integration, we used a virtual mirror paradigm to investigate whether embodying an infected virtual face influences subjective embodiment and immune activation. In Experiment 1, we first asked whether participants could embody a virtual face displaying visible signs of infection. Participants viewed either a neutral or an infectious avatar whose movements either mirrored their own or were randomly generated. Mirroring produced robust enfacement, with higher ownership and agency ratings than the random movement condition. Importantly, visible signs of infection did not reduce participants' ability to embody the virtual face. In Experiment 2, participants viewed an infectious avatar whose movements either mirrored their own or were randomly generated, allowing us to compare immune responses to infection cues presented on an embodied virtual face versus a non-embodied virtual face. Embodiment was assessed using questionnaire measures and an implicit self-recognition morphing task. Capillary blood samples were analyzed using a BioLegend neuroinflammatory panel. Preliminary analyses revealed lower circulating CCL2 levels following exposure to the mirroring infectious avatar. Moreover, stronger subjective embodiment (ownership and agency) was associated with lower CCL2 levels in the mirroring cohort, suggesting that the degree to which participants embodied the infected virtual face predicted the magnitude of the immune response. Together, these findings suggest that anticipatory immune responses are shaped not only by the presence of disease cues but also by whether those cues are perceived on one's own body or on another person's body. More broadly, they provide initial evidence that flexible self-representations can influence immune-related processes, with the strength of embodiment predicting the biological response.

Bourgeois Mathieu

Quantitative instrumented assessments of lower-limb motor tasks in children with cerebral palsy: a scoping review

Mathieu BOURGEOIS[1], Nawale HADOUIRI[2], Nathalie DE BEUKELAER[1], Alice BONNEFOY-MAZURE[1], Marine CACIOPPO[1], Mathieu GUEUGNON[2], Stéphane ARMAND[1]

[1]University of Geneva, [2]Université de Dijon

Children with cerebral palsy (CP) are mainly evaluated in laboratory setting using instrumented clinical gait analysis. However, according to the International Classification of Functioning, Disability and Health (ICF), daily mobility relies on a broader spectrum of functional movements, such as running, jumping, and kicking, which are crucial for autonomy and social participation. Furthermore, level walking may not provide sufficient biomechanical challenge for children with mild CP, potentially masking subtle motor deficits. Consequently, tasks beyond walking need to be evaluated to gain a better overview of motor capabilities. Although emerging tools like inertial sensors and markerless motion capture offer the potential to analyse these complex functional movements in daily-life environments, their use in CP remains limited, as does the range of tasks assessed. Which motor tasks are utilized to assess lower-limb motor skills in children with CP, and what are the associated quantitative instrumented tools, environmental contexts, and clinical utilities? Methods Initially registered in PROSPERO as a systematic review (CRD420251131322), the protocol was adapted to a scoping review conducted following the PRISMA Extension for Scoping Reviews (PRISMA-ScR) guidelines. Using the Population–Concept–Context framework, PubMed and EMBASE were searched from inception to May 2025 for studies quantitatively assessing non-walking lower-limb motor tasks in children with CP (6–18 yrs) using instrumented methods. Two reviewers screened records and extracted data on task types, measurement tools, protocols, environmental contexts, and biomechanical outcomes. Seventy-two studies were included (1,775 children; mean age 10.3±2.6 yrs), predominantly involving spastic diplegia or hemiplegia, classified as GMFCS I (42%) or II (32%). Thirteen motor tasks were identified. Sit-to-stand (n=23) and running (n=15) were most frequent (53%), followed by cycling (n=8) and stair negotiation (n=7). Assessments were overwhelmingly laboratory-based, primarily utilizing force plates (n=43) and optoelectronic systems (n=41) to generate spatiotemporal, kinematic, and kinetic outcomes. Portable/emerging tools were rare: inertial sensors appeared in three studies, only four assessed tasks outside the laboratory, and none employed markerless capture. Despite the diversity of tasks identified, non-walking assessments remain underrepresented compared with level walking, with sit-to-stand and running predominating among ambulant children. The reliance on force plates and optoelectronic systems confines assessments to the laboratory, capturing a child's capacity under controlled conditions rather than their capability or performance in daily life, as distinguished by the ICF framework. Selecting an appropriate task requires balancing the clinical question, the child's functional level, and feasibility, scaling mechanical demand to functional capacity to avoid floor and ceiling effects; high-challenge discrete tasks appear necessary to unmask subtle deficits in mildly affected children. Bridging laboratory and daily-life assessment will require rigorously validated and responsive portable tools able to measure motor tasks in ecological environments.

Bouzourène Narimane

Chronic unpredictable stress during the adolescent sensitive period induces sex-specific prefrontal microglial remodeling and differential astrocytic responses to extracellular vesicles in vitro

Narimane Bouzourène[1], Aatmika Barve[1], Valentin Zufferey[1], Kevin Richetin[1], Benjamin Boutrel[1]

[1]Lausanne University Hospital

Chronic mild unpredictable stress (CMUS) during adolescence, a developmental window of heightened prefrontal-limbic plasticity, triggers sex-dependent trajectories: externalizing manifestations are more frequently reported in males, while internalizing phenotypes predominate in females. The biological mechanisms underlying these divergent outcomes remain poorly understood, particularly regarding sex-specific neuroimmune responses. We therefore investigated stress-induced prefrontal microglial remodeling and, since extracellular vesicles (EVs) carry molecular cargo reflecting the physiological state of their tissue of origin, tested whether PFC-derived EVs from stressed animals modulate astrocytic responses in vitro. Wistar Han male and female rats were exposed to a CMUS paradigm during adolescence. Disinhibited behavior was assessed using the Elevated Plus Maze. Ex vivo microglial morphology was analyzed in the PFC. EVs were isolated from the PFC and applied to primary astrocyte cultures monitored for up to 72 h. EV protein cargo was profiled using quantitative proteomic approaches. CMUS induced behavioral disinhibition in males only. Ex vivo analyses revealed more pronounced stress-induced microglial morphological remodeling (ameboid shape) in female PFC. Proteomic analyses of PFC EV cargo further revealed sex-dependent compositional shifts following stress. Preliminary astrocyte assays showed that EVs from stressed males elicit more pronounced cellular responses compared to female donors. Our findings demonstrate that adolescent stress produces sex-dependent prefrontal neuroimmune adaptations encompassing microglial morphological remodeling and altered astrocytic responses to stress-derived EVs. These results highlight sex as a critical biological variable shaping the neuroimmune consequences of adolescent adversity and support the use of PFC-derived EVs as molecular probes of sex-specific stress vulnerability.

Bratschi Catherine

Neural and autonomic response to daylight vs. electric light exposure in naturalistic settings

Catherine Bratschi[1], Marilyne Andersen[1]

[1]EPFL

Light constitutes a major regulator of human physiology and behavior. Yet its influence on brain function has predominently been investigated using highly simplified laboratory stimuli poorly reflecting real-world exposure patterns. Human neurophysiology evolved under dynamic daylight conditions characterized by continuous spectral, temporal, and spatial variation, whereas modern indoor environments increasingly rely on electric lighting, which drastically differs from daylight in terms of both physical and perceptual properties. Whether these differences influence neural and autonomic regulation beyond what is captured by current melanopsin-based metrics remains largely unknown. The present study investigates whether daylight and electric lighting differentially modulate prefrontal activity, cognitive performance, and autonomic regulation under ecologically valid conditions. A multi-day within-subject protocol was conducted in office-like environments comprising four carefully controlled lighting conditions designed to isolate physical and perceptual properties of daylight while maintaining comparable photopic illuminance and, where applicable, melanopic equivalent daylight illuminance (mEDI). Participants completed two consecutive days of exposure per condition while engaging in typical office work interspersed with repeated cognitive assessments and resting-state measurements. Prefrontal cortical activity was measured using functional near-infrared spectroscopy (fNIRS) during executive-function tasks and resting-state periods. In parallel, autonomic and metabolic variables were continuously monitored through heart rate, heart-rate variability, electrodermal activity, core body temperature, sleep, and individual light exposure measurements. This multimodal approach enables characterization of neural and physiological responses to prolonged environmental light exposure across both acute and cumulative timescales. Ongoing analyses examine whether natural daylight elicits distinct patterns of prefrontal activation and autonomic regulation compared with electrically lit environments despite equivalent melanopic stimulation. By integrating measures of cortical function, cognitive performance, and autonomic physiology in a naturalistic setting, this work aims to advance understanding of how environmental light shapes brain-state regulation and brain–body interactions in everyday life.

Brosset Soraya

Subcortical Contributions to Visuospatial Attention: Pulvino-cortical Functional Connectivity and Spatial Bias

Soraya Brosset[1], Carole Guedj[2], Riccardo Galli[1], Frederic Grouiller[2], Patrik Vuilleumier[1]

[1]UNIGE, [2]CIBM Center for Biomedical Imaging

Visuospatial attention research has been for decades mainly cortico-centric. Yet, emerging evidence indicates that subcortical structures also play essential roles, such as the pulvinar which is the largest thalamic nucleus and highly connected to the cortex. In some attention tasks, healthy subjects tend to exhibit a systematic spatial bias toward one hemispace, most often the left side (right pseudoneglect). The neural basis of this bias remains unresolved. Understanding whether resting-state pulvino-cortical interactions predict the strength of this spatial bias may provide novel insights into the subcortical contributions to visuospatial attention. Fifteen healthy participants performed a Landmark bisection task to quantify their individual spatial bias. Based on task performance, participants were classified into high-bias and low-bias groups using a median split. Resting-state fMRI data were then preprocessed and analyzed with the CONN functional connectivity toolbox using an atlas-based approach. Left and right pulvinar were examined separately in relation to cortical networks defined by the Yeo 2011 atlas. The left pulvinar shows no significant connectivity in either group. The right pulvinar shows a differentiated connectivity profile depending on the magnitude of the bias: negatively connected to the Ventral Attention Network (VAN) in subjects with the strongest bias, but positively connected with Somatosensory, Dorsal Attention (DAN) and Limbic networks in those with weaker bias. These preliminary results suggest that individual spatial attention asymmetries are reflected in differential right pulvinar connectivity patterns, supporting subcortical contributions to visuospatial attention with right-hemisphere dominance. These findings require confirmation from a larger cohort.

Brügger Talayeh Sadat

Astrocytic Mitotypes: Mapping Region-Specific Mitochondrial Function in Health and Alzheimer's Disease

Talayeh Brügger[1], Simone Crivelli[1], Jean-Yves Chatton[2]

[1]1University of Lausanne, Department of Fundamental Neurosciences, Lausanne, [2]1University of Lausanne, Department of Fundamental Neurosciences, Lausanne, 2University of Lausanne, Cellular Imaging Facility, Lausanne, Switzerland

Astrocytic mitochondria play a key role in shaping region-specific brain activity, yet their contributions remain poorly understood. Mitochondria, essential for brain homeostasis, exhibit distinct phenotypes known as mitotypes across cell types and regions, reflecting specialized metabolic and functional profiles. To investigate astrocyte-specific mitochondrial function, we implemented immunocapture of CPT1A (carnitine palmitoyltransferase 1A)–a protein enriched in astrocytic mitochondria– in wild-type and Alzheimer's disease (AD) mouse models.

We first confirmed the enrichment of CPT1A in astrocytes relative to non-astrocytic cells using Western blot analysis and immunohistochemistry. We then established a method to immunocapture intact CPT1A-positive mitochondria from mitochondrial fractions isolated from adult mouse brain. Functional validation using Seahorse assays demonstrated robust mitochondrial respiration in CPT1A-positive mitochondria, whereas IgG control samples, which lacked mitochondria, showed no response. Western blot analysis further confirmed enrichment of CPT1A-positive mitochondria in the immunocaptured fraction compared to controls.

Using this approach, we are assessing the bioenergetic, proteomic, and lipidomic signature of region-specific astrocytic mitochondria isolated from the cortex, hippocampus, and cerebellum of wild-type mice. We will then compare hippocampal astrocytic mitochondrial profiles between wild-type and 5XFAD mouse model of AD.

Together, these studies will provide critical insight into the functional properties of astrocyte-derived mitochondria and establish a foundation for future mechanistic investigations into the interplay between mitochondrial biology, brain cell type, and brain region. Ultimately, this work may open new therapeutic avenues in precision medicine by targeting astrocytic mitochondria in neurodegenerative diseases such as AD.

Cambon Agathe

Testing pedagogical translanguaging for L2 French morphology among adult migrants

Agathe Cambon[1], Despina Papadopoulou[2], Julie Franck[1]

[1]Université de Genève, [2]Université de Thessalonique

In Switzerland, only 61% of adult migrants enroll in language training within their first five years of residence (OECD, 2025), and fewer than half of those reach an advanced level of proficiency. This shortfall is unlikely to stem from a lack of motivation, given that language learning is widely recognised as central to integration; a more plausible explanation is the scarcity of pedagogically adapted teaching approaches. The present study is a field replication of an earlier laboratory experiment by our research group, which assessed under controlled conditions the effectiveness of Pedagogical Translanguaging (PTL), a second language (L2) teaching approach that mobilises learners' entire linguistic repertoire. Building on the existing literature, we hypothesise that L2 learning draws on analogical processing from learners' prior linguistic knowledge (L1 and other languages) and should thus be enhanced by explicitly connecting the L2 to that knowledge. Conducted with 167 migrants learning L2 French, the study compares PTL, based on explicitly linking French to learners' native languages, with a traditional monolingual approach (ML) that relies on images as its primary support. We taught 32 French morphologically derived words using both a minimal pair of PTL and ML protocols. Participants' lexical and morphological knowledge was assessed both in comprehension and in production at three time points: a pre-test, an immediate post-test, and a delayed post-test administered one week later. Data collection is now complete, and the results are currently being analyzed. The transition from laboratory settings to real-world classrooms is a crucial step in validating experimental findings, and this study constitutes a direct effort to bridge that gap.

Camelot Léa

MECHANISMS GOVERNING THE DEVELOPMENT OF SYNAPTIC TRANSMISSION IN THE LATERAL HABENULA

Léa Camelot[1], Valentino Totaro[2], Tommaso Pizzorusso[2], Manuel Mameli [3]

[1]University of Lausanne , [2]University of Pisa, Scuola Normale Superiore, [3]University of Lausanne, Lausanne.

The lateral habenula (LHb) is a key brain region involved in processing negative stimuli and adaptive responses to aversive situations. While LHb function in adulthood is well characterized, how its synaptic properties evolve during development remains unclear. Perineuronal nets (PNNs), extracellular matrix structures known to regulate synaptic maturation in other brain regions, progressively accumulate in the LHb during development and are altered by negative experiences, suggesting their potential role in LHb synaptic function regulation. Using in vitro electrophysiology in acute brain slices, we show that excitatory synaptic transmission in the LHb differs between young and adult mice. Young mice display lower AMPA/NMDA ratios, slower NMDA receptor kinetics although similar subunit composition. Additionally, they show reduced spontaneous activity, and weaker burst firing. Importantly, degrading PNNs in adulthood recapitulates the AMPA/NMDA synaptic feature of LHb in young individuals. Behaviorally, PNN degradation in the LHb did not alter active avoidance or escape behaviors but modified behavioral strategies in an anxiety-related task. Together, these findings identify developmental changes in LHb excitatory transmission and support a role for PNNs in stabilizing synaptic function and regulating negative affect-related behaviors.

Canonne Chloé

Shedding Light on the Invisible: Mapping Brain Microstructure Using Diffusion Magnetic Resonance Spectroscopic Imaging

Chloé Canonne[1], Eduardo Sanches[1], Cristina Cudalbu[2], Gabriel Schirmbeck[1], Stéphane Sizonenko[1]

[1]Division of Child Development and Growth, Department of Pediatrics, Gynecology and Obstetrics, School of Medicine, University of Geneva, Geneva, Switzerland, [2]CIBM Center for Biomedical Imaging, Switzerland; Animal Imaging and Technology (AIT), EPFL, Lausanne, Switzerland

Background and aims: Perinatal hypoxic-ischemic (HI) brain injury is a leading cause of neonatal mortality and long-term neurodevelopmental disability. Although advanced neuroimaging techniques have improved the assessment of neonatal brain, they remain insufficient to resolve brain microstructure at the cellular level in vivo. Consequently, the evolution of microstructural alterations following injury remains poorly captured by current in vivo biomarkers (Douglas-Escobar et al., 2015). Diffusion Magnetic Resonance Imaging (dMRI), the current state-of-the-art in vivo approach for probing brain microstructure, provides sensitivity to tissue architecture through water displacement but lacks cellular specificity due to the non-selective water distribution across tissue compartments. In contrast, magnetic resonance spectroscopy (MRS) offers metabolite-based information with greater cellular specificity. In neonatal HI models, MRS has revealed early alterations in energy metabolism and excitatory neurotransmission, while enabling assessment of metabolic responses to neuroprotective interventions such as lactoferrin (Van de Looij et al., 2011; Sanches et al., 2021). In this study, we will integrate the cellular specificity of MRS with the microstructural sensitivity of dMRI through diffusion Magnetic Resonance Spectroscopic Imaging (dMRSI), a novel imaging modality enabling metabolite-resolved diffusion mapping of intracellular and extracellular compartments. Using a multimodal imaging approach, we will try to identify in vivo signatures of normal brain maturation and HI-induced alterations in newborn rats. Furthermore, using lactoferrin as a neuroprotective intervention with demonstrated preclinical efficacy (Schirmbeck et al., 2022), we aim to further characterize microscopic tissue responses associated with injury progression and therapeutic recovery. In this context, dMRSI is expected to provide in vivo characterization of microstructural alterations associated with normal brain maturation, injury, and neuroprotective interventions. Methods: Normal brain maturation will be assessed in Wistar rat cohorts at postnatal days P4, P7, P11, and P28. HI injury will be induced at P3 using a modified Rice-Vannucci model (right carotid artery ligation followed by 30 min exposure to FiO_2 6% at 37°C), with MRI performed at P4, P7, P11, and P28. A neuroprotective cohort will receive dietary lactoferrin from P3 to P28, with imaging at P4 (acute phase, 24 h post-injury) and P28 (long-term outcomes). Each animal will undergo MRI acquisition at a single imaging time point before sacrifice. Imaging will be performed under 1–2% isoflurane anesthesia with continuous monitoring of respiration rate and body temperature. The multimodal approach includes conventional dMRI for water-based microstructural contrast, multivoxel MRSI for spatial metabolite mapping, and dMRSI to probe metabolite-dependent diffusion behavior through combined diffusion weighting and spectroscopic specificity. Following imaging, animals will be perfused with saline followed by 4% paraformaldehyde. Brain tissue will be collected for immunohistochemistry and tissue clearing using the EZ-Clear protocol for volumetric cellular reconstruction. Cellular architecture will be assessed by IHC using neuronal, oligodendrocyte, and glial markers, enabling validation of the modelling and direct comparison between imaging-derived diffusion metrics and microstructural organization at the cellular level, enabling validation of the modelling. Conclusion: By combining metabolite-specific diffusion measurements with quantitative histological validation, dMRSI can provide the first non-invasive imaging framework capable of approaching microscopic characterization of brain tissue in vivo. This methodology may enable cell-specific investigation of normal brain maturation, neonatal HI-induced microstructural alterations and neuroprotective mechanisms while establishing a new generation of MRI biomarkers. We believe this approach can bridge conventional neuroimaging and histopathology and provide highly detailed prognostic information.

Cantando Iva

A reversible mitochondrial stress–senescence-like neuronal program links 22q11.2 hemideletion to prefrontal circuit dysfunction

Iva Cantando1,7, Eva Cristina De Oliveira Figueiredo1,7, Anthony Laugeray1, Laurine Gonzalez1, Farha Bouteldja1, Tamara Zehnder1, Jiafeng Zhou2, Noemie Belanger1, Silvia Di Angelantonio3, Daniela Rossi4, Claudia Bagni1, Franck Polleux5,6, Claudia Kathe1, Manuel Mameli1, Riccardo Bocchi2 and Paola Bezzi1,3

1. Dept. of Fundamental Neurosciences (DNF), University of Lausanne (UNIL), Lausanne, Switzerland; 2. Dept. of Basic Neurosciences, University of Geneva (UNIGE), Geneva, Switzerland; 3. Dept. of Physiology and Pharmacology, Sapienza University of Rome, Rome, Italy; 4. Laboratory for Research on Neurodegenerative Disorders, IRCCS Maugeri Clinical and Scientific Institutes SpA SB, Italy; 5. Dept. of Neuroscience, Columbia University, New York, NY 10032, USA; 6. Mortimer B. Zuckerman Mind Brain Behavior Institute, Columbia University, New York, NY 10032, USA; 7. These authors contributed equally.

22q11.2 deletion syndrome is one of the strongest genetic risk factors for schizophrenia and is associated with cognitive and behavioral abnormalities linked to altered prefrontal cortex maturation. Although mitochondrial dysfunction has been implicated in 22q11.2 deletion syndrome and schizophrenia, how early mitochondrial vulnerability is converted into persistent cortical circuit dysfunction remains unclear. Here, using the LgDel mouse model, we identify a reversible mitochondrial stress–senescence-like neuronal program in developing prefrontal excitatory neurons. Single-cell transcriptomics at postnatal day 14 revealed a cell-type-specific stress architecture, with excitatory neurons enriched for senescence-compatible, inflammatory, redox and p53-related programs. Orthogonal validation showed DNA damage response-associated γH2AX signaling, p21 induction, HMGB1 nuclear loss, SASP-like inflammatory activation and reduced Bcl2/Bcl-xL stress buffering, without widespread execution-phase apoptosis. Restoring BCL-xL/BH4-dependent mitochondrial stress buffering with TAT-BH4 reduced oxidative stress, rescued mitochondrial morphology, normalized BCL2-family balance and reversed γH2AX, p21, HMGB1 and inflammatory readouts. This molecular rescue was accompanied by recovery of dendritic architecture, excitatory synaptic input and selected PFC-dependent behavioral deficits, with effects persisting beyond the treatment window. These findings link 22q11.2 hemideletion to a reversible senescence-like neuronal stress trajectory and identify mitochondrial stress buffering as a mechanism coupling genetic risk to prefrontal circuit vulnerability.

Cataldo Eugenie

From object-centered perception to object-based neglect: mapping a ventral temporal network across intact and lesioned brain

Eugénie Cataldo[1], Thibaud Delavy[1], Giulia Marin[1], Prosper Fiave[1], and Ilaria Sani[1]

1 Department of Basic Neurosciences, Faculty of Medicine, University of Geneva, Switzerland.

Interacting with the world requires decoding where objects are, and how they are configured. Take your watch: knowing it is on your left wrist (viewer-centered location) does not help you stay on schedule unless you can read how the hands are arranged (object-centered configuration). Following stroke, patients may fail to attend to the side of space (viewer-centered neglect) or to the side of individual objects (object-based neglect) opposite their brain lesion. While viewer-based neglect is well documented, object-based deficits remain understudied, despite their impact on daily life. A recent task-based fMRI study from our group (Fiave & al., 2026) identified the posterior inferior temporal area (PIT) and the posterior parietal cortex (PPC) as critical nodes for object-centered perception. Here, we test the hypothesis that stroke-induced functional damage, or subsequent disconnections to the PIT-PPC axes disrupts the integration of object identity and spatial information, resulting in object-based spatial deficits.

To address this question, we recruited 26 subacute stroke patients and compared their behavioral and neural profile with those of 31 healthy participants tested in the previous study. All participants completed the same computerized task in which they viewed a visual stimulus and, under time constraints, made one of three judgments: an object-based (the object's intrinsic orientation), viewer-based (its orientation relative to the observer), or color judgment (control condition). Patients with object-based deficits were independently classified using neuropsychological tests. Finally, behavioral data were combined with resting-state functional magnetic resonance imaging (rs-fMRI) to evaluate whole-brain functional connectivity.

Behaviorally, stroke patients without clinically diagnosed object-based deficits generally maintained intact accuracy despite expected overall post-stroke response slowing. However, some individuals exhibited similar behavior to patients diagnosed with object-based deficits, demonstrating slowing of behavioral responses and lower accuracy, especially in object-based condition. This suggests that standard paper-and-pencil assessments may lack the sensitivity to detect more subtle object-based processing impairments. Regarding the brain, preliminary results indicate that stronger resting-state functional connectivity between the left posterior inferior temporal area (PIT) and the right intraparietal sulcus (IPS1) is associated with better performance in the object-based condition.

These findings suggest that object-based deficits may be underestimated by current neuropsychological tools and are linked to a damaged distributed network linking ventral temporal and dorsal attention systems. Expanding our current sample size will provide the necessary statistical power to validate these trends.

Centofanti Cristiana

Slc6a8Y389C knock-in rat model of Creatine Transporter Deficiency exhibits multisystemic alterations

Cristiana Centofanti[1], Pauline Léal [2], Marc Lanzillo[2], Eda Imeri[2], Lara Duran-Trio[2], Gabriella Fernandes-Pires[2], Jocelin Grosse [3], Stephen J. Bruce[2], Clothilde Roux-Petronelli[2], Cristina Cudalbu[3], Olivier Braissant [2]

[1] Service of Clinical Chemistry, Lausanne University Hospital and University of Lausanne, [2]Service of Clinical Chemistry, Lausanne University Hospital and University of Lausanne, [3]CIBM Center for Biomedical Imaging, Lausanne, Switzerland

Creatine transporter deficiency (CTD) is a still untreatable debilitating Inborn Error of Metabolism (IEM), X-linked and associated with loss-of-function mutations in the SLC6A8 gene encoding the creatine transporter responsible for cellular creatine uptake throughout body tissues. This is reflected in the clinical profile of patients characterized by intellectual disabilities, delayed speech development, seizures, movement disorders as well as distinct cardiac phenotypes. Our recently described Slc6a8Y389C knock-in (KI) rat model carries a patient-derived missense mutation that completely abolishes creatine transporter activity. Our previous results on 4-months-old KI male rats exhibits deficits in muscles development with no sign of muscle atrophy and altered neuronal connectivity in the cerebellum. These findings, together with altered behavioral outcomes in motor tests, indicate that our model recapitulates the main phenotypes of the disease. Our group newly aimed to explore the cardiac phenotype of our CTD model. Our results indicate a trend towards an increase in cardiomyocyte width in the KI group. This observation may suggest a compensatory structural adaptation to the disruption of the creatine-phosphocreatine system. At the same time, we measured the expression levels of specific calcium and potassium channels (Cav1.2 and Kv11.1), which are involved in the regulation of cardiac excitation-contraction coupling. Our findings suggest an overexpression of both proteins in the KI group compared with the WT one. This ion channels remodeling could be associated with alterations in the electrocardiogram (ECG) profile that have been previously reported in other murine models and in a recent clinical study.

Chataing Thibaut

Decoding the Non-Verbal Social Behavior of Autism from Body Movement

Marie Schaer[1], Thibaut Chataing[1], Thomas Maillart[1], Giuseppe Chindemi[2], Nada Kojovic[1], Camilla Bellone[1], Sara Seyed Akhavan[1]

[1]Faculty of Medicine, University of Geneva & Fondation Pôle Autisme, [2]ETH AI Center, ETHZ

Autism Spectrum Disorder is defined by differences in social interaction, yet these differences are still characterized almost entirely through subjective expert observation. We ask whether the social dynamics of a child–clinician interaction can offer insight into autism through an objective, interpretable vocabulary of movement extracted directly from body motion, without speech, faces, or diagnostic labels. We introduce HumanLISBET, a self-supervised spatiotemporal Transformer that adapts a rodent social-behavior model (LISBET) to human dyads. Working from 2D pose alone (17 keypoints per person, no audio or pixels), the model is trained with temporal contrastive objectives (order, shift, warp, group consistency) complemented by a new spatial-invariance task. We applied the pipeline to ADOS-2 recordings of 119 children (79 ASD, 40 TD; 15–47 months) from the Geneva Autism Cohort. Unsupervised two-stage clustering of the learned embeddings yields a vocabulary of 105 discrete dyadic behaviors. We validate these behaviors along two complementary axes. First, by crossing them with clinical knowledge: each self-supervised behavior is tested for enrichment during specific clinician-annotated moments relevant to diagnosis (e.g., name calling, shared enjoyment, sensory behaviors), and specific behaviors are significantly enriched during these events. Second, by confronting them with the diagnostic outcome: although diagnostic labels were never used during training, several behaviors show spontaneous ASD/TD separation and track ADOS-2 symptom severity (Spearman $r = 0.49$, $p < 0.001$), and a Bayesian accumulator over these behaviors discriminates ASD from TD children (weighted $F1 = 0.82$) from 10 minutes of recording. The convergence of these independent axes shows that a privacy-preserving, pose-only representation captures genuine social-behavioral structure, offering an objective and interpretable window onto the non-verbal phenotype of autism.

