PSYCH 260/PSYCH BBH

Emotion II

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2022-03-24 09:30:10

Announcements

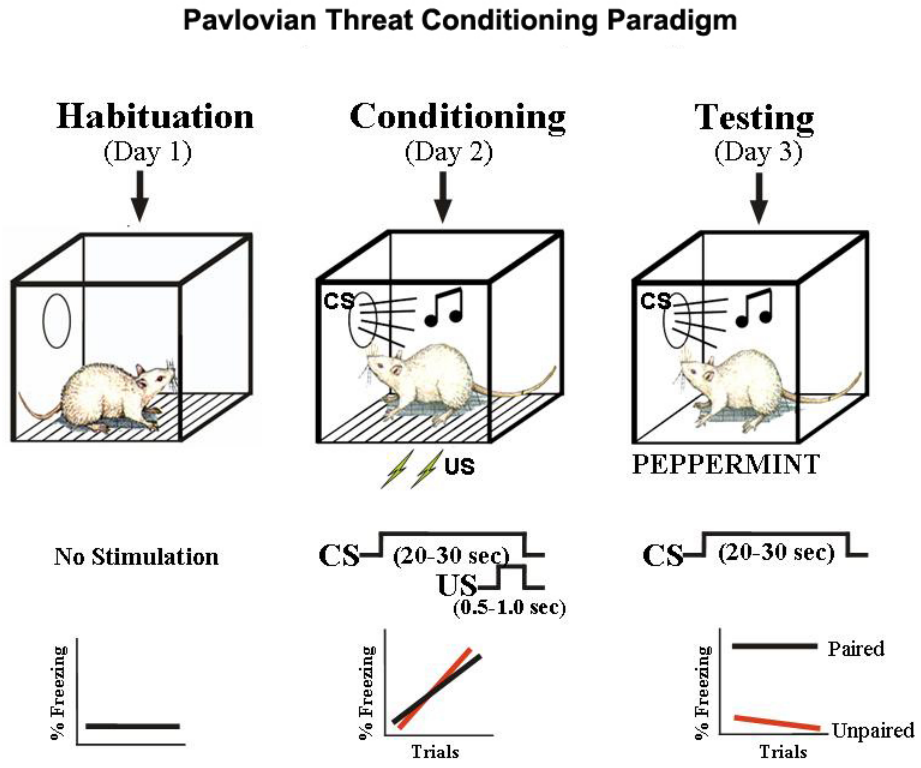
- Exam 3 next Thursday, March 31

Today's Topics

- Fear & stress

Fear and stress

Inducing “fear-like” behavior in animals



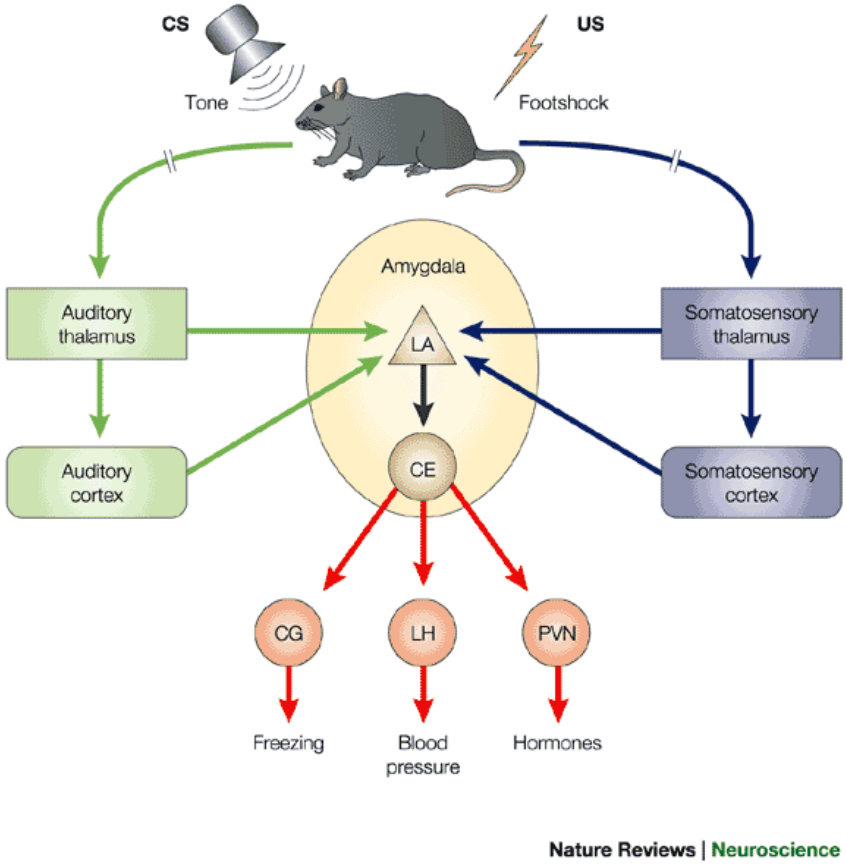
http://www.cns.nyu.edu/labs/ledouxlab/images/image_research/fear_conditioning.jpg

