How to design a research poster

Jillybeth Burgado
Quirine van Engen

Summer 2023

Colors of the Brain

What is the purpose of a research poster?

- Visually communicate your research in an interactive setting
- Showcase cutting-edge research that is unpublished
- Promote and develop networking
- Research poster = type of scholarly publication

- Typically presented at a conference

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Poster Presentation Opportunities

University-wide conferences: https://ugresearch.ucsd.edu/conferences/src/index.html

Large URM conferences:

https://www.sacnas.org/conference/2023-sacnas

https://abrcms.org/

Other large, topic specific conferences:

Society for Neuroscience Annual Meeting https://www.sfn.org/meetings/neuroscience-2023

Gordon Research Conferences

Cold Spring Harbor Meetings

Keystone Meetings

Poster vs Presentation vs Publication

CoB symposium, on September 8th: you'll be presenting (slides) your research.

However, posters will be essential to your PhD/research career

	Poster	**Presentation (slides)**	**Publication**
Why	Showcase cutting-edge (pilot) research that is unpublished	Showcase cutting-edge research (that is unpublished)	Share your finished and polished findings with a larger public
Where	Conferences (or smaller scale gatherings/classes)	Conferences / symposia / lab meetings	In a journal
How	Printed poster (~42" x 60")	Slide show	Paper
Time	2-4h session: 3-min, 5-min or 10-min talk depending on audience	~10-20 minutes	It can take >1 year to publish

For instance SfN: poster session is 4 hours, but only 1h dedicated hour to be there. So, your poster has to speak for itself.

August 22: workshop "how to present your research"

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What goes on a poster?

Title → contains keywords and most important finding

Authors and Affiliations → First Last name[1] , 1. Neuroscience, UCSD.

Abstract/Background/Introduction/RQ/hyp → highlight importance of research

Methods → overview of most important methods to understand results

Data → show some raw data and analyzed results

Summary/Conclusions → take-home message

Acknowledgements and References

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Poster logistics

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  - Depends on the conference, and whether you do portrait or landscape
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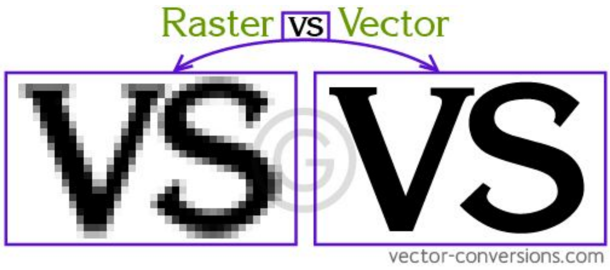
- **Poster printing**
  - Don't wait until the last minute to print your poster!!! It can take a couple days depending on where you print it (UCSD/FedX/conference service)
  - Traveling with a poster can be awkward if you're flying (although I've never had problems)
  - Some institutions offer fabric vs paper options
- **Images need to scale to a larger size for it to not be blurry**
  - DO USE vector based image types: PDF, SVG, etc.
  - AVOID pixel (raster) based image types: JPEG, PNG, GIF, etc.
- **Fonts**
  - Sans Serif fonts are easier to read
  - Size: at least 18
- **Tools to use**
  - Windows: illustrator / powerpoint
  - Mac: pages / keynote
  - Linux: you’re screwed



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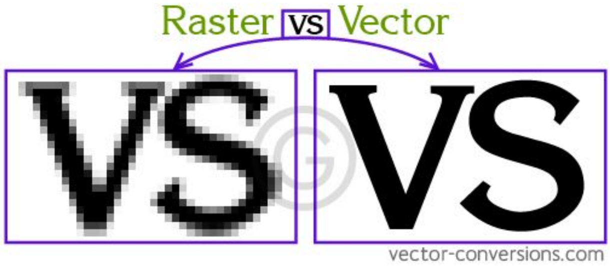


Examples of poster from your mentors

Poster need to meet standard requirements, but there is room to personalize it!

Add your own flair/favorite colors etc.