Chauveau Anna

Stem cell models highlight proteostasis defects as key features in genetic FTLD

Anna Chauveau[1], Clara Gaillard[2], Paolo Salvioni Chiabotti[2], Olivier Rouaud[2], Gilles Allali[2], Sylvain Perriot[2]

[1]CHUV-UNIL, [2]CHUV

Introduction Mechanistic understanding of Frontotemporal Lobar Degeneration (FTLD) is currently based on cardinal features defining the four neuropathological entities in FTLD and associated mutational genes. These include cytoskeletal abnormalities linked to MAPT mutations (tauopathy), RNA foci, dipeptide repeat proteins (DPRs) and autophagolysosomal dysregulation associated with C9orf72 repeats (TDP-43 proteinopathy) as well as lysosomal dysfunctions for GRN variants with progranulin (PGRN) haploinsufficiency (TDP-43 proteinopathy). However, emerging evidence suggests that proteostasis impairment may represent a convergent mechanism across FTLD forms. Objective We hypothesized that alterations in proteostasis represent common pathological events in the pathogenesis of FTLD. Thus, this study aims at characterizing dysfunctions in degradation pathways across FTLD subtypes using human induced pluripotent stem cells (hiPSC)-derived neuronal models. Methods Human iPSC lines carrying pathogenic mutations associated with major FTLD subtypes were differentiated into neurons: MAPT (FTLD-Tau), GRN (FTLD-TDP type A), TARDBP and TBK1 (FTLD-TDP type B), and CHMP2B (FTLD-UPS). We first characterized disease-associated hallmarks, including proteinopathies, neuronal function, and vulnerability. We then investigated autophagic and proteasomal pathways to assess proteostasis dysfunctions and establish kinetics of FTLD pathogenic hallmarks. Results We could observe mutation-specific molecular and cellular alterations associated with FTLD neuropathological hallmarks, such as proteinopathy-linked alterations and neuronal vulnerability. In addition, proteasomal/autophagic defaults were found across all FTLD subtypes as assessed by ubiquitin/p62 and lysosome stainings. Last, we are investigating if this dysfunction in the proteostasis pathways comes upstream to the proteinopathy. Conclusion By leveraging genetically defined hiPSC models, this study aims to identify shared proteostasis defects in FTLD, providing new insights into convergent pathogenic mechanisms.

Chippalkatti Vaibhav

Investigating the role of long-range corticocortical and thalamocortical projections in sensory perception

Vaibhav Chippalkatti[1], Foivos Markopoulos [2], Ronan Chéreau[1], Anthony Holtmaat[1]

[1]University of Geneva, [2]University of Geneva

Mice explore the world with their whiskers, and tactile signals reach whisker primary somatosensory cortex (wS1) via the thalamus. wS1 is driven by ventral posteromedial thalamus (VPM), but it is also shaped by long-range glutamatergic inputs from contralateral S1 (cS1) and the higher-order posteromedial thalamus (POm). How these pathways influence perceptual decisions remains unclear. Using electrophysiology in brain slices, neurogliaform cells (NGCs) were identified as synaptic targets of cS1 projections, and thus as potential key cellular mediators of this interhemispheric inhibition. We then tested whether this slice-defined circuit predicts behaviour. Head-fixed mice performed a lick-based detection task with varying whisker deflections while causal manipulations were applied. Silencing wS1 impaired detection, confirming its necessity. Activating cS1 projections in wS1 reduced detection relative to interleaved controls, and selectively activating NGCs produced a comparable suppression, matching the slice results. Stimulating POm with rhythmic whisker stimulation, or inhibiting POm chemogenetically, however, did not measurably shift psychometric performance. Together, these data identify an NGC-mediated transcallosal inhibitory gate on sensory detection, while POm manipulations under these conditions have limited behavioural impact. Ongoing two-photon imaging of pyramidal neurons (L2/3, L5) and layer 1 dendrites will link pathway-specific modulation to cortical neuronal dynamics during perception and learning.

Chiron Aimie

Identification of Ehlers Danlos Syndrome and Hypermobility spectrum disorders sub-phenotypes based on sensory and psychophysiological characterization with a focus on dysautonomia

Aimie Chiron[1], Paola Golay[1], Emma Desriac[1], Nicole Puskaric[1], Lucie Godot[1], Fabian Wüthrich[1], Lisa Burnier[1], Luzia Grabherr[1], Aurore Fernandez[1], Chantal Berna Renella[1]

[1]Center for Integrative and Complementary Medicine, Department of Anesthesiology, Lausanne University Hospital (CHUV)

Background: Hypermobile Ehlers-Danlos Syndrome (hEDS) and Hypermobility Spectrum Disorders (HSD) are heterogeneous connective tissue disorders characterized by chronic widespread pain, joint hypermobility, and multisystemic comorbidities including dysautonomia, small fiber neuropathy, gastrointestinal dysfunction and psychiatric comorbidities. Associated symptoms have predominantly been studied in isolation, limiting pathophysiological understanding. This study aims to extensively describe the hEDS/HSD phenotype, characterize interactions between affected systems, identify clinically meaningful subtypes, and uncover syndrome-specific biomarkers.

Methods: This observational study enrolls N=180 female participants with hEDS/HSD and N=90 controls across three data collection phases. Prior to the testing day, participants collect biological samples at home (saliva, 24-hour urine, stool) alongside standardized questionnaires and a food diary. On the testing day, a blood draw is performed, followed by small fiber neuropathy investigations, proprioceptive and interoceptive tasks, neuropsychological testing, functional neurological signs assessment, autonomic testing, and a structured psychologist-led interview on the history of symptoms and trauma. Participants subsequently complete a 7-day pain and intrusive images diary.

Expected Outcomes: The present thesis focuses on dysautonomia assessment within this cohort. Literature positions dysautonomia as a potential mechanistic hub connecting several systems affected in hEDS/HSD. Notably, a pilot study suggested that loss of small fiber function may be more pronounced in patients with dysautonomia. Autonomic dysfunction further intersects with central sensitization, neuroimmune activation, gastrointestinal dysmotility, and psychiatric comorbidities including anxiety and cognitive impairment. Mapping these intersections may help resolve whether dysautonomia is a driver, consequence, or parallel feature of hEDS/HSD multisystemic involvement. Preliminary findings from the dysautonomia assessment will be presented at the annual meeting.

Colin Laure

Decoding Temporal Memory in Habit Formation and Disruption

Laure Colin[1], Alison Montagrin[2]

[1]UNIGE, [2]CISA

Habits allow us to navigate daily life efficiently by freeing up cognitive resources. They enable many actions to be performed automatically, such as locking the door before leaving home. Even when these actions are automatic, we are usually able to remember when they occurred, for example, distinguishing whether we locked the door today or yesterday. This ability requires situating an action within a specific spatio-temporal context, a core function of episodic memory. Traditionally, however, habits have been associated with procedural memory. How do these two memory systems interact? Do they encode spatial and temporal information independently, or in a coordinated manner? This proposal aims to investigate the interaction between these memory systems by combining behavioral measures with advanced neuroimaging techniques. An additional objective is to assess mental time travel as a central cognitive mechanism supporting access to past, present, and future information. We hypothesize that during habit formation, induced through training in a Virtual Reality (VR) task, the hippocampus and amygdala are initially recruited to align actions with task demands. As behavior becomes automatized, neural engagement is expected to shift toward the striatum, supporting the formation of stable cognitive routines. However, when an unexpected or unusual event occurs, the hippocampus and amygdala are expected to resume a central role in guiding decision-making and goal-directed behavior. These hypotheses will be tested by characterizing the neural mechanisms underlying habit formation over several days, habit disruption, and mental time travel in healthy participants. We will develop an innovative experimental design combining immersive VR with ultra-high-field 7T fMRI, integrating concepts from habit learning, episodic memory, and spatio-temporal cognition. This work will advance our understanding of memory mechanisms in typical habit formation, and may inform future interventions aimed at promoting adaptive behavior, such as in addiction and obsessive-compulsive disorder.

Comparini Alessio

Breaking Permutation Symmetry in Brain Graph Neural Networks via Compact Node Representations

Alessio Comparini[1], Damien Marie[2], Vanessa Siffredi[3], Jonas Richiardi[3], Lea Schmidt[3], Clara James[4]

[1]CHUV/UNIL, [2]HES-SO, [3]CHUV, [4]CIBM

Magnetic resonance imaging gives us much of our empirical access to the living brain, which researchers routinely model as a connectome: a graph whose nodes are fixed anatomical regions from a shared atlas and whose edges encode inter-regional connectivity. Graph neural networks are the standard tool for predicting phenotypes from these graphs, yet they enforce permutation equivariance, a symmetry that suits arbitrary graphs but fights the fixed node identity of brain graphs. The connectome-based node features in common use discard that identity, while a one-hot encoding recovers it. The paper makes four contributions. First, we give a theoretical account of one-hot and related node-identity encodings on fixed-topology brain graphs, linking a good node representation to the effective rank of its features, which a collapsed encoding loses. Second, we attach per-region task activation maps from a general linear model (applied at the n-back task fMRI imaging) as node features, so a graph neural network can decode performance on the very in-scanner task the maps come from. Third, we combine these functional features with an identity-preserving positional encoding through a theoretically grounded injection that keeps node representations distinct, adding the functional signal without collapsing identity. Finally, we pretrain the network on one task, age, and transfer it to another, cognition, within the same cohort. On the Philadelphia Neurodevelopmental Cohort and the smaller ORBIT cohort, and across graph convolutional, graph isomorphism, and brain-specialized backbones, this identity-and-activation representation beats one-hot, and purely structural baselines at predicting working-memory performance, and pretraining adds a further gain in the small samples typical of clinical neuroimaging.

Constantin Medeleine Ioana

Sex-specific longitudinal trajectories of biomarker-clinical associations in asymmetric Parkinson's disease

Ioana Medeleine Constantin [1], Leonardo Ceravolo[1], Anthony Nuber-Champier [1], Gilles Allali[2], Frederic Assal[3], Julie Anne Péron[1]

[1]University of Geneva, [2]CHUV, [3]HUG

Background. Motor symptom asymmetry in Parkinson's disease (PD) has been associated with distinct cognitive, psychiatric, and biomarker profiles, with patients exhibiting predominantly right-sided motor symptoms (RPD) generally showing greater verbal-executive impairment, while those with predominantly left-sided symptoms (LPD) present more pronounced visuospatial and neuropsychiatric manifestations. Recent evidence further suggests that biological sex constitutes a major source of heterogeneity in PD, influencing neuroinflammatory, neurodegenerative, and metabolic processes. However, little is known about how sex interacts with motor symptom asymmetry to shape longitudinal relationships between biomarkers and clinical outcomes in early-stage PD. Objective. This study aims to characterize sex-specific trajectories of biomarker-clinical associations in patients with asymmetric PD. Specifically, we will investigate whether longitudinal relationships between cerebrospinal fluid (CSF) biomarkers of neurodegeneration and cognitive, psychiatric, and motor outcomes differ according to both motor symptom asymmetry and sex. Secondary analyses will explore the contribution of systemic markers, including uric acid and tumor necrosis factor-alpha (TNF-α), to these trajectories. Methods. Data will be obtained from the Parkinson's Progression Marker Initiative (PPMI) cohort. Patients will be classified according to the side of predominant motor symptom onset (LPD versus RPD) and biological sex, yielding four subgroups. Longitudinal analyses from baseline to three-year follow-up will be performed using generalized linear mixed-effects models (GLMMs). Clinical outcomes will include measures of global cognition, memory, executive functions, visuospatial abilities, psychiatric symptoms, and motor severity. Time-varying predictors will include CSF α-synuclein, phosphorylated tau, total tau, and amyloid-beta 42, alongside exploratory analyses of serum uric acid and TNF-α. Models will incorporate interactions between time, sex, motor asymmetry, and biomarker levels while adjusting for relevant demographic and clinical covariates. Expected Results. We hypothesize that sex will differentially modulate biomarker–clinical trajectories in LPD and RPD patients, reflecting distinct patterns of hemispheric vulnerability and neurodegenerative progression. We expect female patients to exhibit more preserved cognitive trajectories and distinct associations between systemic and CSF biomarkers and clinical outcomes compared with male patients. Conclusions. Characterizing sex-specific biomarker trajectories in asymmetric PD may contribute to a better understanding of disease heterogeneity and support the development of more personalized approaches to clinical monitoring and intervention.

Dallosto Dominic

Object manipulation and affordance learning in Drosophila

Matthias Durrieu[1], Dominic Dall'Osto[1], Thomas Ka Chung Lam[1], Victor Lobato-Rios[1] and Pavan Ramdya[1]

[1]Neuroengineering Laboratory, Brain Mind Institute & Interfaculty Institute of Bioengineering, EPFL, Lausanne, Switzerland

Interacting with and manipulating different objects is critical for an animal's survival. For previously unseen objects, efficient manipulation requires that their affordances — the possible actions that can be performed upon them — first be learned through experience. However, the behavioural and neural mechanisms underlying the learning of object affordances remain largely unknown. To address this gap, we show that adult fruit flies can learn to push small spherical objects without being given any explicit reward. In doing so, flies appear to learn the ball's pushability affordance: manipulating one ball accelerates pushing of a second one in a new context, and pushing is delayed after animals are exposed to an immobile ball. Via a neural silencing screen, we show that dopaminergic neurons in the fly's mushroom body, a centre for learning and memory in insects, are critical for learning object affordances. These findings open the door to a mechanistic understanding of object manipulation and affordance learning.

Damery Claire Françoise Ghislaine

NMN accumulation sources responsible for Programmed Axonal Degeneration

Claire Damery[1], Lukas Neukomm[1]

[1]University of Lausanne

The metabolite nicotinamide mononucleotide (NMN) plays a crucial role in Programmed axonal degeneration, a genetically encoded self-destruction pathway essential for nervous system maintenance but devastating when activated by disease. Its balance with its downstream metabolite nicotinamide adenosine dinucleotide (NAD+) dictates the faith of the neuron. NMN acts as a potent molecular trigger that activates the pro-degenerative protein dSarm. The accumulation of NMN serves as a metabolic "point of no return," initiating rapid axonal fragmentation. While this process is well-characterized in injured axons during Wallerian degeneration, NMN accumulation also appears to drive the decay of non-injured axons under conditions of low NAD+ seen in various neurodegenerative pathologies. Here, we used genetic tools available Drosophila melanogaster to manipulate metabolic pathways with single-axon resolution using the MARCM (Mosaic Analysis with a Repressible Cell Marker) system. We generated different mutant clones deficient in specific NMN biosynthetic enzymes to observe if we success in preventing NMN accumulation and if this could prevent the trigger of degeneration in injured neurons by monitoring the wing injury assay and glial engulfment responses. We used enzymatic assay on dNrk to investigate the precise enzymatic origins and cellular compartments where NMN accumulation begins in axons to identify the exact moment an axon commits to death. We explored how NMN toxicity impacts local protein synthesis and whether stabilizing these metabolic and translational environments can arrest the degeneration program before it becomes irreversible. We combined this with the development of NMN transporter and NMN biosensors and high-resolution imaging to visualize metabolic flux in vivo to track how the metabolic collapse of an axon leads to its physical clearance. By identifying the exact source of NMN accumulation, we describe axonal death to identifying specific "metabolic brakes." Such findings have profound therapeutic implications, offering potential strategies to treat conditions like ALS, glaucoma, and peripheral neuropathy by targeting the metabolic triggers of axonal loss.

De Riedmatten Ines

OCTOPUS: An open-source tool creating realistic digital twins of brain cells for diffusion MRI simulations

Inès de Riedmatten[1], Malte Brammerloh[2], Juliette Beaubis[3], Jasmine Nguyen-Duc[1], Ileana Jelescu[2]

[1]Université de Lausanne, [2]Centre Hospitalier Universitaire Vaudois, [3]Ecole Polytechnique Fédérale de Lausanne

Brain cell morphology plays a crucial role in determining function and pathology. Biophysical models of diffusion MRI (dMRI) enable the in vivo quantification of cell morphology and the development of novel biomarkers. Most of these models represent cells by simplified geometries, such as spheres and randomly oriented sticks or cylinders, for which analytical models are available. However, the dMRI signal is sensitive to more fine-grained morphological features, such as branching, tapering, undulation, beading, and protrusions. Simulations of the dMRI signal in synthetically generated cells offer a powerful tool to explore the sensitivity of the dMRI signal to microstructural morphologies within an imaging voxel. Nevertheless, an openly available tool to generate digital replicas of realistic brain cells is lacking. To address this gap, we introduce the open-source OCTOPUS toolbox, which generates cells featuring all fine-grained features described above. We recreated a set of histological neuronal and glial cell reconstructions, including pyramidal, GABAergic and glutamatergic neurons, as well as astro- and microglia. To illustrate the plausibility of OCTOPUS-generated cells, we reproduced established properties of dMRI signals from brain tissue, such as the diffusivity time dependence for short-range disorder. By comparing the geometry and dMRI signal of generated and original cells, we found different growth strategies adequate for more isotropic and more anisotropic cells. OCTOPUS will enable validation of biophysical models, development of dMRI sequences sensitive to fine-scale morphology, and aid in generating realistic gray matter substrates.

Defferrard Léa

Rehabilitation of Attentional Disorders Following Acquired Brain Injury Using a New Immersive Virtual Reality Protocol : a Feasibility Study

Léa Defferrard[1], Loredana Catinari[2], David Zeugin[3], Daniel Perez-Marcos[4], Andrea Serino[3], Sonia Crottaz-Herbette[3]

[1]Lausanne University, [2]Bologna University (IT), [3]Centre Universitaire Hospitalier Vaudois (CHUV), [4]MindMaze Therapeutics

Attentional disorders are frequently documented following stroke, with significant consequences for rehabilitation and patients' quality of life. While promoting some improvements, current interventions, mainly based on paper-and-pencil tools and/or computerized exercises, , show inconsistent efficacy and limited generalization to everyday life contexts. Recently, Immersive Virtual Reality (iVR) has emerged as a promising alternative, allowing intensive cognitive rehabilitation in ecologically valid environments, while maintaining high experimental control. Based on this evidence, the present study aimed to evaluate the feasibility of a new iVR-based protocol for the rehabilitation of attentional disorders. Eighteen patients with attentional deficits following right-hemispheric stroke were included in a new iVR-based cognitive rehabilitation program (MindFocus, MindMaze SA). The rehabilitation protocol consisted of 20 iVR sessions in addition to standard of care, including various gamified activities targeting specific attentional components, with individually tailored adaptive difficulty levels. Attentional abilities were assessed before and after the rehabilitation program using standardized tests on spatial attention and alertness. In addition, eye-tracking data were collected during an iVR task with the aim of exploring potential gaze-based markers that could predict patients' cognitive improvement.. We observed significant improvements in alertness and orienting attention. Moreover, positive correlations emerged between the actual time spent by patients on iVR rehabilitation activities and the improvements achieved. Finally, specific eye-tracking parameters predicted patients' outcomes. These findings demonstrate that the new iVR protocol is effective in promoting improvements across different components of attention. Finally, the correlation data suggest that the improvement observed depended on the amount of time dedicated to rehabilitating a specific function.

Denkinger Sylvie

Game Mechanics Promoting Attentional Control

Sylvie Denkinger[1], Freya Joessel[2], C. Shawn Green[2], Daphné Bavelier[1]

[1]University of Geneva, [2]University of Wisconsin-Madison

Research indicates that playing Action Video Games (AVG) improves attentional control, potentially providing crucial pointers for developing effective cognitive training paradigms. These beneficial effects are thought to stem from a combination of three key components: fast-paced decision-making, divided attention, and timely shifts to focused attention. Building upon a previous feasibility study utilizing a gamified Multiple Object Tracking (MOT) task with an embedded dual task, the current study investigates a refined training methodology designed to optimize how these specific cognitive loads are implemented. We deployed four game versions—Pacing, Divided Attention, Focused Attention, and a Combined version integrating all three components - alongside a no-contact passive control group. Participants (N = 231, ages 18–35) were recruited via Prolific and completed a web-based randomized controlled trial, undertaking 12 hours of gameplay over 4–6 weeks. Attentional control was assessed at pre- and post-test using a battery of tasks. The primary outcome was the Useful Field of View (UFOV) task; secondary outcomes included the Multiple Object Tracking (MOT) task as a measure of near transfer, and the Test of Variable of Attention (ToVA) as a measure of far transfer. Exploratory outcomes comprised the Attentional Blink (AB), and the Bron-Lyon Attention Stability Task (BLAST). Results across all outcomes will be presented and discussed in terms of the efficacy of these targeted game mechanics and their impact on the transfer of attentional control skills.

Dennaoui Lea

Microglia influence astrocyte maturation in the developing hippocampus

Lea Dennaoui[1], Katia Monsorno[1], Sara Balletta[2], Felipe Bodaleao Torres[3], Amit Agarwal[3], Rosa Chiara Paolicelli[1]

[1]Université de Lausanne, [2]Universita di Roma, [3]Heidelberg Universität

Microglia and astrocytes, along with oligodendrocytes, represent the major glial cell types in the brain. While microglia cells originate in the yolk sac during primitive hematopoiesis and populate the embryonic brain starting at embryonic day (E)9.5, astrocytes differentiate from neural stem cells (NSCs) later in brain development. The peak of astrogenesis occurs from late prenatal to early postnatal stages (E18-P7). Thus, microglia invasion preceding astrogenesis may support a role for microglia in promoting and guiding astrocytes maturation, similarly to what has been shown for other brain cell types. However, very little is known on how microglia influence these cells in early brain development. Here, we set out to investigate the role played by microglia in the process of astrocyte maturation, including the potential refinement of astrocytic branchlets during early postnatal development. We used an established model of microglial dysfunction, the Cx3cr1 knockout mouse line, in which microglia lack the fractalkine receptor (CX3CR1), to study how defective microglia could affect astrocytes density and morphology at different postnatal time points and in adulthood. We found that the density of glutamine synthetase (GS)-positive astrocytes during the second and third postnatal weeks was significantly increased in the stratum radiatum of the hippocampal CA1 region of Cx3cr1 KO mice. Conversely, the area covered by GS was significantly reduced, suggesting that microglial dysfunction could impact astrocytes morphology or GS expression. Using sparse astrocyte labeling and confocal microscopy, we conducted morphometric analyses and found that, during the same developmental window, astrocytes from KO mice occupied a larger volume and exhibited increased neuropil volume infiltration, compared to control littermates. At the adult stage, both astrocyte density and morphology were restored to control levels. Finally, by imaging approaches, we investigated the astrocyte mitochondrial network and found that, during the second postnatal week, astrocytes from KO mice displayed reduced mitochondrial density. Further analyses are ongoing to assess the underlying mechanisms. Overall, our results suggest that microglia impact astrocyte density and morphology during early postnatal brain development.

Deschanet Chloé

Probing spatial attention in 360° using a virtual reality paradigm

Chloé Deschanet[1], Loïc Kreienbühl[1], Patrik Vuilleumier[1], Joan Llobera[2]

[1]Université de Geneve, [2]Artanim Foundation

Orienting attention in space is crucial to modulate perception and adapt behavior. The Posner paradigm has been widely used to understand the cognitive and neural mechanisms that shift attention across locations. However, most of the literature has focused in frontal space. Here we adopt immersive Virtual Reality (VR) and adapt the Posner paradigm to study the deployment of attention both in front and rear peripersonal space using both response times and eye movements. Twenty participants in a VR storage room had to search for and discriminate as quickly as possible between 2 targets in 4 possible locations arranged circularly around them. Targets were preceded by a spatialized sound cue whose validity was manipulated (80% Valid, 20% Invalid), and presented with varying distractors (None, One near the target, One far from the target, or Three), with the goal of validating the serial search effect in both front and rear space. Response times were comparable to the classical Posner paradigm when the target was presented both front and rear to the participant, with participants being significantly faster with Valid cues, compared to Invalid ones. Distractors also delayed significantly target detection. However, response times for rear conditions were significantly greater, possibly due to greater spatial exploration and body movements. Gaze data confirmed the impact of invalid cues and distractors on attention shifts, and were tightly correlated with response times for both front and rear space. We believe this is one of the first studies to quantify eye-tracking in 360° around the participant and validates VR as a powerful tool for quantifying attentional dynamics. Results show that orienting attention in front and rear space engages similar mechanisms of sensory competition, supporting an overlap or a continuity in space representation, while revealing how overt gaze strategies mediate performance. Acknowledgements: This research is supported by ABC-Space, research grant #10000279 awarded by the Swiss National Science Foundation (SNSF). We would like to thank Yves Schmid-Dornbierer from the Artanim Foundation for helping in the development of the VR environment.

De Wouters Louise

Structure-function coupling of interictal epileptiform discharges to predict surgical outcomes in epilepsy

Louise de Wouters[1], Stanislas Lagarde[2], Emeline Mullier[3], Nicolas Roehri[1], Dimitri Van De Ville[4], Patric Hagmann[3], Isotta Rigoni[1], Serge Vulliémoz[1]

[1]University of Geneva, [2]Aix-Marseille University, [3]University of Lausanne, [4]Ecole polytechnique fédérale de Lausanne

Background: Epilepsy surgery can be effective in drug-resistant epilepsy, although one third of patients do not achieve seizure freedom, highlighting the need for improved presurgical markers. Epilepsy is increasingly recognised as a network disorder, characterised by alterations in both functional activity and structural connectivity. However, how pathological activity is constrained by the brain's structural architecture, and whether this relationship predicts surgical outcomes, remains unclear. Methods: Thirty temporal lobe epilepsy (TLE) patients who underwent epilepsy surgery were included. High-density electroencephalography recordings containing interictal epileptiform discharges (IEDs) were projected onto the structural connectome derived from diffusion magnetic resonance imaging using graph signal processing to quantify structure-function coupling. We then compared structure-function coupling during IEDs across surgical outcomes (good versus poor). Results: Structure-function coupling was higher in seizure-free patients than in non-seizure-free patients (Wilcoxon rank-sum test, $p<0.05$, effect size = 0.47). This suggests that seizure freedom might be associated with the extent to which IEDs are constrained by the brain's structural connectome.