Rat vs. Human

Measures in Animal Model	DSM-III: Generalized Anxiety
Heart rate increase	Heart pounding
Salivation decrease	Dry mouth
Stomach ulcers	Upset stomach
Respiration change	Respiration increase
Scanning & vigilance	Scanning & vigilance
Startle response increase	Jumpiness, easy startle
Urination	Frequent urination
Defecation	Diarrhea
Grooming	Fidgeting
Freezing	Apprehensive expectation

Adapted from (Davis, 1992)

Amygdala circuits



(Medina, Repa, Mauk, & LeDoux, 2002)

Amygdala's inputs

- Convergent inputs
  - Thalamus ("direct" or "fast"")
  - Cerebral cortex ("indirect" or "slow")

Amygdala's outputs

- Project to
  - CG (central gray matter) of tegmentum: behavior
  - LH (lateral hyp): ANS
  - PVN (paraventricular n. of hyp): hormones
- Fast-acting, involuntary responses
- Lesions of amygdala impair 'fear conditioning'

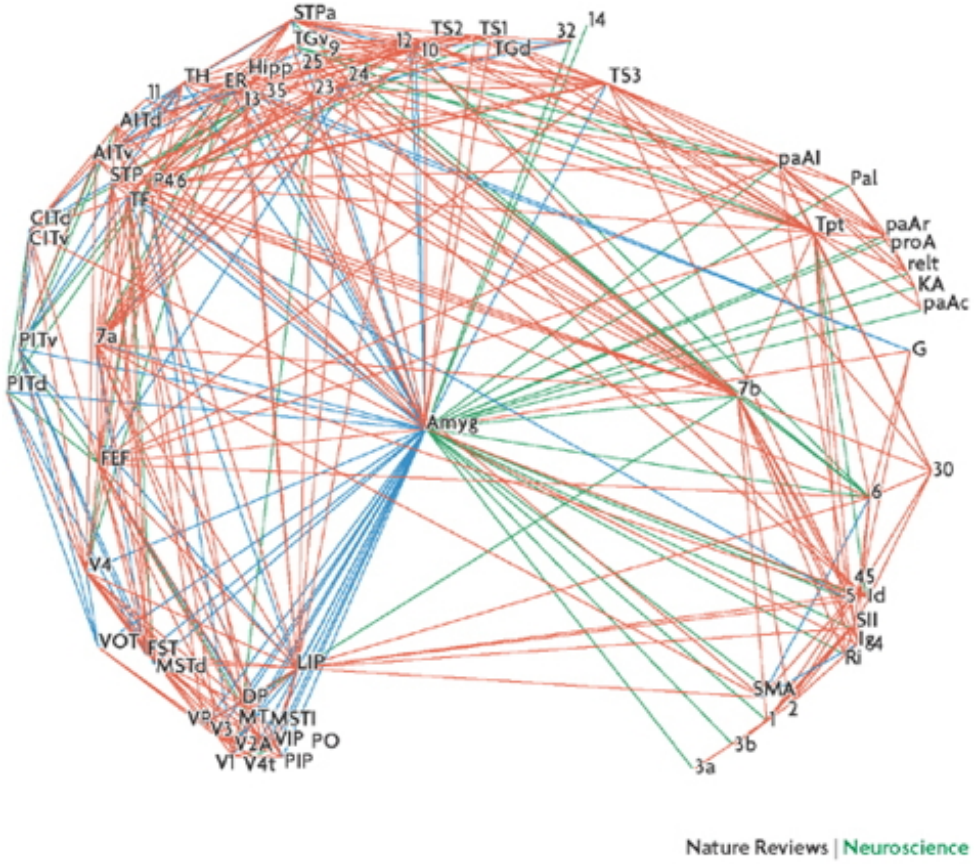
Cerebral cortex role

- Response discrimination?
  - Cortex lesions cause generalized not cue-specific fear response
- Fast, crude responses vs. slower, detailed ones
  - That’s a stick, not a snake!
  - Prefrontal cortex and response inhibition