Here are some examples (also to highlight the progression within one person over the years)

Dynamically changing aperiodic activity confounds theta (4-8 Hz) power and phase estimates

VOYTEKlab

UC San Diego

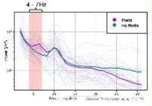
Quirine van Engen[1,2], Aaron Smith[1,2], Bradley Voytek[1-5]

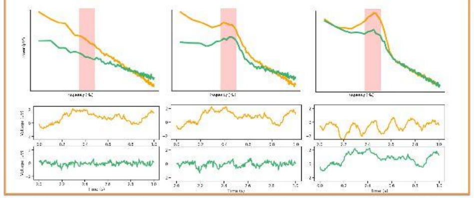
[1]Dept. of Cognitive Sci., [3]Halıcıoğlu Data Sci. Inst., [4]Neurosciences Grad. Program, [5]Kavli Inst. for Brain and Mind, [2]Univ. of California San Diego, La Jolla, CA

Abstract & Background

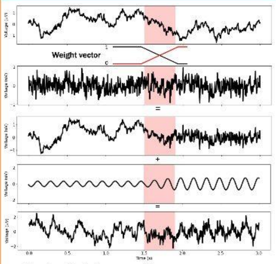
- An increase in midline frontal theta (4-8Hz) is associated with higher working memory (WM) performance (Klimesch, 1999; Adam et al., 2018; Brzozicka et al., 2019; Jensen & Tesche, 2002)
  - Theta oscillations are hard to find in EEG (Bailey et al., 2019) and MEG (Donoghue et al., 2020)
- Theta oscillations phase lock to a stimulus (Sauseng & Klimesch, 2008)
- Higher theta phase-locking relates to less variable behavior (Papenberg et al., 2013)
- Aperiodic activity changes dynamically
  - Aperiodic activity can change due to task demand or state (Wilson et al., 2022)
  - Or change with stimulus property (Waschke et al., 2021)

• Does aperiodic activity influence power and phase estimates?





Methods



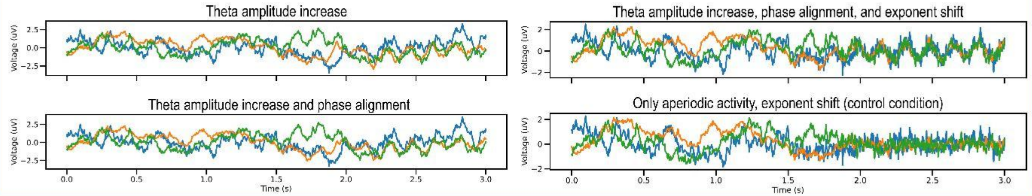
1. Simulate aperiodic activity that dynamically changes within a trial
   - signal with high exponent
   - signal with low exponent
   - weight vector to combine signals
     - "Time-locked event" at 1.5 s
2. Simulate periodic activity
   - center frequency 6 Hz
   - manipulate amplitude
   - manipulate phase

	Phase alignment	Amplitude increase	Aperiodic shift
1	✓	✓	✓
2	✓	✓	×
3	✓	×	✓
4	✓	×	×
5	×	✓	✓
6	×	✓	×
7	×	×	✓
8	×	×	×
9	-	-	✓

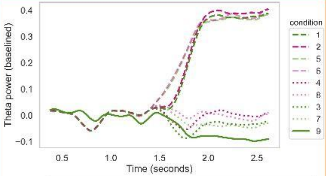
- Simulate 60 trials per condition

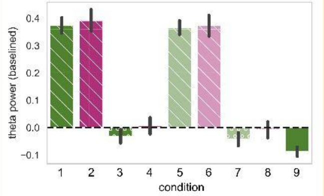
Analyses
- Hilbert transform to calculate theta power over time
  - Repeated measures ANOVA between conditions
- Phase-locking value to determine inter-trial phase coherence of theta oscillations
- Time-window for statistics: 1.75 - 3 s

Simulated time series



Aperiodic shift influences theta power estimates

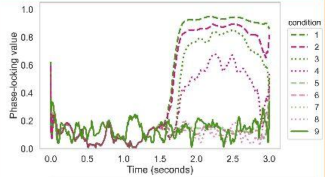


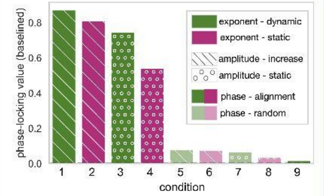


Amplitude increase:	$F(1, 59) = 4758$, $p < 0.0001$
Exponent change:	$F(1, 59) = 24$, $p < 0.0001$
Exponent:amplitude:	$F(1, 59) = 35$, $p < 0.0001$

The control condition (9) was significantly different from condition
3 ($p = 1.5 * 10^{-3}$), 4 ($p = 3.5 * 10^{-6}$),
7 ($p = 9.4 * 10^{-3}$), 8 ($p = 7.6 * 10^{-5}$).
All p-values were Bonferroni corrected.

