2021 - Hybrid Meeting at FIU/Zoom

<u>If attending the meeting in person</u> you should be vaccinated because this is the best way to protect yourself and the community. <u>*We are following CDC guidelines which now require everyone (vaccinated or not) to wear a mask*</u>. Prior to your visit you will receive a screening questionnaire via email from the Panthers Protecting Panthers (P3) app. Generally, FIU policies on operations during COVID can be found here: <u>https://repopulation.fiu.edu/university-operations/index.html</u>.

The conference is at FIU main campus on the corner of 8th street (aka Calle Ocho or Tamiami Trail) and 107th. The exact address is:
AHC3 Rm 205
11200 SW 8th St
Miami, FL 33199

Parking is best in Parking Garage 5, which has visitor parking on the first floor that is metered paid using the paybyphone app https://parking.fiu.edu/visitor/.

<u>If attending the meeting on Zoom</u>, use this link and password:
https://fiu.zoom.us/j/99261755435?pwd=dGRoenhCSHpjTldFVEtzSlFuUExLQT09
Password: FCNC@2021!

<u>Day 1 - Thursday August 5th, 2021</u>

8:30am – Introduction and Welcome (Dr. Tim Allen, FCNC President)

9am-11am - Session 1: **From Genes to Circuits: Mechanisms Underlying Cognition and Disease**
Organizer: Dr. Sarah Stern, MPFI - Zoom

- **Dr. Tim Holford (Bolton Lab), MPFI** – "*Intercalated Neurons: The gate keepers of the amygdala*" – Zoom
- **Brandon Hindman (Stackman Lab), FAU** – "*Brief Novel Context Exposure Enhances Object Recognition Memory: Dopaminergic Recruitment and Context Relevancy*" – Zoom
- **Dr. Henriette Van Praag, FAU** – "Effects of exercise on hippocampal function" – Zoom
- **Jenna Levy (Page Lab), Scripps** – *"Regulation of growth in the developing brain by autism risk genes"* – Zoom

11-11:15am – Break & Place Lunch Orders (Sorry - In Person Only)

11:15am-1:15pm - Session 2: **A Translational Look at Risk for Alzheimer's Disease**
Organizers: **Danielle Benthem, FSU** – In Person and **Melissa Mendasy, FSU** - Zoom

- **Dr. Aryeh Sudwarts (Thinakaran Lab), USF** – "*BIN1 regulates inflammatory transcriptome in microglia*" – Zoom
- **Dr. Allaura Cone (Meckes Lab), FSU** – "*Mesenchymal stem cell-derived extracellular vesicles ameliorate Alzheimer's disease-like phenotypes in a preclinical mouse model*" – Zoom

- **Dr. Karina Alvina, UF** – "The myokine FNDC5/Irisin as mediator of exercise-related cognitive improvement and implications for Alzheimer's disease" – Zoom
- **Andrea Mejia (Glen Smith Lab), UF** – "*Behavioral Interventions for MCI*" – Zoom

1:15-2:30pm – Individually Packaged Lunch. Outside eating area with ample space for spreading out.

2:30-3:00pm - Dr. Andrew Maurer – **Featured Member Talk – "*A pragmatic position on neural rhythms*" –** Zoom

3:00-3:15pm - Break

3:15-5:00pm **Sarah Johnson Data Blitz** – 1st 2nd and 3rd place cash awards.