Dimou Maria

Comparison of SEEG Rereferencing Techniques for EEG Source Imaging Validation

Maria Dimou[1], Andrea Pigorini[2], Ezequiel Mikulan[3], Laurent Spinelli[1], Shahan Momjian[4], Margitta Seeck[1], Serge Vulliemoz[1], Nicolas Roehri[1]

[1]1. EEG and Epilepsy Unit, University Hospitals and Faculty of Medicine, University of Geneva, Geneva, Switzerland, [2]2. Department of Biomedical, Surgical and Dental Sciences. University of Milan, Milan, Italy, [3]3. Department of Health Sciences. University of Milan, Milan, Italy, [4]4. Department of Neurosurgery, University Hospitals and Faculty of Medicine, University of Geneva, Geneva, Switzerland

Background: Stereotactic intracranial EEG (SEEG) signals are recorded relative to a reference electrode, but no reference electrode is electrically silent. Consequently, rereferencing is a fundamental preprocessing step. Although several rereferencing techniques have been proposed, only a few studies have systematically compared them, and these have largely focused on analyses of focal neuronal activity. It remains unclear which rereferencing technique is most appropriate for multimodal studies combining SEEG and scalp EEG. Methods: We analyzed simultaneous high-density EEG (hdEEG) and SEEG recordings from 29 patients with focal epilepsy. Four reference configurations were compared: the original recording reference (no additional rereferencing), gray matter common average reference (GMCA), white matter common average reference (WMCA), and bipolar montage (BM). Virtual SEEG signals reconstructed from hdEEG using eLORETA were compared with measured SEEG. Generalized linear mixed-effects models were used to evaluate the effect of rereferencing on SEEG–virtual SEEG correlation across frequency bands, while peak localization error (PLE) and spatial deviation (SD) were used to assess its effect on localization accuracy and spatial spread, respectively. Results: BM consistently led to lower correspondence between measured and virtual SEEG than the other reference schemes, except in the theta band. In the broadband signal, predicted correlations were 0.126 for GMCA, 0.126 for WMCA, 0.120 for no rereferencing, and 0.115 for BM (all adjusted $p < 0.01$). In contrast, BM consistently yielded the lowest PLE and SD across frequency bands. Conclusions: BM may be less suitable for multimodal studies comparing SEEG with scalp EEG. However, its lower PLE and SD are consistent with previous studies recommending BM for applications targeting focal neuronal activity. By leveraging simultaneous hdEEG–SEEG recordings, our findings provide direct experimental evidence supporting previous suggestions that the optimal rereferencing technique depends on the scientific objective rather than a universally optimal choice.

Djordjijevic Martina

The contribution of lexicality, semantics and structure to meaning assembly in rapid parallel visual presentation

Martina Djordjijevic[1], Marianne Hundt[2], Alexis Hervais-Adelman[1,3]

1 Department of Basic Neurosciences, University of Geneva, Geneva, Switzerland

2 English Department & Department of Computational Linguistics, University of Zurich, Zurich, Switzerland

3 Zurich Center for Linguistics, University of Zurich, Zurich, Switzerland

Sentence comprehension entails incremental integration of word-level (lexical) and structural (syntactic) information to construct the higher-order meaning encoded within it (Martin, 2020). Despite this, several recent studies have shown that when entire short phrases are presented for very brief periods of as little as 200ms (a method called rapid parallel visual presentation, RPVP) behaviour and neural responses bear the hallmarks of entire phrase processing. Words embedded in sentences are identified more accurately and rapidly than those in unstructured sequences, with neural responses demonstrating a divergence between sentence and unstructured stimuli as early as ~130ms after stimulus onset (Fallon & Pylkkänen, 2024), a phenomenon labelled the sentence superiority effect (SSE). The observed facilitation suggests that rapidly available syntactic information contributes to the SSE. However, it remains unclear to what extent this advantage depends on lexical-semantic information from the words themselves, which may facilitate the rapid identification and integration of sentence structure. The present study therefore investigates whether the SSE persists as lexical-semantic information is progressively reduced. Using RPVP, we compare the SSE for canonical French sentences (e.g., l'enfant mange l'orange) with matched conditions progressively replacing its three content words with pseudowords (e.g., l'arirof bône l'ancée) while preserving word order and determiners. Forty adult native French speakers will perform a visual sentence matching task, during a 64-channel electroencephalography (EEG). We expect linguistically structured conditions to show early neural differentiation from non-compositional consonant string controls, with the magnitude and temporal profile of this differentiation varying with preserved lexico-semantic information. The experiment will establish how robust rapid sentence-level facilitation is to reduced lexical content and characterize the linguistic information sufficient to support the SSE under highly time-constrained presentation.

Dulex Hannah

Decoding Tanycyte-Mediated Lipid Homeostasis in the Hypothalamic Cellular Network

Hannah Dulex, Natalia Tonet, Xavier Berney, Fanny Langlet1

Department of Biomedical Sciences, FBM, University of Lausanne

Tanycytes are specialized ependymoglial cells which line the wall of the third ventricle. Their unique morphology, characterized by a ventricular cell body and a long basal process extending into the hypothalamic parenchyma, positions them at the crossroad between the cerebrospinal fluid (CSF), the blood vessels, and neural circuits controlling energy balance. Although tanycytes are recognized as key regulators of metabolic homeostasis, it's still poorly understood how they place themselves in hypothalamic lipid sensing and metabolism. Here, we explore how tanycytes may orchestrate lipid homeostasis within the hypothalamic network, through the neuroanatomical characterization of three interconnected lipid-related axes. First, we investigated lipid shuttling by analyzing apolipoprotein E (ApoE) protein distribution. Distinct rostrocaudal patterns were observed, suggesting that rostral tanycyte ApoE may be associated with lipid shuttling towards the CSF whereas caudal tanycyte ApoE may support communication with parenchymal cells. Second, we investigated lipid storage through the lipid droplet-associated perilipin-2 (Plin2). Lipid droplets were found within tanycyte cell bodies and processes, suggesting potential roles in intracellular lipid storage but also intercellular lipid exchanges. Lastly, we focused on de novo lipid synthesis through fatty acid synthase (FASN). FASN protein was mostly found within β tanycyte cell bodies and processes. Given the neural stem and progenitor cell properties of β tanycytes and the established roles of FASN in stem cell proliferation, these findings suggest a potential link between lipid metabolism and tanycyte neurogenic capacity. Together, these observations provide a framework for understanding the cellular organization of lipid homeostasis within the hypothalamic network and establish a foundation for future functional studies.

Elshareif Nadia

Maternal programming: How maternal diet imprints lifelong metabolic health outcomes

Nadia Elshareif[1], Leane Allaz[1], Chaitanya K. Gavini[1], Virginie Mansuy-Aubert[1]

Affiliation: [1]University of Lausanne - Switzerland, Department of Biomedical Sciences

Why does maternal diet powerfully shape offspring metabolic health, long before lifestyle choices have an effect? Evidence suggests that vulnerability to metabolic disease is programmed in utero and during critical early life windows, yet signals linking maternal nutrition to the development of offspring metabolic regulation remains poorly defined. Western-style diets are largely composed of ultra-processed foods, characterized by high fat, sugar, and low fiber, that disrupt the maternal gut microbiota and reduce fermentable substrates, thus impairing gut-brain signaling pathways vital for metabolic regulation. Consequently, bacterial production of short-chain fatty acids (SCFAs), including acetate, propionate, and butyrate, is reduced. These metabolites regulate glucose homeostasis, energy expenditure, and autonomic function via the gut-brain axis. However, their role in programming the gut-brain axis during early life remains unclear and a comprehensive characterization of this regulation is needed. Here, we investigated whether maternal nutrition and gut-derived metabolites program offspring brown adipose tissue (BAT) thermogenesis through alterations in adipose tissue morphology and autonomic regulation. Using maternal dietary interventions, we performed metabolic phenotyping of offspring alongside analyses of BAT structure, and autonomic regulation across offspring lifespan. We show that maternal fiber intake and SCFA production during offspring development may protect against metabolic dysfunction, accompanied by preserved BAT morphology and thermogenic capacity. In contrast, disruption of the maternal gut microbiota by western diet increased susceptibility to impaired BAT thermogenesis and metabolic dysfunction. These findings highlight the importance of nutrition and gut-derived metabolites for neuro-metabolic programming as early as in the womb.

Elshove Stacey

Toward Translational Gait Analysis: An Open-Source Pipeline for Locomotor Assessment

Stacey Elshove1,2, Farha Bouteldja1, Ed Hasanovic1, Quentin Amossé1, Claudia Kathe1

1 Department of Fundamental Neurosciences, University of Lausanne (UNIL), Lausanne, Switzerland

2 Presenting author

Quantifying locomotor function remains a central challenge in neuroscience, particularly in preclinical models of neurological disorders. While recent advancements in marker-less, machine learning-based tracking software, such as DeepLabCut, SLEAP or Lightning Pose, have enabled low-cost tracking of body parts across time, the downstream analysis and interpretation of this data remain highly variable between laboratories. To address this, we are developing an open-source, GPU-free Python toolbox for standardised quantification of gait from marker-less tracking output. This robust and adaptable pipeline extracts a broad set of interpretable and informative gait parameters including step height, joint angles, velocity, limb intra- and inter-coordination, designed to capture a wide range of locomotor deficits, enabling clear and quantitative assessment of movement deficits across various neurological disease models. The toolbox includes a step annotator and supports single and batch analysis. We demonstrate that this pipeline is sensitive to different phases of recovery after spinal cord injury and can also detect subtle gait abnormalities in rodent models of cerebral palsy. We are further extending this toolbox to human gait analysis, currently applying it to children with cerebral palsy, to improve alignment between preclinical models and clinical populations to enable translational studies of movement deficits. By providing a standardized and accessible toolbox, our pipeline can be broadly adopted across research laboratories and clinics to improve the reproducibility and depth of locomotor analyses in neurological motor deficits.

Farhat Hania

The Role of Cognitive Reserve in Neurodegenerative Disorders: A Systematic Review of Neuroimaging Evidence

Hania Farhat[1], Sayonara Pereira da Silva[1], Tainá dos Santos Rêgo[2], Charikleia Lampraki[1], Giovanni Frisoni[1], Federica Ribaldi[1], Paolo Ghisletta[1], Matthias Kliegel[1], Jürgen Maurer[3], Matthias Studer[1], Elvio Gouveia[4], Marcelo de Maio Nascimento[5], Andreas Ihle[1]

[1]Université de Genève, [2]Université de Zurich, [3]Université de Lausanne, [4]Universitário da Penteada, [5]University of the São Francisco Valley

Neurodegenerative disorders are characterized by progressive brain changes that often lead to significant cognitive and physical impairments. Despite shared neuropathological features, individuals often show markedly different cognitive outcomes, suggesting the existence of compensatory mechanisms that confer resilience to brain damage. One such mechanism is cognitive reserve (CR), defined as the brain's capacity to adapt to pathology by using lifelong experiences such as education, occupational complexity, and engagement in cognitively stimulating activities. Higher CR is associated with later symptom onset and milder cognitive impairment despite brain pathology, a resilience supported by neuroimaging evidence of preserved brain structure and function. This systematic review examines the role of CR as a protective factor in neurodegenerative disorders, with a focus on neuroimaging-based evidence. Methods follow PRISMA guidelines. Peer-reviewed empirical studies involving CR and neuroimaging or other biomarkers are identified through PubMed. Studies are screened by two reviewers using RAYYAN, and data are synthesized narratively to highlight shared neuroimaging correlates of CR. Preliminary results indicate that 160 studies were analysed across Alzheimer's disease, Parkinson's disease, multiple sclerosis, frontotemporal dementia, and other neurodegenerative conditions, using structural MRI, PET, and fMRI. Across disorders, higher CR was consistently associated with better cognitive performance despite greater brain pathology, including greater amyloid and tau burden on PET and more severe atrophy on MRI. Higher CR was also linked to preserved gray matter volume, stronger functional connectivity within default mode and frontoparietal networks, and moderation of the atrophy-cognition relationship, particularly in early disease stages. These protective effects diminished at advanced levels of neuropathology, suggesting a threshold beyond which compensatory mechanisms are overwhelmed. These findings highlight the value of neuroimaging-based assessment of CR as a tool for identifying at-risk individuals and developing targeted interventions aimed at strengthening cognitive resilience across neurodegenerative conditions.

Ferrari Asia

Functional gradients as transdiagnostic features of the psychosis spectrum

Asia Ferrari[1], Bin Wan [1], Judith Kabbeck[2], Amin Saberi[3], Stefan Kaiser[4], Valeria Kebets[5], Clara Moreau[6], Paul Thompson[7], Theo Van Erp[8], Jessica A. Turner[9], Thomas B. T. Yeo[5], Boris Bernhardt[10], Sofie Valk[3], Matthias Kirschner[4]

[1]Faculty of Medicine, University of Geneva, Geneva, Switzerland;, [2]Department of Adult Psychiatry and Psychotherapy, University Hospital of Psychiatry Zurich, Zurich, Switzerland;, [3]Otto Hahn Group Cognitive Neurogenetics, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany;, [4]Division of Adult Psychiatry, Department of Psychiatry, University Hospitals of Geneva, Geneva, Switzerland;, [5]Department of Electrical and Computer Engineering, Clinical Imaging Research Centre, N.1 Institute for Health and Memory Networks Program, National University of Singapore, Singapore;, [6]Centre de recherche CHU Sainte Justine, Department of Psychiatry and Addictology, University of Montreal, Montreal, Quebec, Canada;, [7]Imaging Genetics Center, Mark and Mary Stevens Neuroimaging & Informatics Institute, Keck School of Medicine of the University of Southern California, Marina del Rey, CA, USA;, [8]Clinical Translational Neuroscience Laboratory, Department of Psychiatry and Human Behavior, University of California Irvine, Irvine, CA, USA;, [9]Department of Psychiatry and Behavioral Health, the Ohio State University, Columbus, OH, USA;, [10]McConnell Brain Imaging Centre, Montreal Neurological Institute and Hospital, McGill University, Montreal, QC, Canada

Introduction: Schizophrenia (SZ) and bipolar disorder (BD) overlap substantially across psychotic, cognitive, negative, and mood symptoms, challenging the classical dichotomy. Both show brain-wide functional connectivity alterations, which functional gradients reduce to continuous axes of brain organization. Whether gradients are reshaped across the psychosis spectrum, and how this relates to symptoms, is unclear. This study characterizes this reorganization and its links to clinical dimensions.

Methods: Using resting-state fMRI from the UCLA Consortium for Neuropsychiatric Phenomics (110 controls, 37 SZ, 40 BD), we built cortical connectomes and estimated functional gradients via diffusion map embedding, aligned to a normative reference. We compared gradient organization between groups, then used partial least squares to derive two brain patterns linking gradients to symptoms and cognition. We then scored how closely each participant's gradients matched each pattern, placing them on a two-dimensional map.

Results: Cortical organization was largely preserved, but individual gradients deviated more from the normative template in SZ and BD. Both disorders showed frontoparietal compression, plus disorder-specific patterns: visual contraction in SZ and somatomotor displacement in BD. The two patterns captured distinct profiles, one BD-like, with milder symptoms and preserved sensory differentiation, and one SZ-like, with greater severity and cognitive impairment. Patients scored high on their own profile, while controls scored low on both and fell between the two groups on the map.

Conclusions: These results reveal shared and disorder-specific gradient signatures across the psychosis spectrum. The intermediate position of controls supports a graded rather than categorical view, and offers a way to characterize heterogeneity.

Forrer Silas

Developmental Brain Network Trajectories Differentiate Resilience and Vulnerability to Psychosis in 22q11.2 Deletion Syndrome

Silas Forrer[1], Farnaz Delavari[1], Corrado Sandini[1], Dimitri Van de Ville [2], Stephan Eliez[1]

[1]University of Genève, [2]EPFL

BACKGROUND: Disrupted maturation of functional brain networks has been increasingly linked to elevated risk of psychosis, yet the spatiotemporal characteristics of these deviations remain unclear. We used longitudinal connectome fingerprinting and jointly analyzed the functional connectivity (FC) and intraclass correlation (ICC) to obtain age-dependent trajectories of functional brain organization in 22q11.2 deletion syndrome (22q11DS), a high-risk model for psychosis.

METHODS: Resting-state fMRI from 62 individuals with 22q11DS and 63 controls (ages 8–30, 2–5 visits) were analyzed. Patients were stratified by the presence of positive psychotic symptoms (PPS+, PPS–). The FC and ICC characterization of connectome fingerprints were projected into a joint principal component space, yielding three orthogonal axes of maturation: PC1 (Sensory-Association Axis), PC2 (Emotional-Cognitive Balance), and PC3 (Executive-Sensory Control). Longitudinal trajectories along these axes characterized the directionality and coordination of connectome maturation.

RESULTS: Controls showed a clear decrease in identifiability and stability during adolescence, followed by recovery into adulthood, reflecting coordinated, direct maturation along all three axes. PPS(–) individuals exhibited a partial decrease and subsequent recovery, preserving adaptive reorganization along PC3. In contrast, PPS(+) participants displayed disorganized and irregular trajectories in the PC space and a decline in PC3, indicating disrupted temporal coordination of network maturation and fragmented executive-sensory integration.

CONCLUSION: Loss of developmental synchrony in FC was associated with psychosis vulnerability in 22q11DS. The PCA-based multi-axis mapping reveals that resilience and vulnerability are determined by the direction and synchrony of brain maturation, rather than by stability alone, highlighting a novel marker for tracking neurodevelopmental risk across psychiatric disorders.

Galli Riccardo Mattia

Mapping functional and oscillatory correlates of visuospatial attention via EEG-fMRI multimodal imaging and NFB

Riccardo Galli[1], Patrik Vuilleumier[1]

[1]University of Geneva

Selective attention relies on coordinated interactions between occipital and fronto-parietal brain regions to balance sensory-driven and top-down attentional processes. Following right hemisphere lesions, this balance can be disrupted, leading to Unilateral Spatial Neglect (USN). To restore this imbalance, neurofeedback (NFB) has emerged as a promising brain-modulation approach. fMRI-based NFB studies have shown that participants can learn to selectively regulate visual cortex activity and improve visual attention. In parallel, EEG-based NFB has focused on controlling parieto-occipital alpha oscillations, which are strongly linked to spatial attention and are abnormally lateralized in neglect patients. However, the precise relationship between alpha modulation and changes in early visual cortex activity remained unclear. We bridge these two complementary NFB approaches using simultaneous multimodal EEG-fMRI. By combining functional imaging with EEG "fingerprinting" analyses, we identified oscillatory EEG signatures associated with the modulation of interhemispheric visual cortex balance during fMRI-NFB. This multimodal framework provides a critical link between fMRI-derived neural mechanisms and scalable EEG biomarkers, paving the way for more accessible EEG based neurofeedback therapies for USN.

Gashi Adem

De-differentiation in Regional Brain Volume Changes Across Aging: The Modifying Role of Genetic, Vascular, and Metabolic Factors

Adem Gashi[1], Naftali Raz[2], Ana M. Daugherty[3], Cheryl L. Dahle[3], Paolo Ghisletta[1]

[1]University of Geneva, [2]Stony Brook University, [3]Wayne State University

Cognitive abilities become increasingly correlated in older adulthood, a phenomenon known as cognitive de-differentiation. Whether an analogous process occurs in the structural organization of the aging brain remains unclear, as most evidence derives from cross-sectional designs that cannot capture within-person change. We tested the longitudinal structural de-differentiation hypothesis in two independent samples of healthy adults assessed twice with manual volumetry of 6 common and 5 unique cortical and subcortical regions: Sample 1 (N = 87; mean age = 53.6 years) scanned approximately five years apart on 1.5 Tesla, and sample 2 (N = 167; mean age = 52.8 years) scanned approximately two years apart on 4 Tesla. Using univariate and multivariate latent change score models, we estimated baseline volumes, longitudinal changes, and their covariance structures, and examined whether chronological age, vascular, metabolic risk, apolipoprotein E (APOE) ε4 status, and socioeconomic factors modified these associations. Baseline regional volumes were uniformly positively correlated, whereas baseline–change associations were weak. Critically, change–change correlations were positive across regions and more pronounced in the five-year cohort (mean r = .24), with particularly strong coupling among frontal, cerebellar, and temporo-limbic regions (e.g., lateral prefrontal cortex–prefrontal white matter, r = .67). Vascular and metabolic risk explained variance in frontal and neostriatal shrinkage but left the overall covariance pattern largely unchanged. These findings suggest that coordinated regional shrinkage is an intrinsic feature of normative brain aging, with systemic risk factors scaling the magnitude—but not the architecture—of decline.

Gaudré Martin

Is knowledge a reward ? An fMRI investigation of epistemic curiosity in the brain.

Martin Gaudré[1], Yoann Stussi[1], Jade Seguin[1], Sylvain Delplanque[1], Eva Pool[1], David Sander[1]

[1]Université de Genève

Humans are inherently curious and constantly seek knowledge beyond its immediate benefits. Growing evidence suggests that information that satisfies our epistemic curiosity may act as a reward, just like money or pleasant odors, engaging overlapping neural systems with primary and secondary rewards. However, does the brain encode epistemic value through shared or distinct mechanisms relative to monetary or olfactory rewards? This study aims to address this question by directly comparing the brain responses to interesting information, olfactory, and monetary rewards. Participants will complete an adaptation of the Monetary Incentive Delay (MID) task in an fMRI scanner. Trivia questions eliciting high or low curiosity and their answers will be used as epistemic stimuli, highly or moderately pleasant odors as olfactory rewards, and high or low amount of money as monetary rewards, and neural activations during their anticipation and consumption will be measured. A machine-learning algorithm trained on classifying high- versus low-value stimuli for one reward type will be tested on the other reward types to assess whether interesting information relies on a common neural valuation process with primary and secondary rewards. A secondary objective is to examine whether high curiosity enhances memory for trivia answers. Data collection is currently underway.

Gay Ayla

Upper limb perceptual and motor errors

Ayla Gay1,2, Gaia Risso1,3, Michel Akselrod1,4, Eugenio Scaliti5, Francesco Crottini6, Cristina Becchio7, Andrea Serino4, Michela Bassolino1,4

1 HES-SO Valais-Wallis, Institute of Health Sciences, Sion, Switzerland 2 Lemanic Neuroscience Doctoral School, Lausanne, Switzerland, 3 The Sense Innovation & Research Center, Sion & Lausanne, Switzerland, 4 MySpace Lab and NeuroRehab Research Center, Service of University Neurorehabilitation (SUN), Lausanne University Hospital, Institution de Lavigny, Switzerland, 5 University of Turin, Italy, 6 University of Pavia, Italy, 7 University Medical Center Hamburg-Eppendorf, Germany

Even in healthy individuals, representations of our own body are not entirely accurate. People typically perceive their hands as shorter and wider than they actually are (Longo & Haggard, 2010; Peviani & Bottini, 2018). However, while shape and size distortions are well studied, less is known about how we perceive the spatial location of our body parts without visual guidance, and how such distortions influence motor execution. In this experiment, we investigated upper-limb representation in healthy right-handed adults (N=40) using a body landmarks localization task. Participants verbally indicated when a moving stick aligned with specific landmarks on their hidden right arm, in 4 different spatial positions forming a square. They consistently underestimated their arm length by ~20% across all spatial positions. Additionally, their estimated positions deviated by ~10 cm from the real positions, typically biased toward the midline and closer to the body, with increasing mislocalization across trials. In a subsequent pointing task using the same 4 positions, participants reached forward without visual feedback or online correction, overshooting targets by ~5 cm. Crucially, perceived (and not real) arm length significantly predict the pointing trajectory length, suggesting that participants used their internal distorted body dimensions rather than veridical ones. These findings broaden our understanding of upper-limb representation by showing how perceptual distortions shape motor behavior.

Gomez Navarro Alberto

Understanding the effects of environmental enrichment on microglia in a mouse model of Alzheimer's Disease

Alberto Gomez-Navarro[1], Camilla Sprega[1], Sharon Tsang[2], Huan Liao[2], Kinga Szydłowska[3], Bożena Kamińska-Kaczmarek[3], Ali Jawaid[4], Anthony Hannan[2], Rosa Chiara Paolicelli[1]

[1]University of Lausanne, [2] University of Melbourne, [3]Nencki Institute of Experimental Biology, [4]PORT Polish Center for Technology Development

Environmental enrichment (EE) provides a multimodal combination of sensory, social, cognitive, and motor stimulation that enhances brain activity and has shown beneficial effects in models of Alzheimer's disease (AD). Microglia, the brain's frontline immune sensors, support tissue homeostasis under physiological conditions. However, during AD progression, microglia shift from early protective amyloid-β (Aβ)–clearing responses to dysfunctional states that contribute to synaptic loss and neurodegeneration. Notably, microglial behavior is shaped by environmental and lifestyle-related factors such as social interaction and physical activity, which have emerged as potential modulators of disease progression. In this study, we investigated the role of microglia in mediating the beneficial effects of EE in a mouse model of AD using a microglial depletion approach. Wild-type (WT) and 5xFAD mice of both sexes were housed under standard or enriched conditions and continuously treated with either a control diet or a PLX3397-containing diet, a colony-stimulating factor 1 receptor (CSF1R) inhibitor that depletes microglia. We first assessed AD-associated changes in pre- and postsynaptic markers in cortex and examined how these alterations were modulated by environmental enrichment and PLX3397 treatment. In parallel, we analyzed microglial interactions with amyloid aggregates and investigated how EE and PLX3397 treatment reshape microglial responses to amyloid pathology. Our results show that EE attenuated the loss of VGLUT1+ pre-synaptic structures in 5xFAD mice, and that this was associated with reduced microglial engulfment of VGLUT1+ puncta. Furthermore, EE promoted recruitment of microglia around Aβ aggregates, and both EE and PLX treatments differentially affected $6E10^{+}$particle engulfment in a sex-dependent manner.

Hamon Myriam

Brain-wide neural dynamics underlying goal-directed single-session learning

Myriam Hamon*, Axel Bisi*, Robin Dard, Anthony Renard, International Brain Laboratory, Sylvain Crochet, Carl Petersen

Brain Mind Institute EPFL

Animals flexibly learn new associations by leveraging prior knowledge and using rewards as a teaching signal, a process affected by changes in behavioural strategies and internal states. Understanding how distributed neural circuits reorganize during learning requires measuring population dynamics continuously at the single-trial level, yet most studies compare static snapshots in naive versus expert animals or sample intermittently across days, missing how specific neuronal populations reorganize as learning unfolds. Here, we leveraged brain-wide Neuropixels recordings from 288 insertions across 80 mice yielding ~100,000 neurons (~40,000 well-isolated) spanning 60+ brain areas to investigate how neural activity reorganizes as mice rapidly acquire a novel sensorimotor mapping in a single session. Mice were first pretrained to lick for a reward following an auditory cue. After reaching expert performance, mice were then confronted with a novel whisker-reward contingency, with separate cohorts experiencing either Go or No-Go whisker stimuli, while maintaining auditory performance in interleaved trials. Both cohorts rapidly acquired the new sensorimotor mapping within tens of trials. Learning trajectories were highly individualized, with fast transitions between low- and high-performance, and correlated with ongoing movements and pupil area. Single-unit analyses revealed brain-wide encoding of performance states and licking, and a sparser encoding of sensory and choice variables. The activity of a small but distributed subset of neurons reflected rapid changes in performance and behavioural history. This brain-wide dataset recording from multiple brain areas simultaneously provides a foundation for dissecting the coordinated activity of distributed circuits during rapid learning.

Harput Elif

Mapping Amyloid-PET Uptake in the White Matter in Alzheimer's Disease

Elif Harput[1], Cecilia Boccalini[1], Max Scheffler[2], Karl-Olof Lovblad[2], Nicholas J. Ashton[3], Henrik Zetterberg[3], Oskar Hansson[4], Hadrien M. Lalive[2], Aurelien Lathuiliere[2], Giovanni B. Frisoni[2], Valentina Garibotto[2]

[1]University of Geneva, [2]Geneva University Hospitals, [3]Sahlgrenska Academy at the University of Gothenburg, [4]Lund University

Introduction: Alzheimer's disease (AD) is characterized by amyloid-beta plaques and tau neurofibrillary tangles, but white matter (WM) alterations may also contribute to disease progression. Amyloid-PET tracers show physiological WM uptake, potentially reflecting myelin integrity, although its biological significance remains unclear. This study investigated whether WM measures derived from amyloid-PET are associated with AD biomarkers and whether they provide additional diagnostic and prognostic value.

Methods: We included 320 individuals with baseline [18F]flutemetamol amyloid-PET, T1-weighted and T2-FLAIR MRI, and Mini-Mental State Examination (MMSE). A subset also underwent tau-PET and longitudinal cognitive assessment. WM hyperintensity (WMH) and normal-appearing WM (NAWM) masks, total lesion volume (TLV), and cerebral microbleeds (CMB) were derived from FLAIR. WM standardized uptake value ratios (SUVR) were corrected for global cortical amyloid uptake and transformed to z-scores. Linear regression examined associations between WM SUVR and AD biomarkers, vascular markers, cognition, and cognitive decline. Linear mixed models evaluated the contribution of WM measures to cognitive outcomes.

