

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

- 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 A β 42 production, inoculate with small amounts of A β 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