Aperiodic shift influences theta phase locking





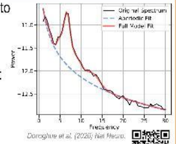
- If there is phase alignment, then phase-locking is higher
- It seems possible there is an interaction effect on phase-locking between aperiodic activity and amplitude changes
  - This pattern looks similar between conditions with phase-alignment and without

Summary & Discussion

- Periodic power and phase estimates are contaminated by dynamically changing aperiodic activity
- It is important to distinguish periodic from aperiodic activity, because they arise from different underlying mechanisms
  - Aperiodic activity is linked to the inhibition/excitation ratio (Gao et al., 2017; van Bueren et al., 2022)
  - Periodic activity is linked to rhythmic synchronous spiking activity and membrane voltage resonance (Buzsáki et al., 2012)

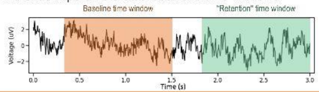
Suggestions for future research

- Use spectral parameterization to differentiate between:
  1. Aperiodic, 1/f like activity
     - exponential fit and offset
  2. Periodic, oscillatory activity
     - gaussian fit



Donoghue et al. (2020) Nat Neuro.

- Spectral Parameterization Resolved in Time (SPRiNT; Wilson et al., 2022)
- Difference in parameters between two time windows



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SfN 2022

Orbitofrontal Cortex Encoding of Associative Information Underlying Goal-Directed Actions

Cazares C.[1] & Gremel C.M.[1,2]

The Neurosciences Graduate Program[1] and the Department of Psychology[2], University of California San Diego, La Jolla, CA, 92093, U.S.A.

Christian Cazares
SfN 2018

Goal-directed decision-making arises in the self and emerges through continuous adjustments using internal and externally-derived information.

The orbitofrontal cortex (OFC) is thought to represent state-dependent associative information necessary for performance of goal-directed decision-making.

How this state-dependent information is encoded in the OFC is unknown.

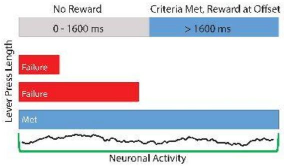
We adapted a task to examine emergence of continuous goal-directed decision-making and its representation within OFC.

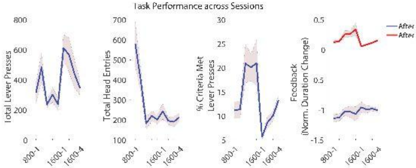
Self-initiated, Continuous, Uncued, Goal-directed Lever Press Hold Down Task

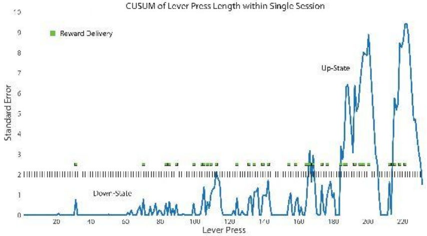
Food restricted mice are trained to hold down a lever beyond a time dependent criterion (800 ms followed by 1600 ms).

Meeting hold-down criteria is rewarded with valued reinforcer (pellet).

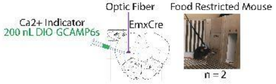
OFC activity is continuously monitored throughout daily 90 minute training sessions.





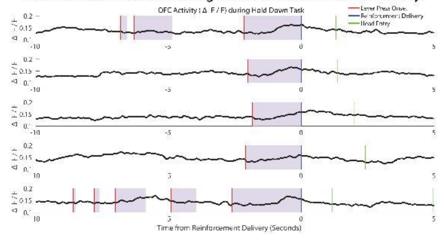


Measuring OFC Activity using Fiber Photometry

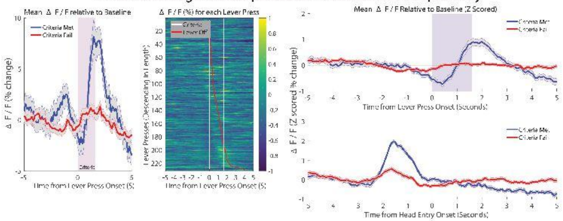


$$\Delta F / F = \frac{470\text{ nm Signal} - \text{fitted 410 nm signal}}{\text{fitted 410 nm signal}}$$