Results: WM SUVR measures were not associated with AD-specific biomarkers. Higher WMH SUVR was associated with higher baseline MMSE (P=0.0001), while lower NAWM SUVR was associated with greater TLV (P=0.005), higher neurofilament light (P=0.001), and increased lobar (P=0.025) and non-lobar CMB burden (P=0.016). Adding NAWM and WMH SUVR significantly improved models predicting baseline MMSE, while NAWM SUVR also improved prediction of annual cognitive decline in the tau-PET subgroup (P=0.044).

Conclusion: Amyloid-PET WM uptake may reflect myelin integrity, with NAWM SUVR capturing early WM damage and WMH SUVR relating to cognitive performance. Although not associated with core AD pathology, both measures improved prediction of cognitive outcomes, supporting their value in multimodal assessment of AD.

Hausmann Alessa

Developing an FPVS-EEG Paradigm for Biomarkers in Neurodegenerative Diseases: Methodological Framework and Analytical Pipeline

Alessa Hausmann[1], Paula Sabatés[1], Valentina Borghesani[1]

[1]Université de Genève

Neurodegenerative diseases such as Alzheimer's disease (AD) and frontotemporal dementia (FTD) are known to alter language and cognitive processing, often well before clinical symptoms become apparent. This underscores the need for scalable, objective tools capable of detecting early markers of decline. Fast Periodic Visual Stimulation (FPVS) coupled with EEG offers a promising approach, providing a passive, behaviour-free measure of neural discrimination responses. However, no standardized FPVS paradigm has yet been validated specifically for neurodegenerative populations. This project presents the development and methodological framework of an FPVS-EEG paradigm designed to characterize semantic and executive processing in AD and FTD. The paradigm presents a stream of standard images at 6 Hz with embedded oddball images at 1.2 Hz, under two experimental conditions varying in semantic distance: a semantically distant condition and a semantically close condition, each paired with phase-scrambled control stimuli. EEG data will be collected from 15 healthy controls, 15 AD patients, and 15 FTD patients using a 64-channel system, with a structured ten-step preprocessing and analysis pipeline encompassing filtering, downsampling, segmentation, ICA, interpolation/rereferencing, averaging, FFT, and harmonic-based SNR/Z-score metrics. We hypothesize that oddball discrimination responses will be attenuated in neurodegenerative groups relative to controls, particularly in cases with moderate-to-severe semantic or executive impairment and in the semantically close condition, alongside reduced temporo-occipital connectivity. Differential response profiles across AD and FTD are expected to support the paradigm's potential for syndrome differentiation. Future work, conducted within the LiMoN-2 project in collaboration with partners in Peru and Argentina, will extend this approach toward a language-independent, cross-culturally applicable diagnostic tool.

Herve Nino

Beyond Localization: Intracranial Validation of Connectivity-Informed Source Imaging

Nino Herve[1], Yasser Alemán-Gómez[2], Nicolas Roehri[3], Patric Hagmann[1]

[1]UNIL/CHUV, [2]CHUV, [3]UNIGE/HUG

M/EEG source reconstruction is usually validated by how well it localizes activity to a single brain region, a criterion that misses the real value of connectivity-informed methods, whose strength lies in reconstructing how activity spreads across brain networks. A major obstacle to better validation is the lack of a true reference for this kind of interconnected activity. We address this by reviving a strategy from Grova et al. (2016) that uses simultaneous EEG and intracranial EEG (iEEG) recordings. Unlike fMRI or brain-resection outcomes, iEEG measures electrical activity directly inside the brain, offering a genuine ground truth free from the blurring and delay of other measures. We reconstruct EEG sources and project them onto the recording sites of the intracranial electrodes, producing an "estimated" iEEG signal that can be compared directly to the real one. Using recordings from three patients, we compare our connectivity-informed method, weighted CSET (wCSET), to standard methods (wMNE, sLORETA, dSPM) channel by channel. The improvement is clearest on channels that recorded the spike: there, wCSET reproduces a visible response timed to the true event, while standard methods stay flat. Channels that did not record the spike mostly contain background activity, limiting how much improvement can be seen regardless of method, and deep channels remain poorly reconstructed by every method tested. These preliminary results suggest that connectivity-informed reconstruction can recover transient network activity that standard methods miss entirely, rather than simply refining where that activity is located.

Hinnen Gabriel

Healing sleep to improve cognitive and emotional functioning in adolescents

Gabriel Hinnen[1], Paola Soulié[1], Kevin Mammeri[2], Camille Piguet[2], Sophie Schwartz[1], Virginie Sterpenich[1]

[1]University of Geneva, [2]University of Geneva, University Hospitals of Geneva

Sleep is a vital physiological process that plays a fundamental role in cognitive and emotional functioning. However, many adolescents experience poor sleep quality, although they need more sleep than adults. The aim of this project is to improve adolescents' sleep and measure its impact on cognition and emotional regulation. We designed a 4-week intervention consisting of group workshops on sleep, inspired by cognitive-behavioural therapy for insomnia (CBT-I). Adolescents monitored their sleep at home using both a sleep diary and an actigraph. Before and after the intervention, their cognitive and emotional functioning were assessed using questionnaires and behavioural tasks. These tasks included the Sustained Attention to Response Task (SART), a go/no-go paradigm assessing vigilance, and a virtual reality (VR) emotional regulation task inspired by the Montreal Imaging Stress Task (MIST). Here, adolescents performed arithmetic calculations in front of a virtual classroom and received positive or negative feedback based on their performance. Skin conductance and heart rate were recorded to quantify physiological arousal during stress induction. Participants were assigned either to an intervention group or to a waitlist control group. A total of 147 adolescents aged 15-25 years took part in the workshops. We observed that, following the intervention, participants showed improved sleep quality and efficiency. They also made fewer errors in the vigilance task, indicating a potential higher cognitive control. In the VR task, they demonstrated higher heart rate variability only during easier calculations, nuancing the impact of the intervention on acute stress regulation. These findings provide further evidence for the key role of sleep in supporting cognitive and emotional functioning, particularly during adolescence.

Ho Dac Léa Kim-Mi

Effects of hippocampal transcranial temporal interference stimulation on spatial navigation in TBI patients: a study design

Léa Ho Dac[1], Serena Reverberi[1], Hyuk-June Moon[2], Elena Beanato[3], Bertrand Léger[4], Karl Schaller[3], Friedhelm Hummel[5]

[1]École Polytechnique Fédérale de Lausanne, [2]Korea Institute of Science and Technology, [3]Hôpitaux Universitaires de Genève, [4]Clinique Romande de Réadaptation, [5]École Polytechnique Fédérale de Lausanne, Université de Genève

People who have suffered a traumatic brain injury (TBI) may experience spatial navigation issues and struggle to orient themselves in their environment. The hippocampus-entorhinal cortex (HC-EC) complex, which supports spatial memory functions, could be a good target for non-invasive brain stimulation (NIBS)-based therapy to ameliorate these symptoms. It has recently been shown that NIBS can target such deep brain regions using the principle of temporal interference. Transcranial temporal interference stimulation (tTIS) delivered to the HC-EC has been shown to reduce decision time to retrieve an encoded object, suggesting a facilitation of encoding processes[1]. Here, we present a study design involving a TBI population undergoing task-based functional magnetic resonance imaging (fMRI). After completing a screening session including a resting-state fMRI scan, thirty TBI patients will perform a spatial memory task in a virtual environment, where they must encode and then retrieve locations of objects in a virtual arena. The previously demonstrated task design was adapted for TBI population with high fatiguability. The paradigm will be conducted in a crossover design with two task blocks per stimulation conditions, excitatory iTBS-tTIS and high-frequency tTIS as a control condition. We expect to observe a reduced departure time and grid cell-like entorhinal cortex fMRI activity, as previously demonstrated in a healthy cohort. However, we anticipate that the effect will be more pronounced given that tTIS stimulation has demonstrated greater efficacy in patient populations with greater potential for improvement. Additionally, potential predictors of stimulation effect, such as the hippocampal grey matter volume and functional connectivity, will be investigated. [1] Beanato et al., 2024, Science Advances

Huang Yingqi

Rescuing Semi-Dry EEG Signals: Comparing Denoising Methods

Yingqi Huang[1], Abele Michela[1], Victor Ferat[2], Serge Vulliémoz[3], Tomas Ros[1]

[1] University of Geneva, Geneva, Switzerland.

[2] Fondation Campus Biotech Geneva, Geneva, Switzerland.

[3] Hôpitaux Universitaires de Genève, Genève, Switzerland

With the rapid advancement of clinical neuroscience and Brain-Computer Interfaces, there is an increasing demand for convenient, patient-friendly EEG acquisition methods suitable for diverse environments. Traditional gel-based EEG systems, while reliable, are often cumbersome and time-consuming, whereas dry electrode systems[2] tend to suffer from elevated noise levels. In a previous study, we found that wetting the hair with water (hereafter referred to as the wet condition) significantly reduces electrode impedance and improves both spectral power and functional connectivity measures relative to dry electrode application. In the present study, we systematically evaluated four EEG denoising pipelines under the wet condition. Twenty-two healthy participants underwent resting-state EEG recordings during eyes-open and eyes-closed conditions using wet and gel electrode setups. Each condition included 5 minutes with eyes open and 5 minutes with eyes closed. Gel-based EEG data were manually preprocessed and cleaned using ICA and served as the reference. Four denoising pipelines were applied to the wet EEG data: HAPPE[1], GEDAI[3], ASR, and pyLossless. Performance was assessed using spectral power, phase-locking value (PLV)-based functional connectivity, and microstate similarity. The results showed that GEDAI cleaned wet data (wet_GEDAI) exhibited the greatest overlap with the gel reference in spectral power. Topographic analyses of the EC/EO alpha-band power ratio showed that wet_GEDAI was the only pipeline showing no significant different channels from gel. Furthermore, wet_GEDAI demonstrated the highest similarity to the gel in PLV connectivity and produced individual microstate templates with the strongest correlation to the grand mean microstate maps obtained from gel EEG. These results demonstrate that GEDAI is a rapid and accurate EEG denoising tool.

Igelbüscher Carla Marie

The role of lipid droplets during mouse and human brain development

Carla Marie Igelbüscher[1], Carlotta Gilardi[1], Jocelyn Fleurimont[1], Marlen Knobloch[1]

[1]University of Lausanne

Lipid droplets (LDs) are intracellular lipid storage organelles. Recently, we showed that adult mouse neural stem/progenitor cells (NSPCs) contain a large number of LDs, which directly influence NSPC proliferation and metabolism (1). With our endogenous fluorescent LD reporter mouse, which allows staining-free visualization of LDs, we have also demonstrated that LDs are highly abundant in various cell types in the healthy adult brain (2). Furthermore, we found numerous LDs in the developing brain, and adding lipids to the medium of ex vivo embryonic brain sections resulted in increased LDs (2). These findings suggest that the build-up, breakdown, and storage of lipids in LDs might play an important role for brain development. However, very little is known about how LDs influence mouse and human brain development. Using the LD reporter mouse, we show that LD distribution in the embryonic brain dynamically changes over developmental time and between brain regions, and differs between NSPCs and neurons, suggesting that LD buildup and/or usage is regulated in a cell-type and region-dependent manner. To manipulate LDs during brain development, we are genetically ablating the key lipase adipose triglyceride lipase (ATGL) in the developing forebrain, which leads to an accumulation of LDs due to impaired lipolysis. We are currently assessing the consequences of such impaired LD usage on NSPC proliferation and cell fate at different developmental timepoints. Furthermore, we found that human NSPCs in cerebral organoids also accumulate LDs in a maturation-dependent way. Similar to the mouse approach, we are perturbing LD usage by inhibition of human ATGL and assess the consequences on human NSPC behavior and fate choice. These different model systems allow us to better understand the importance of LDs during early mouse and human brain development.

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Ilaridou Iliana

The Association of Joint Attention Skills across the Different Language Profiles in Autistic Children

Iliana Ilaridou[1], Nada Kojovic[2], Thibaut Chataing[2], Kenza Latreche[2], Fiona Journal[2], Sara Akhavan[2], Stefania Solazzo[2], Margot Giraud[2], Alice Longoni[2], Eva Vuilleumier[2], Corrado Sandini[2], Marie Schaer[1]

[1]University of Geneva, Switzerland, Fondation Pole Autism, Geveva, Switzerland, NCCR Evolving Language, [2]University of Geneva, Switzerland, Fondation Pole Autism, Geveva

Autism is a complex neurodevelopmental condition characterized by substantial variability in language skills. Early social communication skills, including Joint Attention (JA) are essential for language acquisition. JA, typically emerging by 6-9 months, includes Response to Joint Attention (RJA), the ability to follow others' attentional cues, and Initiation of Joint Attention (IJA), the ability to direct other's attention towards a reference point. Prior studies associate JA difficulties with later language outcomes and atypical development of social brain regions. Amygdala is among the brain regions most frequently implicated in autism's neurobiology, following an abnormal neurodevelopmental trajectory. This study investigates the developmental trajectories of early social skills across different language profiles in autistic children and their associations with structural alterations of amygdala. Data were drawn from the Geneva Autism Cohort, a longitudinal cohort of autistic preschoolers. IJA and RJA were measured using the Early Social Communication Scales (ESCS). The sample included 168 autistic prescholers (29F, 2.65±0.52 years) and 340 ESCS assessments. Language profiles were based on the clustering approached introduced by Latrèche et al., (2024), which identified 3 groups; a) Language Unimpaired (LU) with minimal or no impairments in language, b) Language Impaired (LI) characterized by important challenges in language and c) Minimally Verbal (MV) with limited verbal skills. Language skills stabilized by age 3.9 and verbal outcomes were assessed at a mean age of 4.5. K-means clustering based on the Verbal DQ skills at 4.5 years ($Verbal_{Outcome}$) revealed 3 groups; LU (43.5%, $Verbal_{Outcome}$=97.9), LI (33.9%, $Verbal_{Outcome}$=68.02) and MV (22.6%, $Verbal_{Outcome}$=27.4). More frequent IJA at age 2 predicted unimpaired language skills by age 4.5. Greater difficulty following the examiner's distal pointing predicted more language difficulties in later childhood. Additionally, higher rates of successfully following proximal pointing predicted better language outcomes. Beyond JA, more initiations and greater engagement in social interactions and more frequent and complex behavioral requests predicted better language skills. Associations between amygdala structure and early social skills across the different language profiles will also be presented. Our findings suggest that stronger IJA and RJA at age 2 predicted better language outcomes by 4.5 y.o., highlighting JA's importance in language acquisition.

Jana Nishant

Neuropeptide release and disinhibition interact in the control of inter-male aggression by medial amygdala GABA neurons

Nishant Jana, Ralf Schneggenburger, Olexiy Kochubey

LSYM BMI SV EPFL

Aggression is a fundamental social behavior, critical for the success of animal populations. The medial amygdala (MeA) is an important hub for processing social cues, and contains both glutamatergic and GABAergic projection neurons. Optogenetic stimulation of MeA-GABA neurons triggers inter-male aggression (Hong et al. 2014); however, this effect depends on the excitatory opsin variant employed (Baleisyte et al. 2022). We show that MeA-GABA neurons project to hypothalamic nuclei including Esr1+ neurons in the VMHvl, and GABAergic neurons in the adjacent tuberal (TU) area. TU-GABA neurons, in turn, contact VMHvl-Esr1+ neurons; the latter neurons are involved in aggression regulation (Lee et al., 2014). Here, we hypothesize that stimulation of MeA-GABA neurons under a strong optogenetic stimulation regime drives aggression via a possible interaction between disinhibition of VMHvl-Esr1+ neurons, and mobilization of neuropeptide release. VGATCre mice crossed with the CD1 strain were used in the resident-intruder assay, to ensure reliable baseline aggression. Optogenetic stimulation in the VMHvl of MeA-GABA axons expressing the slow excitatory opsin ChR2H314R (called ChR2 below), led to reliable stimulation of aggression, whereas stimulation with the faster Chronos had no effects. To test the role of TU-GABA mediated disinhibition, we combined optogenetic stimulation of MeA-GABA axons using ChR2, with chemogenetic inhibition of TU-GABA neurons. This significantly reduced the degree of aggression stimulation, but some amount of stimulated aggression remained. We therefore next tested whether aggression stimulation might be caused by a mobilization of neuropeptide release from MeA-GABA axons, by employing Neutral Endopeptidase targeted to large-dense core vesicles (LDCV-NEP), which suppresses neuropeptide release (Kim et al., 2024). Cre-dependent co-expression of LDCV-NEP, alongside with ChR2 in MeA-GABA neurons, led to a significant, but still incomplete block of aggression stimulation, and to qualitative changes in attack behavior. Finally, to test whether the remaining aggression stimulation in the presence of LDCV-NEP is driven by disinhibition, we combined LDCV-NEP expression with chemogenetic inhibition of TU-GABA neurons in optogenetic MeA-GABA axon stimulation experiments. This led to a near-complete absence of aggression stimulation. Our results show that a disinhibition of VMHvl neurons, originating from MeA-GABA neurons via the TU-GABA neurons, together with neuropeptide release caused by strong optogenetic activation of MeA-GABA axons, synergistically drive an immediate aggressive state.

Kanani Mehdi

ApoE and Tau interaction in astrocytes: trafficking and metabolism in Alzheimer's disease

Mehdi Kanani[1], Samantha Caboussat [1], Ola El Atab[1], Annne-Claude Gavin[1], Aurélien Lathuilière [1]

[1]Université de Genève

Background: Apolipoprotein E (ApoE) is the strongest genetic risk factor for sporadic Alzheimer's disease (AD), while tau pathology is the neuropathological feature that most closely tracks with disease severity and cognitive decline. Both proteins converge on overlapping receptor systems including the LDL receptor family (LRP1) and heparan sulfate proteoglycans that are highly expressed by astrocytes. Astrocytes are therefore uniquely positioned at the intersection of ApoE and tau biology, yet how these two proteins interact at the receptor level, and how this interaction shapes astrocyte metabolism, remains poorly understood. Here we present early, preliminary data tackling three questions: (1) How does tau affect ApoE internalization? (2) How does ApoE interact with tau seeds? (3) How does tau affect astrocyte lipid metabolism? Methods: Using the human astrocytic cell line CCF-STTG1 and isogenic iPSC-derived astrocytes, we established a recombinant ApoE production and lipidation platform covering all major isoforms (ApoE2, E3, E4) and rare variants. ApoE uptake was quantified by immunocytochemistry. Tau seeding was measured using a stable FRET biosensor line and flow cytometry. Lipid droplet dynamics were assessed by fluorescence imaging following oleic acid induction, and downstream signaling was characterized by western blot. Results: Extracellular monomeric tau significantly reduced ApoE internalization in an isoform- and lipidation-dependent manner, an effect blocked by receptor-associated protein (RAP), implicating the LDL receptor family. Reciprocally, ApoE, particularly in its lipidated form reduced tau seeding activity, and endogenous ApoE co-clustered with intracellular tau aggregates. A pilot experiment using high-content imaging across both cell models suggested isoform-dependent ApoE uptake, with ApoE2 showing the lowest internalization; given the possibility of isoform-specific antibody recognition bias, a site-specific fluorescent labeling strategy is currently being developed to validate these findings independently of antibody detection. Finally, extracellular tau monomers reduced lipid droplet formation through a receptor-dependent mechanism, associated with transient activation of ERK signaling downstream of receptor engagement. Conclusion: These preliminary findings reveal a reciprocal, receptor-mediated interaction between ApoE and tau in astrocytes that influences both their cellular fate and astrocyte lipid metabolism, supporting a working model in which astrocytic receptor engagement determines the balance between protective clearance and pathological propagation in Alzheimer's disease. Ongoing work aims to dissect the specific receptors involved and the downstream metabolic consequences of this interaction.

Konstantopoulou Stefania

Left, not right, congruency effects in the flanker task activate frontoparietal and control networks

Stefania V. Konstantopoulou1, Bianca Borsarini1, Sélim Coll1, Emilie Marti1, Radek Ptak1,2

1) Network Plasticity Modulation (NetPM) Lab, Department of Clinical Neuroscience, Faculty of Medicine, University of Geneva, Geneva, Switzerland

2) Division of Neurorehabilitation, Geneva University Hospitals, Geneva, Switzerland

Introduction: The congruency effect in the flanker task is generally considered to reflect executive control processes and inhibition. Previous studies have shown that incongruent flankers tend to engage fronto-cingulate networks responsible for conflict monitoring and response selection. We here show that when the flanker is unilateral and congruency is defined by color, the congruency effect for flankers in the left hemifield activates bilateral fronto-parietal networks in addition to the cingulate cortex.

Methods: Forty-five healthy adults (26 females; mean age = 61.7 years) performed a color-based flanker task during fMRI acquisition. They were required to react to a central, colored target preceded by a single left or right flanker of the same (congruent, ConL or ConR) or a different (incongruent, IncL or IncR) color. Data were pre-processed and analyzed using SPM. Contrasts were computed with main effects and interactions of congruency and side. Whole-brain results were corrected for age and FWE-thresholded at $p < .05$.

Results: Compared to each other, left and right flankers activated contralateral occipito-temporal cortex, irrespective of congruency. When comparing the congruency effects for left flankers (IncL-ConL > IncR-ConR) we found bilateral activation of frontoparietal regions including the dorsolateral prefrontal cortex (dlPFC), frontal eye field (FEF), dorsal anterior cingulate (dACC), visual and motor areas. The reverse contrast did not yield any significant results.

Conclusions: Our findings show that only the congruency effect associated with left flankers triggers a strong bilateral activation of attention and executive networks, suggesting a bias in the left hemifield toward conflicting information.

Krishnamoorthy Deeksha Gopinath

Mapping the social behavior spectrum of juvenile zebrafish: from affiliation to aggression escalation

Deeksha Krishnamoorthy[1], Johannes Larsch[1]

[1]CIG, University of Lausanne

Social interactions are highly variable within and across individuals. The sight of a conspecific may trigger affiliation, antagonism, or no response at all, depending on predisposition, past and present experience. The neuronal cell types, connectivity, and activity patterns controlling such context-dependent social decisions are poorly understood. Juvenile zebrafish have emerged as a model system to study the neuronal basis of social interactions because of convenient optical and genetic access to the brain, and because they have an innate drive to interact. Here, we characterize the social behavior spectrum of juvenile zebrafish pairs, with particular emphasis on the progression of aggressive interactions. Using supervised (Random Forest classifiers) and unsupervised (clustering and Hidden Markov Models) machine learning approaches, we segment and characterize juvenile zebrafish social behaviors. Across arena configurations, wild-type lines, and developmental stages, these approaches reveal repeatable trends in aggression dynamics, while also highlighting behavioral features that remain more variable and require further refinement. Together, these findings provide a framework for linking juvenile zebrafish social behavior to its underlying neural mechanisms.

Labancová Katarína

Decoding the incremental construction of syntactic structure

Katarína Labancová[1], Nina Kazanina[1]

[1]Department of Basic Neurosciences, Faculty of Medicine, University of Geneva

Real-time language comprehension requires incrementally integrating lexical items into hierarchical phrase representations. Because linguistic input unfolds sequentially over time, earlier word representations may need to be maintained until the information required to form the complete concept becomes available. Prior work has shown that individual words are actively represented in neural activity until they can combine into a phrase (Desbordes et al., 2024). However, this study used simple phrase constructions, and it remains unclear how these dynamics extend to more complex syntactic configurations involving multiple phrases and delayed integration across longer temporal spans. Here, we investigate how long word-level representations remain actively represented in the neural signal when they must be bound to a phrase head, and how this timing depends on whether integration occurs immediately or is delayed by intervening material. This provides a temporal test of how lexical information is coordinated during incremental phrase construction. In an ongoing MEG study, healthy adult participants read sentences presented one word at a time. Using French language stimuli, where adjectives can precede or follow a noun that they modify, we manipulate when a complete phrase is formed. Compare “le beau petit verre” (the pretty little cup), where adjectives can only bind to the noun at the end of the phrase, and “le table rouge lourde” (the table red heavy) where each adjective can immediately bind to the noun, which is incrementally modified by them. At a higher hierarchical level, we manipulate whether two phrases are integrated into a single complex representation (PP-modification: “Look at the pretty little cup ON the heavy red table”) or describe two separate objects (conjunction: “Look at the pretty little cup AND the heavy red table”). After sentence presentation, participants answer a question (e.g. “What color is the table?”) probing one of the phrases. Multivariate decoding is used to identify neural activity patterns corresponding to individual words. We then use the temporal generalization method to track how long these word-level representations remain decodable during sentence processing and whether they re-emerge at retrieval. Crucially, this allows us to quantify when individual words are no longer independently decodable and how this timing relates to points of syntactic integration within the sentence when lexical information should be incorporated into higher-level representations. We test three main predictions. First, lexical items awaiting integration into phrase structure will remain decodable until the phrase head becomes available. Pre-nominal adjectives should therefore be decodable longer than post-nominal adjectives, which can immediately bind to the noun and do not need to be represented independently. Second, phrase heads are expected to remain decodable until the phrase is complete, both within a simple noun phrase (the noun should remain active throughout the presentation of post-nominal adjectives) and when they serve as anchors for larger hierarchical structures (i.e. “cup” should be active longer in the PP-modification condition compared to the conjunction condition), consistent with their role in organizing phrase-level representations. Data collection is ongoing, with pilot analyses currently underway and full within-subject results expected by the time of presentation.

Luo Junlian

A multivariate approach linking alpha activity and aperiodic EEG features to perception and cognition

Junlian Luo[1,2], Maëlan Menétrey[1,2], Marina Kunchulia[3], Khatuna Parkosadze[3], Michael Herzog[4] & David Pascucci[1,2]

[1]Psychophysics and Neural Dynamics Lab, Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland
[2]The Sense Innovation and Research Center, Lausanne, Switzerland
[3]Research Institute of Cognitive Neurosciences, Free University of Tbilisi, Georgia
[4]Laboratory of Psychophysics, Brain Mind Institute, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Perceptual science is often driven by the aim of linking behavioral phenomena to neural activity, such as relating the EEG alpha rhythm (8–12 Hz) to perception and cognition. Almost all studies in the field correlate the outcome of one single perceptual or cognitive task with the individual alpha frequency or power. Here, we adopted a multivariate approach, using a protocol that combines resting-state and task-based EEG recordings (N = 22) with a battery of eight canonical tasks, including orientation discrimination, temporal integration, bistable perception, the Stroop task, spatial attention, visual search, and working memory. We assessed associations between behavioral measures (accuracy and reaction times) and EEG features, including alpha peak frequency and amplitude, as well as aperiodic slope and offset. We found only weak and sparse correlations among behavioral measures, with stronger consistency mainly for reaction times across tasks, but not for accuracy. EEG features show moderate test–retest reliability but no clear or consistent relationship with behavior. Overall, these results indicate that the relationship between EEG alpha features and perceptual and cognitive performance is far from a simple one-to-one mapping and instead exhibits substantial heterogeneity.

Mammeri Kevin

Home sleep monitoring: Assessing the reliability of a wearable device for sleep in Insomnia Disorder

Kevin Mammeri[1], Pavlos Topalidis[2], Vincent Rochas[1], Laurence Bayer[1], Manuel Schabus[2], Lampros Perogamvros[1]

[1]University of Geneva, [2]University of Salzburg

Insomnia disorder (ID) is the most prevalent sleep disorder and is associated with significant daytime impairment. As its diagnosis relies entirely on subjective clinical criteria, the complaint of insomnia reflects an individual's perception of sleep accumulated over many nights. Although electroencephalography (EEG) is the gold standard for objectively measuring sleep, its use is limited by its cost, complexity, and lack of ecological validity. Consequently, there is a need for reliable, accessible, and home-based sleep monitoring tools. Wearable devices have shown promising accuracy for estimating sleep but remain less reliable for detecting wakefulness, a key feature of ID. This study aimed to evaluate the reliability of one wearable (Polar Verity Sense) in individuals with ID. More than 70 participants underwent a home-based overnight EEG recording while simultaneously wearing the device. Data collection has been completed, and analyses comparing wearable-derived sleep metrics with EEG outcomes are currently underway.