But, are we really studying learned ‘fear’?

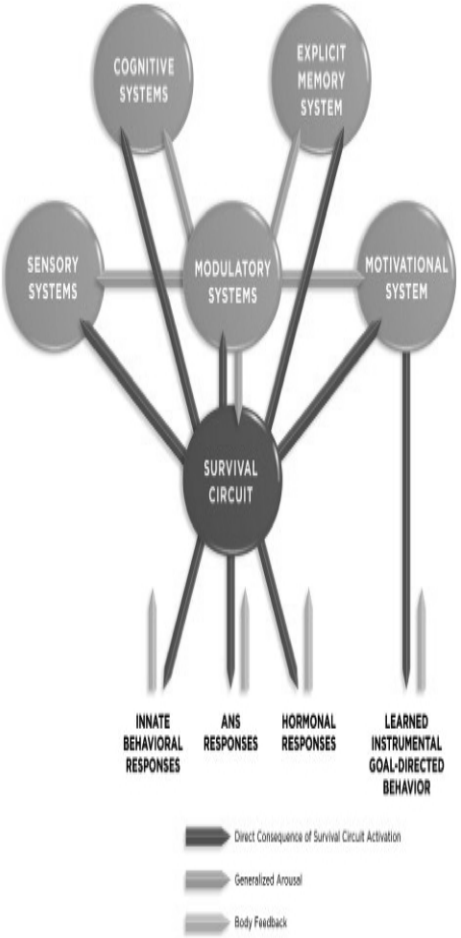
- Amygdala connected to other ‘affective’ nodes in neural network
- Emotion not just about subjective feelings

Amygdala as processing hub



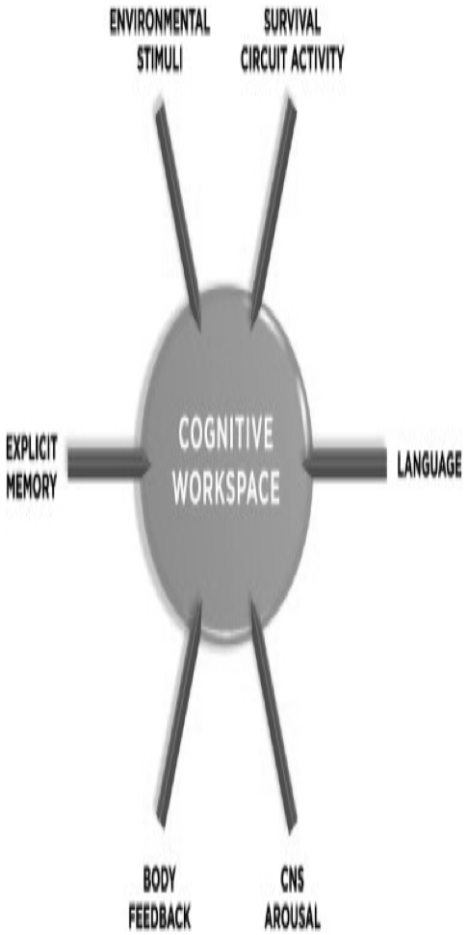
(Pessoa, 2008)

Amygdala as key hub in circuit for survival



(LeDoux, 2012)

Emotion as global physiological/behavioral "state"



(LeDoux, 2012)