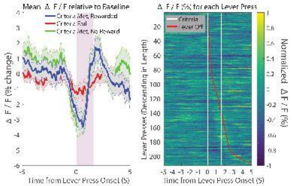
1. Goal-directed decision-making related modulation of OFC activity



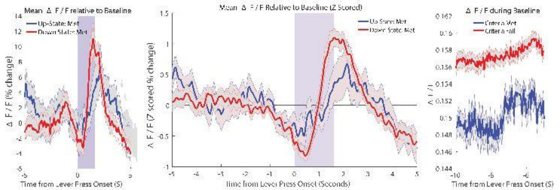
2. OFC encoding of future performance and outcome expectancy



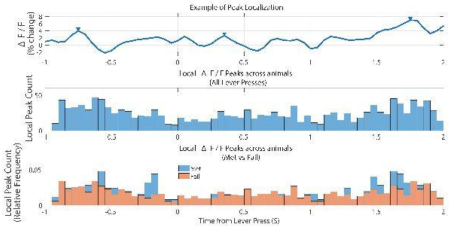
3. OFC signaling of outcome expectancy in the absence of outcome delivery



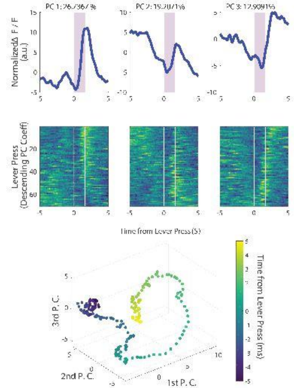
4. Periods of more effective decision-making reflected in OFC activity



5. Single-trial OFC dynamics reflect future performance and outcome expectancy delivery



6. Principal Component trajectory reflects continuous decision-making

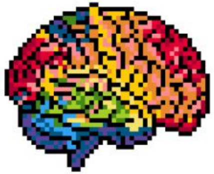


- OFC shows dynamic encoding of future action performance and outcome expectancy
- OFC encoding is subject to state modulation during phases where decision-making is more effective
- It appears that OFC dynamics reflect continuous goal-directed decision-making

Supported by R00AA021780, R01AA026077, Whitehall and Brain and Behavior Foundations, NSF GRFP grant number DGE-1650112

Orbitofrontal cortex populations are differentially recruited to support actions

Cazares C.[1], Schreiner D.C.,[2] Lopez Valencia M.,[2] & Gremel C.M.[1,2]
The Neurosciences Graduate Program[1] and the Department of Psychology[2], University of California San Diego, La Jolla, CA



Christian Cazares
2022

Introduction

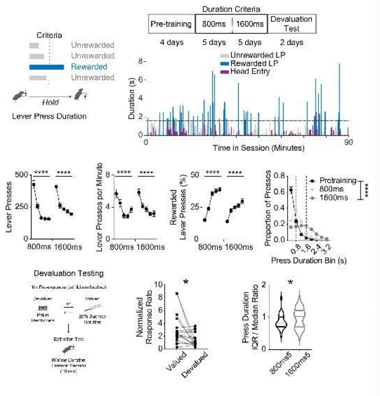
Information from prior actions can contribute to inference-guided behavior.

While Orbitofrontal cortex (OFC) has been hypothesized as key for inferences made using Pavlovian and value-related information, whether OFC populations contribute to behavior by use of information from self-initiated actions is not clear.

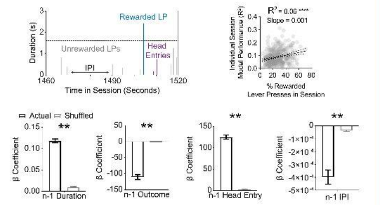
We used a self-paced lever-press hold down task in which mice infer prior lever press durations to guide subsequent lever press performance.

Our results identify a novel role for lOFC in the integration of action information to guide adaptive behavior.

