

# Emotions and Aggression

SSAP4006

# Aim of the Lecture

- ▶ To define what is emotion and to discuss how many emotions we experience.
- ▶ To critically discuss the James - Lange theory of emotion
- ▶ To discuss Brain Circuitry in Emotions.
- ▶ To discuss problems in research emotions and more recent research.
- ▶ To discuss aggression and the role of Testosterone and Serotonin.

# Just how many emotions are there?



We will come back to this question later in the lecture.....

# What is Emotion

- ▶ “An increase or decrease in physiological activity that is accompanied by feelings that are characteristic of the emotion and often accompanied by a characteristic behaviour or facial expression” (Garret, 2011).
- ▶ All know what emotions are, but very difficult to define it (LeDoux, 2011).

# At least four different aspects to emotions

- *Feelings*
  - private and subjective.
  - range of states
- *Actions*
  - emotions can be actions, commonly deemed emotional
- *Physiological arousal*
  - states of physiological arousal –displays of distinctive somatic and autonomous responses.
- *Motivation*
  - motivational programmes that coordinate responses to solve specific adaptive problems

# What Exactly are Emotions?

- An emotion involves physiological arousal, expressive behavior and conscious experience
- What psychologists do agree on is that emotions contain both a cognitive and physiological element
- What they do not agree on is, which comes first? When we encounter a situation that scares us, do we become aroused and from this state of arousal deduce that we are scared? Or do we decide mentally that the situation is scary, which then causes our physiology to react?

# Basic Characteristics of Emotions

Pure emotions do not last long and have a short duration. Mood, on the other hand, tends to last longer

Emotional experience can act as a motivation for action. The disgusted diner, for example, sending his uncooked steak back to the chef and putting his coat on to leave the restaurant. Where motivations are internal stimuli, emotions are reactions (responses)

Emotional experience is elicited in part by conscious mental assessments. Such perceptual assessment can lead to very different emotional expressions. So getting an annual bonus might bring joy, which might turn to anger when you learn your co-workers all got bigger bonuses than you. Therefore cognitive appraisal is central to emotional experience

Emotional experience is either positive or negative, pleasant or unpleasant to us

# What are the Functions of Emotions?

1. They are a source of information
2. They prepare us for action
3. They help us communicate with others, e.g. **facial expressions** and attachment (Evolutionary By-Product?)
4. They regulate social behaviour
5. They can create cognitive bias and maintain self-esteem



# Basis of Emotional Experience: Physiology or Cognition?

- ▶ At one extreme, emotions can be seen as biological responses to situations over which we have little control
- ▶ At the other extreme, there are psychologists who define emotions more by the conscious experience rather than by the biological response (Lazarus, 1991)

# James-Lange Theory of emotion

Emotions are the *perception* of bodily changes

James (1842-1910) - the emotions we experience are *caused by* bodily changes

e.g. we experience fear because we perceive particular bodily activity

Lange (1834-1900) - peripheral physiological events regulated by the autonomic nervous system – involved in the perception of emotion

*Different emotions feel different because.....?*

They are generated by a different combination of physiological responses

# James-Lange Theory.

- ▶ “We feel sorry because we cry, angry because we strike, afraid because we tremble”

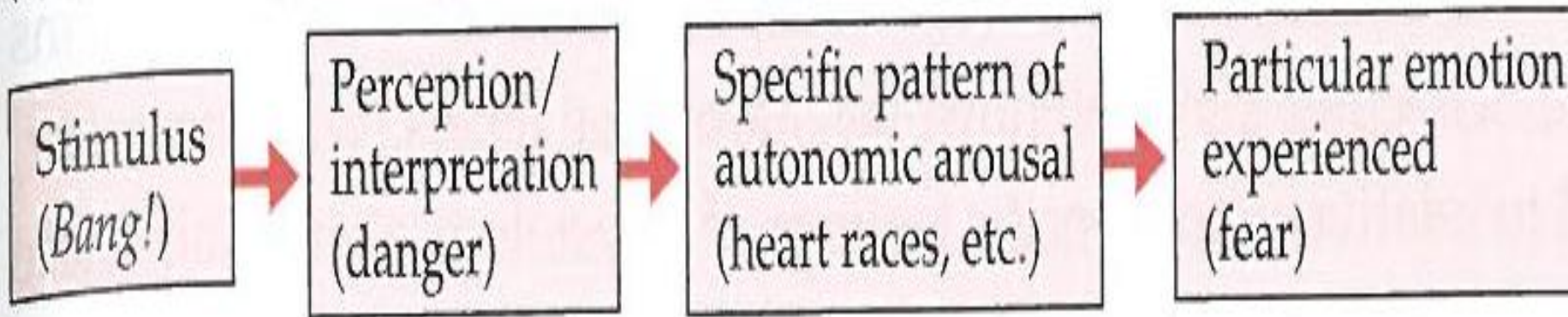
- ▶ William James, 1893.



- ▶ We have experiences, and as a result, our autonomic nervous system creates physiological events such as muscular tension, heart rate increases, perspiration, dryness of the mouth, etc. This theory proposes that emotions happen *as a result* of these.
- ▶ The sequence thus is as follows:
- ▶ Event ==> arousal ==> interpretation ==> emotion
- ▶ The bodily sensation prepares us for action, as in the fight or flight reaction.

