

## 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)
- Compares 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

1<sup>st</sup> 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 A $\beta$ 42 production, inoculate with small amounts of A $\beta$ 42

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