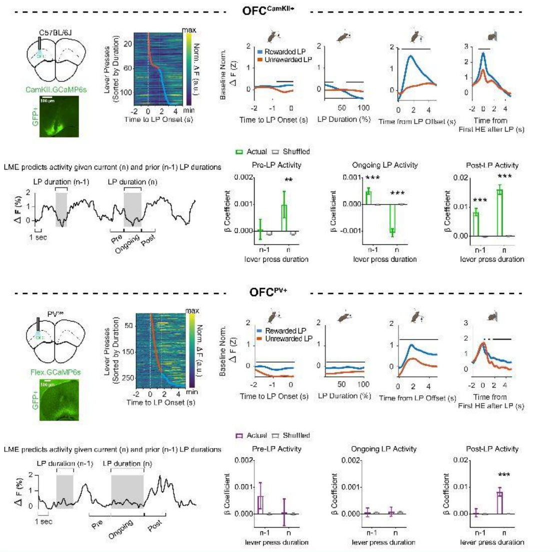
1. Mice adjusted self-generated lever presses and used prior experience to guide performance



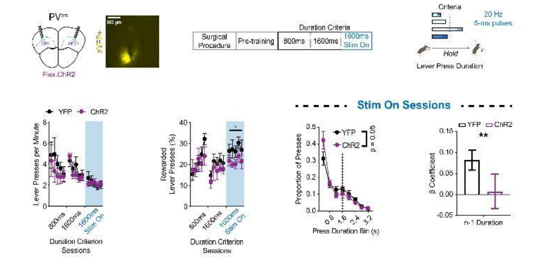
LME predicts current (n) lever press duration given prior (n-1) behaviors



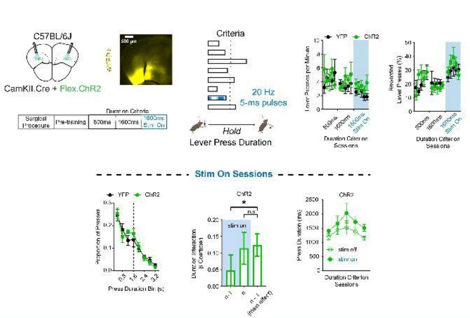
2. lOFC populations differentially encoded actions, outcomes and prior action-related information during lever press performance



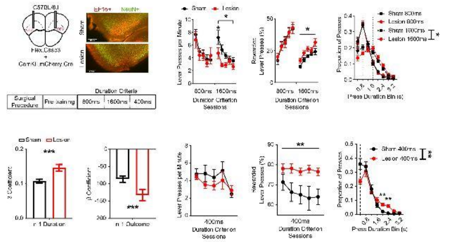
3. Excitation of lOFC inhibitory interneurons during action execution reduced rewarded performance and use of prior action-related information



4. Selective optogenetic excitation of lOFC excitatory projection neurons during action execution reduced encoding, but not performance, of ongoing actions