Stress

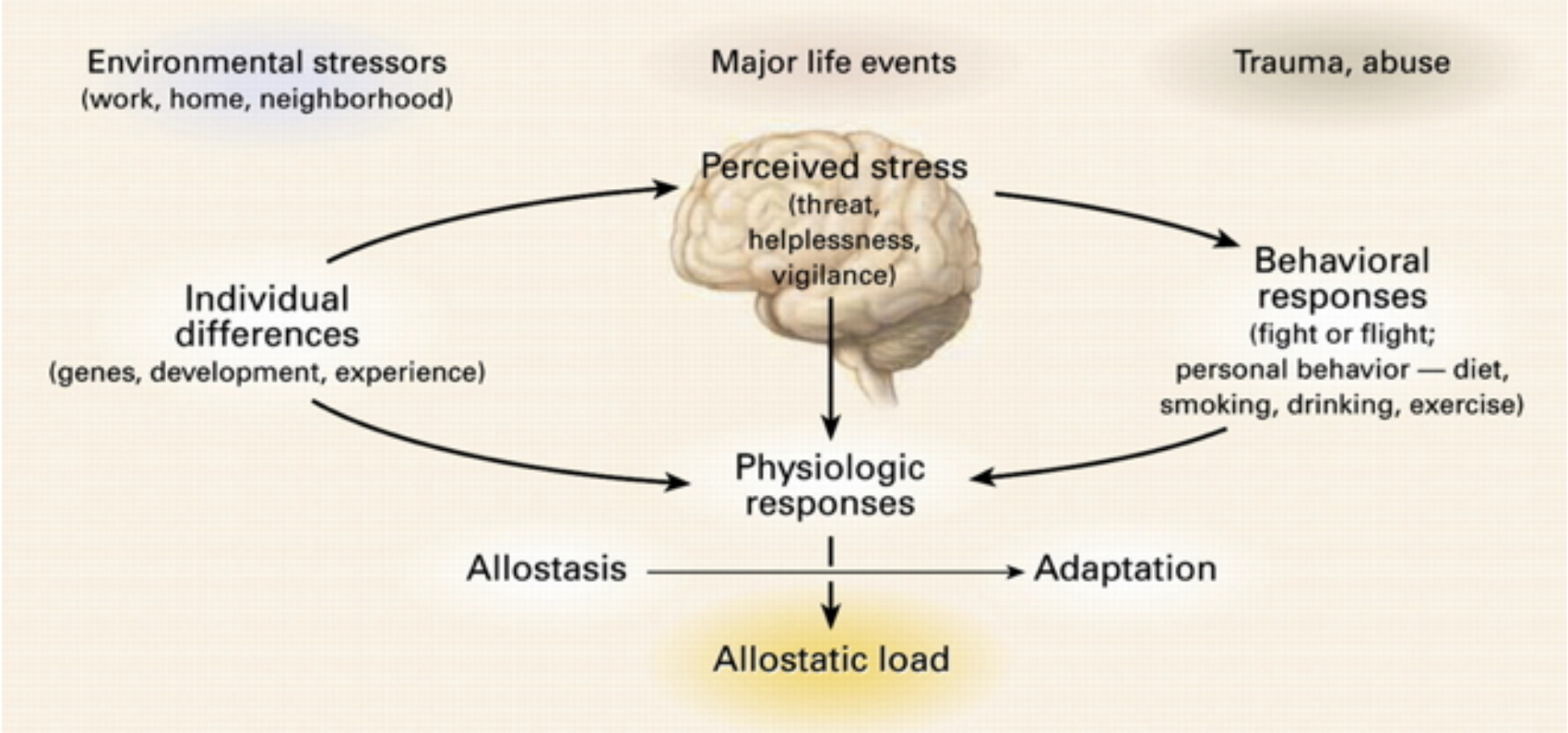
Stressors linked with biological imperatives

- Sustenance
  - Hunger, thirst
- Well-being/defense
  - Threat

Stressors linked with biological imperatives

- Reproduction
  - Rejection
- Affiliation
  - Loneliness

Stress and the brain



(McEwen, 2007)

Regulating internal states

- Homeostasis
  - Regulation of physiological variables (e.g., blood O_2) via negative feedback (Cannon, 1929)
- Allostasis (Sterling, 1988)
  - Regulation is active process
  - Regulation is anticipatory, varies by circumstance
  - Target levels vary (Ramsay & Woods, 2014)

Brain under stress

- **Acute** stress
  - Short duration
  - Fast action required
  - HPA (Cortisol), SAM (NE/Epi) axes
- Brain detects threat
- Mobilizes physiological, behavioral responses

