Stress Neurocircuitry & Airway Inflammation in Asthma

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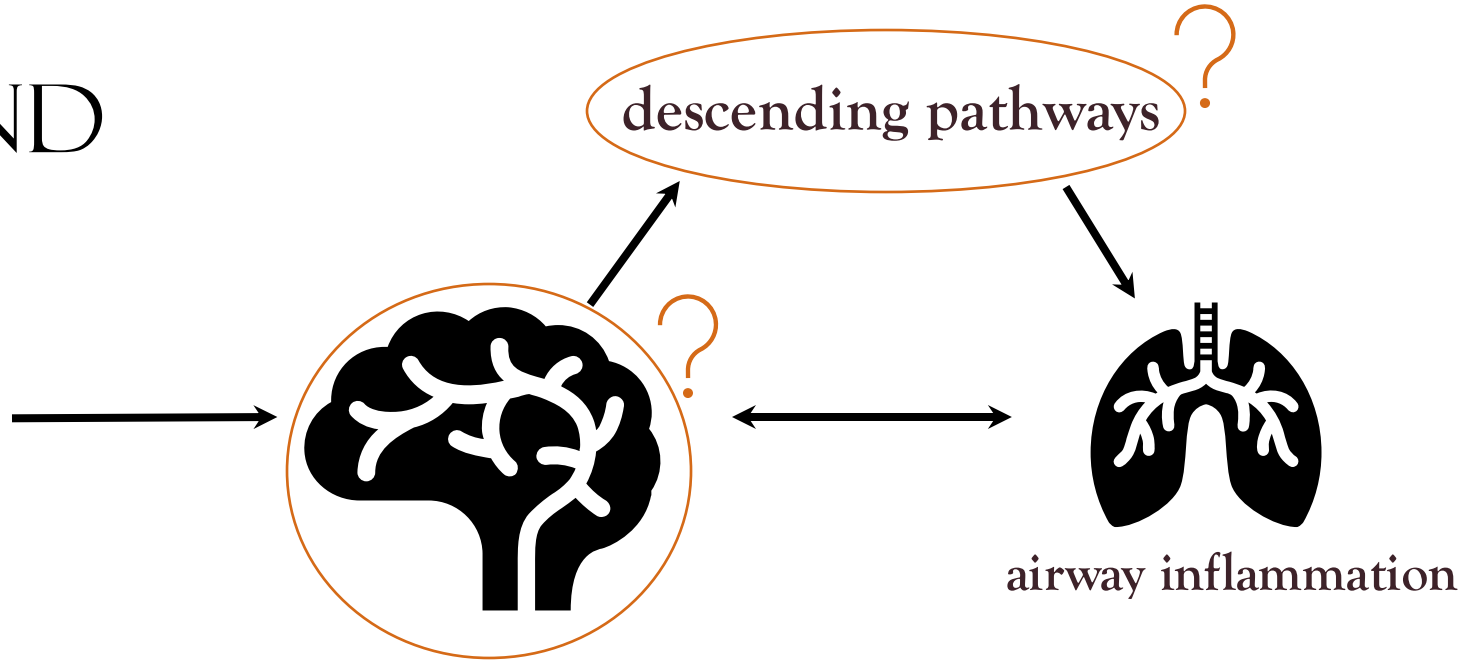
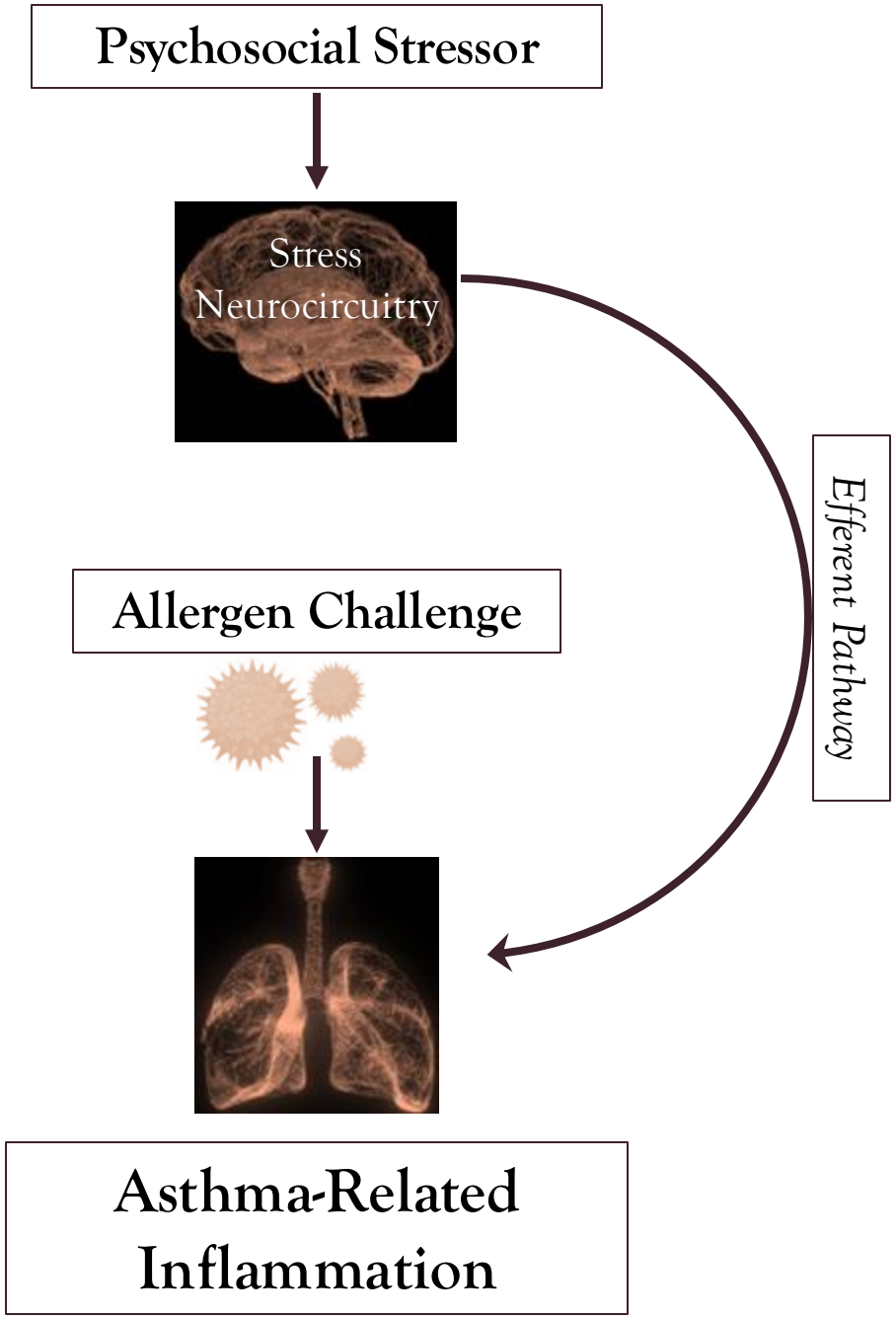
Background