5. Loss of functional lOFC circuit increased reliance on immediate prior actions and outcomes for performance



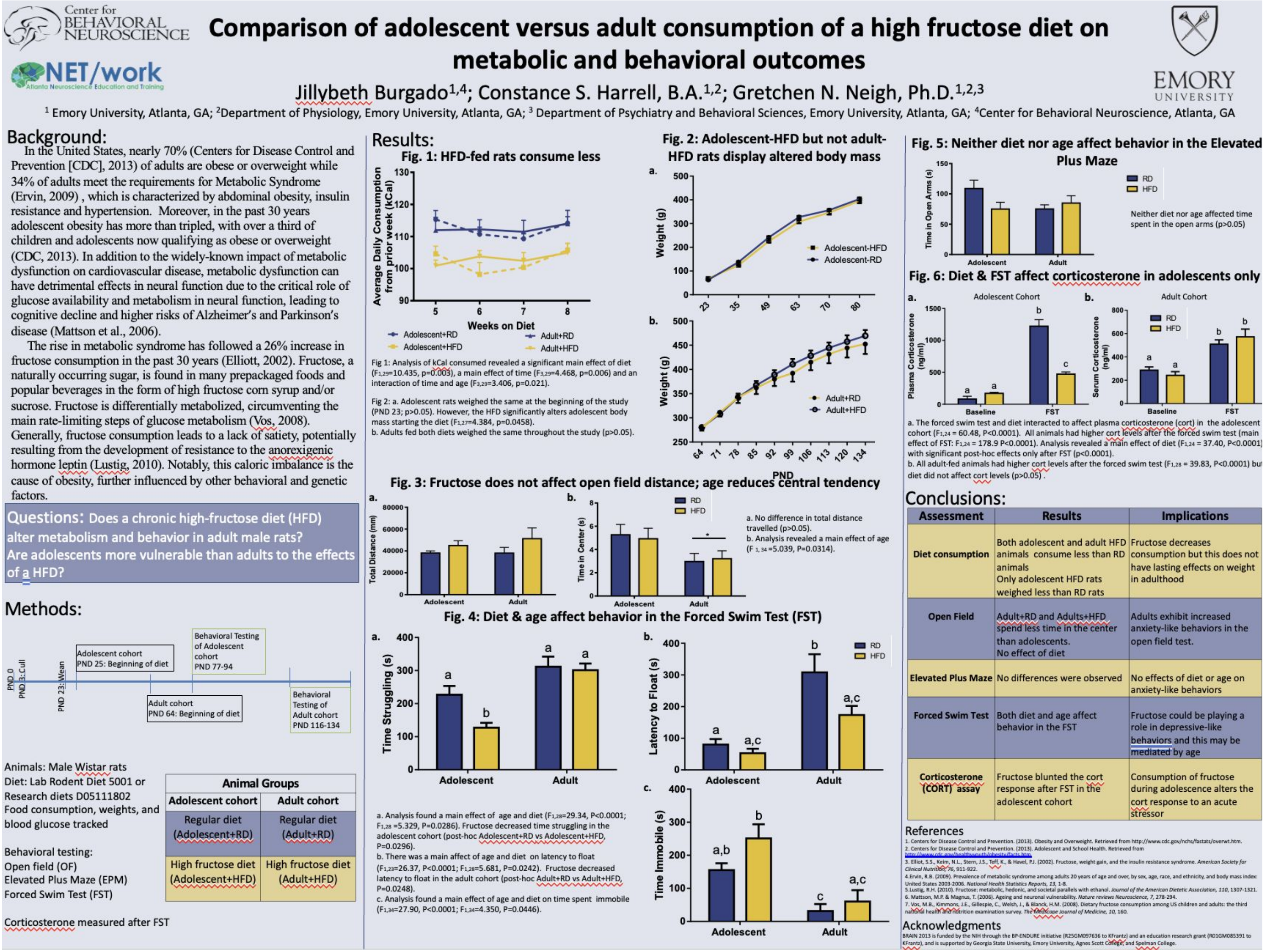
Conclusions

Mice recruit and use lOFC activity to encode action-related information that can be used for inferences critical to adaptive control of behavior.

A loss of lOFC circuits left mice more reliant on a strategy of repeating action execution to gain reward and impaired the updating of action contingencies.

lOFC disruptions may lead to an alteration of volitional action control biased towards excessive repetition, as seen in diseased states associated with disrupted action control.

This work was funded by F99NS120434 (C.C.), F31AA027439 (D.C.S.), R01AA026077 (C.M.G.), and a Whitehall Foundation Award (C.M.G).



Comparison of adolescent versus adult consumption of a high fructose diet on metabolic and behavioral outcomes

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[1] Emory University, Atlanta, GA; [2]Department of Physiology, Emory University, Atlanta, GA; [3] Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta, GA; [4]Center for Behavioral Neuroscience, Atlanta, GA

Background:

In the United States, nearly 70% (Centers for Disease Control and Prevention [CDC], 2013) of adults are obese or overweight while 34% of adults meet the requirements for Metabolic Syndrome (Ervin, 2009) , which is characterized by abdominal obesity, insulin resistance and hypertension. Moreover, in the past 30 years adolescent obesity has more than tripled, with over a third of children and adolescents now qualifying as obese or overweight (CDC, 2013). In addition to the widely-known impact of metabolic dysfunction on cardiovascular disease, metabolic dysfunction can have detrimental effects in neural function due to the critical role of glucose availability and metabolism in neural function, leading to cognitive decline and higher risks of Alzheimer's and Parkinson's disease (Mattson et al., 2006).

The rise in metabolic syndrome has followed a 26% increase in fructose consumption in the past 30 years (Elliott, 2002). Fructose, a naturally occurring sugar, is found in many prepackaged foods and popular beverages in the form of high fructose corn syrup and/or sucrose. Fructose is differentially metabolized, circumventing the main rate-limiting steps of glucose metabolism (Vos, 2008). Generally, fructose consumption leads to a lack of satiety, potentially resulting from the development of resistance to the anorexigenic hormone leptin (Lustig, 2010). Notably, this caloric imbalance is the cause of obesity, further influenced by other behavioral and genetic factors.

Questions: Does a chronic high-fructose diet (HFD) alter metabolism and behavior in adult male rats?
Are adolescents more vulnerable than adults to the effects of a HFD?