1. **Jessica Dixon (Undergraduate in Wilber Lab), FSU** – "Spatial Disorientation and Alzheimer's Disease: The Relationship Between Activation Profiles in the Brain's Navigational System and Reorientation Deficits in the 3xTg-AD Mouse Model of Tau and Amyloid Beta Aggregation" – Zoom
2. **Jordan Ogg (Undergraduate in Kee Lab), Stetson** – "Amyloid-β-Induced chemotaxis behavior and neuronal morphology in transgenic *Caenorhabditis elegans*" - Zoom
3. **Caroline Davidson (Undergraduate in Burke Lab), UF** – "*Paired Associates Learning Task to Assess Cognitive Impairment in Traumatic Brain Injury*" – Zoom
4. **Dr. Carly Logan (Postdoctoral Fellow in Burke Lab), UF -** *"Expression of the Immediate-early Genes Arc and Narp during Cognitive Multitasking is Attenuated in Aged Rats"* – Zoom
5. **Dr. Nathan Shultheiss (Postdoc in Allen Lab), FIU** - "*Deescalating Seizure and Behavior-Related Hypersynchrony of the Hippocampal Theta Rhythm Caused by Chronic Exposure to Lead (Pb^{2+})*" – In Person
6. **Maanasa Jayachandran (Graduate Student in Allen Lab), FIU** – "Neuronal representations in Medial Prefrontal Cortex during Nonspatial Memory for Sequences of Events" – In Person
7. **Alina Stimmell (Graduate Student in Wilber Lab), FSU** – "Sleep reverses Spatial Reorientation Impairments in a Mouse Model of Alzheimer's Disease" – In Person
8. **Puck Reeders (Graduate Student in Allen Lab), FIU** – "Finding the midline thalamus in humans for the investigation of neurological disorders" – In Person
9. **Danielle Benthem (Graduate Student in Wilber Lab), FSU** – "Rescuing impaired cortical-hippocampal interactions during sleep in a mouse model of Alzheimer's disease" – In Person
10. **Samantha Smith (Graduate Student in Burke Lab), UF** – "The Role of the Dorsal Striatum in Paired-Associates Learning" – Zoom
11. **Sabrina Zequeira (Graduate Student Bizon and Setlow Labs), UF** - "*Acute Effects of Cannabis on Cognition in Aging*" – Zoom
12. **Andy Garcia (Undergraduate Student Allen Lab), FIU** - "Rapid shifts in the spectral dynamics of the medial prefrontal cortex and hippocampus during nonspatial memory for sequences of events in rats" – Zoom

Day 2 - Friday August 6th, 2021

9-10:40am - Session 3: **Neurodevelopment and Cognition**
Organizer: **Dr. Tim Allen, FIU**

- **Adam Kimbler (Mattfeld Lab), FIU** – *"Differential effects of emotional valence on mnemonic performance with greater hippocampal maturity*" - In Person
- **Dr. Dana McMakin, FIU** – "Sleep-dependent memory consolidation in pediatric anxiety: A programmatic example of how developmental neuroscience might inform our understanding and treatment of child psychopathology" - In Person
- **Dr. Alex Meyer, FSU** – "*Individual differences in the error-related negativity (ERN) and cognitive control*" - Zoom

10:40-10:55am – Break & Place Lunch Orders (Sorry - In Person Only)

11:00am-12:00pm **- Bita Moghaddam – Keynote Speaker – "*Thinking differently about modeling anxiety*" – In Person**

12:00-1:00pm – Individually Packaged Lunch. Outside eating area with ample space for spreading out.

1:00pm – 2:30pm - Session 4: **Important Risk Factors and Contributors to Cognition and Cognitive Decline**
Organizer: **Dr. Barry Setlow, UF** and **Yenisel Cruz-Almeida, UF** - Zoom

- **Dr. Barry Setlow, UF – "**Social contributions to risky decision making" **–** Zoom
- **Dr. Elizabeth Losin, UM** – "Neuroimaging sociocultural modulation of pain"– Zoom
- **Nicholas DiCola (Burke and Maurer Labs), UF** - *"Velocity modulated theta in the hippocampus is increased in age rats*" - In Person

2:30-2:45pm – Break

2:45-3:15pm - Continuation of Session 4:

- **Dr. Yenisel Cruz-Almeida, UF** – "Studying Pain and Cognition in Aging" - Zoom

3:15-5:15pm - Session 5: **Role of Medial Prefrontal Cortex and Medial Temporal Lobe Circuitry in Cognition**
Organizers: Dr. Mojdeh Faraji, UF and Dr. Carly Logan, UF – In Person