stress

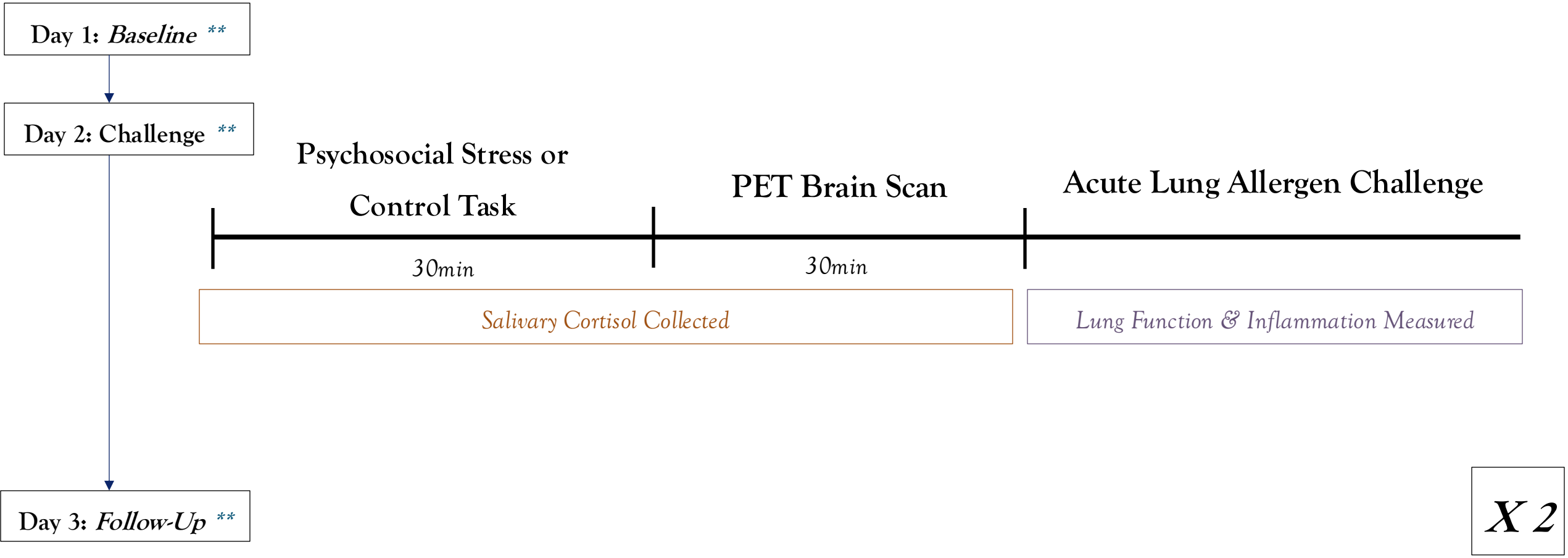


- **Initial evidence:**
  - Emotion neurocircuitry & inflammation
  - Th17 cells, asthma, & psychological distress

Hypotheses


Psychosocial Stressor
Stress Neurocircuitry
Efferent Pathway
Allergen Challenge
Asthma-Related Inflammation