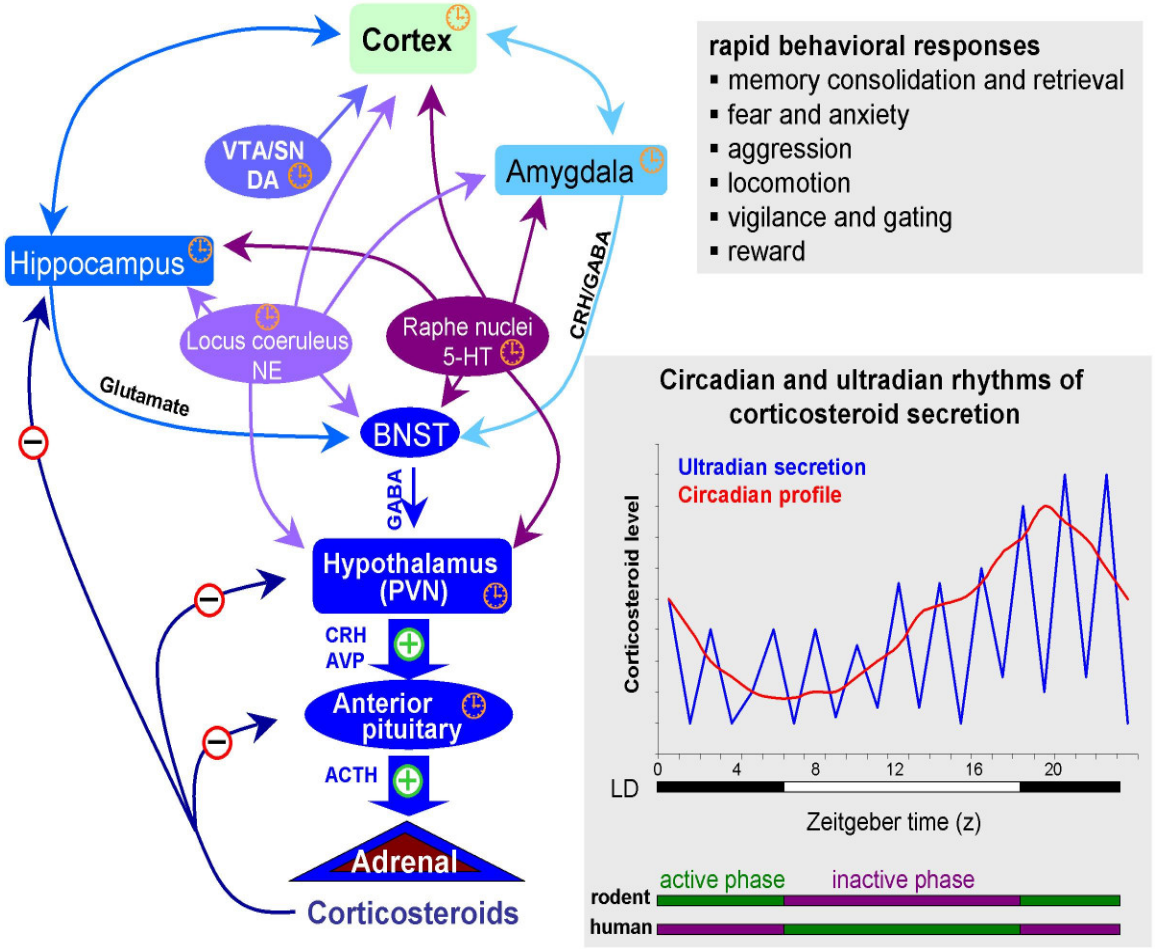
Brain under stress

- vs. **Chronic** stress
    - Long duration, persistent

Glucocorticoids

- Adrenal cortex releases cortisol (hydrocortisone)
  - Increases blood glucose levels
  - Suppresses immune system
  - Reduces inflammation
  - Aids in metabolism
- Receptors in brain and body

Cortisol and the brain



http://www.molecularbrain.com/content/figures/1756-6606-3-2-1-l.jpg

Glucocorticoid cascade hypothesis

- Cort receptors in hippocampus, amygdala, hypothalamus
    - Hippocampus (hipp) regulates HPA axis via hypothalamus
- Prolonged cortisol exposure reduces hippocampus response
    - Reduces volume, connectivity in hippocampus
- Hipp critical for long-term memory formation
    - Chronic stress impairs long-term memory

