

# **Fuel for thought: Nutrition and cognitive wellness for lawyers**

Dr Amy Reichelt



# About me

- PhD, Neuroscience (Cardiff University)
- BSc Psychology (University of Birmingham)
- Professor (Adjunct) Western University
- Certified Nutritionist – Private practice
- Chief Innovation Officer – PurMinds Neuropharma



# **Overview: Food choices, stress and mental health, and high cognitive performance**

- Why do we love sugary foods so much?
- What happens to the brain when you eat a “junk food” diet?
- What happens to our food choices when we are stressed?
- How can we improve our brain health for optimal performance?

Nutritious dietary patterns improve prospects for health and well-being. Yet pursuing a healthy lifestyle is incredibly difficult in a society seemingly designed to incentivize the opposite.

Cheap

Readily available

Hyper-palatable



Require effort

Less rewarding

Can be more expensive

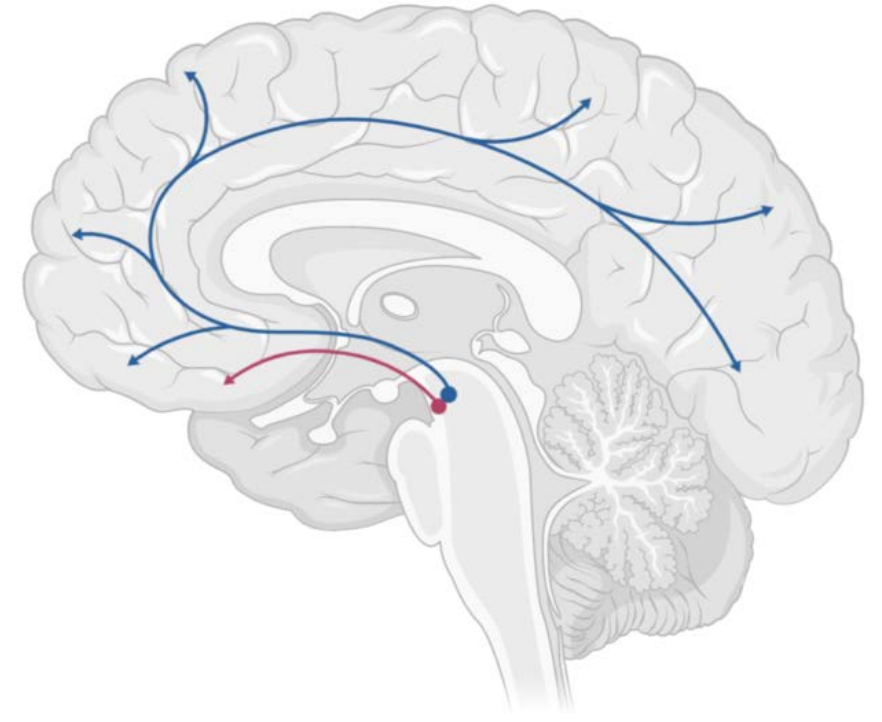
# Food as a natural reward

Key components of reward processing:

- **Liking:** hedonic impact of a reward
- **Wanting:** motivation for reward
- **Learning:** associations, representations and predictions about future rewards based on past experiences

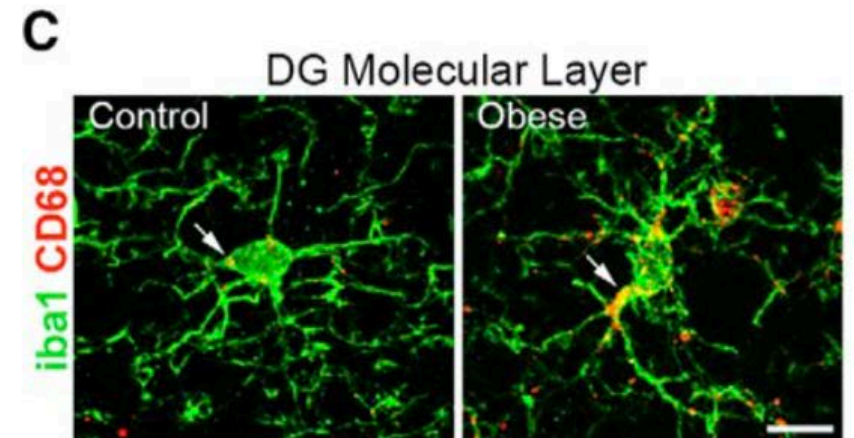
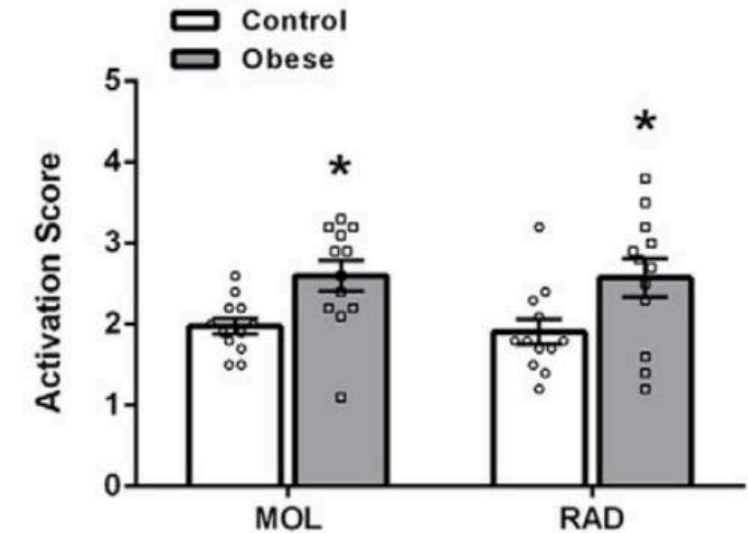
*Berridge and Kringelbach, 2008*

- Highly palatable foods stimulate the brain's **reward circuit**
  - mesocorticolimbic dopamine system
- Dopamine release motivates behavior → increases the frequency of engaging in behaviors essential for survival (sex, social contact, eating high energy food)