- **Dr. Tim Allen, FIU** – "*Medial prefrontal cortex and hippocampus circuits and dynamics in memory for time*" – In Person
- **Dr. Sara Burke, UF** – "*Age-related changes in medial temporal-frontal cortical functional connectivity in relation to cognitive multi-tasking*" – Zoom
- **Alfonso Brea Guerrero (Kabbaj Lab), FSU** – "*Brain circuit communication during relapse to ketamine*" – In Person
- **Jessica Wood (Nee Lab), FSU** – "*Interactions among frontal-parietal and cingulo-opercular networks supporting cognitive control*" – In Person

Optional Abstracts for data blitz talks:

1. Spatial Disorientation and Alzheimer's Disease: The Relationship Between Activation Profiles in the Brain's Navigational System and Reorientation Deficits in the 3xTg-AD Mouse Model of Tau and Amyloid Beta Aggregation

Jessica Dixon

Abstract: Impaired navigation is one of the first symptoms of Alzheimer's disease (AD). Understanding the brain changes associated with this early impairment is critical for the development of earlier AD diagnosis methods and treatments. Previously, we found that 6-month female 3xTg-AD mice are impaired at using distal cues to get re-oriented in space (spatial reorientation task; Stimmell et al., 2019), and subsequently, that the pTau density profile across a parietal-hippocampal network was a strong predictor of this impairment (Stimmell et al., 2021). Thus, in 6-month female 3xTg-AD mice and age matched controls, we assessed the c-Fos activation profile across the parietal-hippocampal network induced by the spatial reorientation task. Specifically, we used c-Fos immunohistochemical staining to assess the c-Fos positive cell density in seven regions: the parietal cortex (PC), the dorsal and ventral CA1 field of the hippocampus, the dorsal and ventral subiculum (Sub), and the dorsal and ventral areas of the retrosplenial cortex (RSC). We found that, as in our previous work, female 6-month 3xTg-AD mice, which accumulate tau and amyloid beta (Aβ), are impaired at the spatial reorientation task (Stimmell et al., 2019). Further, task-induced c-Fos density was higher in the PC but not the remaining 6 regions, suggesting that there may be hyperactivation of the parietal cortex of 3xTg-AD mice. This is consistent with some studies that have reported hyperactivation of the default mode network in individuals with preclinical AD (Sperling et al., 2009) and of the cortex of AD mice in response to Aβ oligomers (Keskin et al., 2017). Surprisingly, the strongest correlations between task induced c-Fos activation and spatial reorientation performance were with the CA1 and RSC and the weakest correlations were with the ventral Sub and PC. Taken together, this suggests that network level dysfunction is driving the hyperactivation in the PC and that other components of this network are more closely tied to spatial reorientation performance. Finally, the direction of the strongest correlations was negative, meaning that the higher the density of activation in the RSC and the CA1 region of the hippocampus, the worse spatial learning and memory (i.e., more active RSC and CA1 cells were associated with worse performance). This suggests that, at early time points prior to significant tau and Aβ accumulation (e.g., pre- plaque), hyperactivity in the parietal-hippocampal network may be reflective of pathophysiology of AD.

2. Amyloid-β-Induced chemotaxis behavior and neuronal morphology in transgenic *Caenorhabditis elegans*

Jordan Ogg

Abstract: Alzheimer's Disease is a progressive neurodegenerative disorder that remains the leading cause of dementia in the aging population in the United States. Accumulation of amyloid-beta (Aβ), is a hallmark of the neurodegeneration seen in AD patients. While this has been the prevailing theory at times as a primary causative agent, this has been called into question recently and there are still gaps in the literature examining the mechanistic, biological, and genetic basis for this protein build-up in humans. The present study utilized two transgenic strains of *C. elegans* (CL2355 and CL2006) to investigate the role of Aβ on behavior and neuronal morphology. For each strain, worms were tested with chemotaxis protocols to evaluate chemosensation in the presence of the odorant, diacetyl. Worms were given test and control plates, and were analyzed by the calculation of a Chemotaxis Index (CI) for each strain. A fluorescent dye-staining assay (DiI) was performed to examine neuronal morphology. After being incubated with fluorescent dye, each strain was counted for proportion that expressed properly dye-filled neurons. Transgenic strains CL2355 and CL2006 showed statistically

significant impairments in chemotaxis behaviors, indicating Aβ-induced disruption in chemosensation. Only strain CL2355 demonstrated improperly dyed neurons (Dyf), with strains N2 and CL2006 exhibiting normal dye-uptake. Strain CL2355 failed to have dye-filled neurons in adult but not larval stages, indicating age-dependent changes in neuronal morphology when Aβ is found in chemosensory neurons and not musculature.