But, cortisol -> stress link not straightforward

(Faresjö et al., 2013)

Stress and coping across the animal kingdom

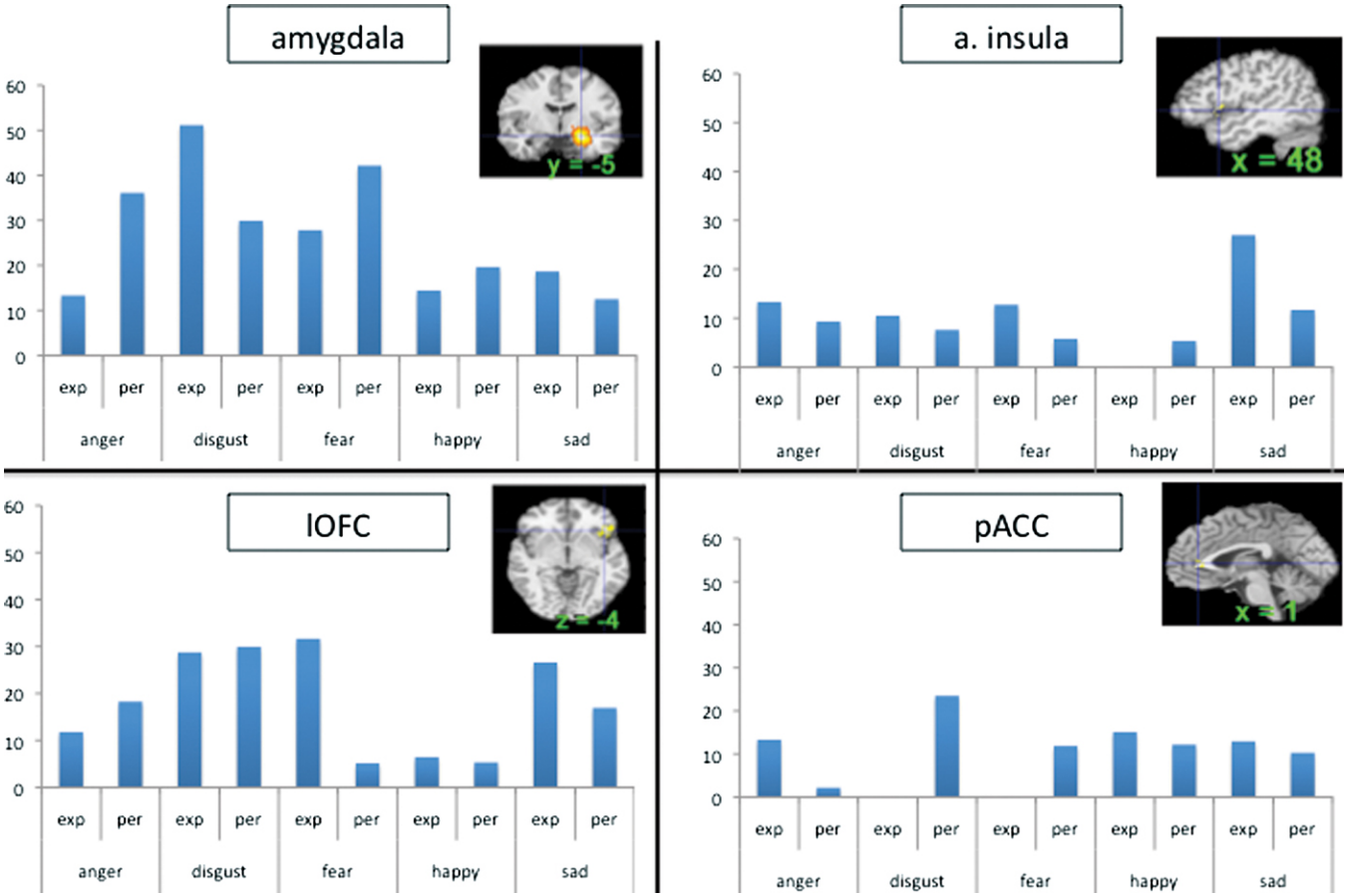
- Pain thresholds lower (sensitivity greater) when a mouse's cage mate is also in pain
- Rats will cooperate to release distressed cage mate, foregoing food rewards
- (Sapolsky, 2016)

