Diseases of the Brain
(Psychiatric diseases of the brain)

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Why worry about mental illness?

- 26% of American adults with a mental illness each year
- Cost to treat mental illness
  - About 10% of health care costs per year are for mental illness
  - Serious mental illnesses (SMI), cost society $193.2 billion in lost earnings per year
- Suicide
  - About 30,000 of suicides / year in US
  - Twice as many suicides as homicides every year
Why study the brain in mental illness - couldn’t you just make yourself well?

- If you could make yourself well, who would be sick?
- Lots of people don’t respond to the treatments we have
- Lots of illnesses don’t have good treatments
- Lots of things happen in your brain that you aren’t aware of
Big questions

- What the brain does
- Parts of the brain
- When things don’t work right
How do we know what the brain does?

2 main ways: *What do you think?*

1)
2)
How do we know what the brain does?

Its really (really really really) hard to figure out how the brain works.

2 main ways:
1) See what happens with brain damage
2) Use new machines to look through the skull into the brain
How to know what the brain does?

Look for what changes when the brain is damaged
Different jobs for different parts of the brain
Phineas Gage & brain anatomy

- **Before** “shrewd, smart businessman”, “possessed a well-balanced mind
- **After** accident 1848 – didn’t care about other people, couldn’t follow rules & couldn’t make up his mind, drunk, friends said “he was no longer Gage”

from Damasio H et al Science. 1994
“insula… bodily sensations & conscious emotions”

Insula for chest/abdomen sensation - “gut feelings”

Damage to the insula $\Rightarrow$ loss of urge to smoke

Naqvi et al '07 Science
How to know what the brain does?

A different way to know what the brain does - see it working
Stimulation of brain during surgeries told us about simple movements / simple sensations
Structural and functional neuroimaging - “pictures of the brain & brain activity”

- Structural
  - CT
  - MRI

- Functional
  - PET
  - SPECT
  - fMRI
  - MEG

You don’t need to open someone’s skull to do it - people like that
MRI scanner
Some important parts of the brain

- Frontal Lobe – words/plans/actions
- Temporal lobe – put your senses together
- Amygdala and hippocampus
Amygdala & hippocampus in temporal lobe
Amygdala & hippocampus

- **Amygdala**
  - Emotional knowledge and emotional memories

- **Hippocampus**
  - Memory about facts/places
How you know what your senses tell you

Senses start at the back and move forward
Mental picture of what your senses tell you - amygdala & hippocampus help
What happens when some brain parts don’t work right

Amygdala - fear & anxiety
Frontal lobe - depression
Fearful faces or frightening scenes increases amygdala activity
Amygdala has a stronger reaction in anxiety illnesses

Phan et al 2006 BiolPsy
Top of the frontal lobe helps quiet down emotion

This can help decrease anxiety and sadness
Middle of frontal lobe responds to emotion pictures / stories
Depression in the brain

Depressed subjects vs non-depressed controls

Red means more active, blue means less active

A normal function converted to abnormal function

Mayberg et al 2005 Deep brain stimulation for treatment-resistant depression. Neuron
Depression in the brain - treatment

Patients vs Normals

Before treatment vs after treatment

Mayberg et al 2005 Deep brain stimulation for treatment-resistant depression. Neuron
Brain activity changes when depression improves

Mayberg ’03
BrMedBull
So....

Psychiatric diseases are due to changes in the how the brain works.
Depression & anxiety diseases are exaggerated normal functions.
Questions

• 1. Are you in control of your thoughts?

• 2. What diseases do you know about and how do they affect your life?

• 3. What is the importance of treatment in psychiatric disorders?
Behavior and the basal ganglia

What is this yellow thing?
Reward systems

Ventral striatum / accumbens
Lesion in ventral striatum makes sweet “taste” sour

Ventral Pallidum
‘Aversion lesion’
Bullies activate ventral striatum when viewing pain in others

From Jean Decety, PhD
Activation with mutual cooperation

Rilling et al ’02 Neuron Neural Basis for Social Cooperation
Pleasurable music – scrambled music

Menon, Levitin ’05
NeuroImage
Ventromedial frontal cortex & beneficial decision making

“higher VMPFC activity is associated with better decision-making performance”

Northoff et al ’06 Affective Judgment and Beneficial Decision Making Human Brain Mapping
Facial expressions in ventral temporal lobe

Anger  Disgust

Fear  Happy  Swirl

Neutral  Sad

Steve Lewis - 2008