6. Neuronal representations in Medial Prefrontal Cortex during Nonspatial Memory for Sequences of Events

Maanasa Jayachandran

Abstract: Memory for sequences of events facilitates organization of episodic experiences into serial or ordinal associations representing the flow of events that have occurred. It is established that hippocampus (HC) is essential for formation (e.g., Fortin et al., 2002, *NatNeurosci*) and representation of sequential context (Allen et al., 2016, *JNeurosci)*. We recently showed that specific cell populations in medial prefrontal cortex (mPFC) differentially contribute to retrieval strategies in sequence memory (Jayachandran et al., 2019, *Cell Rep*). Yet, how individual mPFC neurons respond while processing sequence memory is not fully understood. We expect mPFC activity to be related to the sequential context, ordinal position, and accuracy aspects of the task. Specifically, mPFC neurons will encode features with a temporal pattern complementing CA1 dynamics. Here, rats were trained to remember two sets of four odor sequences (Side 1, Sequence 1: A1-B1-C1-D1; Side 2, Sequence 2: A2-B2-C2-D2) presented at opposite ends of a linear track. Rats demonstrated sequence memory in both sequences by holding their nose in the port for >1s for in sequence odors, and withdrawing prior to 1s for out of sequence odors for a small water reward. We recorded ~200 neurons during the task in five rats (2males, 3 females) using NeuroNexus silicon probes with a 2x4 tetrode pattern targeting prelimbic cortex and dorsal CA1. Single mPFC neurons were isolated offline, and their spike times analyzed across task variables (odors, positions, sequential context, and accuracy) in temporal analysis windows aligned to poking behaviors (poke in/out). Results showed that ~30% of mPFC neurons were related to position, sequential context and accuracy, but not odors. Moreover, mPFC spike activity changed around poking behaviors with ramping-like changes in firing rates. These response patterns generalized between sequences, and were thus nonspatial. In addition, local field potential dynamics reliably show a patterned dominance of HC theta (5-11Hz) running up to the port, mPFC delta (1-4Hz) around poking behaviors, and mPFC and HC coherent beta (15-30Hz) during odor sampling. We next looked within spike-phase relationships in these spectral bands and observed mPFC spikes are often entrained to local delta around poking behaviors, and phase entrained to beta and theta related to trial accuracy (Symanski et al., 2021, *bioRxiv*). The spiking dynamics raise interesting questions about the supremacy of different rhythmic mechanisms governing mPFC neuronal integration during processing epochs related to sequence memory. Overall, the results are consistent with sequence memory as a mPFC-HC based process.

7. Sleep reverses Spatial Reorientation Impairments in a Mouse Model of Alzheimer's Disease

Alina Stimmell

Abstract: In early Alzheimer's disease (AD), getting lost is one of the first cognitive impairments to emerge. The precise cause of this impairment is unclear. Previously, we demonstrated that impaired spatial navigation may result from a failure to use distal cues to get oriented in space (spatial reorientation task; Stimmell et al., 2019). This impaired use of distal cues for spatial reorientation in 3xTg-AD mice, which accumulate both amyloid beta (Aβ) and tau, emerges early in disease progression before the onset of plaques and tangles, suggesting the impairments we observed in mice may be informative about those observed in early AD in humans (Henderson et al., 1989;

