emotion

theories of emotion

- james-lange theory (1880s)
    - emotion is an <u>after the fact label</u> we give to autonomic arousal and associated behavior
    - subjective "feelings" are an interpretation we make of our body's reaction to stimuli
- cannon-bar theory (1930s)
    - emotion <u>simultaneous</u> to situation perceived
- schachter-singer theory (1980s)
    - interaction between <u>cognitive appraisal</u> and autonomic/limbic activity
    - combines both theories above, plus top down

judgements of emotional stimuli

- inject subjects with amphetamine and expose to emotional stimuli → exaggerated emotional response
    - report stimuli are *extremely* sad, funny, scary, etc
- facial feedback
    - subjects with pen in teeth (face muscles in smile-like configuration) report things are funnier
    - facial muscles in smile-like configuration affected quality of emotion
    - subjects directed to alter particular muscle groups in particular ways → emotion reported corresponded to universal qualities of associated facial expression
        - produced corresponding body responses (change in heart rate, skin temp, etc)
- learned helplessness
    - shock delivered to rats without option of stopping shock become depressed and develop ulcers from stress
    - remove rat's prefrontal cortex → no ulcers developed, not depressed, not interpret situation as helpless
        - cognitive appraisal affects autonomic response

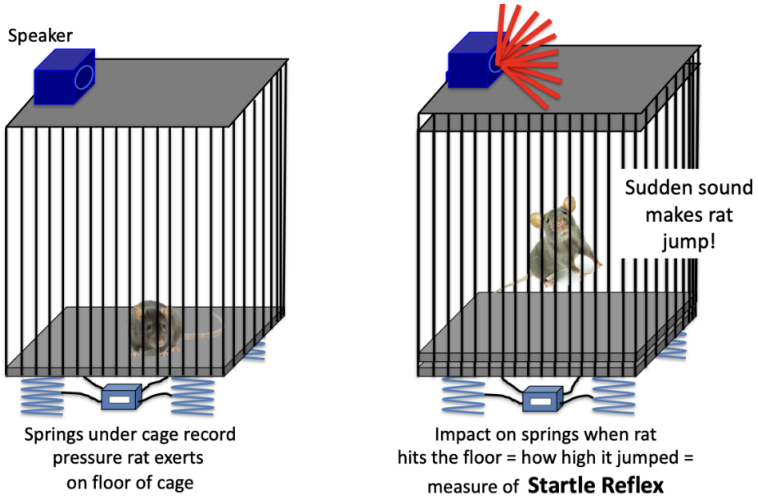
emotional expression

- universals but there are also culture specific display rules
    - for when and to whom you may show what kinds/extents of emotion
- neonatal imitation: we are pre-wired to practice manipulating the muscles of emotional expressions
    - based on behavior of others

limbic system

amygdala

- multiple nuclei with various functions and patterns of connection with other brain areas
- cortico-medial amygdala (first area studied)
    - direct stimulation → rage (fear/anger)
    - most prima emotion, critical to survival
    - virus that causes rabies affects this area (probably)
- lateral amygdala
    - startle reflex



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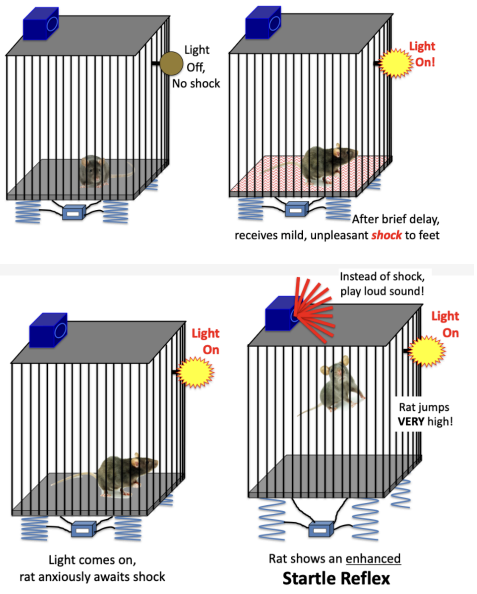
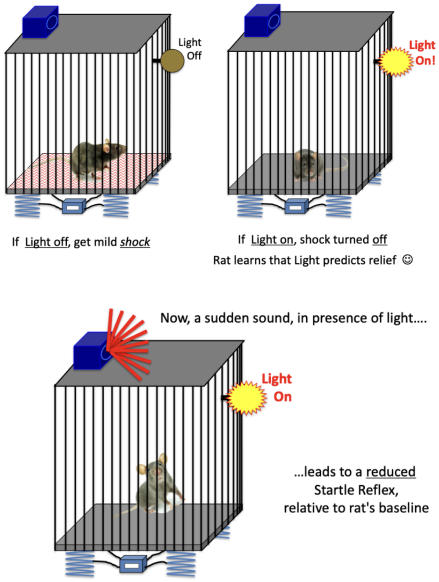
- conditioned fear
    - after establishing baseline startle reflex, trained rat on association between light and shock → rats learn negative association by anticipating shock when light turns on