Mauriello Cheyenne

Temporal order memory abilities in individuals with Down or Williams syndrome, and typically developing children

Cheyenne Mauriello[1], Lucia-Manuela Cantonas[2], Pierre Lavenex[1], Pamela Banta-Lavenex[2]

[1]University of Lausanne, [2]UniDistance Suisse

Temporal order memory enables the encoding, maintenance and retrieval of the temporal structure of events. However, different types of temporal order memory may rely on dissociable neural systems, and the developmental trajectories and specific brain regions that subserve them remain poorly understood. Here, we aimed to characterize temporal order memory abilities in individuals with Down (DS) or Williams (WS) syndrome and typically developing (TD) children, focusing on two theoretically distinct forms of temporal coding: temporal distance (which event occurred first) and relative temporal order (the precise order of events). Individuals with DS (n=23), WS (n=26) and TD children (n=27) completed novel behavioral tasks developed with this multiple memory systems framework in mind. Temporal distance memory was assessed using a Primacy/Recency task. Relative temporal order memory was assessed using a What-Where-When task. TD children served both as a mental age-matched comparison group for individuals with DS or WS, as well as an experimental group in which to describe the typical development of different temporal order memory abilities. We will present data on (1) between group differences in performance for each temporal order memory task; and (2) within-group differences between different temporal order memory tasks. In TD children, we predict age-related improvements varying by task, supporting our hypothesis that temporal order memory is composed of distinct processes with distinct developmental trajectories. In individuals with DS or WS, we predict different performance between tasks, supporting our hypothesis that distinct types of temporal order memory are supported by dissociable neural systems.

Miftari Arben

Connectome-Level White Matter Changes in Idiopathic Normal Pressure Hydrocephalus

Arben Miftari [a], Giulia Bommarito [a], Stéphane Armand [b], Frédéric Assal [c], François R. Herrmann [d], Dimitri Van De Ville [e,f], Alessandra Griffa [a,e], Gilles Allali [a]

a Leenaards Memory Centre, Department of Clinical Neurosciences, Lausanne University Hospital and University of Lausanne, Lausanne, Switzerland
b Kinesiology Laboratory, Geneva University Hospitals and University of Geneva, Geneva, Switzerland
c Division of Neurology, Department of Clinical Neurosciences, Faculty of Medicine, Geneva University Hospitals, University of Geneva, Geneva, Switzerland
d Department of Rehabilitation and Geriatrics, Geneva University Hospitals and Faculty of Medicine, University of Geneva, Geneva, Switzerland
e Neuro-X Institute, École Polytechnique Fédérale De Lausanne, Geneva, Switzerland
f Department of Radiology and Medical Informatics, University of Geneva, Geneva, Switzerland

Idiopathic normal pressure hydrocephalus (iNPH) is the most common reversible dementia in older adults, marked by ventriculomegaly with gait, cognitive, and urinary disturbances. White-matter disruption is well documented, but most diffusion MRI studies rely on voxel-based approaches. As iNPH affects widespread pathways via mechanical and CSF-related mechanisms, a connectome-level view is needed. This study tests whether FA-weighted structural connectomes reveal network-specific alterations beyond periventricular damage.

iNPH patients (n=26; 80.1±5.9y; 15M/11F) and healthy controls (n=41; 74.9±5.4y; 11M/30F) underwent T1 and diffusion MRI. FA maps were derived via MRtrix3 tensor fitting. FA-weighted connectomes were built by sampling mean FA along HCPA-422 atlas streamlines across 374 regions. Edge-wise group differences were tested with Student's t-tests (covarying age, sex, education), FWE-corrected via network-based statistics (NBS; q=0.05). Per node, we computed a dominance score (direction of FA change) and the percentage of significant edges relative to degree, then mapped alterations onto resting-state networks (RSNs).

6.15% of edges survived NBS correction, mostly increased FA in patients (74.65%), with smaller decreased-FA clusters (25.35%). Increased-FA edges dominated lateral posterior regions (occipital, posterior temporal, inferior parietal), while decreases clustered in left medial occipito-parietal and right ventral temporal areas. Significant-edge burden peaked in posterior/medial parietal and dorsal occipital regions. At the RSN level, visual central, dorsal attention, and control networks showed the highest dominance scores.

FA connectomes reveal widespread, spatially organized WM disruption in iNPH, combining posterior FA increases (possibly reflecting compensatory reorganization or mechanical compression) with focal medial/ventral decreases. Connectome metrics could complement existing microstructural biomarkers.

Milanese Paola Esther

Neuromelanin accumulation induces a projection specific LC vulnerability that leads to altered REMS in mice predisposed to Alzheimer's Disease

Paola Milanese[1], Georgios Foustoukos[1], Laura M.J. Fernandez[1], Lila Banterle[2], Matthias Prigge[3]

[1]University of Lausanne, [2]Sorbonne University, [3]Humboldt Berlin University

The onset of Alzheimer's disease (AD) is signaled by initially minute but ultimately disastrous physiological brain malfunctions. The Locus Coeruleus (LC) generates strong noradrenaline (NA) signals that are key for sleep architecture and belongs to the earliest brain areas to show malfunctions in AD. Therefore, insights on how sleep disturbances relate to LC malfunctions could provide sensitive signatures of the prodromal stages of AD. We explore the real-time functionality of the noradrenergic system in APPNL-F/MAPT knock-in mice (dKI) with or without virally-induced neuromelanin (NM) accumulation. A biosensor for neuronal Ca2+ fluctuations (GCaMP8s) was injected in subpopulations of LC, sometimes paired with a human tyrosinase virus inducing NM accumulation. A biosensor for free NA levels (GRABNE1h) was injected in the projection area. We also record polysomnography (EEG/EMG), and local field potential (LFP) activity in the somatosensory cortex and in CA1 to assess vigilance states and local sleep properties in dKI aged 12-17 months. Our data indicates that in the absence of NM, dKI up to 17 months-old show preserved sleep and NA signaling. In contrast, within weeks of NM accumulation, we observe a projection-specific unsilencing of LC activity during REMS that coincides with a decrease in time spent in REMS and its mean bout length, while NREMS remains preserved. These experiments are complemented by histological analysis of NM-associated neurodegeneration, and by in-vitro patch-clamp recordings. Decoding the patterns of LC's dysfunction during the prodromal phase of AD and their consequences on sleep could prove essential to early diagnosis of AD and interventions.

Mohrhauer Lucy

Distinct Developmental Windows Generate ARH and RCH POMC Neurons

Lucy Mohrhauer[1], Sophie Croizier[1]

[1]Université de Lausanne

Hypothalamic pro-opiomelanocortin (POMC) neurons control various functions such as energy balance and glucose homeostasis through projections to other brain areas and the spinal cord. POMC neurons are found in the arcuate nucleus (ARH), and the adjacent retrochiasmatic area (RCH). Interestingly, POMCARH and POMCRCH neurons display distinct projection patterns, with only POMCRCH neurons projecting to the spinal cord. Unpublished studies from the lab show that, during development, cells in the RCH are generated earlier than cells in the ARH. We have thus hypothesised that the date of birth (DOB) of POMC neurons contributes to their anatomical distribution within the ARH and the RCH and influences their projection pattern. To determine POMCARH and POMCRCH DOB, pregnant C57Bl6/J mice received a single EdU injection between embryonic days E9 and E15. Brains from males and females were collected at postnatal day 7 (P7), and POMC immunohistochemistry and EdU detection were performed on brain cryosections. The number of EdU-positive POMC neurons was quantified throughout the ARH and RCH. Preliminary results reveal distinct temporal patterns of POMC neurogenesis across hypothalamic RCH and ARH. In both males and females, POMCARH neurons show a birth peak at E12, whereas most POMCRCH neurons are generated earlier, between E9 and E11. These findings establish developmental timing as a potential source of POMC neuronal diversity and provide a foundation for further studies investigating whether birth date influences projection patterns and functions of POMC populations.

Mombelli Elena

Direct and indirect pathway neurons in the auditory tail striatum oppositely modulate defensive behavior and might regulate fear memory expression

Elena Mombelli[1], Olexiy Kochubey[1], Ralf Schneggenburger[1]

[1]EPFL

Fear learning and expression are two important processes enabling organisms to identify threats and properly react to them, respectively. In the laboratory, these processes are studied using the auditory-cued fear conditioning paradigm (AFC), in which an auditory cue (CS, conditioned stimulus) is paired with a mildly aversive stimulus (US), and freezing behavior is measured as a readout of learned fear. Fear learning and expression have been linked to the activity of the lateral and central amygdala. In addition, emerging evidence has highlighted the contribution of the auditory tail striatum (TS) to the acquisition of auditory-cued fear memories. However, the contribution of specific TS neuronal populations, like "direct" (D1R) or "indirect" (D2R) pathway neurons to the regulation of fear responses remains largely unknown. Because D1R neurons are known to co-express the Tac1 gene, and D2R neurons the Adora2 gene, we here employed Tac1Cre and Adora2Cre mouse lines to target direct and indirect pathway neurons of the TS. Using Tac1Cre mice crossed with a tdTomato reporter line (Ai14), we found that Tac1Cre neurons in the TS (TS-Tac1+ neurons) show a characteristic, non-homogenous distribution along a dorso-ventral band in the medial TS, that overlaps with D1R expression. We then studied the connectivity of TS-Tac1 neurons. Using a rabies-based tracing approach, we identified monosynaptically connected presynaptic neurons across multiple subdomains of the auditory cortex, with the highest density located in the primary and ventral auditory cortex. Furthermore, mapping of the output targets of TS-Tac1 neurons using synaptophysin-mCherry to label axon terminals, revealed strong projections to the lateral part of the substantia nigra pars reticulata (SNpr-lat). We next investigated the role of TS-Tac1+ neurons in fear expression. Optogenetic stimulation of TS-Tac1 neurons after Cre-dependent expression of Chronos (2 ms pulses at 25 Hz for 30s; 10 mW) significantly reduced locomotion in the open field, coupled with horizontal, sweeping head movements, whereas in control mice expressing eGFP, blue light application was uneffective. Correspondingly, when mice were trained with weak footshocks in the AFC (0.4 mA), optogenetic stimulation of TS-Tac1+ neurons was sufficient to elevate CS-induced freezing to normal levels during the recall session. Interestingly, similar behavioral effects were found when we stimulated the TS-Tac1 axons in the SNpr-lat. In contrast, optogenetic stimulation of TS-Adora2 neurons reduced freezing levels, both when the manipulation was performed during a contextual recall session, and during the CS presentation in a changed context. However, optogenetic stimulation of TS-Adora2+ neurons in the open field during regular exploration of mice was uneffective. Thus, we show a complementary and opposite regulation of defensive responses and exploratory behavior by "direct" and "indirect" pathway neurons in the tail striatum. In addition, these findings reveal an unexpected reversed function with respect to the classical role attributed to dorsal striatal direct - and indirect pathway neurons in movement control.

Mousavi Seyedeh Maryam

Therapeutic Potential of Urolithin A in a Preclinical Stroke Model

Maryam Mousavi[1], Julia Castillo-González [1], Lara Buscemi[1], Melanie Price[1], Lorenz Hirt[1]

[1]University of Lausanne, Lausanne University Hospital

Stroke is one of the leading causes of mortality and morbidity worldwide. Recent studies have highlighted the significant impact of the gut-brain axis and metabolites derived from intestinal microbiota on stroke outcome. Our current studdy investigates the effects of short-term and long-term treatment with Urolithin A (UA), the predominant metabolite produced from ingested ellagitannins and ellagic acid by gut bacteria, on stroke outcome in a transient middle cerebral artery occlusion (tMCAO) model. For this purpose, two sets of experiments were designed, and infarct size, neurological score, and blood-brain barrier (BBB) leakage were evaluated. In the short-term trial, mice received intraperitoneal injection of UA 24h and 1h before, as well as 24h and 48h after the surgery, and were sacrificed on day 3. In the extended experiment, mice were treated with UA until day 6 and sacrificed on day 7 following MCAO. Our findings indicated a remarkable improvement in functional outcome following short-term UA treatment and a significant reduction in infarct ratio in the hippocampus. Continuous administration of UA until day 6 also significantly ameliorated neurological deficiency starting from day 4 following stroke. Moreover, UA treatment in both paradigms significantly abbreviated the IgG leakage ratio compared to the saline-treated animals. Present data show beneficial effects of UA on functional outcome and BBB integrity in our MCAO model. Further analysis investigating the role of UA in vascular remodeling and automated gait assessment following stroke induction are ungoing.

Oropallo Matilde

Slow Waves across Epileptogenesis in Kainate-induced Epilepsy

Matilde Oropallo[1], Prince Kumar Singh[2], Tawfeeq Shekh-Ahmad[2], Matthew C. Walker[3], Laurent Sheybani[4]

[1]Department of Fundamental Neurosciences, University of Lausanne, Switzerland, [2]The Institute of Drug Research, The School of Pharmacy, Faculty of Medicine, The Hebrew University of Jerusalem, Jerusalem, Israel, [3]Research Department of Epilepsy, UCL Queen Square Institute of Neurology, University College London, London, United Kingdom, [4]Neurologie, Département des Neurosciences Cliniques, Geneva University Hospitals and University of Geneva, Geneva, Switzerland

Background: Epilepsy is one of the most common neurological disorders, and imbalance between excitation and inhibition is central to its pathogenesis. In people with epilepsy, recent studies have provided suggestive evidence of a protective effect of slow waves (SWs) against epileptic-associated excitability. However, we lack an understanding of SW dynamics during epileptogenesis, i.e., before seizures start. Here, using the kainate intrahippocampal model of temporal lobe epilepsy, we asked whether SW incidence and their interplay with high-gamma (HG) activity, a proxy of neuronal activity, changes during epileptogenesis.

Methods: We used automatic detection of SW in >50 days longitudinal recordings across wake and sleep in 8 epileptic rats. We computed HG activity at SW peak to probe the propensity of SW to modulate neuronal discharges.

Results: Preliminary analyses reveal a progressive increase in SW incidence across time, potentially reflecting a compensatory response against epilepsy-related excitability. Interestingly, we also observed a dynamic shift in the relationship between SW activity and HG modulation over time, with wake SW being progressively more associated with down-states than sleep SW.

Conclusions: Current analyses focus on identifying a specific epileptic biomarker (seizures, epileptiform discharges, fast-ripples), whose expression—including incidence and timing—may be shaped by SW and their interplay with HG.

Panfilova Diana

Endogenous lipid droplets exhibit profound proteomic and lipidomic differences across neural stem cell states

Diana Panfilova[1], Mergim Ramosaj[1], Manfredo Quadroni[1], Marlen Knobloch[1]

[1]UNIL

Lipid droplets (LDs) are protein-coated organelles that regulate neutral-lipid storage and hydrolysis, and their functions have been increasingly recognized to extend well beyond energy management. Recent work has implicated LDs in metabolic regulation of neural stem/progenitor cells (NSPCs). We previously observed that LD abundance and morphology differ between quiescent NSPCs (qNSPCs), proliferative NSPCs (proINSPCs), and NSPC-derived astrocytes, yet whether LD protein and lipid composition varies across these states remains unknown. Here, we generated the first comprehensive endogenous LD proteome and lipidome of NSPCs and their progeny. State-resolved analyses reveal striking differences in LD-stored lipids and LD-associated proteins across NSPC states, with extensive and selective enrichment of specific proteins on qNSPC LDs. To illustrate functional relevance of this state-specific LD composition, we focused on CIDEB, a protein strongly enriched on qNSPC LDs. CIDEB knockdown was associated with altered LD size and transcriptional features resembling a senescence-like transition in qNSPCs, suggesting a role in quiescence maintenance. In summary, this study provides a comprehensive endogenous LD proteomic and lipidomic atlas of NSPCs and their progeny, uncovers robust cell-state-specific LD composition, and establishes a resource for investigating LD biology in NSPC maintenance and lineage progression.

Panzeri Alessandra

Cardiac interoception and insular cortex: a pathway to understanding social deficits in autism

Alessandra Panzeri[1], Lorena Jourdain[1], Amirali Kalbasi[1], Marialucia Telesca[2], Caroline Lourenco Alves[1], Njiva Andrianarivelo[1], Sarah Costantino[2], Francesco Paneni[2], Camilla Bellone[1]

[1]University of Geneva, [2]University Hospital Zurich and University of Zürich

Interoception enables the brain to monitor internal bodily states and adapt behavior accordingly. The posterior insular cortex (pIC) plays a central role in integrating interoceptive and sensory information, yet its contribution to negative social experiences remains poorly understood. This gap is particularly relevant for autism spectrum disorder (ASD), where altered sensory integration and social behavior co-occur. Here, we investigate how brain–heart communication supports behavioral responses to negative social encounters, using Shank3-deficient mice as a model of ASD and wild-type controls. We focus on social behaviors with negative valence, which remain unexplored in ASD research. By combining behavioral assays with fiber photometry, miniscope imaging, and cardiac telemetry, we monitor neuronal activity in the pIC and cardiac dynamics during baseline and social interactions. Shank3-deficient mice display altered aggressive behavioral organization despite preserved total engagement time. In wild-type animals, aggressive encounters elicit coordinated changes in pIC activity and heart rate. In contrast, Shank3-deficient mice show reduced synchrony between cardiac signals and pIC activity during negative social events. To assess the circuit basis of this dissociation, we examine the contribution of distinct behavior-specific neuronal populations within the pIC. Parallel functional and structural analyses of the heart indicate that loss of Shank3 alters cardiac properties that may impair brain–heart integration. Together, these findings suggest that Shank3 loss leads to maladaptive responses to negative social encounters by disrupting the integration of cardiac signals with interoceptive cortical circuits. This work highlights brain–heart communication as a key mechanism linking interoception, social behavior, and ASD-related phenotypes.

Parapera Papantoniou Lito

Dissecting Social Stress Responses Through A Paradigm Of Contextual Processing

L. Parapera Papantoniou1, C. Bezzola1, P.H. Prouvot Bouvier1, P. Boadas Vaello2, K. Monsorno1, R.C. Paolicelli1, S. Tzanoulinou1

1University of Lausanne, Department of Biomedical Sciences, Lausanne, Switzerland, 2University of Girona, Department of Medical Sciences, Girona, Spain

Social stress represents an intense and omnipresent stressor that can manifest as war, bullying or interpersonal violence, and that is associated with increased risk for developing anxiety and stressor-related disorders in more susceptible individuals. The environment where stress is experienced poses a great impact on the way aversive information is encoded and in fact, deficits in contextual processing are considered a contributing factor to PTSD. While protocols for social stress have been well-established, it is often studied as a separate domain from contextual processing. Here, we developed a protocol for social conditioned-place avoidance (sCPA) and we characterize its effects on behavioral, central and peripheral processes. Our results indicate that stressed mice consistently learn to avoid the defeat-associated context, exhibit increased anxiety-like behavior and develop a long-lasting and generalized memory for the aggressors. Interestingly, our analyses reveal region-specific changes in microglia density, with increased density observed in the basolateral amygdala and decreased density in the hippocampal CA1. Moreover, we observe alterations in peripheral immune markers in the aftermath of stress. Regarding indices of vulnerability, anxiety trait emerges as a potential driver for the observed behavioral variability. In fact, whereas mice stratified in high and low anxiety groups show no differences in acquiring associations between social stress and context, they, however, display a different phenotype during delayed recall, suggesting distinct behavioral adaptations between the anxiety groups. Overall, our data address diverse social stress effects on distinct behavioral and physiological domains and aim to uncover the underlying factors of stress response variability.

Pascucci Alessandro

From Sleep Dysfunction to Psychosis Risk: Longitudinal Wake EEG Signatures in 22q11.2 Deletion Syndrome

Alessandro Pascucci[1], Natacha Reich[1], Caren Latrèche[1], Corrado Sandini[1], Stephan Eliez[1]

[1]University of Geneva

Background: Sleep disturbances are increasingly recognized as contributors to psychosis vulnerability and may interact with neurodevelopmental and inflammatory processes. Individuals with 22q11.2 deletion syndrome (22q11.2DS), one of the strongest genetic risk factors for schizophrenia, frequently exhibit alterations in sleep physiology, fatigue, and daytime sleepiness. However, polysomnography is difficult to acquire longitudinally, highlighting the need for accessible biomarkers of sleep-related physiology. Methods: Resting-state EEG recordings from 191 participants (371 recordings), including healthy controls and individuals with 22q11.2DS, were analyzed. Wake EEG slow-wave density (SWD) and slow-wave peak-to-peak amplitude (PTP) were extracted as candidate sleep-related markers. Partial Least Squares (PLS) analysis was used to investigate associations between wake SWD and nocturnal slow-wave slope obtained from matched sleep and wake EEG recordings. Developmental trajectories of wake PTP were examined using linear mixed-effects models across childhood, adolescence, and early adulthood. Results: Wake SWD was significantly associated with nocturnal slow-wave slope, a marker of sleep pressure dissipation, supporting further investigation of wake EEG slow-wave metrics in relation to sleep-related physiological processes. Longitudinal analyses revealed significantly different age-related trajectories of wake PTP between healthy controls and individuals with 22q11.2DS (Diagnosis × Age interaction, $p < 0.001$), indicating atypical developmental patterns of wake EEG activity in the deletion syndrome. Conclusions: Resting-state wake EEG may provide an accessible approach for investigating sleep-related physiological alterations across development in 22q11.2DS. Future work will examine associations between wake EEG markers, biological measures including glymphatic and inflammatory markers, cognitive functioning, and psychosis-risk trajectories to better understand the relationships between sleep dysfunction, biological processes, and psychosis vulnerability.

Patsourakos Vasileios

Optogenetic therapy to treat spasticity in a mouse model of spinal cord injury

Vasileios Patsourakos[1], Steven Ceto[2], Sriparna Ghosal[2], Luca Liebi[3], Ivana Gantar[4], Domitille Rajot[2], Samira Osterop[2], Dominik Friedli[2], Aaron Egounlety[2], Johanne Jarrige [2], Jocelyne Bloch[1], Gregoire Courtine[3], Stephanie Lacour[3], Thomas H. Hutson[2]

[1]University of Lausanne, [2]Wyss Center for Bio and Neuroengineering - Geneva, [3]École Polytechnique Fédérale de Lausanne, [4]Hôpital national des Quinze-Vingts

Spasticity is a sensorimotor condition affecting more than 12 million people worldwide and presents a large unmet clinical need. Spasticity is characterized by involuntary, painful, muscle spasms, hypertonicity, hyperreflexia and clonus. Current treatments are often ineffective due to slow pharmacokinetics, tolerance, or nonspecific side effects, highlighting the urgent need for therapies with greater spatiotemporal precision. To address this, we are developing an optogenetic therapy for spasticity composed of two elements: a motor-neuron-targeted gene therapy to deliver light-sensitive inhibitory opsins to affected muscles, and a soft, stretchable optoelectronic nerve cuff containing micro-LEDs for photo-stimulation of peripheral nerves. Focusing on the gene therapy component, we have achieved efficient retrograde transduction and opsin expression in spinal motor neurons that innervate specific muscles. Leveraging cell-type-specific targeting strategies including RNA-sensing, which uses an endogenous RNA repair mechanism to couple the detection of a unique cell-defining RNA with the expression of the opsin. We are now assessing the translational potential of our targeted gene therapy using human iPSC-derived spinal cord organoids. By combining cell-targeted gene therapy with implantable, biocompatible optoelectronic devices, we have demonstrated efficient optogenetic inhibition of muscle function in both acute electrophysiological test and chronically implanted mice. This platform has the potential to transform treatment for a range of neurological disorders.

Peithi Amalia

Quantitative neuroanatomy of the hippocampus in two mouse models of Williams syndrome

Amalia Peithi[1], Laurens W.J. Bosman[2], Stéphanie Dijkhuizen[2], Chris I. De Zeeuw[2], Victoria Campuzano[3], Bruno Bontempi[4], Susanna Pietropaolo[4], Pamela Banta Lavenex[5], Pierre Lavenex[1]

[1]University of Lausanne, [2]Erasmus MC Rotterdam, [3]University of Barcelona, [4]University of Bordeaux, [5]UniDistance Suisse

Williams syndrome (WS) is a rare neurodevelopmental disorder caused by the hemizygous deletion of approximately 26 genes on chromosome 7. Individuals with WS exhibit cognitive deficits suggestive of hippocampal dysfunction, yet the underlying structural abnormalities remain poorly understood. Here, we provide quantitative data on the structural organization of the hippocampus in two mouse models that replicate the human WS hemideletion: the complete deletion (CD) model, retaining the Ncf1 gene, and the long deletion (LD) model, in which Ncf1 is deleted. This comparison allows assessment of potential cardiovascular contributions to brain structural alterations. We used design-based stereological techniques on 50-µm-thick Nissl-stained brain sections to estimate volume, neuron number, and neuronal soma size in the major hippocampal regions of wild-type and mutant mice. Both CD and LD mice exhibited reduced forebrain volume, consistent with findings in individuals with WS. In LD mice, the reduction in hippocampal volume was proportional to that of the forebrain, whereas in CD mice it was proportionally greater. In the dentate gyrus, both CD and LD mice exhibited fewer granule cells but preserved cell density and soma size. In CA1, neuron number was preserved in both CD and LD mice, whereas neuronal soma size was reduced only in CD mice. Altogether, our findings show that the WS hemideletion alters hippocampal structure in a region- and layer-specific manner. These alterations were more pronounced in CD mice, suggesting hypertension-related effects. Such structural abnormalities may contribute to deficits in pattern separation and allocentric spatial memory, as observed in individuals with WS.

Pereira Da Silva Sayonara

Cognitive reserve contribution to cognitive performance in old age (preliminary results)

Sayonara Pereira da Silva[1], Charikleia Lampraki[1], Tainá dos Santos Rêgo[2], Paolo Ghisletta[1], Matthias Kliegel[1], Jürgen Maurer[3], Matthias Studer[1], Élvio Rúbio Gouveia[4], Marcelo de Maio Nascimento[5], Andreas Ihle[1]

[1]University of Geneva, [2]University Hospital Zurich, [3]University of Lausanne, [4]University of Madeira, [5]Federal University of Vale do São Francisco

Cognition comprises the set of mental processes developed across the lifespan, including memory, attention, perception, language, executive function, and decision-making, all of which support an individual's ability to interpret and interact with their environment. Extensive research has examined the impact of intrinsic and extrinsic factors on cognitive functioning. However, the role of cognitive reserve (CR) in cognitive changes related to health and disease remains poorly understood. In this study, we analyze data from The Aging, Demographics, and Memory Study (ADAMS) to examine the association between CR proxies, APOE genotype, dementia status, and cognitive performance among 484 older adults (mean age = 80.3, SD = 6.47; Female = 274). The ADAMS study is a supplement to the Health and Retirement Study (HRS), which is sponsored by the National Institute of Aging (grant number NIA U01AG009740). It was conducted jointly by Duke University and the University of Michigan. In a weighted linear regression analysis, dementia diagnosis and age were linked to a decline in cognition scores. Conversely, years of education, obtaining a professional degree, and engaging in writing activities, as well as daily crossword puzzles and daily reading of the news, were positively associated with cognition scores. The model explained 50% of the variance in cognition scores. These results align with the CR hypothesis, which suggests that engaging in cognitively stimulating activities contributes to cognitive health. Understanding this relationship enhances our comprehension of cognitive development later in life and provides strategic tools for preserving functional cognitive performance.

