Orbitofrontal Notes

Frontal lobe prefrontal cortex
1. Dorsolateral
   Last to myelinate
   Sleep deprivation
2. Orbitofrontal
   Like dorsolateral, involved in:
     Executive functions
     Working memory
     Cognitive flexibility
     Planning
   OFC is considered anatomically synonymous with ventromedial cortex
   Named by location: above eye orbits

Characteristics
   Least explored
   Least understood
   Sometimes considered part of limbic system

Vary by person
   Considerable individuality

Research Difficulties
   OFC is close to sinuses (air filled)
   Hard to image (MRI, etc)

Orbitofrontal Functions
   Cognitive processing
   Decision making
   Sensory integration
   Affective value of reinforcers

Controls
   Social adjustment
   Responsibility
   Mood
   Drive

Extensive connections with other brain regions
   Reciprocal connections
   Ventral & dorsal visual streams
   Auditory-spatial processing
     phonetic processing (rostral stream)
     auditory-spatial processing (caudal stream)
   Phonetic processing
   All sense modalities
   Visual Processing
     both ventral & dorsal streams
     integration of spatial and object processing
   Connect with hippocampus, cingulate and thalamus
Connect with amygdala (emotional center)
Compare expected with actual
Compare expected reward/punishment with actual reward/punishment
Intuitive judgments
  Activated during intuitive coherence judgements
Stimulus-outcome associations
  Evaluation of behavior
  Encode new expectations about punishment and social reprisal
Conflict resolution
  Suppressing negative emotions
  Approach-avoidance situations
    game of chicken
Damage
  Inappropriate displays of anger
  Inappropriate responses to anger
  Defensive, present self in "angelic light"
Lesions – might feel no regret
Damage causes problems with
  decision-making
  emotion regulation
  reward expectation
ADHD
  dysfunction of reward circuitry
  controlling motivation
  reward
  impulsivity
Obsessive-Compulsive
  executive functioning
  impulse control
Addictions
  Dopaminergic activation of reward circuits
  Compulsive behavior
  Increased motivation take drug
Visual discrimination test
  DON’T PRESS BUTTON
  OFC damage: gotta press!
Reversal learning
  Presented pictures A and B
  Learn rewarded for picking A
  When rule set, switch
  Damage to OFC, stay with A
Disinhibited behavior
  Excessive swearing
  Hypersexuality
  Drug, alcohol & tobacco use
  Compulsive gambling
Iowa Gambling Task (Bechara & Damásio)
simulation of decision making
4 virtual decks of cards
goal of game is to earn as much money as possible
choose cards by gut reaction
start with $2000 (monopoly $)
don’t know how many cards in deck (it’s virtual)
deck A and B can win $100 reward but large penalty
deck C and D can win $50 reward but small penalty
   Good deck = lose slower
   Good deck = win some
After 10 cards
   healthy show "stress" reaction
      GSR if hover over bad deck
damage to amygdala
   never develop GSR
After 40-50 cards
   healthy stick to the good decks
   OFC damage, stick with bad deck
even though know losing money
Probabilistic Learning
   must pass up potential large immediate rewards for small longer-
   warning cues feel like excitement & pleasure?
Poor social interaction
Faux pas Test
   1st used with autism
   series of vignettes about social occasions
   someone said but should not have said; awkward occurrence
   Asked to:
      Identify what awkward
      Identify why awkward
      Identify how would have felt
      Identify factual control fact
OFC dysfunction
   Understand the story
   Can’t judge social awkward
Acquired brain injury have these symptoms:
   disinhibited behavior
   poor social interaction
   excessive swearing
   hypersexuality
   compulsive gambling
   drug, alcohol & tobacco use
   low empathy
Alzheimer's disease
   Neurofibrer tangles in orbitofrontal area
Endoplasmic reticulum collapse
  Tau protein
  Tangles in cell bodies

Neuro-plaque
  Brain proteins fold abnormally
    Amyloid proteins clump together
    Cause plaque between neurons
    Causes cell loss

Progressive disease
  Symptoms get worse with time

Symptoms
  Inappropriate emotional R
  Decline in intellect
  Confused thinking
  Memory loss
  Repeated questioning
  inappropriate emotional R
  Violence

Procedural memory last longer than declarative
Can acquire new skills but not remember learning them

Age related
  Likelihood increases with age
  Strikes 50% of those over 85

Genetic components
  Person with Down’s syndrome (3 copies of chromosome 21)
    Always acquire Alzheimer’s in middle age
  Early onset: chromosome 1 & 14
  Late onset: chromosome 10 & 19

Environmental component
  50% no relatives with disease

Yoruba people of Nigeria
  high-risk genes
  low incidence
  Maybe due to diet?
    low-calorie, low fat, low salt diet

Treatment to improve memory
  Increase glucose & insulin
  Acetylcholine activator drugs
  Diet rich in antioxidants?
  Block Aβ42 production, inoculate with small amounts of Aβ42

Addiction
  involved in development of addictive behavior
  dopaminergic activation
  reward circuits
  addicts show deficits in orbitofrontal, striatal, and thalamic regions
  cocaine withdrawal shows increased OFC activity, proportional to drug craving