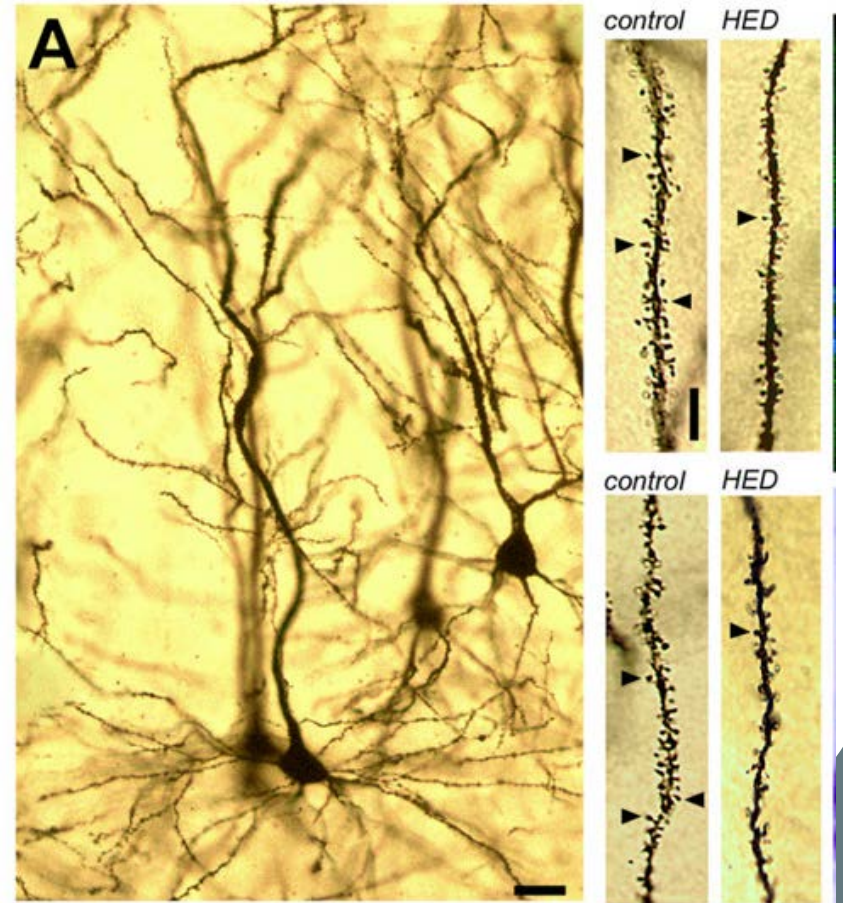
# Detrimental impact of diets high in fat and sugar

- Junk food diets shown to rapidly cause disruption of brain function in rats and people
- Increase neuroinflammation:
- Release of inflammatory cytokines
- Activation of microglia
  - Microglia play a crucial role in immune responses, including inflammation.
  - Microglia activation and hypothalamic inflammation is seen as early as 3 days after high-fat diet exposure, before changes in body weight occur



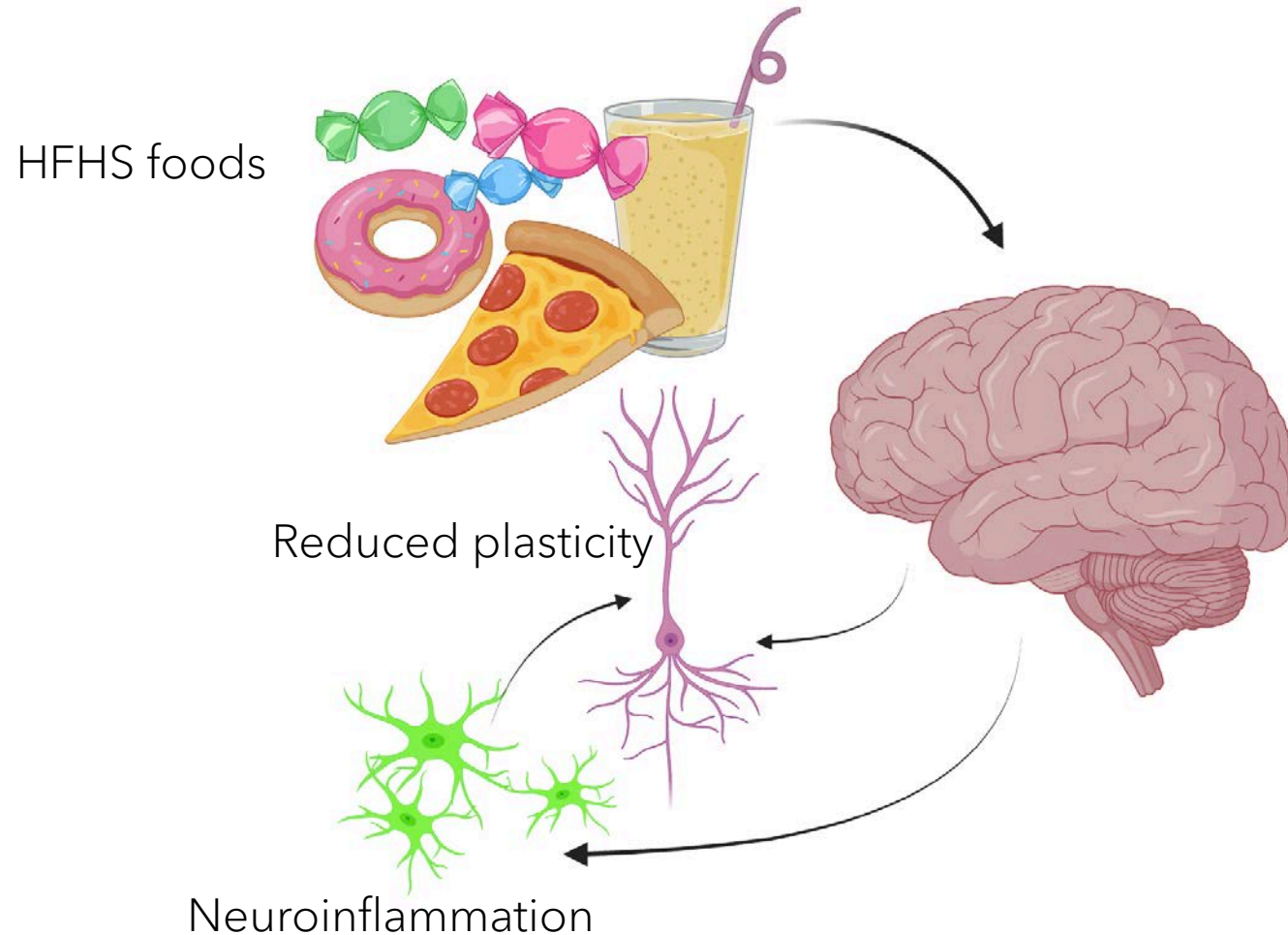
# Detrimental impact of diets high in fat and sugar