Perlstain Loïc

Computational modeling of perceptual and recognition memory in task-based fMRI

Loïc Perlstain1, Cristina Ramponi1, 2, Bogdan Draganski1,2, 3, Ferath Kherif1

1 Laboratory for Research in Neuroimaging (LREN), Department of Clinical Neurosciences, Lausanne University Hospital (CHUV) and University of Lausanne, Lausanne, Switzerland
2 Imaging Neuroscience of Ageing – inAGE laboratory, Neurology Department - Inselspital, University Hospital Bern, University Bern, Bern, Switzerland
3 University Institute for Diagnostic and Interventional Neuroradiology - Inselspital, University Hospital Bern, University Bern, Bern, Switzerland

This work aims to understand how visual representations are transformed into memory traces and how this process varies across individuals. Data are drawn from BrainLaus, a nested study within the CoLaus cohort, in which participants undergo task-based fMRI to characterise functional markers of brain and cognitive health. During fMRI acquisition, participants were presented with natural images spanning a range of visual and semantic similarity. Following scanning, a mnemonic similarity task was administered in which studied images, perceptually similar lures, and novel items were classified as identical, similar, or novel, providing a sensitive measure of pattern separation and hippocampal-dependent memory function at the individual level. In this project, deep visual learning models are used to extract stimulus representations at multiple levels of the visual hierarchy, from low-level perceptual features to higher-level semantic content. Representations from each layer are incorporated as parametric modulators in the general linear model framework in SPM. The central question is whether higher-level representations preferentially predict encoding-related responses in occipito-temporal and medial temporal cortex, including the hippocampal formation. The nature of the task provides a direct test of this, as the depth of semantic processing engaged during encoding is expected to determine how well participants later discriminate studied items from perceptually similar lures. To move beyond localization, SPM's multivariate Bayesian framework is used to compare encoding models derived from different layer combinations, with model selection based on log model evidence to identify which level of the visual hierarchy best accounts for distributed patterns of encoding-related brain activity. At the group level, Parametric Empirical Bayes is used to relate individual encoding parameters to mnemonic similarity performance and age, enabling the characterization of inter-individual differences in visual-memory representations and their relation to the precision of pattern separation.

Perrin Florian

Intracranial Investigation of Heartbeat Evoked Potentials Across Vigilance States In Human

Florian Perrin[1], Marzia De Lucia[1], Carolina Ciumas[2], Philippe Ryvlin [2]

[1]Université de Lausanne, CHUV, [2]CHUV

Heartbeat-evoked potentials (HEPs) are commonly used to investigate cortical responses to cardiac afferent signals and to probe central autonomic network and visceral processing. However, the identification of genuine neuronal HEPs is complicated by cardiac field and pulse-related artifacts, particularly in scalp EEG recordings, where spatial resolution and artifact control remain limited. As a result, their anatomical generators and dynamics across vigilance states remain incompletely understood. Here, we used stereo-electroencephalography (SEEG) to characterize intracranial HEPs across wakefulness and non-rapid eye movement sleep, with a specific focus on the posterior insula as a major hub of cardiac and visceral signal processing. We retrospectively analyzed one full-night SEEG recording from 10 patients with drug-resistant focal epilepsy. Sleep stages were automatically identified from intracranial recordings, and analyses focused on wakefulness, N2 sleep, and N3 sleep. HEPs were computed from R-peak-locked intracranial signals using surrogate-based analyses to identify responsive channels, combined with explicit control of cardiac-related artifacts. Vigilance-state modulation of HEP magnitude in the posterior insula was assessed using a linear mixed-effects model controlling for interictal spike rate. Across 253 retained bipolar channels, 55 channels were classified as HEP-responsive in at least one vigilance state. Responses were observed across multiple cortical regions, with the highest proportions in somatosensory cortex, posterior insula, and motor/premotor regions, supporting a distributed cortical network for cardiac signal processing. HEP-responsive channels were present during wakefulness, N2 sleep, and N3 sleep, indicating that cortical responses to cardiac signals are preserved during non-REM sleep. In the posterior insula, vigilance state significantly modulated HEP magnitude, with a selective increase during N3 sleep compared with both wakefulness and N2 sleep. This effect appeared attenuated when the posterior insula was involved in the epileptogenic network, suggesting a potential interaction between pathological epileptic activity and cardiac-related cortical processing, with possible relevance for autonomic dysfunction in epilepsy. These findings provide intracranial evidence that cardiac-related cortical responses persist across vigilance states and are selectively enhanced in the posterior insula during deep non-REM sleep. They support a state-dependent modulation of interoceptive processing during sleep and highlight the posterior insula as a key region for the cortical representation of cardiac signals.

Petrova Teya

Pathway-specific polygenic risk and trauma: uncovering sex differences in clinical, cognitive and functional outcomes of psychosis

Teya Petrova[1], Giorgio Pistis[1], Giulia Trotta[2], James MacCabe[2], Benedicto Crespo-Facorro[3], Lilith Abrahamyan-Empson[1], Pascal Steullet[1], Raoul Jenni[1], Sandra Vieira[1], Kim Do[1], Margot Fournier[1], Philippe Conus[1], Javier Vázquez-Bourgon[4], Paul Klauser[1], Luis Alameda[2]

[1]Lausanne University Hospital and the University of Lausanne, [2]King's College London, [3]University of Sevilla, [4]University Hospital Marqués de Valdecilla

Psychotic disorders arise from a complex interplay between genetic liability and environmental adversity, yet the biological mechanisms through which these factors jointly influence illness outcomes remain poorly understood. Childhood abuse is an environmental risk factor associated with poorer functional and clinical outcomes in psychosis, although substantial inter-individual variability suggests that genetic susceptibility may moderate these effects. Pathway-specific polygenic risk scores (PRS), restricted to biologically relevant systems implicated in schizophrenia, provide a more mechanistic framework for investigating gene-environment (G×E) interactions. Biological sex may further shape these relationships through differential neurobiological responses to stress. We investigated whether pathway-specific schizophrenia PRS interact with childhood abuse to influence symptoms, functioning and cognition in early psychosis, and whether these associations differ by sex. Data were obtained from two independent cohorts: TIPP, Switzerland (n = 229) and PAFIP, Spain (n = 139). Schizophrenia PRSs were computed using expression quantitative trait loci (eQTL)-informed mapping across five biological pathways: neuroinflammation, oxidative stress, glutamate, GABA interneurons, and myelin. Linear regression models tested main and interaction effects of pathway-specific PRSs and childhood abuse on symptom severity, global functioning, and cognition. Interaction effects were combined across cohorts using inverse-variance weighted fixed-effects meta-analysis. A significant interaction between neuroinflammation PRS and childhood abuse was associated with poorer functional outcomes in female patients, consistently across both cohorts and supported by meta-analytic evidence. In contrast, effects on symptom severity and cognition were limited. These findings support a sex-specific and biologically informed model of psychosis outcomes, in which genetic variation within neuroinflammatory pathways may increase vulnerability to the long-term functional consequences of early-life adversity in female patients.

Piotti Andrea-Giorgia

Injured DRG neurons release extracellular vesicles that functionally modulate spinal cord microglia in an RNA-dependent manner

Andrea-Giorgia Piotti[1], Alexandru-Florian Deftu[2], Guylène Kirschmann[2], Paul Chu Sin Chung[2], Marc René Suter[1]

[1]CHUV - UNIL, [2]CHUV

Background/Objectives: Neuropathic pain (NP) arises from lesion or disease of the somatosensory nervous system and is sustained by spinal cord microglial reactivity following peripheral nerve injury. How injured dorsal root ganglia (DRG) neurons signal to spinal microglia remains incompletely understood. Extracellular vesicles (EVs) have emerged as key mediators of intercellular communication capable of transferring functional RNA cargo to recipient cells. We investigated whether injured DRG neurons release EVs that are internalized by spinal microglia and whether these EVs functionally modulate microglia in an RNA-dependent manner. Methods: EVs were collected from injured and non-injured primary DRG neurons (spared nerve injury model) and characterized by dynamic light scattering and cryo-electron microscopy. Uptake by primary spinal microglia was assessed with DiD-labelled EVs. Functional effects were tested by whole-cell patch-clamp recordings of naive primary spinal microglia exposed to EVs, with or without prior RNase treatment. Small RNA sequencing of the EV cargo is ongoing. Results: EVs from both populations were lipid bilayer-enclosed particles of 140–200 nm, with no sex differences in size or concentration; injured neurons produced significantly more EVs. DiD-labelled EVs were efficiently internalized by primary spinal microglia in vitro. In patch-clamp recordings, EV exposure increased inward current and induced membrane hyperpolarization in naive microglia. These functional changes were abolished when EVs were pre-treated with RNase, indicating that EV-associated RNA is required for the effect. Conclusion: Injured DRG neurons release EVs that are efficiently internalized by spinal microglia and trigger electrophysiological changes consistent with microglial modulation. The RNase sensitivity of this effect identifies EV RNA cargo as the active component. Ongoing small RNA sequencing will define this cargo, supporting the hypothesis that DRG-derived EVs drive microgliosis in NP.

Piron Nicolas

Late emergence of cross-modal semantic generalization between words and images in a sequence learning paradigm

Nicolas Piron[1], Théo Desbordes[1], Itsaso Olasagasti[1], Sophie Schwartz[1], Nina Kazanina[1]

[1]University of Geneva

A central question in cognitive neuroscience is how and under what conditions the brain arrives at representations that are independent of input modality. Neuroimaging studies have shown that different stimulus modalities activate common brain areas and shared representations of concepts (Meyer et al., 2010; Simanova et al., 2010), pointing to the existence of amodal semantic representations considered to be supported by a conceptual hub in the anterior temporal lobe (Lambon Ralph et al., 2017). Yet the temporal dynamics of when such representations emerge remain poorly understood. If amodal semantic representations exist, neural activity patterns evoked by words and images representing the same concepts should be mutually decodable. By training classifiers on MEG data from one modality (e.g. images) and testing them across all timepoints of the other (e.g. words), one can estimate when a shared representational code is first reached, whether it is maintained or reactivated over time, and in which direction this temporal transfer applies across modalities. Previous work by Dirani & Pylkkänen (2023) demonstrated that classifiers trained to distinguish animals from tools in one modality generalized to the other, as early as ~150 ms during picture naming and word reading. Earlier word representations generalized to later image representations and vice versa, suggesting faster access to amodal semantic content for words than for images. Here we extend this approach to a broader and more heterogeneous semantic space using a sequence learning paradigm, in which participants are exposed to words and images incidentally rather than performing explicit naming or reading tasks. Twenty-five participants learned sequences of written words and sequences of images, where items were drawn from six semantic categories (characters, landscapes, shapes, colors, animals, body parts), while MEG was recorded. Using a one-versus-rest approach, Lasso regression classifiers were trained to discriminate each semantic category from all others in one modality and tested on the other for all pairs of timepoints, yielding a time-resolved measure of cross- modal generalization. Bidirectional cross-modal generalization was observed across all six animacy distinctions to a broader and more heterogeneous semantic space. However, unlike in Dirani & Pylkkänen (2023), generalization emerged only after ~500 ms and showed the opposite asymmetry: earlier image (~500 ms) representations generalized to later word representations (~600 ms), and vice versa. This latency falls well outside the window of early perceptual and semantic categorization, which typically occurs within 100–400 ms, suggesting that in this paradigm, convergence onto shared representational content is driven by a late, likely task- dependent process rather than automatic early semantic access. Our findings suggest that convergence onto a common semantic code is not an automatic consequence of stimulus processing but rather depends on task demands and the nature/versatility of semantic categories involved. More generally, access to an amodal representation is a flexible, context-sensitive process, with implications for models of semantic memory that assume fixed, task-independent amodal representations.

Policet-Bétend Héloïse Salomé

The translational functional architecture of cardiovascular interoceptors

Heloise Policet-Bétend[1], Christophe Lamy[1]

[1]UNIGE

Cardiovascular interoception plays a key role in emotional behavior. Its alteration has been linked to emotional dysregulation and anxiety. Cardiovascular states and blood composition are monitored by specialized receptors located in large vessels and the heart. However, it is unclear whether those receptors are altered in disease states linked to interoceptive dysregulation. In addition, their cellular and molecular structure is poorly characterized in humans. In this work we leveraged large scale human tissue clearing and multiplexed immunostaining to provide a detailed mapping of human cardiovascular interoceptors. We also traced their innervation to better understand the pathways linking them to the brain. Eventually, we studied with a similar approach equivalent structures in mice. Altogether, our data provides a detailed, functionally-relevant 3D cellular map of cardiovascular interoceptors in mice and humans which can serve as a base for mechanistic and translational research on interoception and interoceptive pathology.

Pourchet Thomas

Neurophysiological, Neuromuscular and Psychosocial Interactions in Chronic Low Back Pain: A Baseline Exploratory Analysis of the STOP-Low Back Pain Trial

Thomas Pourchet [1], Stéphane Armand[1], Pierre Nicolo[2]

[1]UNIGE, [2]HEDS

Background: Chronic low back pain (CLBP) is a multidimensional condition involving alterations in brain function, motor control, psychological factors, and disability. While these domains are often studied independently, their interactions remain poorly understood. Exploring baseline relationships between neurophysiological, neuromuscular, and clinical variables may help identify mechanisms underlying persistent pain and inform personalized interventions. Objective: To investigate multivariate associations between resting-state EEG functional connectivity, flexion-relaxation phenomenon (FRP), pain-related psychological factors, pain intensity, and disability in individuals with CLBP enrolled in the STOP-Low Back Pain randomized controlled trial. Methods: Baseline data from participants enrolled in the STOP-Low Back Pain trial were analyzed. Variables included resting-state EEG functional connectivity, electromyographic measures of FRP, pain intensity, disability (ODI), pain catastrophizing (PCS), fear-avoidance beliefs (FABQ), anxiety and depression (HADS). Multivariate statistical approaches, including correlation analyses and dimensionality-reduction techniques, were used to identify relationships among neurophysiological, neuromuscular, and clinical outcomes. Results: Baseline data collection from participants enrolled in the STOP-Low Back Pain trial has been completed. Multivariate analyses exploring associations between neurophysiological, neuromuscular, and clinical outcomes are currently underway. Findings will be presented at the conference.

Python Laurena

Flexible learning rate: a principled explanation of dopamine responses to artificial rewards

Laurena Python[1], Charles Findling[1], Agnès Hiver[1], Christian Luscher[1], Alexandre Pouget[1]

[1]University of Geneva

Drug-choice at the expense of natural reward has been suggested to be a hallmark of addiction. It has been hypothesised that a bias towards drug rewards might be due to the pharmacological power of the drugs on the dopamine (DA) system, which results in an overvaluation of the reward to come (Keiflin and Janak, 2022). We investigate the evolution of dopamine release at the cue ("cue value") during the learning phase of an operant task where mice are cued to press a lever and obtain a "drug-like" reward in the form of an optogenetic dopamine neuron stimulation. Unlike the suggested overvaluation, we observe that the cue value tends to rapidly stabilize in most animals. We model this surprising result by reframing the temporal difference learning rule as a special case of Kalman filter. This adjustment naturally replaces a constant learning rate by a flexible one, namely Kalman's gain, which depends on the level of uncertainty of the current cue value estimates. In this framework, the stabilization of the cue value emerges as a consequence of a decreasing learning rate. Interestingly, preliminary results support the idea that the animals with a sharp decrease in learning rate would become inflexible and keep seeking the optogenetic stimulation even when facing a risk of footshock in a separate task. These results show that a flexible learning rate is better suited to model the evolution of dopamine release during the learning phase of a task. The individuality of learning trajectories could play a role in predicting an important symptom of drug addiction: compulsivity.

Reich Natacha

Beyond Chronotype: Daily Circadian Dynamics Shape Sleep and Behavior in Adolescents with ADHD

Natacha Reich[1], Andrea Imparato[1], Maude Schneider[1], Stephan Eliez[1], Christopher Graser[2], Corrado Sandini[1]

[1]University of Geneva, [2]Harvard University

Sleep and circadian rhythms jointly shape cognition, behavior, and mental health, yet they are typically studied as separate processes. Understanding how these systems interact in everyday life is particularly important in adolescents with attention-deficit/hyperactivity disorder (ADHD), who frequently experience sleep disturbances and delayed biological timing. In this study, we combined one month of wearable physiological monitoring with daily behavioral assessments to investigate how sleep and circadian regulation dynamically influence functioning in adolescents with ADHD. Using continuous skin temperature recordings, we estimated individual circadian timing on a day-to-day basis and related these measures to sleep patterns, cognitive performance, and symptom fluctuations. We found that day-to-day shifts in circadian phase were common, especially in adolescents with later circadian timing, reflecting a dynamic interaction between the internal circadian clock and environmental schedules. Daily sleep initiation was best explained by the combined effects of sleep pressure and circadian timing, highlighting the importance of considering both processes simultaneously. Importantly, both insufficient sleep and day-specific circadian misalignment independently predicted increases in ADHD symptoms, perceived stress, and impulsive behavior. In contrast, an individual's average circadian timing alone did not account for these behavioral fluctuations. These findings challenge the view of circadian timing as a fixed individual trait and instead reveal it as a dynamic process that continuously interacts with environmental constraints. More broadly, our work demonstrates how wearable technologies can provide ecologically valid measures of biological rhythms and offers new opportunities for personalized approaches to sleep and circadian health in neurodevelopmental disorders.

Renard Margot

Decoding GnRH Neuron Migration & Development by Single Cell Transcriptomics

Margot RENARD[1], Maxime BRUNNER[2], Ismael TORRES-ROMERO[2], Maude MURISET[2], Andrea MESSINA[1]

[1]Université de Lausanne ; CHUV, [2]CHUV

GnRH neurons derive from the olfactory placode and migrate into the brain, where they regulate puberty onset and adult fertility. The exact molecular mechanisms governing these processes remain elusive. Our study aims to characterize their transcriptomic landscape and identify gene expression trajectories critical to their embryonic development. GnRH neurons and surrounding cells were captured by fluorescence-activated cell sorting from Gnrh1::GFP mouse embryos at different developmental ages (E12.5–E18.5). After single-cell RNA sequencing and quality control, the dataset comprised 100,000 cells, including about 3,000 GnRH neurons. Using unsupervised clustering, cell annotation based on validated markers, and projection on spatial transcriptomic data, we identified cell populations from different forebrain and nasal regions. Next, we applied pseudotime & RNA velocity analysis, identifying the two main trajectories leading to GnRH and olfactory sensory neurons as well as their molecular determinants. We focused our analysis on GnRH neurons and found that spatial location and developmental time are the primary drivers of molecular heterogeneity. At early stages, high expression of genes associated with neuronal migration and cell adhesion is observed, while genes involved in neural circuit formation and neuropeptide maturation are expressed in cells that have reached their final destination. Finally, we evaluated how spatio-temporally driven gene expression dynamics influence cell–to–cell communication and observed that the GnRH neuron molecular repertoire adapts to its surrounding environment. Interestingly, while Netrin-1 is expressed by specific populations in both nasal and brain regions, its receptors Dcc and Unc5c, mainly involved in chemoattraction and chemorepulsion, respectively exhibit opposite gradients along the nose-brain axis. This study advances our understanding of the molecular mechanisms guiding GnRH neuron migration and has the potential to identify novel diagnostic targets for infertility-related disorders.

Rey Alicia

Astrocytic fatty acid beta-oxidation regulates postnatal brain development by orchestrating neuronal lipid turnover

Alicia Rey[1], Francesco Petrelli[1], Hannah Schede[2], Vanille Maillard[1], Jocelyn Fleurimont[1], Livia Di Martino[1], Katia Monsorno[1], Peter Carmeliet[3], Rosa Paolicelli[1], Gioele La Manno[2], Giovanni D'Angelo[2], Marlen Knobloch[1]

[1]University of Lausanne, [2]École Polytechnique Fédérale de Lausanne , [3]VIB-KU Leuven Center for Cancer Biology Leuven Belgium

Neurons and astrocytes are metabolically coupled, and growing evidence suggests that this interaction extends to lipid handling. However, during brain development, neurons are generated before astrocytes, which expand and mature predominantly postnatally. How coordinated lipid metabolism between neurons and astrocytes is established during this early postnatal period remains poorly understood. Here, we identify astrocytic fatty acid b-oxidation (FAO) as a critical regulator of coordinated lipid metabolism during this key period for brain maturation. We find abundant lipid droplets (LDs) in neurons early postnatally, which progressively decline as LDs increase in astrocytes, indicating the emergence of metabolic coupling. Early postnatal astrocyte-specific ablation of the FAO enzyme carnitine palmitoyltransferase 1a (Cpt1a) results in anxiety-like behavior and impaired learning. Mechanistically, loss of astrocytic Cpt1a causes widespread lipid dysregulation, leading to massive neuronal LD accumulation and activation of a metabolic stress response that predominantly affects excitatory neurons. Furthermore, FAO is also required cell-autonomously for postnatal astrocyte maturation. Together, these findings identify astrocytic FAO as a critical regulator of postnatal brain development through the coordination of cellular lipid metabolism.

Richert Noah

Method for behavioral marker elicitation for remote VR clinical monitoring for mental health: A Preliminary Assessment

Noah Richert1,2, Antoine Widmer1

1HES-SO Valais/Wallis, 2Université de Lausanne

Remote care can improve access to care but leaves out valuable clinical information. In mental healthcare, VR-based solutions can provide a greater sense of presence than conventional telemedicine while enabling additional patient information to be captured. Remote monitoring in VR-based mental health interventions requires information that complements, rather than replaces, clinicians' observations. However, determining which aggregated markers are clinically meaningful is challenging; clinicians identify the use of directly observable information, while they find it difficult to interpret and relate sensor-derived behavioral markers to clinical practice. This work proposes a method for eliciting and structuring behavioral markers for clinician-facing remote VR monitoring dashboards.

The method combines complementary top-down and bottom-up explorations. The top-down approach investigates clinicians' existing practices, observations, and expectations regarding patient monitoring. The bottom-up approach maps data that can be collected through VR systems and paired devices—including audio, video, activity logs, electrodermal activity, heart-rate variability, body pose, and eye tracking—to potentially meaningful aggregated information, informed by the literature. These perspectives are progressively connected through concrete application scenarios represented as user stories. Approximately 50 user stories were developed and iteratively reviewed with a clinician, who assessed their usefulness on a 0–6 scale and contributed to their refinement. A basic dashboard and simulated aggregated data were also used to support discussion of potential visualizations.

In a preliminary assessment by one professional, 27 of 51 proposed markers were rated ≥5/6 for usefulness, with the level of fatigue marker receiving the highest rating (6/6). This approach provides a structured pathway for translating heterogeneous VR-collected data into clinically situated monitoring requirements, while maintaining clinician interpretability and practice relevance as central criteria for metric elicitation.

Rimorini Nina

Decoding imagination: Reading the mind's eye

Nina Rimorini[1], Pinar Goktepe Kavis[2], Jean-Paul Calbimonte[3], Ruxandra I. Tivadar[4], Chantal Berna[4]

[1]University of Lausanne, [2]Computational Neuroscience Labs, ATR, Kyoto, Japan , [3]University of Applied Sciences and Arts Western Switzerland, HES-SO Valais-Wallis, Sierre, Switzerland , [4]Center for Integrative and Complementary Medicine, Division of Anesthesiology, Lausanne University Hospital & University of Lausanne (CHUV-UNIL)

Mental imagery, i.e., a sensory experience occurring without external stimulation, has been shown to contribute to disorders such as post-traumatic stress disorder but also chronic pain and anxiety. It is a promising therapeutic target. While the neural mechanisms of mental imagery largely overlap with those of perception, the temporal dynamics of when and how a mental image might be elicited or changed remain underexplored. This project aims to track complex mental imagery in healthy individuals using high-density electroencephalography (EEG) and multivariate pattern analysis. Currently, we seek to decode neural representations of imagined complex scenes under two conditions: structured imagery, prompted by a strict visual stimulus (Experiment 1), and less restricted imagery, prompted by a brief description (Experiment 2). So far, five healthy adults (mean age ± SD: 27±2.5; 4 men), out of a planned sample of seventy, have completed both experiments. Each experiment consisted in 120-150 trials per scene category (family, nature, pipe), with a 3-sec prompt, a 3-sec imagery period and a 1000-1200ms inter-stimulus interval. Preliminary decoding results from data collected up to early August 2026 will be presented, including: (1) cross-validated decoding of visual stimulus data from Experiment 1 (e.g., decoding accuracy, confusion and temporal generalization matrices), and (2) decoding of mental imagery under varying degrees of restriction (Experiments 1 and 2) using classifiers trained on visual data from Experiment 1. Based on prior evidence of strong overlap between perception and imagery, we expect significant decoding of complex imagined scenes with these classifiers. These results may indicate how information about complex scenes can be decoded from brain activity under varying degrees of control, and whether temporal EEG dynamics differ between perception- and imagery-based neural patterns. This approach will then be applied to a third experiment examining freely occurring imagery (i.e., people's "happy place") elicited by an auditory cue.

Rodrigues Apgaua Beatriz

Flexible Behavioral Strategies During Social Competition in Mice

Sami El-Boustani[1], Beatriz Rodrigues Apgaua[1], Dimokratis Karamanlis[1]

[1]University of Geneva

Competition emerges within groups of animals when resources are scarce. To ensure access, animals must adapt their decisions and employ strategies such as physical combat, foraging in different territories, or by imposing their rank in the social hierarchy, where dominant animals have priority over resources. The medial prefrontal cortex (mPFC) is hypothesised to play a prominent role in guiding decisions during competition. Experiments with mice have shown that neurons in mPFC track the actions of conspecifics, their relative rank and the winning status. Norepinephrine might play a pivotal modulatory role in this scenario, as it participates in fight or flight responses and in behavioral switching. Yet, the exact mechanisms linking neural activity and neuromodulation to the selection of competitive strategies is still elusive. To address this gap, behavioral frameworks are needed to quantify decision-making during social competition in animal models. Thus, we developed a two-alternative forced choice task for dyads of freely-moving water-restricted mice. At every trial, a visual stimulus indicates the side of a water reward. In the baseline task, both mice were rewarded only when choosing the correct side together. Once performance was high, a competition task was introduced, in which only the fastest mouse to reach the correct spout was rewarded. We observed that mice winning status is not determined by rank and could fluctuate across trials. Our preliminary analysis suggests that entering a winning streak is accompanied by a shift in the speed-accuracy tradeoff. Furthermore, we observed the emergence of a behavior after mice start competing: they changed their mind halfway to the spout and gave up on trying to obtain the reward. Our data suggests that in a scenario of resource limitation, mice adapt their behaviors to guarantee access to water on a trial-by-trial basis. Future steps aim at recording neuron activity and norepinephrine signals in prefrontal brain regions during this task. With this work, we hope to shed light onto the neural mechanisms underlying flexible behavior in competition, a phenomenon that is ubiquitous in nature.