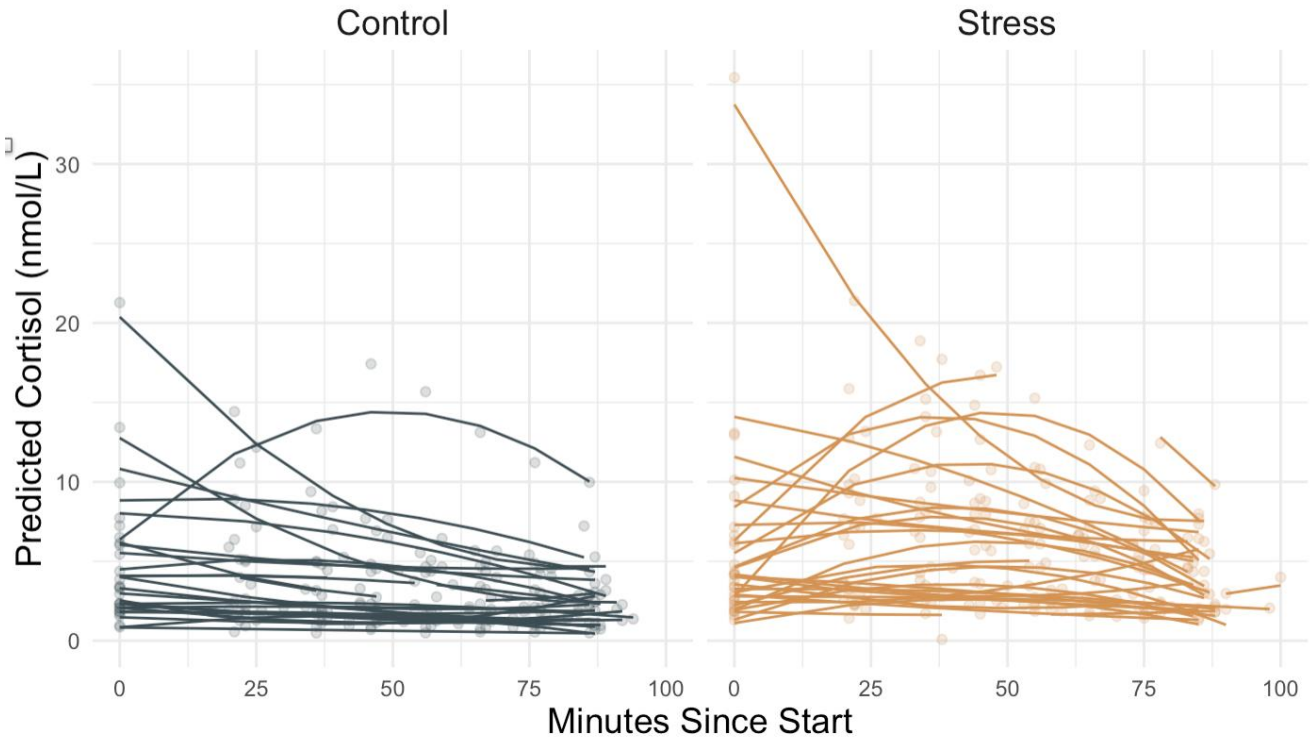
Study Design



** *Airway inflammation measured (daily)*

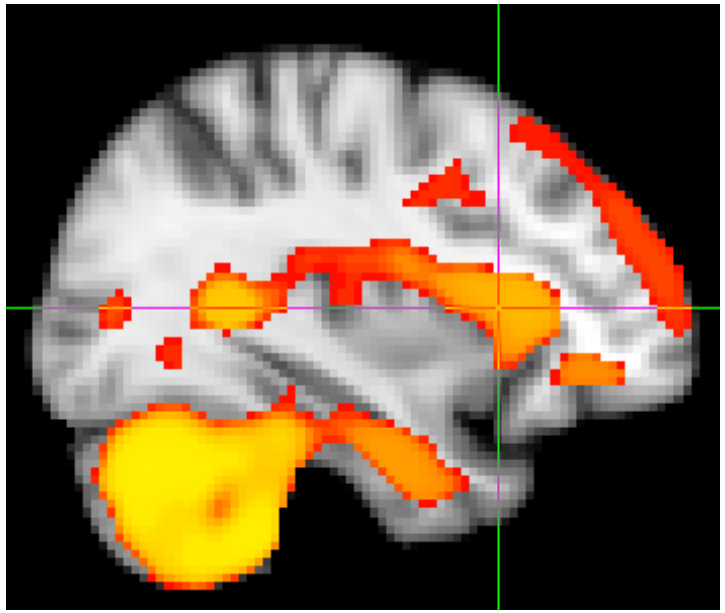
Results

Acute Stress Increases Cortisol