- Junk food diets shown to rapidly cause disruption of brain function in rats and people
- Decreases neuroplasticity:
  - Reduced hippocampal neurogenesis
  - Reduced dendritic spine density
    - Dendritic spines stripped by over activated microglia
  - Decreases brain derived neurotrophic factor (BDNF)
    - Reduced synaptic plasticity

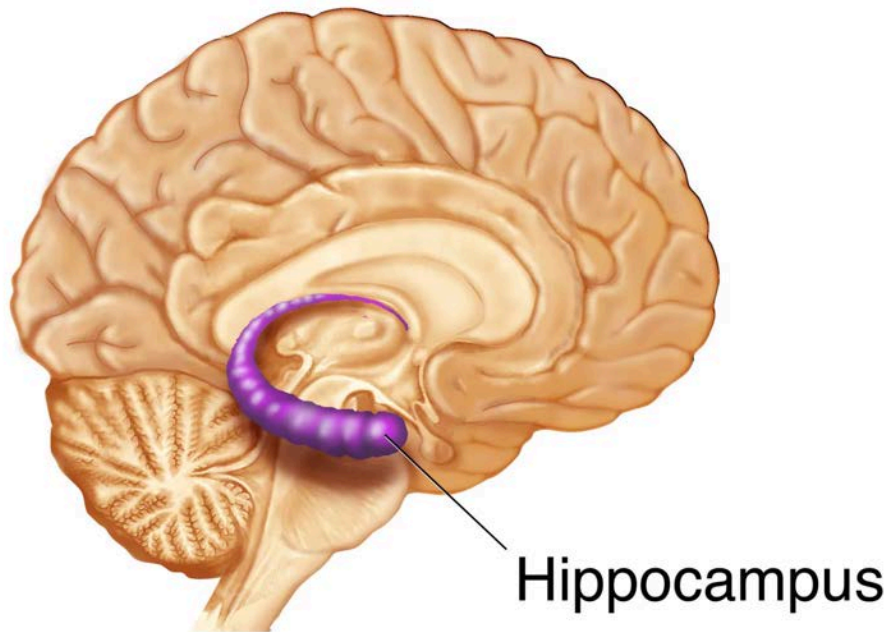


Stranahan et al., 2008, Hippocampus

# Detrimental impact of diets high in fat and sugar



# The hungry hippocampus



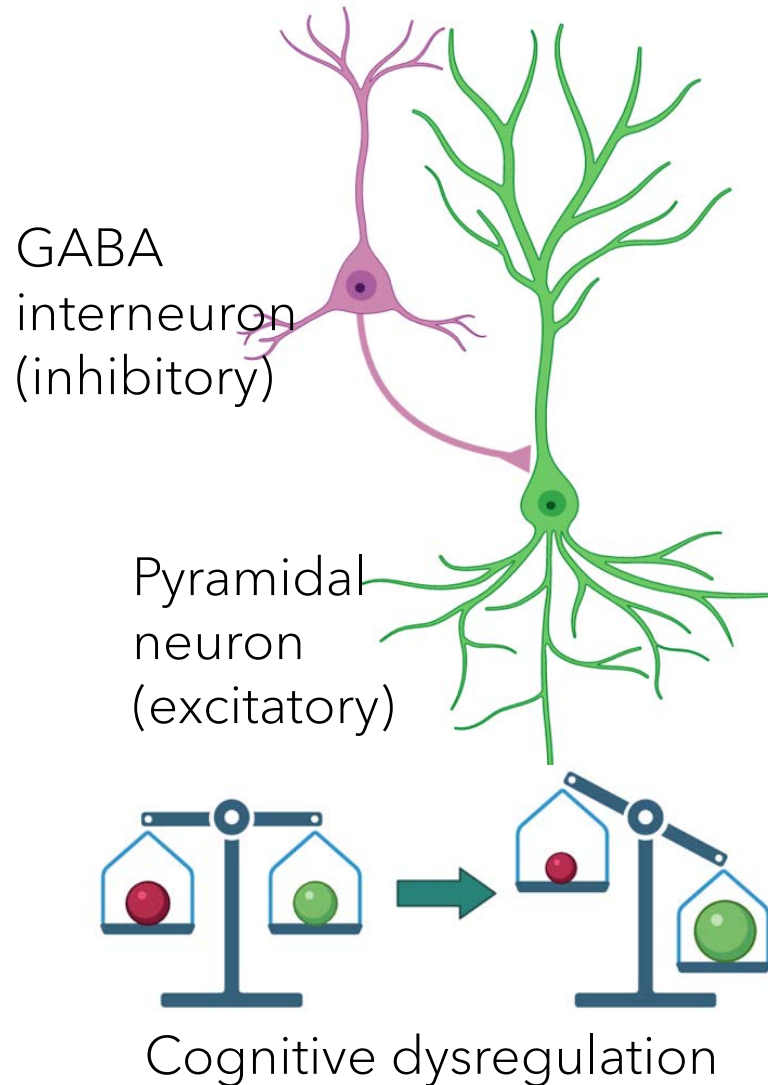
Hippocampus – Encoding memories, but is also involved in mood regulation and internal satiety signaling

- Patients with severe hippocampal damage will overconsume foods
  - Impaired satiety processing
- But high fat / high sugar diets themselves damage the hippocampus → vicious cycle!

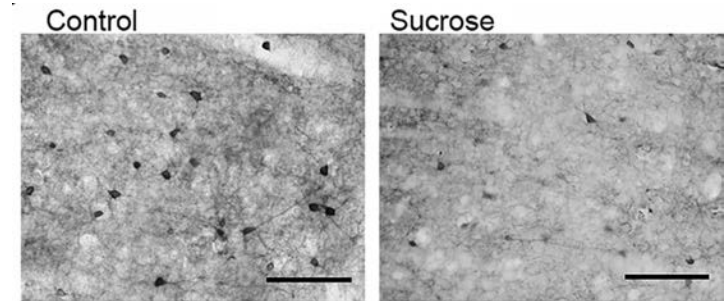
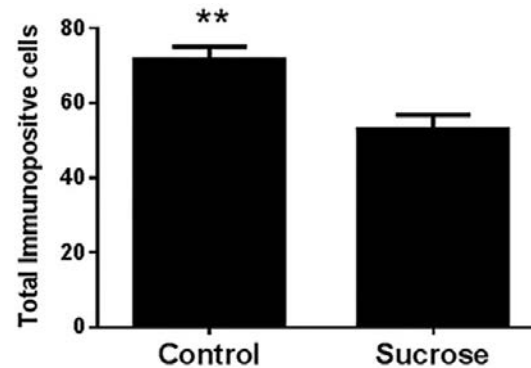
# The Prefrontal Cortex & Executive control