Methods:

PND 0 | PND 3: Cull | PND 23: Wean | Adolescent cohort PND 25: Beginning of diet | Adult cohort PND 64: Beginning of diet | Behavioral Testing of Adolescent cohort PND 77-94 | Behavioral Testing of Adult cohort PND 116-134

Animals: Male Wistar rats
Diet: Lab Rodent Diet 5001 or Research diets D05111802
Food consumption, weights, and blood glucose tracked

Behavioral testing:
Open field (OF)
Elevated Plus Maze (EPM)
Forced Swim Test (FST)

Corticosterone measured after FST

Animal Groups	
Adolescent cohort	Adult cohort
Regular diet (Adolescent+RD)	Regular diet (Adult+RD)
High fructose diet (Adolescent+HFD)	High fructose diet (Adult+HFD)

Results:

Fig. 1: HFD-fed rats consume less

Fig 1: Analysis of kCal consumed revealed a significant main effect of diet ($F_{1,29}$=10.435, p=0.003), a main effect of time ($F_{3,29}$=4.468, p=0.006) and an interaction of time and age ($F_{3,29}$=3.406, p=0.021).

Fig. 2: Adolescent-HFD but not adult-HFD rats display altered body mass

Fig 2: a. Adolescent rats weighed the same at the beginning of the study (PND 23; p>0.05). However, the HFD significantly alters adolescent body mass starting the diet ($F_{1,27}$=4.384, p=0.0458).
b. Adults fed both diets weighed the same throughout the study (p>0.05).

Fig. 3: Fructose does not affect open field distance; age reduces central tendency

a. No difference in total distance travelled (p>0.05).
b. Analysis revealed a main effect of age ($F_{1,34}$=5.039, P=0.0314).

Fig. 4: Diet & age affect behavior in the Forced Swim Test (FST)

a. Analysis found a main effect of age and diet ($F_{1,28}$=29.34, P<0.0001; $F_{1,28}$ =5.329, P=0.0286). Fructose decreased time struggling in the adolescent cohort (post-hoc Adolescent+RD vs Adolescent+HFD, P=0.0296).
b. There was a main affect of age and diet on latency to float ($F_{1,23}$=26.37, P<0.0001; $F_{1,28}$=5.681, P=0.0242). Fructose decreased latency to float in the adult cohort (post-hoc Adult+RD vs Adult+HFD, P=0.0248).
c. Analysis found a main effect of age and diet on time spent immobile ($F_{1,34}$=27.90, P<0.0001; $F_{1,34}$=4.350, P=0.0446).

Fig. 5: Neither diet nor age affect behavior in the Elevated Plus Maze

Neither diet nor age affected time spent in the open arms (p>0.05)

Fig. 6: Diet & FST affect corticosterone in adolescents only

a. The forced swim test and diet interacted to affect plasma corticosterone (cort) in the adolescent cohort ($F_{1,24}$ = 60.48, P<0.0001). All animals had higher cort levels after the forced swim test (main effect of FST: $F_{1,24}$ = 178.9 P<0.0001). Analysis revealed a main effect of diet ($F_{1,24}$ = 37.40, P<0.0001) with significant post-hoc effects only after FST (p<0.0001).
b. All adult-fed animals had higher cort levels after the forced swim test ($F_{1,28}$ = 39.83, P<0.0001) but diet did not affect cort levels (p>0.05) .

Conclusions:

Assessment	Results	Implications
Diet consumption	Both adolescent and adult HFD animals consume less than RD animals Only adolescent HFD rats weighed less than RD rats	Fructose decreases consumption but this does not have lasting effects on weight in adulthood
Open Field	Adult+RD and Adults+HFD spend less time in the center than adolescents. No effect of diet	Adults exhibit increased anxiety-like behaviors in the open field test.
Elevated Plus Maze	No differences were observed	No effects of diet or age on anxiety-like behaviors
Forced Swim Test	Both diet and age affect behavior in the FST	Fructose could be playing a role in depressive-like behaviors and this may be mediated by age
Corticosterone (CORT) assay	Fructose blunted the cort response after FST in the adolescent cohort	Consumption of fructose during adolescence alters the cort response to an acute stressor

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Acknowledgments

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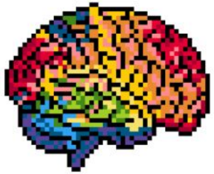