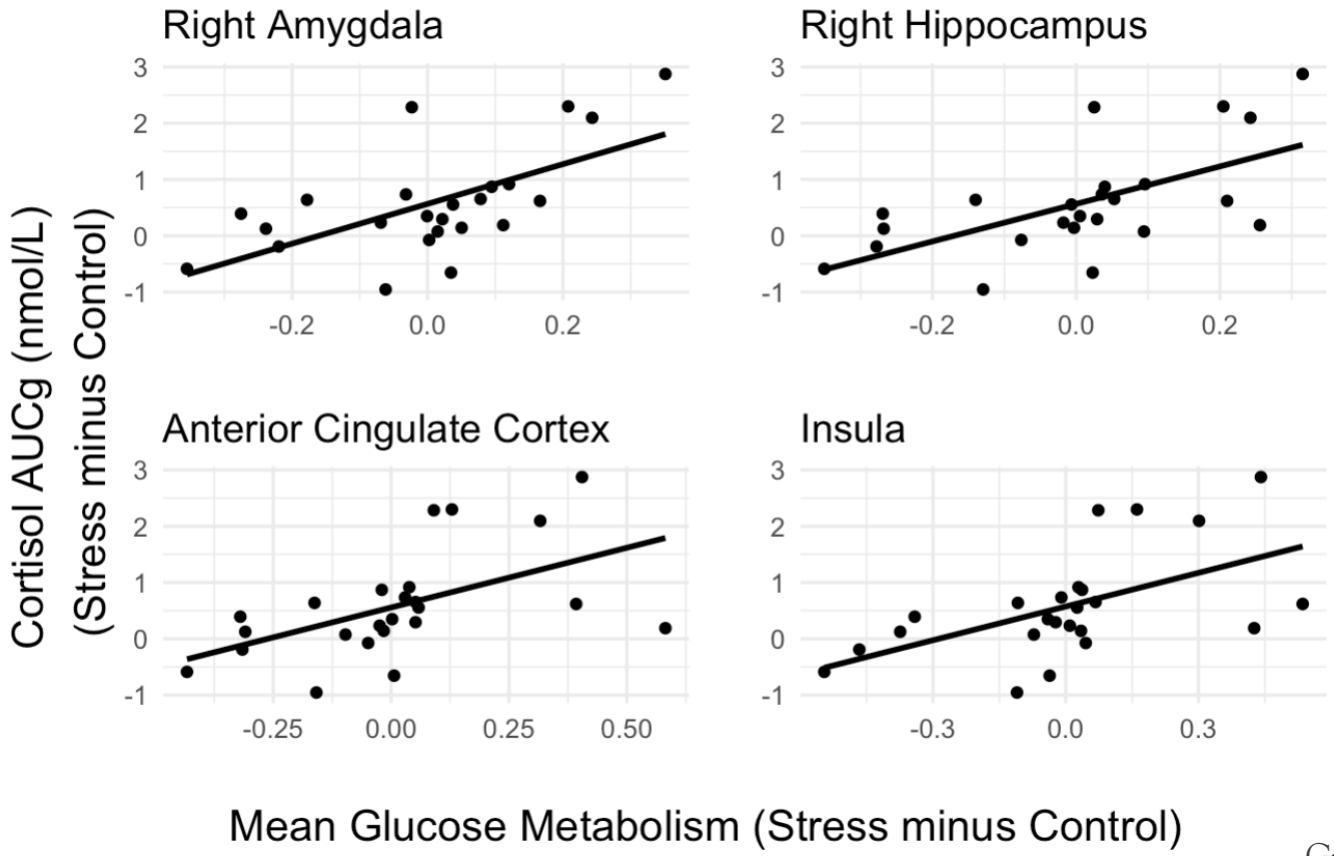


$t(27) = -2.78,\ p = .01$

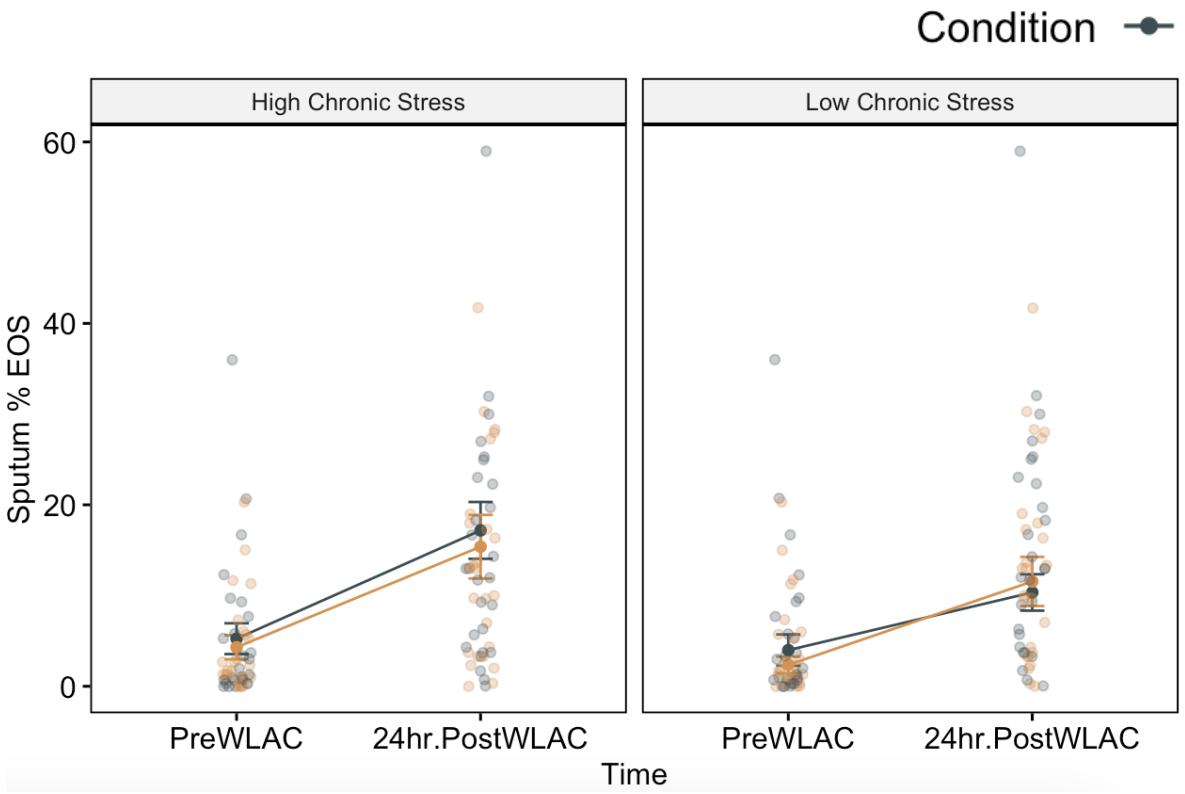
Cortisol Response to Stress is Associated with Salience Network Activation