Why Zebras Don’t Get Ulcers

Your (zebra) stress ain't like mine

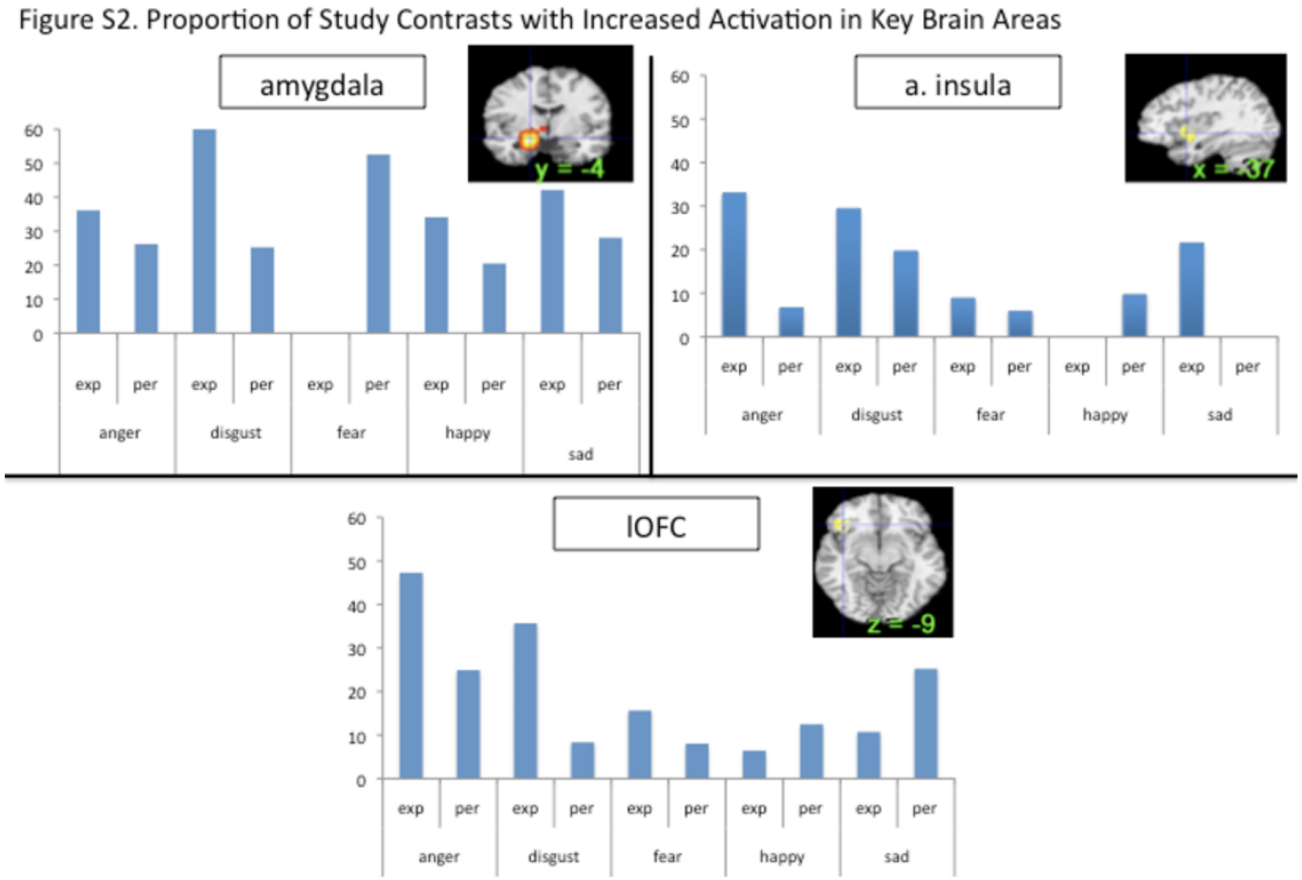
- Phasic (short-term) vs. chronic (long-term)
- Physical stress (hunger, thirst, injury, disease) vs. social stress

Where in the brain is emotion processed?



(Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012)

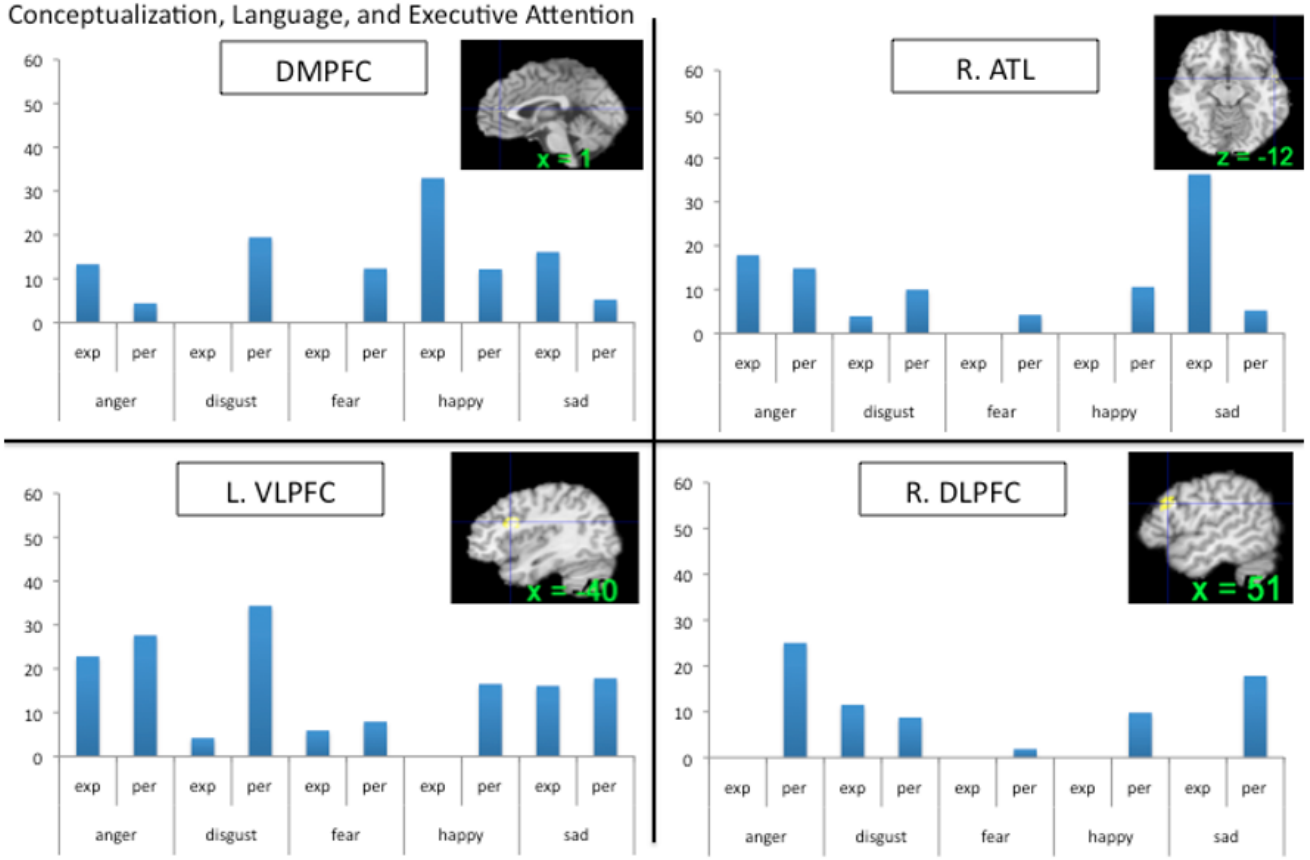
Where in the brain is emotion processed?



(Lindquist et al., 2012)

‘Emotion’ responses in ‘cognitive’ areas

Figure S3. Proportion of Study Contrasts with Increased Activation in Brain Regions associated with Conceptualization, Language, and Executive Attention



The y-axes plot the proportion of study contrasts in our database that had increased activation within 10mm of that brain area.

(Lindquist et al., 2012)

Main points

- Biological approach to emotion
  - Behavior
  - Physiological states
  - Subjective feelings
  - Adaptive function
- Networks of brain systems, multiple NT systems
- Emotional and cognitive processing have strong similarities

References

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