- Executive function includes decision making, attention, cognitive flexibility, and impulse control  
→ Important for food choice behaviours
- When PFC function is suboptimal:  
Inhibitory control is diminished  
And... Reversing habits becomes more difficult

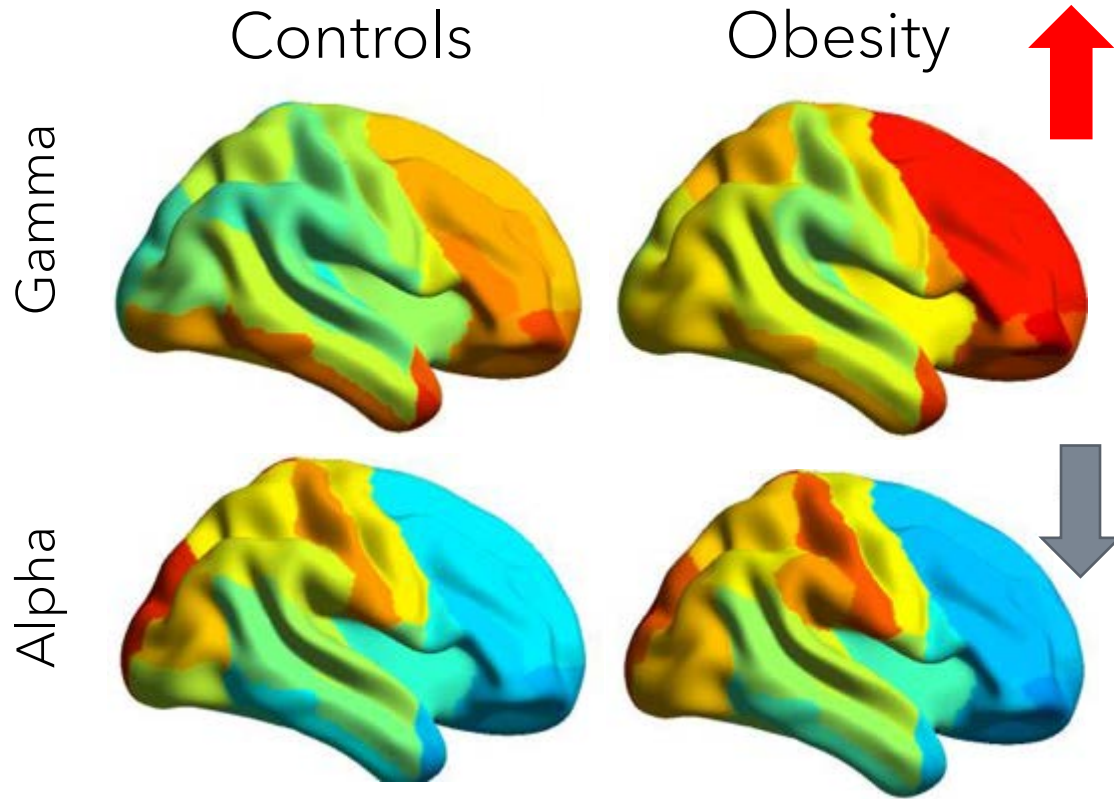




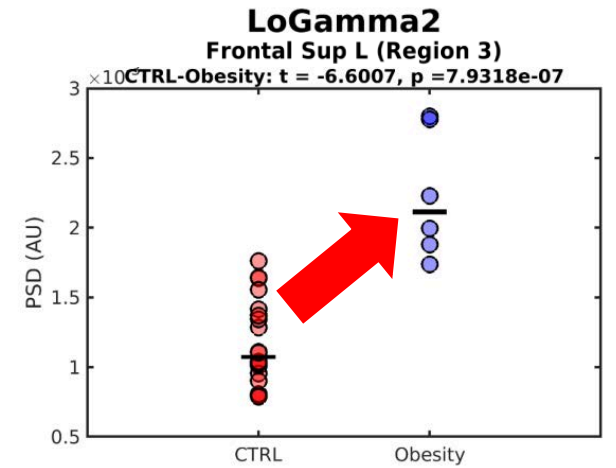
- GABAergic inhibitory interneurons
  - Act as brakes on excitatory neurons
  - Control of **excitatory - inhibitory** balance
  - Susceptible to inflammation - high metabolic demands
- Critical components of high-order cognition



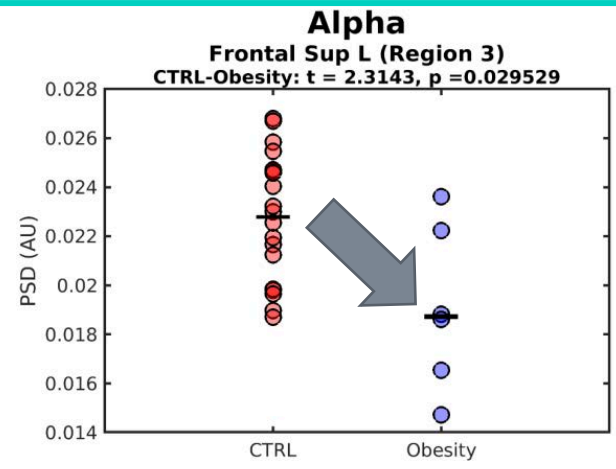
# Effects on human brain function - Brainwaves