Weintraub & Salmon, 2012; Allison et al., 2016). Only 6-month female 3xTg-AD (not 3-month female) mice were impaired on the spatial reorientation task. In addition, we have also shown that the profile of phosphorylate tau positive cell density across brain regions associated with spatial navigation is highly predictive of spatial learning and memory performance in 6-month female 3xTg-AD mice (Stimmell et al., 2021). The search for treatments of AD is ongoing and some treatments are aimed at prolonging quality of life or staving off early symptoms of AD. One such approach is modifying sleep. Poor sleep quality, short sleep duration, and disrupted slow wave sleep are all associated with increased Aβ, poor cognition, and risk of AD (Nebel et al., 2018). Decreased sleep is associated with an increase in the release of tau and phosphorylated forms of tau seen in the earliest stages of AD, as well as decreased clearance of tau (Lucey 2020). Sleeping is also associated with Aβ and tau clearance (Lucey 2020; Nebel et al., 2018; Tononi & Cirelli 2014; Toro et al., 2019). Thus, we set out to test the hypothesis that sleep could ameliorate impairments we observed in 6-month female 3xTg-AD mice. We assessed spatial reorientation performance either with or without pre- and post-task sleep sessions. We replicated our previously observed spatial reorientation impairment in no-sleep mice; while sleep mice did not differ from age-matched controls. Thus, sleep modification may ameliorating cognitive dysfunction in AD.

9. Rescuing impaired cortical-hippocampal interactions during sleep in a mouse model of Alzheimer's disease

Danielle Benthem

Abstract: In preclinical Alzheimer's disease (AD), spatial learning and memory is impaired (Allison et al., 2016). We reported similar navigational impairments in 6-month 3xTg-AD female mice on a virtual task that requires learning and memory for using landmarks to get oriented in space (Benthem et al., 2020). Memory replay during sleep is critical for learning related plasticity (Ego-Stengel & Wilson, 2009; Jadhav et al, 2012; Maingret et al, 2016), and hippocampal-cortical dysfunction is a potential mechanism for memory impairments in individuals with AD (Gennaro et al, 2017; Khan et al, 2014). We found that early in disease progression deficits in hippocampal-parietal cortex (PC) coordination during sleep coincided with navigation impairments on the virtual maze (Benthem et al, 2020). Gamma-stimulation (40Hz) has been shown to clear AD pathology in mice (Iaccarino et al, 2016; Martorell et al, 2019), and improve functional connectivity in preclinical AD patients (He et al, 2021). Thus, we assessed hippocampal-PC coordination in 6-month female 3xTg-AD/PV^{cre} (4xTg) mice that were learning the same *spatial reorientation task*. Mice were implanted with a 16 tetrode recording array targeting PC and hippocampus and an optical fiber aimed at HPC. Then daily recording sessions of rest-task-rest commenced as mice learned to locate the unmarked reward zone. During the same surgery a cre-dependent AAV was used to express channel rhodopsin 2 in the parvalbumin+ interneurons in the hippocampus. This allowed for daily stimulation sessions, with either 40Hz entrainment in hippocampus or SHAM stimulation. We assessed sleep quality metrics, multi-unit activity patterns, cortical spindles, and delta waves (DW) in PC and markers of memory replay in the hippocampus (SWRs) during SWS. We found no difference in any sleep quality metrics. We also found no difference in number or rate of DW or SWRs. However, in SHAM stimulated mice were SWR-DW cross-correlations were significantly reduced, similar to our previous findings in 3xTg-AD mice (Benthem et al, 2020). In the 40Hz stimulated mice, this functional connectivity was rescued. Furthermore, the 40Hz stimulated mice showed improved performance on the virtual reorientation task compared to the SHAM stimulated mice. Thus, 40Hz stimulation of hippocampus may rescue functional connectivity impairments in the hippocampal-PC network and spatial navigation.

