Neurobiology of Emotions
The Main Camps
1. Basic emotions: The categorical approach
2. Biological pieces of emotions: The Componential approach
3. Societies and languages is how emotions are created: The Social Constructivist approach
Basic Emotions

Lists, Lists, Lists...

Ekman: surprise, happiness, anger, fear, disgust, sadness
Plutchik: adds acceptance, anticipation to the above
Johnson-Laird and Oatley: happiness, sadness, anger, disgust, desire
Panksepp: fear, anger, sorrow, anticipatory eagerness, play, sexual
lust, maternal nurture

anger, fear, sorrow, joy

Repeatedly appear on these and many others that are compiled
Ekman - pioneered research using facial expressions in cultures across the world and boiled it down to six universally recognized emotions.
The Componential Approach (Ortony and Turner)

Emotions are not basic. Instead, elementary independent components of visceral-autonomic expressions are innate. We learn how to construct emotions using components in early social development. The components aren’t bound together internally.

Anger

You become aware of being unable to get to a goal: furrow your brow

You want to be aggressive toward the agent that blocks you: form an open, square mouth showing your teeth

To remove the source of goal blockage: Compress lips
Social Constructivism (J. Averill)

Emotions are social constructs - not basic, nor universal

Different societies have untranslatable emotional vocabularies and therefore feelings

Emotions research is flawed:

• So many ways and cultural differences in expressing emotions that studying faces is uninformative and loses sight of the message conveyed and the action that will ensue.

• Lab conditions test emotions using strangers, whereas people express emotions best among those whom they have an ongoing relationship with
Testing Emotions

What IS a convincing test of emotions???

How are emotions, moods and motivations (hunger/thirst/pain) different?

Attempts to create a psychophysical scale
- based on muscular configurations
- based on linguistic lists in order of severity

Words from an “emotional category” prime comprehension of scrambled test words that identify that category
Figure 1. HLM estimates of cross-sectional changes in attack frequency as a function of age and generation in the high-aggressive (NC-900: □) and low-aggressive (NC-100: ○) lines. All subjects assigned for dyadic testing on a given point had no prior history of testing and were from a different litter.
• Rapid and automatic detection of danger
• Arrest of ongoing activity and freezing
• Orientation toward the stimulus
• Assessment of stimulus ---> flight or attack
• Piloerection
• Defecation
• Ultravocalization in rats
• Change in facial expression
• Antinociception- Increases in heart rate and blood pressure; general sympathetic activation
Table 32-1  Comparison of Measures Typically Used to Index Fear in Animals and Those in the DSM-III Used to Index Generalized Anxiety in People*  

<table>
<thead>
<tr>
<th>Measures of Fear in Animal Models</th>
<th>DSM-III Criteria—Generalized Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased heart rate</td>
<td>Heart pounding</td>
</tr>
<tr>
<td>Decreased salivation</td>
<td>Dry mouth</td>
</tr>
<tr>
<td>Stomach ulcers</td>
<td>Upset stomach</td>
</tr>
<tr>
<td>Respiration change</td>
<td>Increased respiration</td>
</tr>
<tr>
<td>Scanning and vigilance</td>
<td>Scanning and vigilance</td>
</tr>
<tr>
<td>Increased startle</td>
<td>Jumpiness, easy startle</td>
</tr>
<tr>
<td>Urination</td>
<td>Frequent urination</td>
</tr>
<tr>
<td>Defecation</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>Grooming</td>
<td>Fidgeting</td>
</tr>
<tr>
<td>Freezing</td>
<td>Apprehensive expectation—something bad is going to happen</td>
</tr>
</tbody>
</table>
Pavlovian Fear Conditioning

Habituation (tone)  Conditioning (tone+shock)  Extinction (tone)

CS: Tone, 30 sec
US: Shock, 0.5 sec
CR: Freezing

(ITI = 4 min)
Before Fear Conditioning

After Fear Conditioning
PTSD is an anxiety disorder that often occurs following a trauma of human design.

<table>
<thead>
<tr>
<th>Trauma</th>
<th>Risk of PTSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serious car crash</td>
<td>2.3%</td>
</tr>
<tr>
<td>Natural disaster</td>
<td>3.8%</td>
</tr>
<tr>
<td>Shot/stabbed</td>
<td>15.4%</td>
</tr>
<tr>
<td>Raped</td>
<td>49.0%</td>
</tr>
<tr>
<td>Tortured/kidnapped</td>
<td>53.8%</td>
</tr>
</tbody>
</table>

(Breslau et al., Archives General Psychiatry, 1998)
A  Extinction is not the same as forgetting

B  Spontaneous recovery

C  Renewal

D  Reinstatement
Lesions of ventral mPFC don’t prevent extinction, but block recall of extinction the following day.
Infralimbic neurons signal recall of extinction

Day 1
- Cond.
- Extinction

Day 2
- Extinction

% Freezing to tone

Trial blocks

Spikes

Habit.+Cond.
Extinction
Extinction

Sec

Sec

Sec
If infralimbic activity signals extinction memory, can infralimbic stimulation “simulate” extinction memory?
Electrical stimulation of IL to mimic tone responses

(Latency: 100-400 ms, Pulse: 0.2 ms, Frequency: 100 Hz, Intensity: 100 uA)
Infralimbic stimulation simulates extinction memory

Decreased blood flow in prefrontal cortex of PTSD patients reminded of trauma

Shin et al., Biological Psychiatry, 2001
Front and lateral view of the cranium, representing the direction in which the iron traversed its cavity; the present appearance of the line of fracture, and also the large anterior fragment of the frontal bone, which was entirely detached, replaced, and partially re-united.

View of the tamping iron, and front view of the cranium, showing their comparative size.

View of the base of the skull from within; the orifice caused by the passage of the iron having been partially closed by the deposit of new bone.