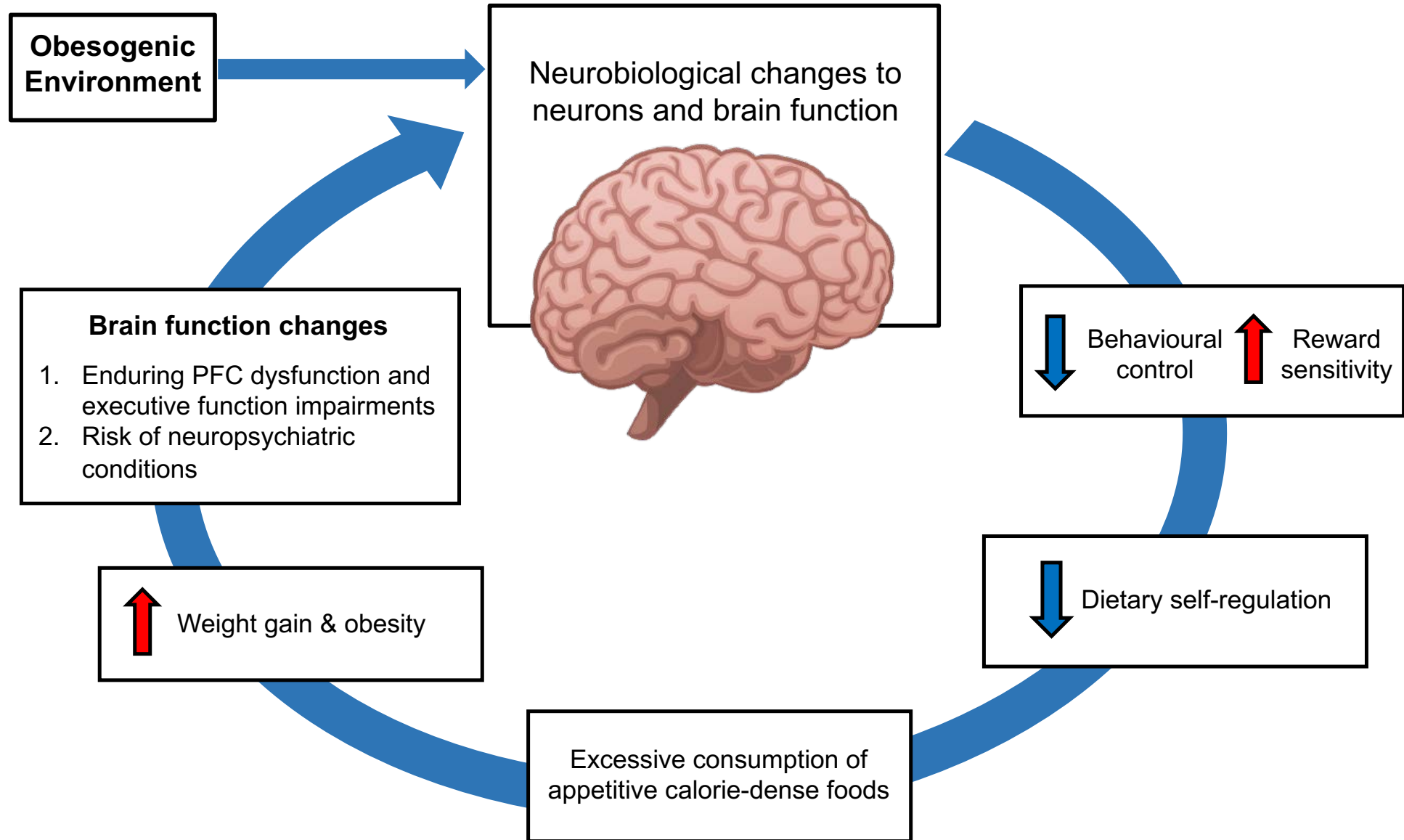


Elevated gamma frequency brainwaves - increased excitation



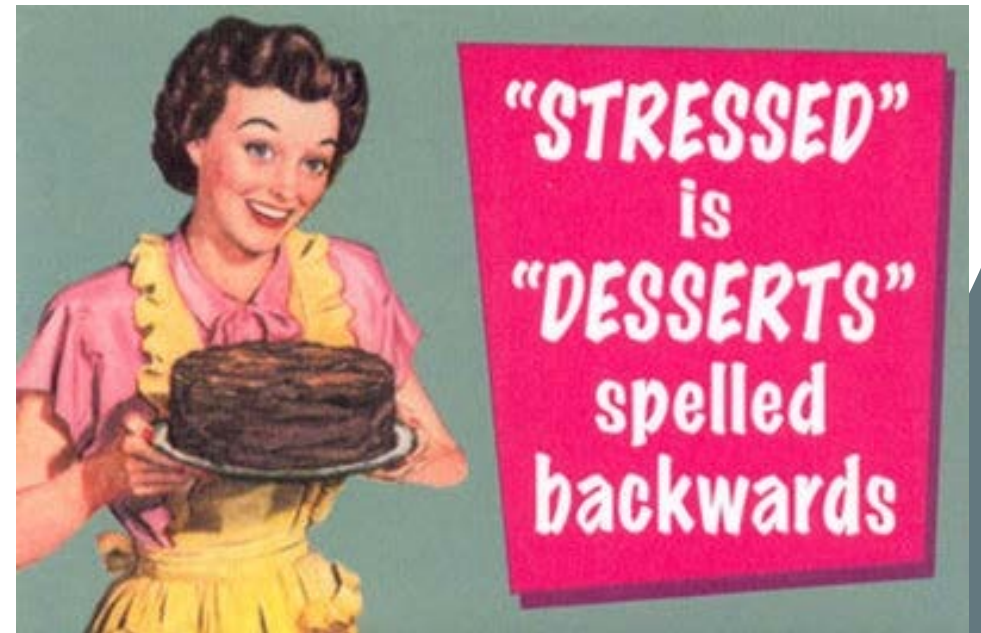
Lower alpha frequency brainwaves - reduced inhibition