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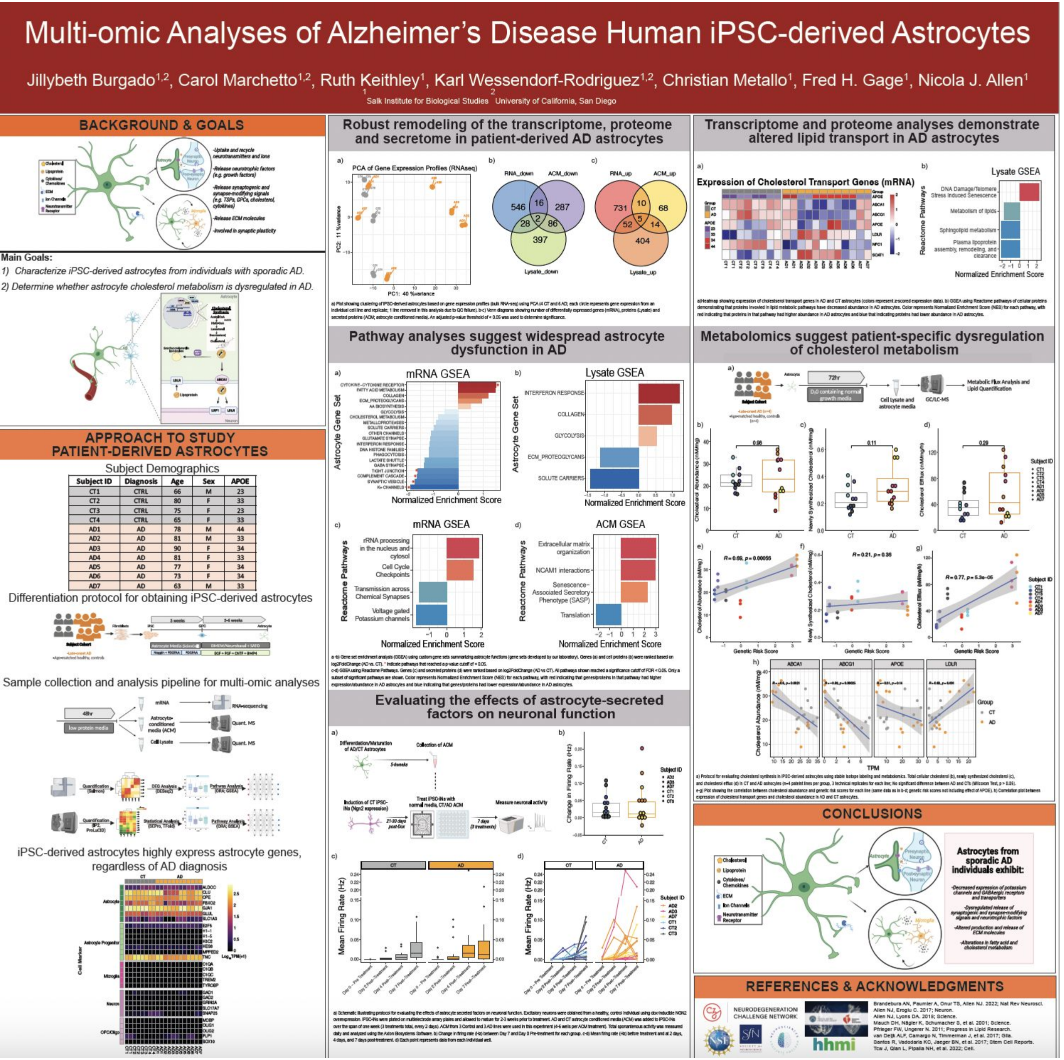

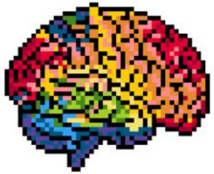

Jillybeth 2023

Medium-sized International Conference in Neurodegeneration

Student Activity Part 1: Elevator Pitch (20 min)

What: An elevator pitch is a short summary of an idea or project that can be delivered and understood in the time span of an elevator ride (1 to 2 minutes).

Goal: Intrigue the listener (often assumed to be someone important) so they want to hear more or be generally excited about the topic and continue the conversation.

Your turn: Describe your research to the person to your left.

Student Activity Part 2: Draft a Poster (20 min)

Sketch your own poster

- Main question & hypothesis
- Background
- Most important analyses
- Most important results (or expected results)
- Discussion/take-home message/Future Directions