Rutz Dionys

A Cluster-Based Approach for the Visualization and Classification of Recovery Trajectories in Individuals with Acquired Brain Injury

Dionys Rutz[1], Antoine Zaczyk[2], Sonia Crottaz-Herbette[1], Maria Gonzalez Mendez [1], David Zeugin [1], Petr Grivaz[1], Michael Single[3], Consortium SwissNeuroRehab[4], Andrea Serino[1], Traian Popa[1]

[1]MySpace Lab @NeuroTech & NeuroRehab Research Center @NeuroTech, Service of University Neurorehabilitation (SUN), Lausanne University Hospital, Institution of Lavigny and University of Lausanne, Switzerland., [2]Service of University NeuroRehabiltation (SUN), Lavigny Institute, 1175 Lavigny, Switzerland, [3]ARTORG Center for Biomedical Engineering Research, Bern University, Switzerland. , [4]Flagship Innosuisse

Background and Aims Acquired brain injuries (ABIs) lead to complex, heterogeneous patterns of deficits, making recovery after rehabilitation difficult to characterize and predict. Patient improvement ranges from rapid recovery to persistent impairment and is influenced by lesion characteristics, time, and multidomain deficits. Capturing this complexity is essential for personalized rehabilitation and improved prognostic models, yet robust approaches to describe and stratify recovery trajectories remain limited. This study aims to identify distinct recovery trajectories in individuals with ABI using longitudinal data and determine factors associated with transitions between pre- and post-rehabilitation states. Methods. Dimensionality reduction using Uniform Manifold Approximation and Projection (UMAP), combined with density-based clustering (HDBSCAN), was applied to identify recovery profiles while preserving longitudinal structure. Clinical variables included descriptive, motor, cognitive, functional, and patient-reported outcomes, enabling multidimensional characterization of patient status. Cluster membership changes were analyzed to capture transitions between pre- and post-rehabilitation states. A Global Change Score (GCS) was developed to quantify overall clinical change, alongside latent-space displacement in UMAP to characterize trajectory shifts. Results Currently, 250 patients were included. Eight distinct clinical profiles were identified, ranging from isolated motor, cognitive impairments to mixed-domain deficits. Overall, from clinical scores, most of the patients show significant improvement across multiple dimensions. Most patients (81%) remained in the same cluster after rehabilitation, while 19% transitioned to different profiles, mainly from severe to less severe states. Those who transitioned had higher median GCS (0.63 vs. 0.06) and greater variability (IQR 1.58 vs. 0.54), reflecting larger, heterogeneous improvement. These changes were consistent across clinical domains. Latent-space displacement was greater in patients who changed profiles. Conclusion Recovery following ABI is dynamic, multidimensional, with a subset of patients showing meaningful changes during rehabilitation. This study enables better characterization of recovery trajectories which may improve outcome prediction, support clinical decision-making, and enable more individualized rehabilitation strategies.

Rémond-Derbez Noëla

Hallucinations in Lewy Body Disease: Phenomenological and Neuropsychological Correlates

Noela Remond-Derbez[1], Fosco Bernasconi[2], Jevita Potheegadoo[2], Olaf Blanke[2], Gilles Allali[3]

[1]CHUV, UNIL, [2]EPFL, [3]CHUV

Introduction: Lewy body disease (DLB) is the second most common cause of neurodegenerative dementia. Early identification of individuals at risk for DLB is crucial to maximize the efficacy of neuroprotective interventions and improved prediction of cognitive decline trajectories is essential for patient counseling and care planning. Hallucinations are an early and key symptom of DLB and may represent an early marker for cognitive decline, as suggested in Parkinson's disease. However, hallucinations remain poorly characterized and under investigated in DLB. Aim: We aim at investigating hallucinations, both minor (misperception of external stimuli) and complex (structured experience in the absence of external stimuli) in DLB, focusing on their phenomenology, neural, and neuropsychological corelates, to better characterize their mechanisms and potential as early markers of DLB and cognitive decline. Method: Preliminary baseline data from an ongoing longitudinal study were analyzed in 16 DLB and 19 patients with non-amnestic mild cognitive impairment (naMCI), considered at risk of DLB. Hallucination phenomenology (modality, frequency) was characterized by using a semi structured interview (PDPSS). Associations with cognitive performance (Moca; PD-CRS) were examined using Fisher's exact test and Wilcoxon rank sum test. Results: Preliminary analysis suggests that hallucinations, particularly minor ones, occur in more than 50 % of DLB patients at stages where cognition is only mildly impaired, with relatively high prevalence, about 30 % in DLB-at risk individuals, which supports their use as an early biomarker. No significant association was observed between hallucinations and global cognitive measures, suggesting that conventional neuropsychological tools may lack sensitivity to detect subtle differences. Implications: Hallucinations, particularly minor ones, may represent promising early clinical markers of DLB. Further longitudinal investigations combining detailed phenomenological assessment with sensitive cognitive and neural measures are needed to determine their diagnostic and prognostic value for cognitive decline.

Sabov Andriana

Sleep Oscillations shape neural and behavioral responses in word learning

Andriana Sabov[1], Marina Laganaro[1], Sophie Schwartz[1]

[1]University of Geneva

Vocabulary learning is a process spanning a lifetime of an individual. According to current models of memory consolidation, the transfer of new memories into long-term storage depends on the precise coordination of slow oscillations (SOs), thalamic spindles, and hippocampal ripples during slow-wave sleep (SWS). With ageing, however, SO amplitude decreases and spindles lose their tight coupling to SOs, impairing hippocampal–neocortical communication and weakening memory consolidation. The present within-participants study investigates how SWS modulation influences lexical learning, with a focus on the integration of novel words into lexical-semantic networks. Young neurotypical adults learn sets of rare, previously unknown words in their native language. Age-related changes in sleep architecture are mimicked by experimentally reducing the quality and propagation of SOs via closed-loop auditory stimulation on one of the two nights during laboratory sleep with polysomnography (PSG). The integration of new words into the vocabulary is assessed behaviourally (through accuracy and speed of production of newly learned items on a Picture-Word Interference task), as well as neurally (through BOLD activation during a Picture Naming task in the fMRI). Additionally, the changes in sleep architecture are examined and related to behavioural outcomes. We expect that words learned before a night with SO suppression are not integrated into the lexical-semantic network to the same extent as words learned prior to a normal, unperturbed night of sleep. We additionally expect that the retrieval of the integrated words will be supported by the neocortical areas (IFG, left MTG), while the retrieval of the not integrated words will be reliant on the hippocampus. Data acquisition started recently, and we plan to present partial sample analyses in September. By modelling age-related sleep disruption in young adults, this study provides new insights into the role of SWS in supporting vocabulary learning and lexical-semantic consolidation.

Saneei Sarah

Investigating Lexico-semantic Representations in Artificial and Biological Neural Networks: An Optimization Loop

Sarah Saneei1, Valentina Borghesani1, Timothée Proix2

1 Faculty of Psychology and Educational Sciences, University of Geneva, Geneva, Switzerland;

2 Department of Information Technology and Electrical Engineering, ETH, Zurich, Switzerland.

A core question in cognitive neuroscience is how and where lexico-semantic representations are encoded in the brain. Neuropsychological and lesion studies have identified the anterior temporal lobe and posterior middle temporal gyrus as critical hubs for semantic processing while correlational studies using natural speech and Large Language Model (LLM) embeddings suggest that semantic information is distributed across a broader network of cortical areas. To reconcile these perspectives, we developed a closed-loop optimization approach that uses intracranial neural recordings to causally test how specific semantic dimensions drive responses across cortical regions.

Four participants with drug-resistant focal epilepsy undergoing stereoelectroencephalography (sEEG) monitoring first listened to "Le Petit Prince" while we recorded broadband neural activity from 135–145 depth electrodes per participant, spanning temporal, frontal, parietal, and limbic regions. As an index of local cortical processing, we focused our analyses on Broadband High-frequency Activity (BHA: 70–150 Hz) which has been shown to reliably track neuronal population activity. We then used regression analysis to identify LLM-derived semantic dimensions maximally predictive of BHA responses, and embedded the corresponding words into short customized narratives. In a subsequent session, participants listened to these stories while we again recorded neural activity and analyzed.

Preliminary findings reveal electrode-specific sensitivity to semantic content: electrodes in the Superior Temporal Gyrus (STG) showed robust responses to speech in general, orbitofrontal electrodes exhibited sensitivity to semantic category (nouns vs. verbs), and hippocampal electrodes showed selective suppression during semantic processing. In some patients, some electrodes showed significantly stronger responses to optimized words compared to control words, suggesting that the closed-loop approach successfully targeted causally relevant semantic representations. Recruitment and analysis are still ongoing.

Scarci Angela

Non-Invasive Deep Brain Stimulation of the Hippocampus to Enhance Spatial Navigation: Toward Clinical Translation in TBI patients

Angela Scarci[1], Ahmet Kaymak[2,3], Friedhelm Hummel[2,3,4], Pierre Mégevand[1,5,6], Elena Beanato[7]

Clinical neuroscience department, Faculty of Medicine, University of Geneva, Rue Michel-Servet 1, Geneva, Switzerland [1], Defitech Chair of Clinical Neuroengineering, Neuro X Institute (INX), École Polytechnique Fédérale de Lausanne (EPFL), Campus Biotech, Geneva, Switzerland [2], Defitech Chair of Clinical Neuroengineering, INX, EPFL Valais, Clinique Romande de Réadaptation, Sion, Switzerland[3], Neurology division, Geneva University Hospitals, Geneva, Switzerland [4], Basic neuroscience department, Faculty of Medicine, University of Geneva, Geneva, Switzerland[5], Clinical Neuroscience, University of Geneva Medical School, Geneva, Switzerland, Hôpitaux Universitaires de Genève[6], HUG-NeuroCentre, Geneva University Hospital (HUG), Geneva, Switzerland[7]

Non-invasive brain stimulation techniques have been widely employed to treat cognitive deficits but, because of their depth-focality trade-off, they have mainly been used to target cortical areas. Transcranial temporal interference stimulation (tTIS) is a novel technique able to non-invasively reach deep brain regions, thus overcoming the main limit of conventional NIBS. To date, it is considered a promising non-invasive deep-brain stimulation technique (nDBS), capable of safely modulating brain activity in both healthy subjects and patients. In our study, we want to determine the clinical translation potential of tTIS in patients who underwent a traumatic brain injury (TBI). In particular, we aim to investigate whether modulating the hippocampus during a spatial navigation task carried out using virtual reality may enhance spatial navigation performance, and whether stimulation effects persist over time. We use an accelerated protocol, that consists in applying multiple stimulation sessions with short intervals between them, in order to achieve larger and more long-lasting effects. Moreover, to render the stimulation more precise, we will personalize the electrode montage to each patient's brain anatomy.
TBI patients will receive both real and sham stimulation and will undergo a follow-up assessment one week after each stimulation to evaluate their behavioural performance and to investigate sustained effects. The experiment is conducted in a double-blind, crossover design. We expect stimulation effects to be larger and more durable due to the accelerated protocol, and we aim to provide a proof-of-concept for a successful clinical translation of the technique.

Schmidt Léa

Temporal dynamics of hemispheric functional connectivity and its links to callosal integrity

Léa Schmidt[1], Jonas Richiardi[1], Vanessa Siffredi[1]

[1]Lausanne University Hospital

Background. The corpus callosum (CC) is the principal commissure connecting the two cerebral hemispheres. Disruptions in its development, including complete or partial absence, or abnormal thinning or thickening, are collectively termed corpus callosum dysgenesis (CCD). Despite the resulting structural disconnection, individuals with CCD show preserved interhemispheric integration, both behaviourally and in functional connectivity. This raises important questions about the precise role of the CC in shaping functional connectivity and related laterality, and compensation mechanisms associated with atypical CC development. Aim. To examine how the severity of callosal malformation relates to the strength and dynamics of interhemispheric functional coupling, hypothesising that greater structural disconnection would alter within- and between-hemisphere coupling and the temporal dynamics of functional lateralisation. Methods. Resting-state fMRI data from 22 participants with CCD and 49 typically developing controls were pooled across two cohorts (Siffredi et al., 2018 & Schmidt et al., 2026) and analysed within a fully individual-space framework to account for anatomical variability across participants. For each participant, data were processed on the native cortical surface with the Schaefer-400 / 7-network atlas projected individually. CCD severity was treated as a continuous variable, from complete callosal absence to near-typical morphology, rather than as a binary contrast. Interhemispheric communication was assessed using two measures: baseline connectivity between the hemispheres and its dynamics, computed with a sliding-window approach. From these, we derived a hemispheric autonomy index and quantified its temporal variability. Conclusion. CCD provides a rare window onto how the developing brain organises and reorganises when a major white-matter pathway is developmentally altered. Linking callosal anomalies severity to the dynamics of interhemispheric coupling gives insight on how hemispheric communication is preserved, and on the plasticity that supports it.

Sequeira Granja Daniel

Seeing Emotion Without Seeing the Eyes: Neural Responses to Natural and Artificial Eye Occlusion

Daniel Granja[1], Nicolas Burra[1]

[1]ESCLab, Section de psychologie, FPSE, Université de Genève

Facial emotion recognition relies on the rapid integration of diagnostic visual cues, with the eye region playing a central role in perceptual and evaluative processing. However, different forms of reduced eye visibility are often treated as equivalent despite their distinct biological and social meanings. This study examined how natural eye closure and artificial eye occlusion by sunglasses modulate behavioural emotion recognition and event-related potentials during emotional face processing. Twenty-nine participants completed an emotion recognition task with fearful, happy, and neutral faces presented with open eyes, closed eyes, or sunglasses; EEG analyses were conducted on the current usable sample of 22 participants. Behaviourally, accuracy was modulated by emotion, eye condition, and their interaction. Recognition was better for open eyes than for occluded eyes, and the occlusion cost was larger for fear than for happy and neutral expressions. At the neural level, N170 amplitudes were larger for open and closed eyes than for sunglasses, while open and closed eyes did not differ, suggesting that early face-sensitive processing distinguishes biologically plausible eye states from artificial occlusion rather than reflecting eye visibility alone. The EPN showed an effect of emotion without modulation by eye condition; however, the predicted emotional enhancement was not confirmed, as the contrast was reversed, with neutral faces eliciting larger amplitudes than emotional faces. No reliable LPP effects were observed for now, as expected with the preregistered target N being 25. Together, these preliminary findings indicate that eye occlusion affects emotion recognition and early neural face processing, but not uniformly across natural and artificial forms of occlusion.

Shah Dhwani

Randomized controlled trial of a gamified Go/No-Go app to lower alcohol valuation and intake

Dhwani Shah[1], Hugo Najberg[1], Lucien Rochat[2], Marie Pittet[1], Lucas Spierer[1]

[1]University of Fribourg, [2]University Hospitals of Geneva

Objective. Alcohol use remains a leading cause of morbidity and mortality worldwide, with even low levels of consumption associated with adverse health outcomes. Targeting the automatic valuation responses to craving-inducing alcohol cue may represent a promising solution because it has been proven a key driver of consumption. A recently identified approach to reducing alcohol cues valuation is the practice of Go/NoGo tasks in which motor responses to the problematic cues are repeatedly inhibited. This randomized controlled trial investigates whether a smartphone-based, gamified GNG training reduces alcohol cue-induced valuation and consumption and increase self-efficacy to resist drinking in adults with at-risk alcohol consumption. Methods. Adults (final n = 134) engaging in unhealthy alcohol use (AUDIT-C ≥ 4 for men, ≥ 3 for women) and motivated to reduce consumption will be randomly assigned to an experimental group (GNG training) or a waiting-list control group. The experimental group will complete a two-week GNG training for a total of 1 hour and 40 minutes of practice. Alcohol-cue valuation, weekly alcohol consumption and heavy drinking episodes frequency, and alcohol resistance self-efficacy will be assessed at baseline, post-intervention, and 6-month follow-up. Results. Our hypotheses for lower craving and consumption and higher self-efficacy in the experimental group at the post training session will be tested with Group x Time interactions for the alcohol valuation and alcohol resistance self-efficacy outcomes, and by comparing pre–post differences of count outcomes (weekly alcohol consumption and number of monthly heavy drinking episodes). Persistence of effects will be evaluated by comparing baseline and follow-up scores in the experimental group.

Sinanaj Lorina

Mapping symptom-general and symptom-specific targets for transcranial magnetic stimulation in schizophrenia: an electric-field modeling meta-analysis

Lorina Sinanaj[1], Konstantinos Pallis[2], Anahita Fazel Dehkordi[1], Philippe Huguelet[2], Stefan Kaiser[2], Indrit Bègue[1]

[1]University of Geneva, [2]HUG

Negative, positive, and cognitive symptoms of schizophrenia relate to disruptions in partially distinct brain circuits. Although promising, transcranial magnetic stimulation (TMS) strategies across and within symptom domains remain to be established due to TMS protocol heterogeneity. For this, we combined standard meta-analysis with electric field (E-field) modeling to identify stimulation sites where E-field strength was associated most significantly with clinical improvement. Standard meta-analysis of randomized, sham-controlled studies in 4283 patients demonstrated the benefit of TMS across symptom domains, regardless of target or protocol. TMS significantly improved negative and cognitive symptoms with high-frequency stimulation applied to the left prefrontal cortex, whereas positive symptoms improved with low-frequency TMS applied to the left temporoparietal cortex. In-depth examination of these results with E-field modeling identified stimulation of the left dorsomedial prefrontal cortex (L-DMPFC), left orbitofrontal cortex (L-OFC), and left cerebellar crus II and right lobule IX to be significantly associated with improvement across all symptom domains. Greater overlap of studies' stimulation targets with L-DMPFC and L-OFC related to improved outcomes. For negative symptoms, E-field distribution in L-DMPFC and L-OFC related most significantly to clinical improvement. Greater proximity to L-DMPFC stimulation site indicated better outcomes, with trend-level significance for L-OFC. In the cognitive domain, E-field distribution in the left dorsolateral prefrontal cortex was related to clinical improvement. Finally, the strongest E-field association with clinical improvement was found in the right cerebellar lobules VIIIA, VIIIB, and IX for positive symptoms. These results support symptom-general and symptom-specific TMS approaches for distinct therapeutic goals towards personalized neuromodulation in schizophrenia.

Susun Zilan Yaren

Profiling of Purified Brain Autophagic Vesicles in perinatal cerebral Hypoxic-Ischemic injury

Zilan Yaren Susun1, Erin Wosnitzka1, Vanessa Ginet1,2, Devanarayanan Siva Sankar3, Anita Truttmann2, Jörn Dengjel3, Vassiliki Nikoletopoulou1 and Julien Puyal1

1Department of Fundamental Neurosciences, University of Lausanne, Switzerland
2Department of Mother, Women and Child, Lausanne Hospital, Switzerland
3Department of Biology, University of Fribourg, Fribourg, Switzerland

Background: Perinatal hypoxic-ischemic encephalopathy (HIE) is a leading cause of neonatal mortality and long-term neurological disability. Therapeutic hypothermia, the current standard of care, provides only partial neuroprotection, highlighting the need to better understand the cellular mechanisms underlying hypoxic-ischemic brain injury. We previously identified neuronal autosis and autophagy-dependent form of cell death, as a major contributor to neuronal injury following HI. However, the autophagic cargo and intracellular components targeted for degradation during neuronal autosis remain largely unknown. To address this, we characterized the content of autophagic vesicles following neonatal hypoxic-ischemic brain injury.

Methods: Neonatal hypoxic-ischemic brain injury was induced using the Rice–Vannucci rat model at P7. Animals were divided into three experimental groups: sham controls, hypoxia, and hypoxia-ischemia (HI). Forebrain tissue was collected at 6h after injury induction and processed for autophagic vesicle profiling. LC3-positive autophagic vesicles were isolated and analyzed by mass spectrometry to characterize changes in their protein cargo under sham, hypoxic and hypoxic-ischemic conditions. Bioinformatic analyses were performed to identify enriched cellular components and biological pathways associated with the autophagic degradome. In parallel, primary cortical neurons subjected to hypoxic-ischemic-inducing conditions were analyzed by western blot and immunocytochemistry approaches to monitor autophagic flux and validate autophagy-degraded protein candidates emerging from the proteomic analysis.

Results: LC3-based immunopurification coupled with mass spectrometry helped for the characterization of autophagic vesicle cargo under sham, hypoxia, and hypoxic-ischemic (HI) conditions. A total of 2630, 4616, and 4787 proteins were identified in autophagic vesicles from sham, hypoxia, and HI groups, respectively, indicating a marked increase in autophagic cargo recruitment in response to hypoxic and hypoxic-ischemic stress. Comparative proteomic analyses revealed remodeling of the autophagic vesicle content following injury, with the most important changes observed after HI. Together, these findings show that hypoxic and hypoxic-ischemic stress are associated with marked changes in autophagic cargo composition, particularly through the enrichment of mitochondrial and synaptic proteins within autophagic vesicles.

Conclusion: Our findings provide the first complete description of the autophagic vesicle degradome following neonatal hypoxic-ischemic brain injury. They reveal extensive remodeling of autophagic cargo in response to hypoxic-ischemic stress and identify intracellular pathways and organelles that may contribute to neuronal autosis. This work establishes a valuable resource for investigating the molecular mechanisms of autophagy-dependent neuronal injury and identifying potential therapeutic targets in HIE.

Tamba Carlo

Application of a T1-based SHIVAI model for automated perivascular space quantification in Alzheimer's disease

Carlo Tamba[1], Alessandra Griffa[1], Patrik Michel[2], Maria Cabello-Toscano[1], Lila Meflah [1], Paolo Salvioni Chiabotti[1], Silvia Pistocchi[4], Yasser Aleman-Gomez[4], Vincent Dunet[4], Olivier Rouaud[1], Patric Hagmann[4], Gilles Allali[1], Giulia Bommarito[1],

[1] Leenaards Memory Center, Dept. of Clinical Neurosciences, CHUV-UNIL, Lausanne, Switzerland
[2] Stroke Center, Neurology Service, Dept. of Clinical Neurosciences, CHUV-UNIL, Lausanne, Switzerland
[3] Dept. of Diagnostic and Interventional Radiology, CHUV-UNIL, Lausanne, Switzerland

Introduction: Enlarged perivascular spaces (PVS) are MRI markers of cerebral small-vessel disease frequently observed in Alzheimer's disease (AD). Automated quantification may improve reproducibility and facilitate large-scale analyses. We assessed whether T1-based automated PVS measures agree with clinician-based ratings and reproduce expected age-related patterns.

Methods: We included 156 patients from a memory-clinic population with a confirmed clinical-biological diagnosis of AD (mean age 71.6±7.5 years; 68 women), including 44 early-onset (EOAD) and 112 late-onset AD (LOAD). PVS were automatically segmented from T1-weighted MRI using SHIVAI v3 and quantified in the centrum semiovale (CSO) and basal ganglia (BG) as cluster counts and raw and intracranial-volume-adjusted volumes. Clinician-rated PVS burden was assessed semi-quantitatively. Associations were tested using Spearman correlations and group differences using non-parametric tests.

Results: Automated PVS counts correlated moderately with clinician ratings in the CSO (ρ=0.502), BG (ρ=0.455), and combined regions (ρ=0.408; all $p<0.001$). Automated volumes showed similar correlations (CSO ρ=0.508; BG ρ=0.421; total ρ=0.435; all $p<0.001$), with comparable results after intracranial-volume adjustment. Automated PVS measures increased across clinician-rated severity stages in both regions. BG automated measures increased with age (ρ=0.330–0.367; all $p<0.001$), whereas CSO and total measures did not. LOAD showed higher automated BG PVS count and volume than EOAD, while CSO and total measures did not differ. No differences were observed across educational levels, as expected.

Conclusions: T1-based SHIVAI PVS measures showed moderate agreement with clinician ratings and captured expected age- and onset-related BG patterns. These findings support automated PVS quantification in AD cohorts, although further validation is warranted.

Tomà Romain

Chemogenetic inhibition of the basolateral amygdala alters reward allocation in a rat prosocial pulling task

R.TOMA[1], E. VAN DEN BURG[1], D. TERBURG[2,3], J. VAN HONK[3], R. STOOP[1]

[1] Centre for Psychiatric Neuroscience, Department of Psychiatry, Lausanne University Hospital Center, Lausanne, Switzerland
[2] Utrecht University, 3584 CS Utrecht, Netherlands
[3] University of Cape Town, Department of Psychiatry and Mental health, Rondebosch, Cape Town, South Africa

The basolateral amygdala (BLA) has been implicated in reward valuation, decision-making, and social behavior. Human studies of patients with Urbach-Wiethe disease (UWD), a rare genetic condition associated with selective bilateral BLA calcification, suggest that the BLA contributes to balancing self-directed and other-directed motivation. However, causal investigations of BLA function in social effort allocation remain limited. Given the evolutionary conservation and functional expansion of the BLA across species, rodent models and in particular rats, which display rich social behavior provide an opportunity to investigate the neural mechanisms underlying these behaviors. To address this question, we developed a rat Prosocial Pulling Task adapted from previous reciprocity paradigms. Female Sprague Dawley rats (n=12) received bilateral injections of inhibitory DREADDs in the BLA and were trained to pull one platform delivering food to themselves and another platform delivering food to a conspecific housed in an adjacent compartment separated by a transparent perforated divider allowing visual, olfactory and limited tactile interactions. Following post-surgery recovery and a four week training protocol, eight animals reached stable behavioral performance and completed testing. Behavioral performance was assessed across three sessions: baseline, chemogenetic inhibition of BLA with deschloroclozapine administration, and recovery. Pulling behavior was normalized to session duration and used to calculate a self/other preference index. No baseline platform bias was observed after training (Wilcoxon signed-rank test, $p=0.350$). Chemogenetic inhibition of the BLA increased the self/other preference index relative to baseline (Wilcoxon signed-rank test, $p=0.039$), with a partial recovery observed during the recovery session (baseline vs. recovery, $p=0.078$). Examination of individual pulling rates suggested that this shift was associated with reduced responding directed toward the conspecific, while self-directed responding was comparatively preserved, although neither measure reached statistical significance when analyzed separately (self: $p = 0.641$; other: $p = 0.547$). These preliminary findings suggest that transient inhibition of the BLA alters the balance between self-directed and other-directed reward-seeking behavior. These results validate a translational rodent model of social reward allocation and provide a framework for future investigations of neural circuits underlying social valuation and effort allocation.

Touya Maylis

AI tools for continuous monitoring and prediction : fatigue and disease progression in patients with glioblastoma.

Maylis Touya[1], Pauline Ducouret[2], Antoine Spahr[2], Stéphanie Viguet-Carrin[3], Nicolas Desbaillets[4], Philippe Ryvlin[4], Andreas Hottinger[3]

[1]Université de Lausanne, [2]NeuroTech@NeuroDigital, [3]Lundin Family Research Center, [4]Centre Hospitalier Universitaire Vaudois

Introduction Fatigue is a highly prevalent yet understudied symptom in patients with glioblastoma (GBM), with a significant impact on quality of life. Its underlying mechanisms remain poorly understood and are likely multifactorial. Fatigue may arise as a direct consequence of the tumor and its treatments, while comorbid depressive and anxious symptoms and dysregulation of the autonomic nervous system may also contribute. We hypothesize that continuous monitoring using a wearable device, capturing both physical activity and autonomic parameters, can provide objective biomarkers reflecting clinical status and disease evolution. Methods Patients were monitored using a wearable device (Embrace+ smartwatch, Empatica) alongside an electronic diary. Seizure occurrence and daily fatigue levels were recorded using a Visual Analog Scale (VAS). In addition, every two months during routine MRI visits, patients completed validated questionnaires assessing sleep, fatigue, mood, and quality of life. Results As of June 2026, 17 of the planned 30 patients have been enrolled. Daily VAS fatigue scores showed only weak correlations with standardized fatigue questionnaires. However, patients tended to exhibit lower levels of physical activity on days associated with higher self-reported fatigue. Preliminary analyses using artificial intelligence models demonstrate very promising performance in forecasting fatigue as well as the risk of disease progression. This could means a potential increase in patient comfort and decrease in health costs. Ongoing analyses are exploring the relationships between fatigue and mood, the impact of therapies, and associations with survival outcomes. Conclusion Preliminary findings suggest that fatigue assessed through standardized questionnaires may be anticipated using simple daily VAS reporting combined with wearable-derived biomarkers. Furthermore, crucial informations regarding disease progression and therefore survival may also be predicted. These results highlight the potential of integrating digital health tools and artificial intelligence to enhance patient monitoring, improve quality of life, and optimize clinical management.