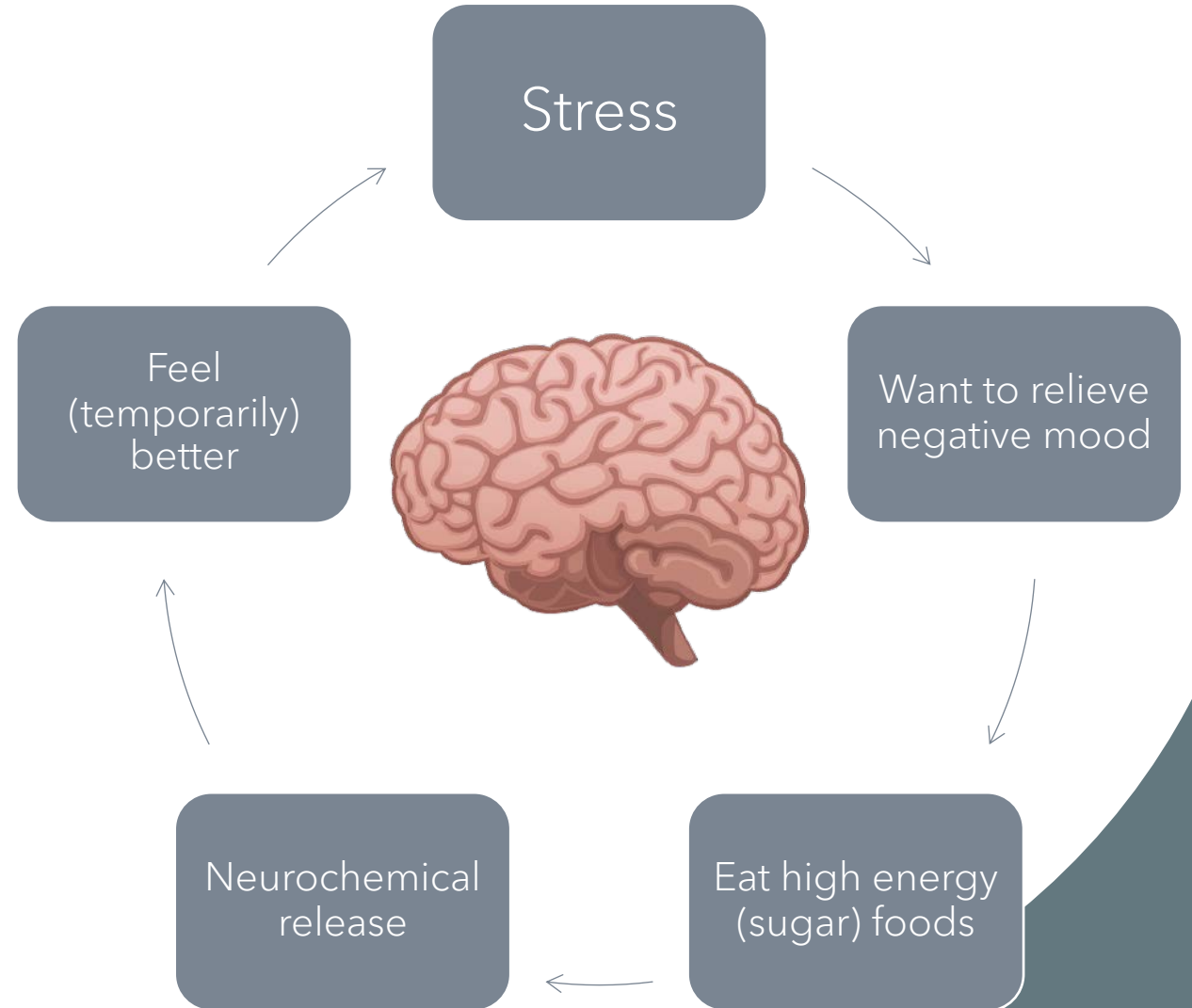
# Stress - another way to impair brain function

- Why do we crave - and often end up eating - sugary and high fat foods when we are stressed?
  1. Psychological response - learned behaviour:
    - Craving palatable foods
  2. Physiological/hormonal response
    - Activation of HPA-axis
  3. Neurobiological response
    - Change in brain function

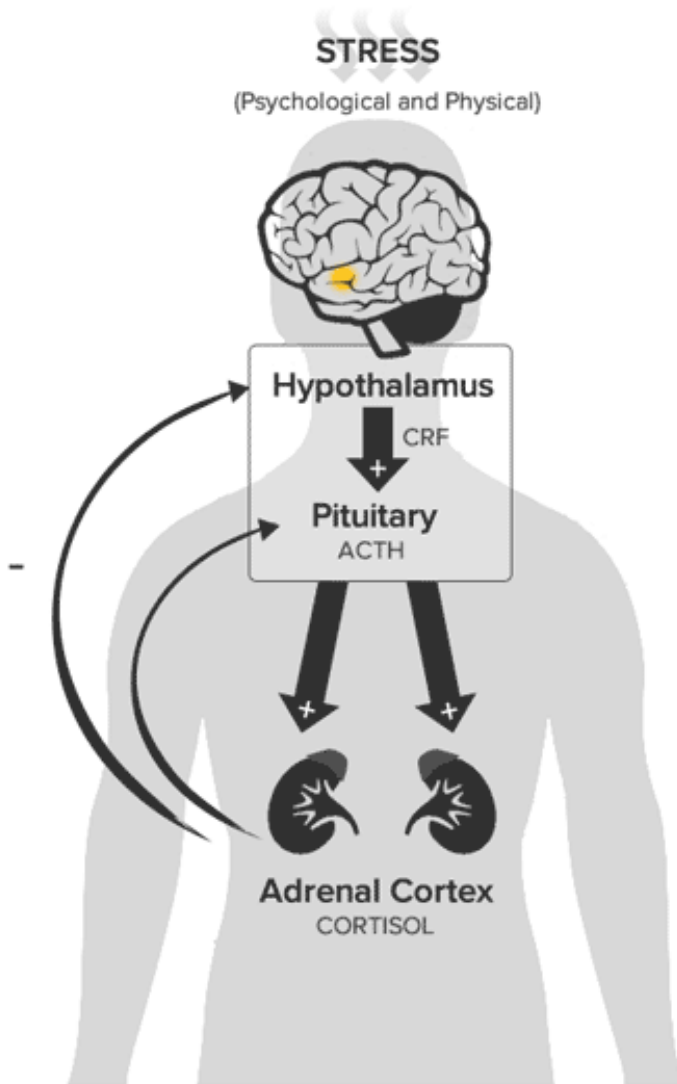


# 1. Psychological response: Learned behavior

- Coping mechanism - Palatable foods activate the reward system  
→ Dopamine drives craving for palatable foods
- Stressful experiences can trigger comfort eating as a learned response