10. The role of dorsal striatum in paired associates learning

Samantha M. Smith

Abstract:
Despite memory being one of the most frequently studied and well-characterized cognitive domains to date, how different memory systems interact, cooperate, and compete with one another across the lifespan is incompletely understood. This poses a distinct challenge in the field of cognitive aging, where some systems might be more "vulnerable" or "resistant" than others. It has been hypothesized that there are multiple dissociable systems working in conjunction to support the multifaceted domain of memory. Two of these systems support distinct types of spatial memory. One is supported by the hippocampus and mediates allocentric spatial behaviors. The other is linked to the dorsal striatum and related to response-driven spatial behavior. While both the hippocampus and striatum can support memory-guided behaviors, they are hypothesized to interact antagonistically. Furthermore, aged rats are more likely than young to use striatal-based strategies to solve spatial tasks, and this is related to elevated activity in the dorsal striatum of old animals. Recently is has also been shown that while young rodents perform better on a hippocampal-dependent task than their aged counterparts, aged rodents perform better on a dorsal striatal-dependent task. Interestingly, aged rats that perform comparable to young on a spatial memory task are better able to flexibly switch between tasks that depend on hippocampus or striatum compared to both young rats and aged rats with spatial memory impairment. Together these data suggest that dorsal striatal-dependent memory may either be resilient or compensatory in comparison to hippocampus-dependent memory in advanced age. The role of striatal versus hippocampus-dependent memory systems has not been examined outside of spatial navigation behaviors, however, and it is unclear if the dissociation of age-related vulnerability of different memory systems applies to associative learning. To further investigate the role of dorsal striatum in the context of different memory systems, the current study used an automated, touchscreen-based platform to assess hippocampus-dependent paired associative learning (PAL) after bilateral cannulation and inactivation of the dorsal striatum in rats. Our lab has recently shown that this task is sensitive to age-related cognitive decline. A total of 14 rats were trained to criterion on the PAL task before undergoing cannulation surgery. After surgery, rodents were tested on both PAL and a control T-maze task with infusions of the GABA agonist muscimol. Preliminary data suggests a minimal role for dorsal striatal activity in the retention of acquired visuospatial associations in young rodents.

12. Rapid shifts in the spectral dynamics of the medial prefrontal cortex and hippocampus during nonspatial memory for sequences of events in rats

Andy Garcia

Abstract: A fundamental feature of episodic memory is the ability to remember a sequence of events as they occurred over time, which depends on interactions between the medial prefrontal cortex (mPFC) and the hippocampus (HC; e.g., Jayachandran et al., 2019, Cell Rep; Eichenbaum 2017, NatNeurosci). While the HC is thought to represent information according to spatiotemporal contexts, mPFC is thought to support the rapid retrieval of information relevant to an action or decision. Nevertheless, how the two structures interact in support of memory for sequences of events is not well understood. Here, we performed simultaneous local field potential (LFP) recordings in mPFC (targeting the prelimbic cortex) and HC (targeting dorsal CA1) using NeuroNexus silicon probes. LFPs in dorsal CA1 have shown to engage theta (5-11Hz) and beta (15-30Hz) during odor sequence memory, with beta activity related to the sequential context (Allen et al. 2016, JNeurosci). Here, we expected that mPFC-HC neural dynamics would have complementary spectral modes that reflect the rapid shifting of cognitive processes necessary to perform the sequence memory task. To look at this, we tested five rats (3 females, 2 males) on a sequence memory task with two sequences composed of four unique odors located in nose ports at opposite ends of a linear

maze (Side 1, Sequence 1: A1-B1-C1-D1; Side 2, Sequence 2: A2-B2-C2-D2). Rats demonstrated sequence memory by holding for >1sec for in sequence odors or withdrawing prior to 1sec for out of sequence odors in order to receive a small water reward. LFPs from mPFC and HC were analyzed using perievent power spectral densities and by looking at coherence between these two regions. We divided our analysis into several epochs including running up to the port, sampling the odor, executing a decision, and receiving the reward. In the spectrograms, we observe strong theta power while running towards the port in HC (and to a lesser degree as the animal poked in the port), strong delta (1-4Hz) power in mPFC around poking behaviors, and strong beta power in both mPFC and HC during odor sampling. Likewise, we observed strong mPFC-HC coherence in all bands, but the task-related modulations were dominated by increased coherence in delta and beta bands during sequence memory. Beta coherence levels seem to be related to performance accuracy, reflecting the olfactory nature of the task. These results indicate that mPFC-HC interactions are highly dynamic and rapidly cycle through multiple modes of rhythmic operation in the delta, theta, and beta bands, reflecting the multiple cognitive stages necessary in memory for sequences of events.