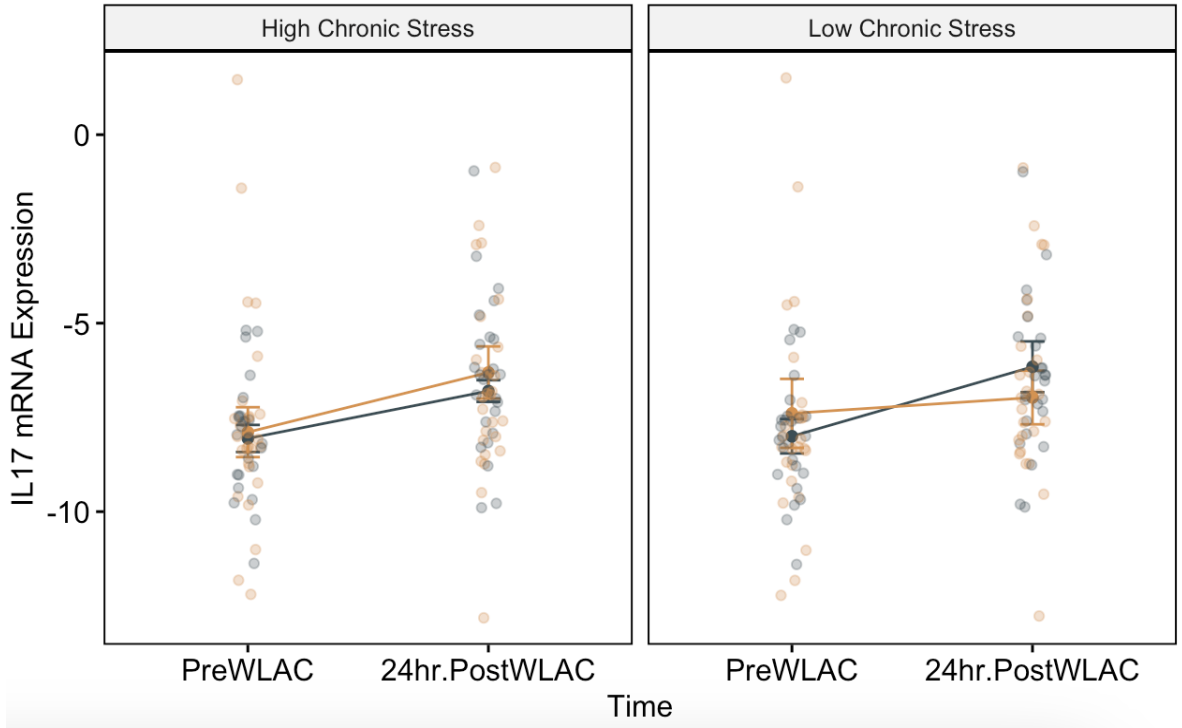
p < .05 corrected



Chronic Stress Impacts the Effect of Acute Stress on Inflammation

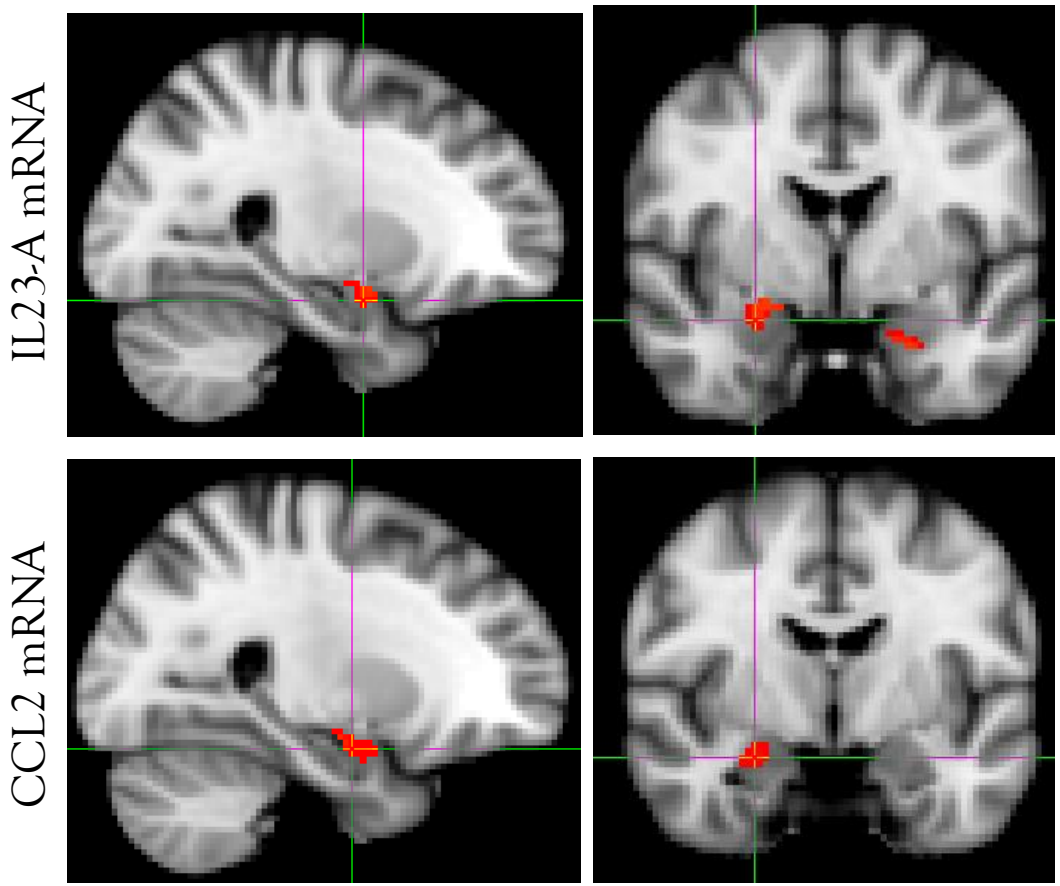


extreme point removed for visualization



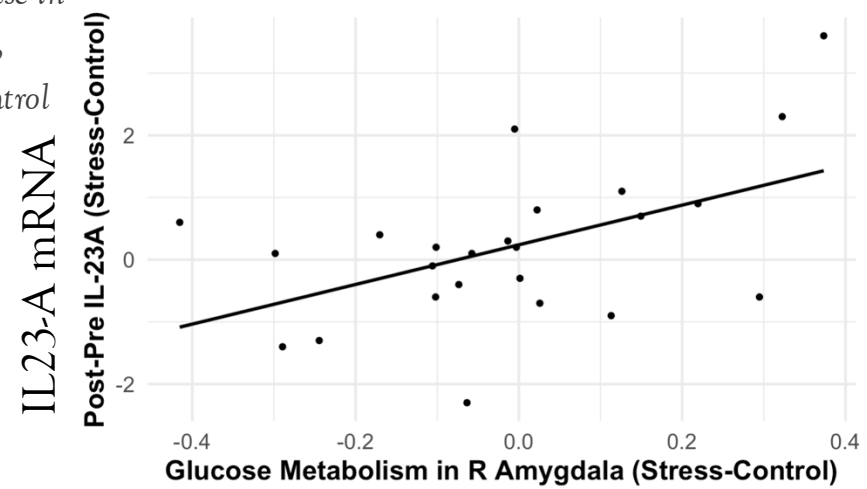
With lower chronic stress, Sputum EOS% increased **more** but IL17 mRNA expression increased **less** following acute stress

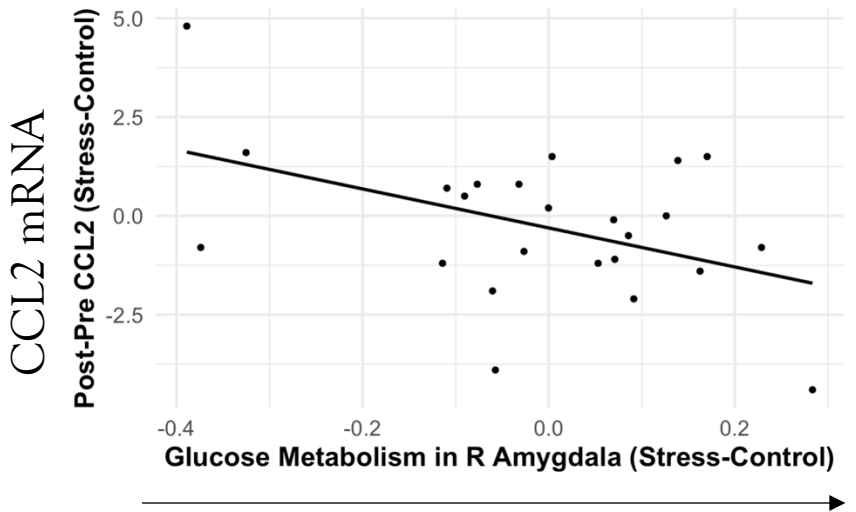
Stress-Related Amygdala Activation Predicts IL-23A and CCL2 Expression Following Airway Challenge



p < .05 corrected

Greater increase in inflammation, in stress vs control





Greater glucose metabolism, in stress vs control

Conclusions

- Psychosocial stress-evoked **cortisol** associated with **salience network brain activity**
- **Chronic stress** moderated effects of acute stress on airway inflammation
  - *which inflammatory pathways AG exposure engages*
- **Stress-related amygdala activity** predicted inflammatory signaling capacity

chronic stress; cortisol

descending pathways

stress

airway inflammation

=> targeted, personalized treatments

mind-body interventions

Thank You!