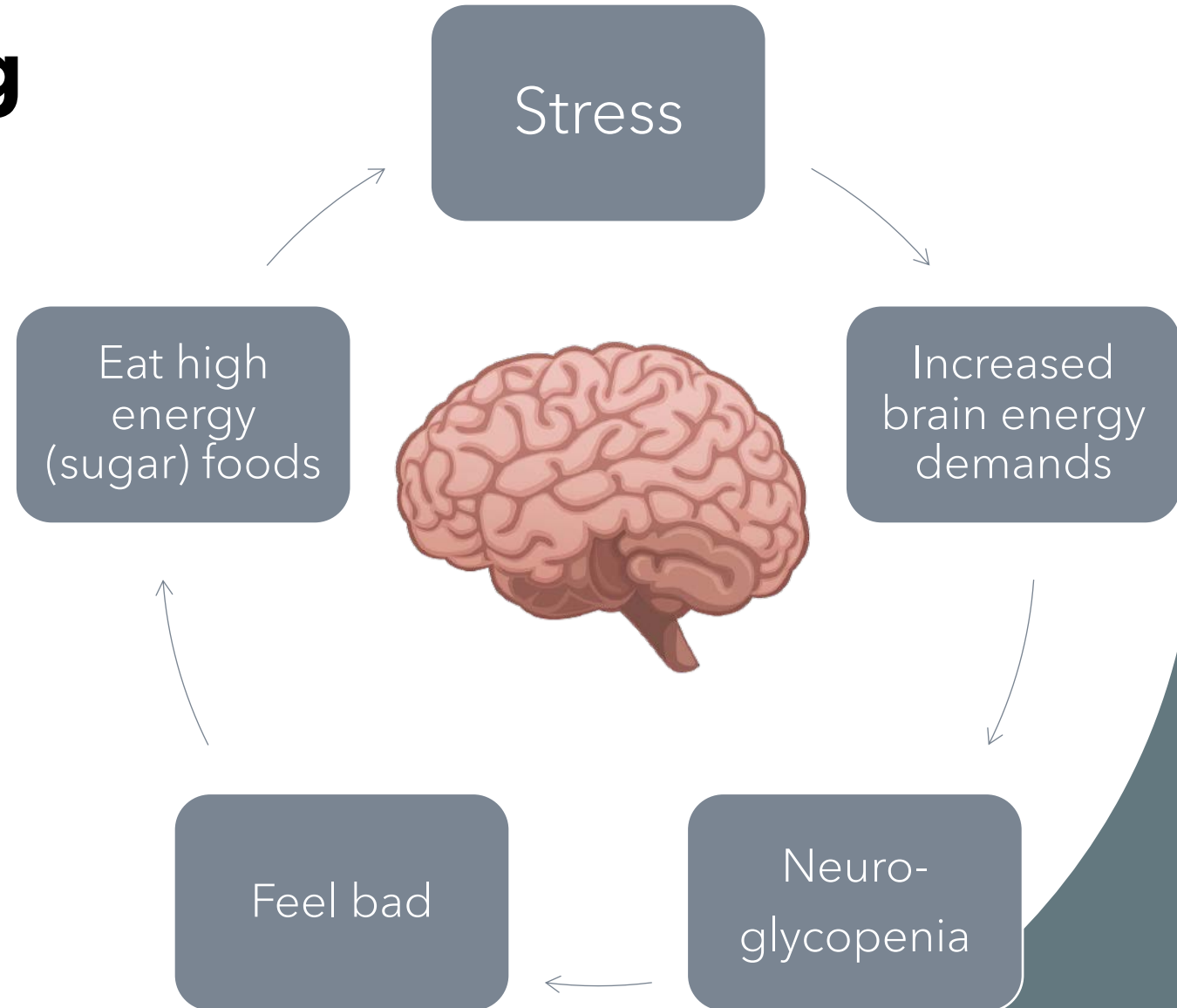
## 2. Hormonal response: The stress circuit



- Hypothalamic-Pituitary-Adrenal (HPA) Axis activation results in the release of cortisol  
Acute stress → loss of appetite  
Chronic stress → often increases appetite
- Cortisol acts to mobilize glucose stores → energy for “flight or flight” response
- The stressed brain uses ~12% more glucose than the resting, unstressed brain (Madsen et al., 1995)

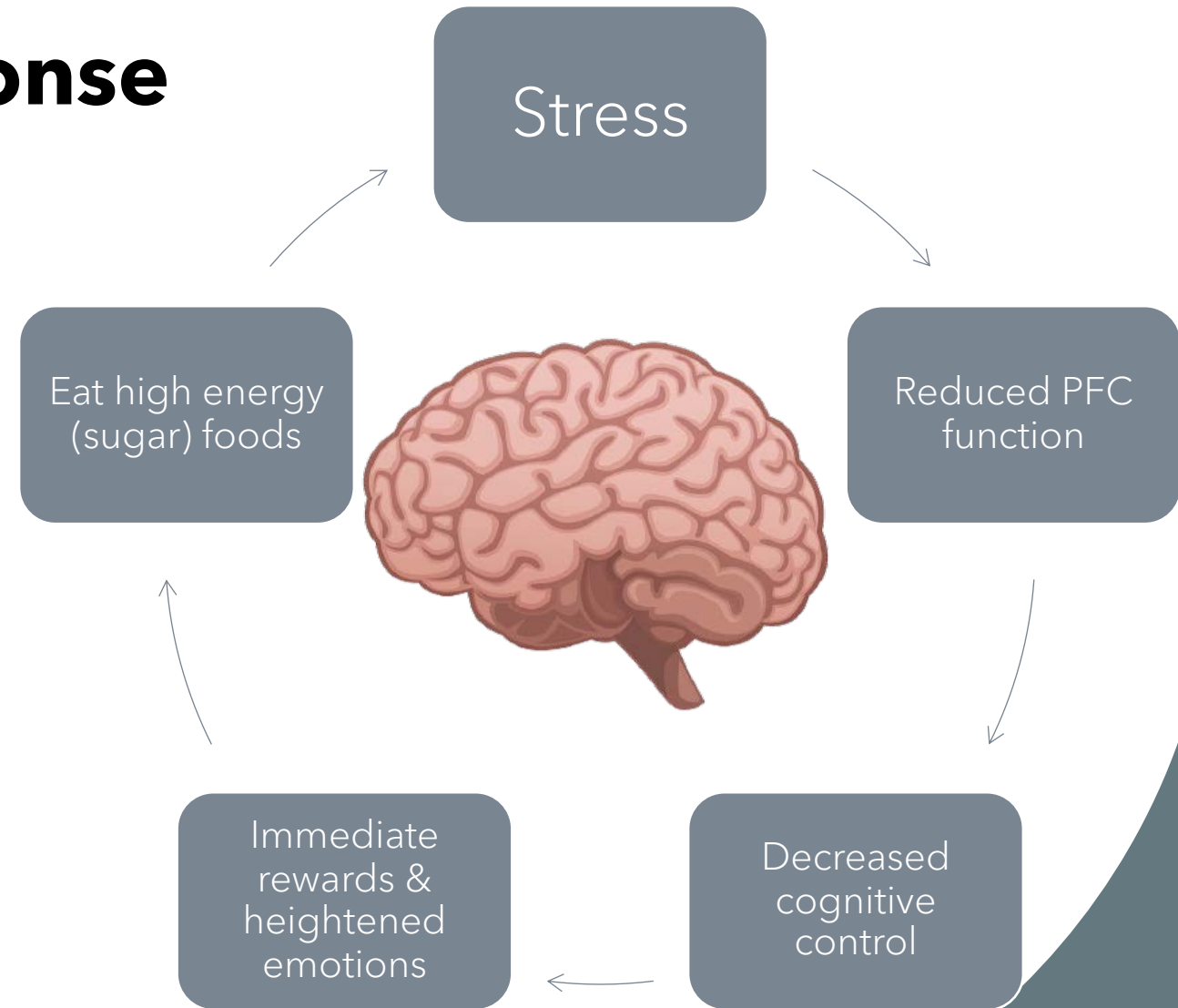
## 2. Stress-induced eating

- After the stress response subsides blood glucose levels are dramatically reduced (hypoglycemia)
  - In the brain, low blood sugar is called **neuroglycopenia**
    - Irritable, poor judgment, headache
- Food preference switches to simple carbohydrate rich foods
  - Quickly replenishes glucose stores