Unsal Burak

Characterization of mediodorsal thalamic projections to the claustro-insular region

Burak Unsal[1], Mathieu Lozieau[2], Vladimir Kouskoff[2], Ivan Rodriguez[3], Alan Carleton[2]

[1]Department of Basic Neurosciences, Faculty of Medicine, University of Geneva, Switzerland, Department of Genetics and Evolution, Faculty of Sciences, University of Geneva, Switzerland, [2]Department of Basic Neurosciences, Faculty of Medicine, University of Geneva, Switzerland, [3]Department of Genetics and Evolution, Faculty of Sciences, University of Geneva, Switzerland

The claustro-insular region is an evolutionarily conserved bilateral brain complex comprising the insula and the claustrum (CLA). The insula, a lateral neocortical area, participates in interoception, salience detection, pain processing, and the regulation of affective states. The CLA, located medially adjacent to the external capsule, is a subcortical nucleus with dense, reciprocal connections to nearly all cortical areas and has been implicated in higher cognitive functions such as working memory and cognitive flexibility. To characterize presynaptic inputs to genetically identified Smim32-expressing CLA neurons, we performed rabies-based transsynaptic retrograde tracing. In addition to extensive cortical inputs, we identified several central thalamic nuclei, including the mediodorsal thalamus (MDT), as direct sources of input to CLA neurons. Given the established role of the MDT in working memory and cognitive flexibility, we further examined thalamo-claustral connectivity. Anterograde viral tracing confirmed that MDT axons densely innervate the CLA while also extending to layers 1, 3, and 6 of the agranular insular cortex. Channelrhodopsin-assisted circuit mapping was used to selectively activate MDT axons in acute CLA slices during whole-cell patch-clamp recordings from genetically identified CLA neurons. A majority of Smim32+ CLA neurons displayed monosynaptic excitatory postsynaptic currents (EPSCs) in response to brief light pulses, while some neurons also exhibited polysynaptic inhibitory postsynaptic currents (IPSCs). Strikingly, when GABAA-mediated inhibition was blocked with gabazine, we uncovered massive depolarizing events lasting hundreds of milliseconds following optogenetic stimulation. These prolonged events were blocked by TTX and were present even in neurons lacking direct MDT input under baseline conditions. This suggests that MDT projections act primarily as a trigger, while the prolonged excitatory events are generated within the intrinsic CLA network. Ongoing experiments aim to dissect the mechanisms underlying these large events and to determine whether thalamo-claustral connectivity contributes to working memory.

Valderrama Andrea

Integration of synaptic and dendritic activity during sensory perception

Andrea Valderrama Alvarez[1], Valentin D'Hondt[1], Ronan Chéreau[1], Anthony Holtmaat[1], Céline Dürst[1]

[1] University of Geneva

Pyramidal neurons in layer 2/3 of the primary somatosensory cortex integrate excitatory thalamic and corticocortical inputs from feedback pathways, but how these inputs shape neuronal activity during perception remains unclear. We aim to investigate this integration by monitoring synaptic, dendritic, and somatic activity in individual L2/3 neurons during sensory processing. Using two-photon laser scanning microscopy (2PLSM), we will simultaneously image presynaptic glutamate release and postsynaptic Ca^{2+} signals through sparse co-expression of genetically encoded indicators in the whisker somatosensory cortex (wS1). Targeted expression will be achieved by injecting a Cre-expressing vector into the posterior medial thalamus (POm) and Cre-dependent reporters into wS1. In awake, head-fixed mice, we will deliver controlled single whisker deflections while recording somatic and dendritic Ca^{2+} activity together with glutamatergic signals from L1 dendrites using dual-plane imaging with an electrically tunable lens. These measurements will reveal how feedback inputs to distal dendrites influence somatic integration of sensory-evoked signals. To study active perception, mice will be trained on a whisker detection task, and neuronal activity will be quantified across varying stimulus intensities to establish psychometric, neurometric, and synaptometric functions. By linking synaptic input patterns to dendritic and somatic computations, this study will provide new insights into how cortical neurons integrate multi-source signals to support sensory perception.

Vasanth Sanjana

NMN accumulation caused by compromised dNmnat activity leads to dSarm-dependent neurodegeneration

Sanjana Vasanth[1], Arnau Llobet Rosell[1], Giulia Perillo[2], Zeynep Yildrim[2], Pei-Hsuan Wu[2], Lukas Neukomm[1]

[1]University of Lausanne, [2]University of Geneva

Nicotinamide adenine dinucleotide (NAD+) is a crucial molecule for most, if not all, forms of life. It is involved in redox reactions and consumed as a cofactor in cellular processes like metabolism, signaling, and DNA repair. As a result, NAD^+ levels in cells must be tightly regulated at all times. Downregulated NAD^+ is a hallmark of many acute and chronic neurodegenerative conditions. Thus, bolstering neuronal NAD^+ levels via dietary precursor supplementation is a fast-emerging neuroprotective strategy. The enzyme nicotinamide mononucleotide adenylyl transferase (NMNAT) converts nicotinamide mononucleotide (NMN) to NAD^+. Compromised Drosophila dNmnat results in neurodegeneration; however, whether this is due to an accumulation of NMN or a decline in NAD^+ remains debated. Here, we present evidence that in neurons with reduced dNmnat activity, NMN neurotoxicity precedes low-NAD^+-induced degeneration. Importantly, this degeneration requires the prodegenerative enzyme Drosophila sterile alpha and TIR motif (dSarm). Our observations suggest that supplementation with NAD^+ precursors such as NMN to bolster neuronal NAD+ homeostasis should be approached with caution.

Vedere Alais

Pre- And Postoperative Changes In Self-Awareness Following Tumor Resection: Preliminary Evidence Of The Clinical Sensibility Of The Self-Other Voice Discrimination Task.

Alais Vedere[1], Philippe Voruz[1], Marta Martins[2], Roberta Ronchi[2], Julie Peron[1], Olaf Blanke[3], Karl Schaller[2], Giannina Rita Iannotti[2]

[1]Université de Genève, [2]Hopitaux Universitaires de Genève, [3]Ecole Polytechnique Fédérale de Lausanne

Background: Preserving higher-order cognition is central in neurosurgery, yet self-related functions are rarely assessed despite their impact on identity and quality of life. Self–Other Voice Discrimination (SOVD) is a brief self-voice recognition task in which patients judge whether ambiguous voice morphs sound more like their own voice or another person's voice, providing an operational measure of self-related processing. In our recent work, SOVD has shown promise in complementing standard neuropsychological evaluation in neurosurgical patients by capturing self-related aspects. However, how best to integrate SOVD into a comprehensive neuropsychological battery remains to be established. Here, we report an initial exploratory case showing encouraging perioperative results and potential clinical relevance. Methods: A 49-year-old woman without major psychiatric or hearing deficits and candidate for surgical resection of a right insular giant cell glioblastoma, IDH-wildtype, CNS WHO grade 4 was considered for this study.The patient underwent full neuropsychological, psychiatric assessments and participated to the SOVD experiment before(-4d) and after surgery(+9d). Results: SOVD performance was standardized to a healthy reference sample from our previous work (Z-scores). In our patient, preoperatively, SOVD showed a mild impairment (Total $Z = -1.20$). Postoperatively, performance worsened across conditions (relative worsening: +219.9% Total, +49.6% Self, +282.6% Other), with Total (self and other voices) and Other (voice) shifting into the severely deficient range ($Z < -2$; Fig. 1). Standard neuropsychological and psychiatric assessment showed a mild decline in executive and attentional functions, along with the emergence of mild signs of left unilateral spatial neglect. Conclusions: This case strongly supports SOVD as a valuable adjunct, providing neurosurgeons with complementary, clinically meaningful information on self-related processing to inform presurgical planning alongside standard neuropsychological assessment.

Vilenchik Elizaveta

Ahead planning in the multi-word utterance production as indexed by contextual effects

Elizaveta Vilenchik[1], Marco Sala[1], Marina Laganaro[1]

[1]Faculty of Psychology and Educational Sciences, University of Geneva

Language production is a complex process, especially when we move beyond the single-word level. There is substantial research indicating that, in picture naming, congruent contextual sentences pre-picture presentation can speed up word production. It has been shown that alpha-beta power decreases are associated with conceptual and lexical retrieval in the contextual paradigm (Piai et al., 2014; 2015; Roos & Piai, 2020). However, this contextual effect has been investigated in single-word production; hence, it is unknown whether this contextual effect can also be observed beyond single word production. In particular, is production faster when there are contextual clues to a word that is not at the onset of the utterance that has to be produced? To address this issue, we studied multi-word (noun phrases) production under different contextual conditions. Prior to the electroencephalographic (EEG) study, we investigated the effects behaviourally on native speakers of French (n = 47; 37 female; age 22.7 ± 7.5 years). They had to produce a multi-word utterance consisting of a determiner, a numeral, and a noun (e.g., les deux oiseaux [the two birds]) in the picture naming task. Before each picture, there was either a sentence context of high constraint (e.g., Dans la campagne, on entend… [In the countryside, they hear…] – HC condition) or a sentence context of low constraint (e.g., Sur le dessin, on voit… [In the painting, they see…] – LC condition). Importantly, the high contextual condition allowed to predict only the noun (not the numeral). The preliminary behavioural results show that response times (RTs) are faster in the high constraint condition compared to the low constraint condition. These results suggest that even when the word that the semantic context points to is not at the utterance onset, there is still a beneficial effect of the constraining context. They also indicate ahead planning until the noun before articulation in noun phrases. Since this behavioural evidence provides grounds for the investigation of neural correlates of contextual effects in multi-word utterance planning, currently, we are carrying out the study on planning multi-word utterances with the same contextual paradigm using EEG.

Vorburger Daphné

Effects of visual-auditory stimulations at 40 Hz during adolescence in a neurodevelopmental mouse model relevant to psychosis

Daphné Vorburger[1], Gauvain Cung[1], Basilio Giangreco[1], Nicolas Toni[1], Daniella Dwir[1], Paul Klauser[1], Pascal Steullet[1]

[1]CHUV

Currently, there is no effective treatment for reducing cognitive deficits in subjects at high-risk of psychosis. Recent studies have shown that 40-Hz stimulations improve memory performance in mouse models of Alzheimer's disease, partly through modulation of microglial activity. However, the effect of these stimulations on memory in schizophrenia is unknown. Here, we investigated the effect of exposure to 40-Hz visual-auditory stimulations during adolescence on mice treated prenatally with methylazoxymethanol acetate (MAM), a model of psychosis. We found that prenatal MAM treatment altered both cognitive performance and microglial homeostasis. MAM females, but not males, exhibited impaired discrimination of a novel object, a deficit that was prevented by 40-Hz but not by random stimulations. In parallel, 40Hz stimulations decreases microglial density in the ventral hippocampus of MAM females, suggesting a normalization of microglial alterations in a brain region critically involved in novelty detection and memory processing. Moreover, 40-Hz stimulations increased exploration of objects newly introduced into a familiar environment in CTR males and MAM mice of both sexes despite normal explorative behavior, indicating enhanced attention to novelty. However, 40-Hz stimulations did not affect the normal behavior of MAM and CTR mice in open field and had limited effect in elevated-plus-maze. The prenatal MAM treatment also resulted in reduced weight gain during adolescence in both sexes, a phenomenon that was mitigated by sensory stimulations. Together, these findings suggest that adolescent exposure to 40-Hz stimulations enhance cognitive functions related to novelty processing and short-term memory while restoring microglial homeostasis in the ventral hippocampus.

Vulliemin Romain

Psychological Predictors of Psychosocial Functioning at Two-Year Follow-Up in Borderline Personality Disorder and Clinical Comparison Group

Romain Vulliemin[1], Ines Culina[1], Setareh Ranjbar[1], Sandra Vieira[1], Sylvie Berney[1], Stéphane Kolly[2], Jérémie André[1], Philipe Conus[1], Ueli Kramer[3]

[1]UNIL/CHUV, [2]Private Practice (Lausanne), [3]UNIL/CHUV/University of Winsdor

Introduction Longitudinal research has shown that symptomatic remission in borderline personality disorder (BPD) is common, yet improvements in symptoms often fail to translate into sustained psychosocial functioning. Despite the clinical relevance of functional outcomes, few studies have systematically examined which baseline psychological factors predict long-term psychosocial trajectories, particularly in comparison with patients without BPD. Objectives The primary objective of this study is to examine whether baseline psychological characteristics predict psychosocial functioning over a two-year follow-up in patients with and without BPD. Methods Participants were recruited from a Swiss university hospital (N = 122; nBPD = 65; nNon-BPD = 57). At baseline, participants underwent comprehensive assessments of childhood traumatic events, impulsivity, maladaptive personality traits, rejection sensitivity, and interpersonal difficulties. In addition, symptoms and psychosocial functioning were assessed at baseline and at a two-year follow-up using respectively the Diagnostic Interview for Borderlines – Revised (DIB-R) and the Borderline Follow-up Interview – Revised (BFI-R). Functional outcome was operationalized as a binary variable (good vs. poor functioning). Primary analyses employed binary logistic regression models to predict functional outcome. Exploratory analyses examined alternative categorical representations of functional trajectories. Results Data collection at baseline (T0) has been completed, while the two-year follow-up (T1) is currently ongoing and will be presented during the congress. Scientific and Clinical Significance From both a scientific and clinical perspective, these findings are expected to advance personalized psychiatry by identifying early psychological risk factors for poor functional outcomes, thereby improving prognostic precision and helping clinicians target interventions.

Wu Cheng-Hsi

The role of Lateral Habenula in pup-directed behaviors: maladaptive responses to excessive distress pup calls

Cheng-Hsi Wu[1], Manuel Mameli[1], Salvatore Lecca[1]

[1]University of Lausanne

Daily infant care can be a major challenge for caregivers. Infants communicate discomfort primarily through crying, and persistent cry-fuss behavior has been identified as a risk factor for caregiver stress and maladaptive caregiving behaviors toward children. Previous studies have reported correlations between maternal mental disorders and the incidence of child injury, particularly in situations involving excessive infant crying. Notably, perpetrators are not limited to parents but can also include other caregivers. The lateral habenula (LHb) is a key brain region implicated in both depressive-like phenotypes and adult-newborn interactions. Elevated LHb activity has been observed not only in animal models of depression but also in response to aversive stimuli, such as the exposure of female mice to distress pup calls (the equivalent of infant crying). Based on this evidence, we hypothesized that prolonged exposure to inescapable distress pup calls would alter LHb activity and associated behavioral responses. We developed a novel behavioral paradigm in which virgin female mice were exposed to an inescapable context with continuous playback of distress pup calls across multiple days. This paradigm resulted in maladaptive adult-newborn interactions in virgin female mice, characterized by reduced alloparental behavior and accompanied by increased behavioral despair. Ex vivo electrophysiological recordings revealed that exposure to chronic distress pup calls reduced both glutamatergic and GABAergic synaptic transmission in LHb neurons and was accompanied by synaptic remodeling of VTA innervations to the LHb.

Wu Feimeng

Tracking the origin of dreams in the brain using a serial awakening paradigm, EEG and transcranial temporal interference stimulation

Feimeng Wu[1], Vincent Rochas[1], Shainess Allard[1], Lampros Perogamvros[1]

[1]University of Geneva

Every night, the brain generates entire worlds, from thought-like experiences to vivid, movie-like dreams. Dreams have fascinated human societies since ancient times. However, for up to 5 % of the population, dreams become a significant burden, as seen in conditions such as recurrent nightmares and epic dreaming. Understanding the mechanisms underlying dreaming is therefore of major importance. Previous work by Siclari et al., identified a neural signature of dreaming characterized by local activation in posterior cortical regions. In addition, the striatum and the hippocampus, both part of the mesolimbic dopaminergic system, are strongly activated during REM sleep. Studies have shown that lesions in the striatum can lead to complete dream loss while lesions in the hippocampus are associated with a partial reduction in dream frequency and episodic content. This project aims to investigate the neurophysiological origins of dreaming, by studying the causal role of the striatum and hippocampus in generating and modulating dreaming during REM sleep. In addition, the project will explore how suppression of dreaming may affect memory and emotional processing. We will use temporal interference electrical stimulation (tTIS), a safe and non-invasive stimulation technique to modulate the activity of these deep brain structures. This approach will be combined with a serial awakening paradigm to assess participants' conscious experiences during sleep. A total of 60 participants will be recruited (30 in the striatum group and 30 in the hippocampus group). Participants will undergo EEG recording over two nights in a sleep laboratory using 128-channel electrode nets. During the intervention night, tTIS will be delivered during REM sleep, after which participants will be awakened and asked to report their conscious experiences. Cognitive tests on emotional regulation and memory will be conducted before and after the experimental night for comparison. Using this technology and paradigm, we aim to study the involvement of subcortical and limbic brain regions in dreaming and their relationship to cortical regions. We hypothesize that inhibition of these subcortical regions will reduce dreaming in REM sleep and its episodic content and that it might affect emotional regulation and memory processes. This project could contribute to a better understanding of dreaming, sleep neurophysiology, and neuromodulation, while potentially opening future clinical perspectives in psychiatry for the treatment of nightmares and anxiety.

Yatikci Ece

Modelling Information Loss in Peripheral Vision

Ece Yatikci[1], Ben Lonnqvist[1], Clementine Levy-Fidel[1], Marco Bertamini[2], Michael H. Herzog[1]

[1]EPFL, [2]University of Padova

Blur explains some aspects of peripheral appearance, but it is unclear whether it provides a general account of peripheral vision across tasks. We addressed this question using two paradigms that rely on different forms of peripheral information: the Honeycomb illusion (Bertamini et al., 2016), in which fine barbs disappear in peripheral vision while global structure remains visible, and visual pop-out search, which depends on preserving an odd-one-out target. The same observers (N = 20) completed both tasks. We first fitted a blur model to performance in the Honeycomb task and then tested whether the same parameters generalised to pop-out search. Although the model captured key aspects of barb disappearance, it failed to account for search performance. We then trained autoencoders with latent bottlenecks as models of compression. Two of the four models reproduced barb disappearance in the Honeycomb illusion, but none preserved the pop-out target. Thus, models that accounted for one task failed on the other. These findings show that current models of peripheral representation do not generalise across tasks and argue against blur or compression alone as sufficient accounts of peripheral perception.

Zamora Lea

Distinct ERP subtypes generalize across tasks and observers and are associated with endogenous EEG fluctuations, not stimulus encoding

Lea Zamora1,2, David Pascucci1,2

1 Psychophysics and Neural Dynamics Lab, Department of Radiology, Centre Hospitalier Universitaire Vaudois (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland

2 The Sense Innovation and Research Center, Lausanne, Switzerland

Human perception and behavior exhibit structured fluctuations over time, often interpreted as reflecting latent internal states. Such states can be derived from both behavioral and neural data, typically yielding a small number of recurring patterns, some of which generalize across tasks. However, the relationship between behaviorally and neurally defined states remains unclear, as neural states show inconsistent associations with behavior. Here, we addressed three questions using a multitask EEG dataset (face and motion detection VEPCON) and a trial-clustering approach applied to single-trial ERPs. We tested whether neural states (1) recur across tasks, (2) reflect differences in stimulus processing, and (3) are associated with prestimulus activity. Clustering revealed two states in each task. A state classifier trained in one task generalized to the other, indicating that at least one state recurs across tasks with a stable topography. Despite marked differences in ERP morphology, we found no evidence for differences in stimulus processing: decoding, ERP components (e.g., N170), and mixed-model analyses showed no consistent effects of state. In contrast, states were reliably associated with differences in prestimulus EEG activity, particularly in the location and magnitude of alpha bursts. Overall, these results suggest that neural states identified via trial clustering can generalize across tasks but are primarily linked to endogenous prestimulus fluctuations rather than differences in stimulus-related processing.

Zhang Runzhong

Re-investigating the role of CeA SOM+ neurons in fear learning

Runzhong Zhang[1], Olexiy Kochubey[1], Ralf Schneggenburger[1]

[1]EPFL

During the process of threat learning, critical for survival, animals form an association between an initially innocuous sensory cue and an aversive stimulus. In the laboratory, this process can be studied as auditory-cued fear learning, in which mice will develop a conditioned response in the form of defensive freezing, in response to an auditory conditioned stimulus. The central amygdala (CeA) is a sub-area of the amygdala mainly composed of inhibitory (GABA) neurons, which was shown to be critical for fear memory expression. Earlier studies showed that one class of CeA neurons, somatostatin (SOM+) neurons that are mainly located in the lateral CeA, are required for the acquisition, and expression of an auditory-cued fear memory (Li et al., 2013). Optogenetic activation of SOM+ neurons promoted passive defensive responses, whereas silencing them reduced freezing or biased mice toward active avoidance (Li et al., 2013; Fadok et al., 2017). However, other studies show that optogenetic activation of CeA SOM+ neurons did not induce freezing in naive mice (Kim et al., 2017). We therefore wished to re-investigate the role of the CeA SOM+ neurons in fear learning, using optogenetic and chemogenetic approaches. To test whether CeA SOM+ neurons are required for fear-memory expression, we expressed the inhibitory DREADD hM4Di-mCherry (or mCherry as control) Cre-dependently in the CeA of SOM-Cre mice, and chemogenetically silenced SOM+ neuron activity on the fear memory recall day by systematic application of CNO (N = 6 and 9 mice, respectively). This manipulation, however, did not result in observable alterations of CS -induced freezing. We next asked whether CeA SOM+ neurons are sufficient to drive freezing behavior in naive mice, and in mice that have undergone submaximal fear learning. For this, we expressed Chronos-GFP (or GFP for control; N = 4 and 8 mice) in CeA SOM+ neurons. In an open field test with naïve mice, a 30s long train of 2 ms blue light pulses at 20 Hz led to a small reduction (12.3%; p = 0.0077) in velocity of locomotion in freely moving. We next verified whether optogenetic activation of CeA SOM+ neurons during the fear memory recall after submaximal training with weak footshocks (0.4 mA) could return the CS-induced freezing responses to normal. For this, trains of blue light pulses (2 ms, 20 Hz) were delivered during the second and the fourth of four CS presentations on the fear recall day, as well as after the last CS. Surprisingly, mice in the Chronos group (N = 8) showed a trend towards a reduction of freezing upon optogenetic stimulation. Nevertheless, further experiments will be necessary to validate these effects. Together, these results suggest that the role of CeA SOM+ neurons in the expression of freezing behavior during fear memory retrieval might be more complex than currently thought. It was recently reported that disynaptic specificity of the inputs- and outputs of CeA-SOM neurons is required for the observation of behavioral effects in fear learning experiments (Massi et al., 2023). Therefore, we will next attempt to study the role of CeA-SOM neurons which make outputs to specific downstream brain areas.

Zufferey Valentin

Development of a microscopy approach using live mitochondrial reporter as an advanced technology to investigate brain disorders

Valentin Zufferey[1], Jeanne Espourteille[2], Enea Parietti[3], Nicolas Preitner[4], Kevin Richetin[3]

[1]University of Lausanne (UNIL) / Centre des Neurosciences psychiatriques (CNP) - Centre Hospitalier Universitaire Vaudois (CHUV), [2]UNIL / CNP - CHUV, [3]CNP, CHUV, [4]AC Immune

Tauopathies such as Alzheimer's disease, Pick's disease, or progressive supranuclear palsy are characterized by abnormal tau accumulation inducing neurodegeneration. Plasma biomarkers (pTau217, GFAP, NFL) facilitate diagnosis but fail to distinguish tau isoforms or identify early pathological entities. In 3D neuron–astrocyte co-cultures, astrocytes clear extracellular PHF-tau aggregates within 48 h without detectable cytotoxicity. MitoTimer imaging over 72 h reveals astrocyte-specific mitochondrial biogenesis after 36 h (but not neuronal). Proteomics confirms mitochondrial and synaptic tau association in astrocytes, linked to increased excitatory synapses via PGC-1α. These results highlight mitochondrial sensitivity and role in response to pathological signals. However, real-time imaging analysis imposes limits on interpretation due to complexity and precludes large-scale sample analysis. To leverage this sensitivity at larger scale, a microscopy workflow (JOBS/GA3) coupled to a KNIME/Python analysis pipeline was developed to characterize astrocyte mitochondrial dynamics in 96-well plates. Multivariate analyses (MANCOVA, UMAP, XGBoost) reveal interpretable trajectories of interest, enabling screening strategies. Astrocyte mitochondria thus emerge as dynamic sensors of tau or other pathological contents, complementing plasma biomarkers for patient stratification from biofluid fractions such as BD-EVs.

van Oorschot David

Layer- and pathway-specific optogenetic mapping of dendritic potentials in the somatosensory cortex

David van Oorschot[1], Ronan Chéreau[1], Anthony Holtmaat[1]

[1]University of Geneva

The posteromedial thalamic nucleus (POm) provides a major feedback pathway to the primary somatosensory cortex (S1) and is thought to shape cortical output by modulating the activity of layer (L)5 pyramidal neurons. L5 contains distinct classes of intratelencephalic (IT; L5a) and pyramidal tract (PT; L5b) neurons, which form corticocortical and corticofugal output pathways, respectively. POm axons contact these neurons at different locations along their dendritic arbors, and the spatial organization of these inputs is likely critical for their functional impact. Connection profiles have been mostly based on a somatocentric representation of postsynaptic signals, in which inputs arriving at the distal dendritic compartment might be underestimated due to their large electrotonic distance from the soma. Here, we combine somatic and distal dendritic patch-clamp recordings with layer- and pathway-specific optogenetic stimulation of ChR2-expressing POm axons to examine the efficacy and distribution of POm inputs onto IT and PT neurons in mouse S1. IT and PT neurons were identified using Cre-dependent AAV expression of fluorescent proteins in Tlx3-Cre and Sim1-Cre transgenic mouse lines, respectively. In addition, PT neurons were also identified by retrograde labeling from the superior colliculus. Optogenetic stimulation of POm axons in layer 1 evoked monosynaptic responses in the distal dendrites of Sim1-positive L5b neurons, but these inputs were comparatively weaker than the robust distal dendritic excitation observed in L5a IT neurons. This finding suggests that synaptic input to the broad-tufted apical dendrites of L5b neurons does not scale simply with extensive axodendritic overlap, consistent with a previously proposed deviation from Peters' rule for this circuit. Nevertheless, when polysynaptic activity was permitted, L5b neurons exhibited more complex synaptic waveforms, consistent with a role for POm in modulating dendritic excitability and somatodendritic coupling rather than directly driving output. Together, these findings support a model in which POm engages L5a and L5b neurons through distinct functional motifs. Ongoing work is aimed at elucidating the nonlinear subcellular and circuit mechanisms underlying these effects.

von der Weid Laure

The Link Between the Menstrual Cycle and Functional Neurological Disorder

Laure von der Weid[1], Michael Mouthon[1], Cristina Concetti[1], Selma Aybek[1]

[1]University of Fribourg

Background: Functional Neurological Disorder (FND), a common neurological disease characterized by bodily symptoms, predominantly affects women. Yet the role of sex hormones in symptom expression remains poorly understood. Hormonal fluctuations across the menstrual cycle are known to influence neurological and psychiatric conditions, and emerging evidence suggests cortical excitability, emotional processing, and the Sense of Agency (SoA), a core mechanism implicated in FND, vary with hormonal phase. We aim to characterize how FND symptoms and their underlying neurocognitive and neural correlates evolve across the menstrual cycle. Methods: Naturally cycling women with FND (aged 18–50) complete two study visits, timed to the follicular and luteal phases (confirmed via ovulation testing and hormonal blood sampling), in randomized order. At each visit, participants undergo neurological examination, symptom severity rating (self-reported and clinician-rated), questionnaires assessing mood, anxiety, and dissociation, behavioral tasks probing cognition, emotional processing, and SoA (including the Libet Clock and Catch-the-X paradigms), and structural and functional MRI. Daily symptom diaries are collected throughout the cycle via an electronic platform. Anticipated results: We hypothesize that FND symptom severity, both self-reported and clinician-rated, will be greater during the luteal phase relative to the follicular phase, alongside corresponding shifts in mood, dissociation, cognitive performance, and SoA. Neuroimaging analyses will explore whether these behavioral changes are paralleled by structural or functional differences, particularly in agency-related networks. Full results, including statistical comparisons across cycle phases, will be presented at the conference. Conclusion: This project will clarify whether the menstrual cycle modulates FND symptomatology, with implications for individualized treatment timing and future neuromodulation trial design.