Center for healthyminds
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...and many more!

Questions/Comments:

please email higgins5@wisc.edu

Thank You (:

Extra Slides

Th17 Cells

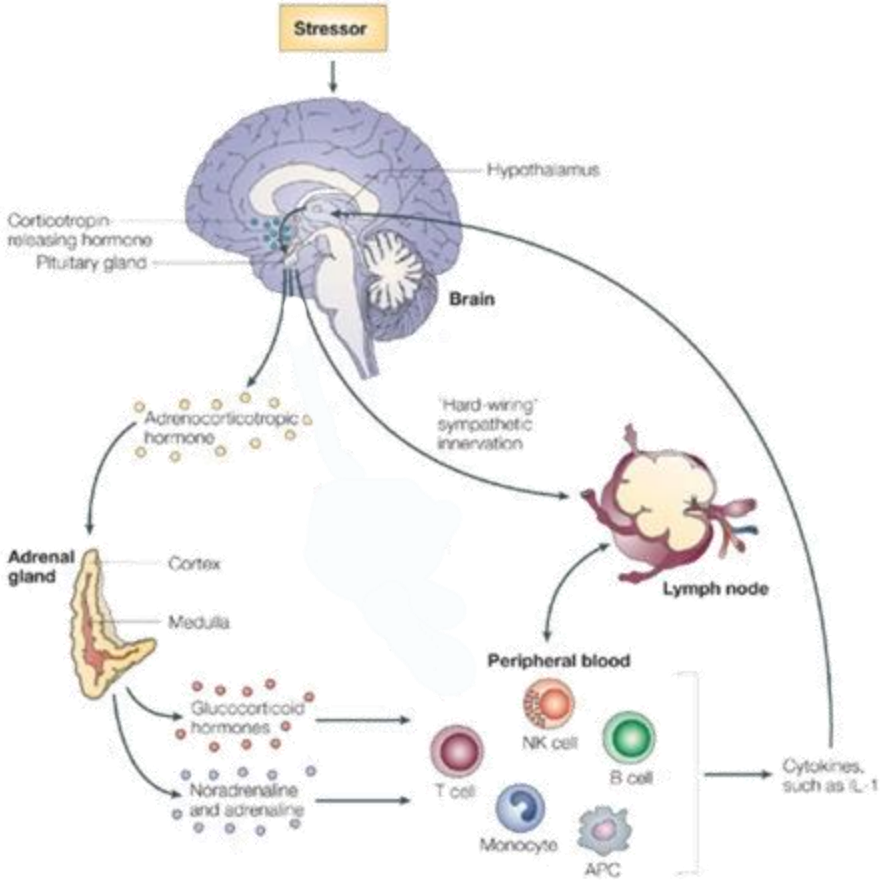
- Adaptive Immune System → IL-17 *(neutrophils)*
- Differentiation promoted by IL-23, TNF-a, IL-1β, IL-21 (requires IL-6 and TGFβ)
- Psychological Stress → ↑ IL-23A, IL-1β, IL-6

Asthma:

- IL-17 in severe asthma; modulates Th2 responses in mild asthma
- EOS (Th2 cells) release IL-1β → IL-17 expression

How does the brain influence the airway?

- **Distal** Mechanism: brain (sub/cortical)
  - *In-Between Mechanisms: brainstem*
- **Proximal** Mechanisms:
  - *HPA Axis*
  - *Sympathetic Nervous System*
  - *Neurogenic Inflammation (Sensory Neuropeptides)*

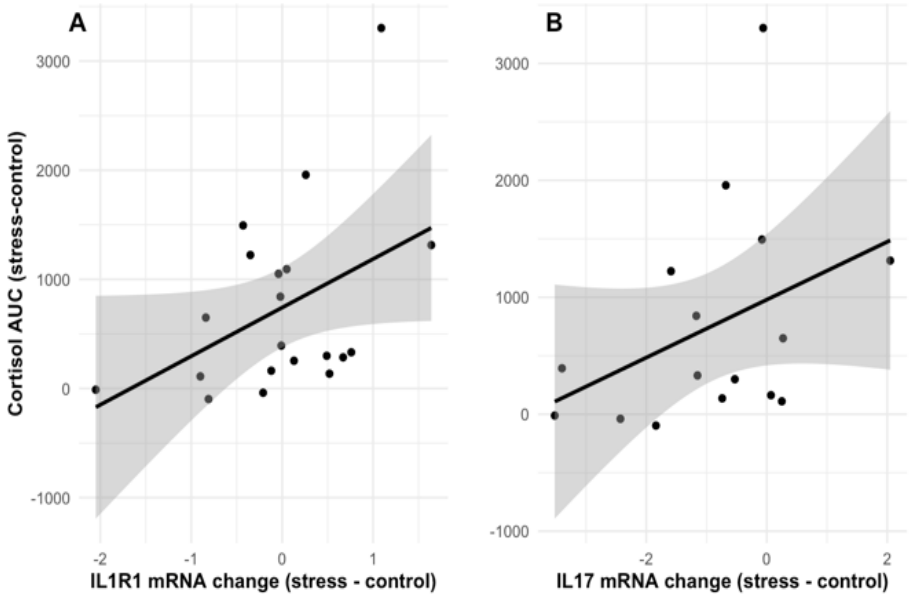


(Glaser & Kiecolt-Glaser, 2005)