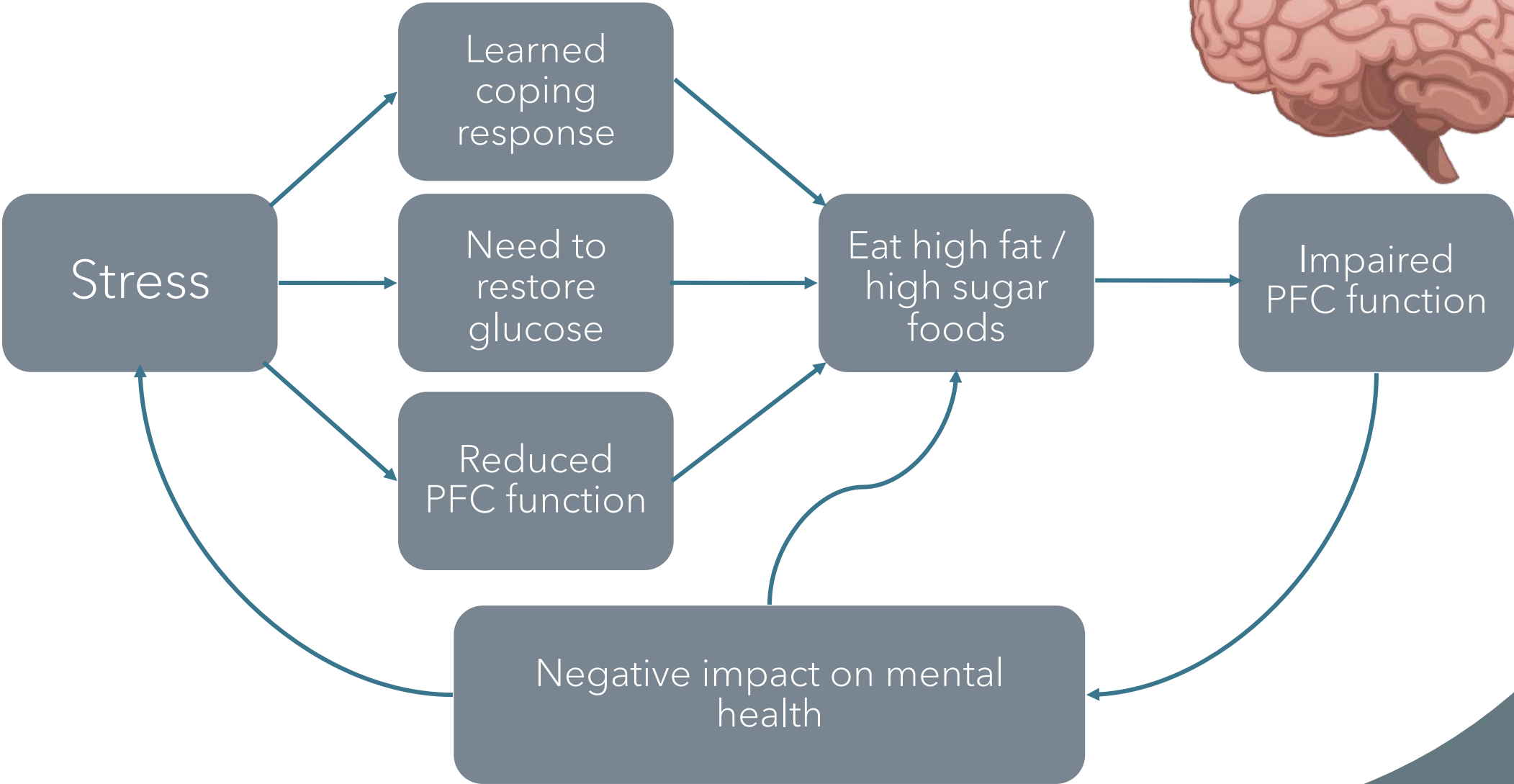


### 3. Neurobiological response

- PFC is essential for cognitive control, including food choices
- During periods of acute stress, the PFC will go "offline"
  - Habits dominate, difficulty making decisions
  - Amygdala activity unchecked → emotional eating
- Chronic stress exposure leads to dendritic atrophy of PFC neurons



# Putting it all together



# How to beat stress eating

1. Know your adversary - when you are stressed your brain is going to tell you to eat unhealthy foods - prepare in advance to avoid cravings!
2. Consuming a diet high in nutritious foods can improve brain function and build mental resilience
3. Aerobic exercise boosts neuroplasticity-promoting chemicals (i.e. BDNF) and can help relieve stress
4. Quality sleep helps to restore the mind



# Brain healthy foods and supplements

- Omega-3's - Maintain neuronal membrane fluidity
- Increases BDNF
- Dietary sources - Oily fish, flaxseeds, chia seeds, walnuts
- Supplements - 1000 mg / day of EPA and DHA in combination



# Brain healthy foods and supplements

- Vitamin D3 – Brain active steroid and antioxidant
  - Stimulation of glutathione
  - Anti-inflammatory
  - Regulates melatonin production
  - 7 days of vacation in the sun isn't enough
- Supplement: 1000 IU-5000 IU / day





# Brain healthy foods and supplements

- **Creatine** - Athletic enhancer that can rescue a stressed brain
  - Important for cellular energy including neuron function
  - Building skeletal muscle
  - Shows some benefits in age-related neurological conditions and memory impairment
- Supplement: Creatine monohydrate 3-5g / day, up to 20g short term useful in periods of stress



# In summary



Poor diet is bad for both mind and body



Stress can precipitate unhealthy diet choices via multiple mechanisms :

Psychological  
Hormonal  
Neurobiological



Essential nutrients for brain health include:

Vitamin D3  
Omega-3s  
Magnesium  
Creatine



**COGNITION  
NUTRITION**

[amy@cognitionnutrition.ca](mailto:amy@cognitionnutrition.ca)