- conditioning reduced startle reflex



  - output to central gray area of midbrain
    - part of tegmentum for motor control, esp of neck muscles
    - clenching these muscles helps protect fragile cervical neurons near surface
  - output to hypothalamus, influences ANS response
    - increase blood pressure, heart rate…
  - input from pain fibers and visual and auditory activity
    - trigger startle reflex
    - also to detect and learn emotional associations in conjunction with central and baso-lateral nuclei
      - conditioned fear
        - unlearned startle reflex becomes associated with other stimuli/contexts
        - either enhance or reduce startle reflex response
  - PTSD
    - includes conditioned enhancement of startle reflex
    - in central and basolateral amygdala, proportions of calming GABA vs stimulating CCK have shifted
- urbach-wiethe disease
  - calcification of amygdala
  - impairs function of feeling/expressing and observing emotion
    - patients show flattening of affect (less emotional expression) and problems with interpreting emotions in others
  - interpreting eyes alone have better performances likely bc eyes are represented in many brain areas

insula

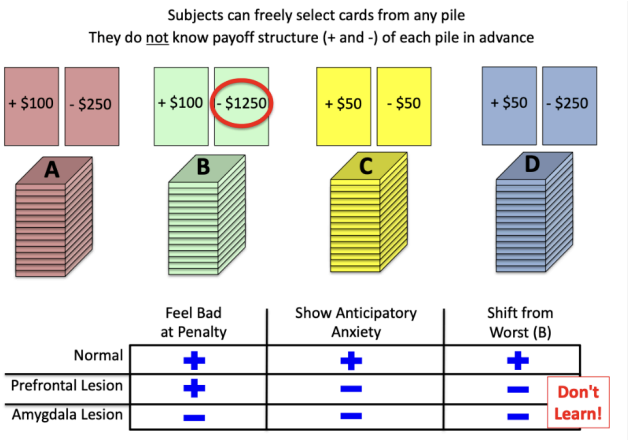
- underside of the rostral temporal lobe

anterior insula

- emotional expression in social contexts
- right hemisphere dominant for function
- connections between amygdala and orbito-frontal cortex
- volitional facial paresis (damage to right motor cortex)
    - cannot produce full smile on command, but does spontaneously smile in a funny social situation
- emotional facial paresis (damage to left anterior insula)
    - can produce full smile on command, but does not spontaneously smile in a funny social situation

prefrontal cortex

- orbito-frontal cortex relevant to social emotional behavior
- phineas gage→ obliterated orbito-frontal cortex
    - changed personality, loss of inhibition/control by social appropriateness
- theory of mind: ability to attribute mental states (knowledge, feelings) to self and other
    - reciprocal connections implicated in autism – poor ToM skills
        - possibly involve premature synaptogenesis within orbito-frontal before connections with amygdala develop
- cost benefit evaluation
    - anterior cingulate, orbito-frontal cortex, amygdala circuit
        - implicated in gambling, risk assessment, self control
        - gambling task



vono economo "spindle" cells

- long fibers with few branches
- found only in large-brained animals (humans, elephants, whales)

- communicate between distant brain areas with little intervening influence
- connect anterior insula (social emotion) to anterior cingulate (social risk, cost/benefit analysis)

neurotransmitter activity in emotion

- serotonin (5HT) in amygdala
    - serotonin reuptake creates metabolic by-product 5-HIAA → disposed of into bloodstream
    - low levels of 5-HIAA in bloodstream symptomatic of impulsivity, depression
        - antidepressants like prozac block 5HT reuptake, freeing available 5HT to restimulate postsynaptic cell
- GABA in amygdala
    - opens Cl- gates to inhibit postsynaptic cell
        - in amygdala this helps suppress startle reflex, reduces anxiety
    - antianxiety drugs like valium are GABA agonists
        - enables GABA to bind more easily and for longer to receptor site, increasing its effectiveness
- CCK in amygdala
    - stimulates postsynaptic cell opening Na+ gates
    - involved in learned enhancement of startle reflex
    - in hypothalamus suppresses hunger when blood sugar rises
        - diet pills are CCK agonists, mimic CCK effects
        - side effects: increase anxiety
    - CCK antagonists (treating ulcers) can block receptor sites without opening gates → calming effects but promote overeating