Prior Evidence

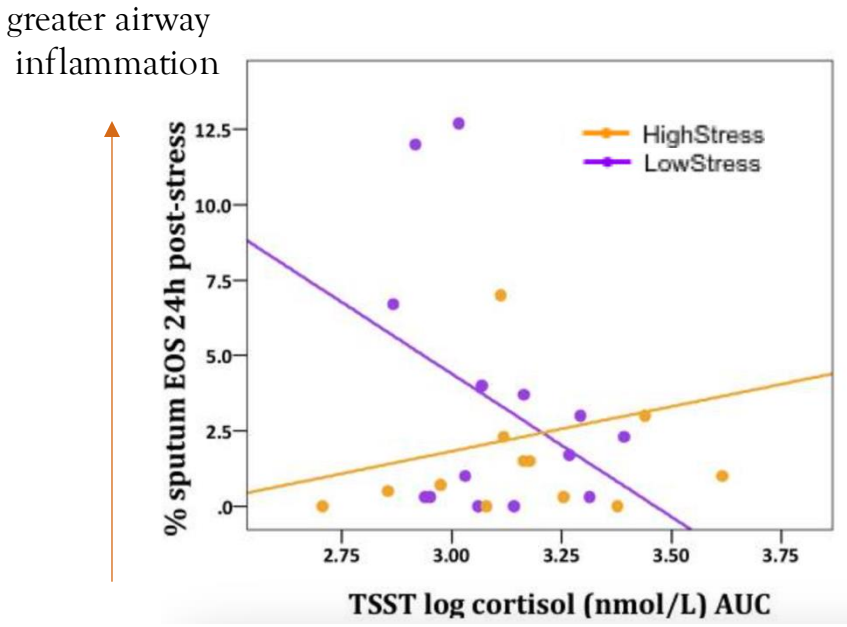
- Psychosocial Stressor ⟶ Increased Cortisol, associated with Airway Inflammation Biomarkers

  - *Th17 path (IL-17A, IL-1R1)*



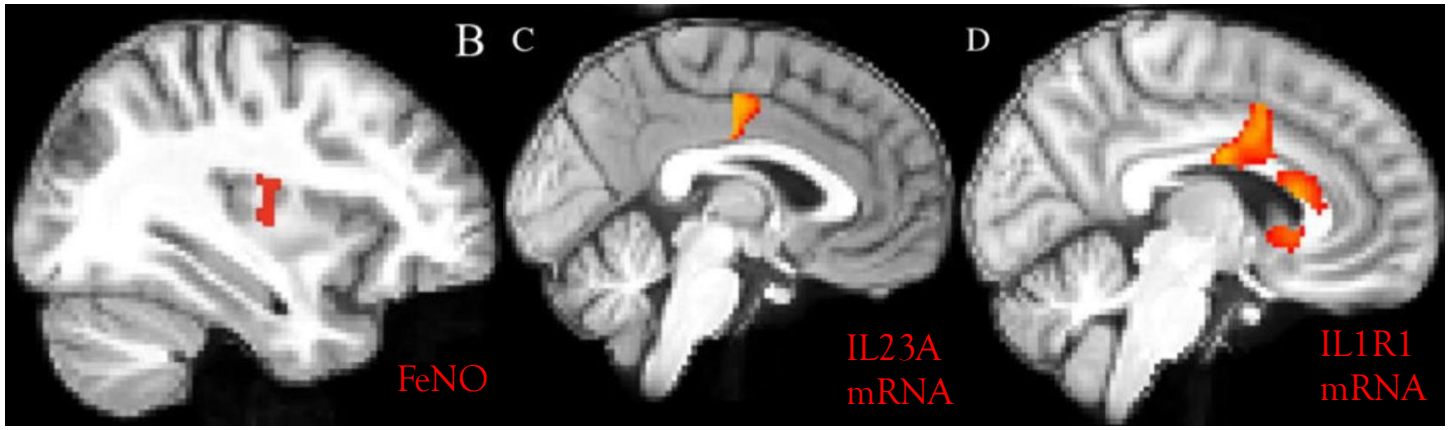
(*Rosenkranz et al., 2016*)

  - *Th2 path (EOS) moderated by chronic stress*



Prior Evidence

- Psychosocial Stressor ⟶ Stress Neurocircuitry Activation associated with Airway Inflammation Biomarkers
  - *Th2 pathway (FeNO) & Th17 cell mRNA (IL23A, IL1R1)*



(Rosenkranz et al., 2016)