# James-Lange Theory

(b) James-Lange theory



# Evidence for the Physiological Basis of Emotion

- ▶ Levenson, Ekman & Friesen (1990) reported distinctive patterns of **autonomic nervous system** (ANS) activity for anger, fear and disgust
- ▶ Rimm-Kaufman & Kagan (1996) have reported that hand and face temperatures were different in a sample of females viewing different film clips
- ▶ **facial feedback hypothesis** of emotion (Davis & Palladino, 2000)

# Facial Feedback Hypothesis

- ▶ The idea here is that facial expressions (facial movement) can influence emotional experience
- ▶ This notion is consistent with the point made earlier that there are physiological differences between the emotions.
- ▶



# Facial Feedback Hypothesis

Strack, Martin, & Stepper (1988)

- Subjects hold pen in one of 3 positions:
  - With lips (resulting in a frown)
  - With teeth
  - With left hand
- These subjects later judge the funniness of cartoons
- Subjects holding pen with teeth judged the cartoons funnier than other two conditions



# Cannon-Bard theory of emotion

Emphasises *central processes*

Experience of emotion begins *before* the autonomic changes

Autonomic changes - very much the same, regardless of type of emotion

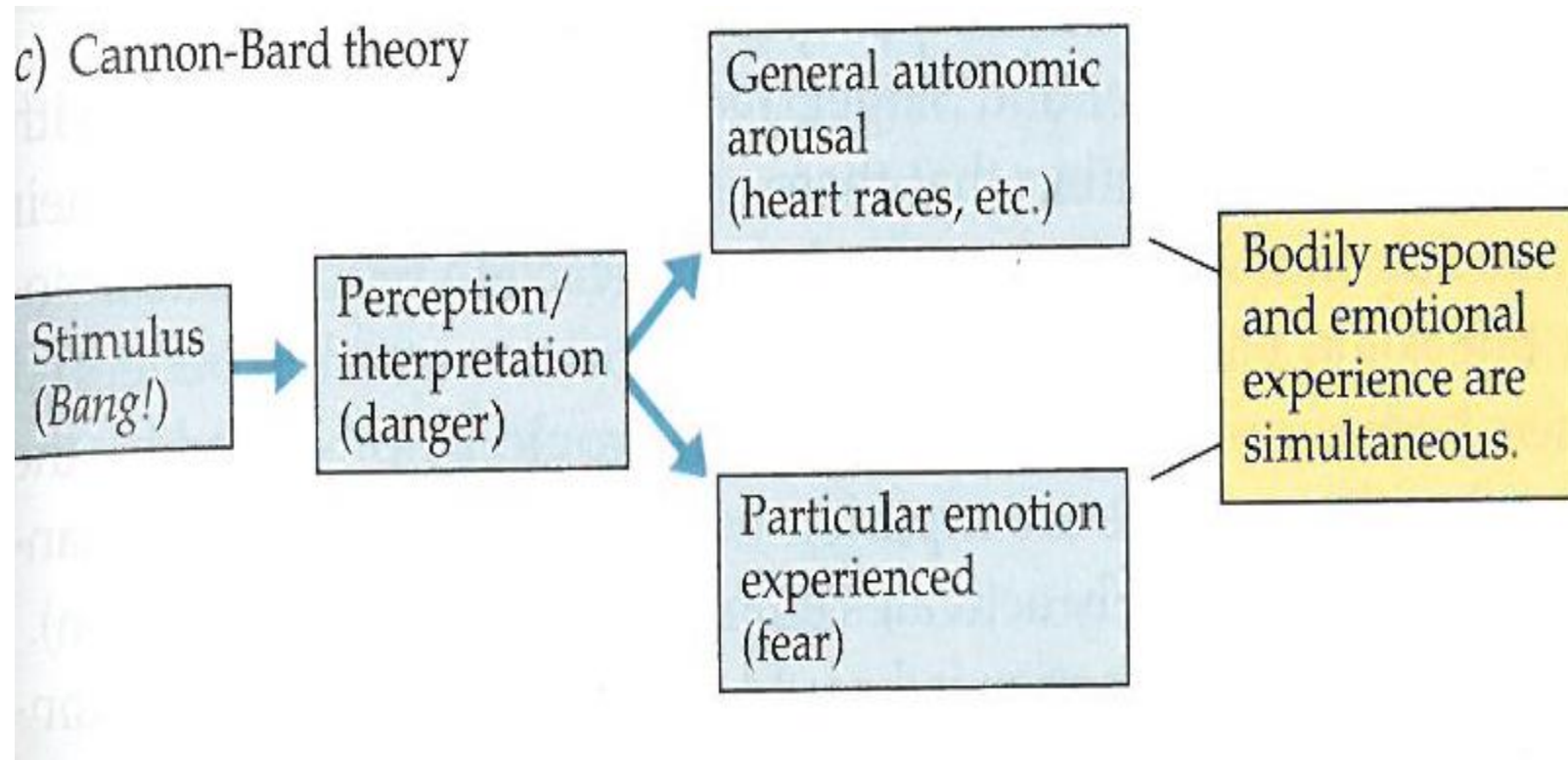
Maximum activation of the sympathetic nervous system - response to a threatening condition (Cannon, 1929)

Brain decides most appropriate emotional response

Cerebral cortex simultaneously:

- decides on appropriate emotional response
- activates the sympathetic system so the body is ready

# Cannon-Bard Theory



# Schachter and Singer (1962)

- ▶ Well known study to empirically research these notions of the Biological Basis of Emotions...
- ▶ Deception Based Study.
- ▶ Told participants that they were too be injected with the a substance called “Suproxin” - designed to give clearer aspects in an eye examination.
- ▶ They were actually injected with Epinephrine (Adrenaline).

# Schachter and Singer (1962)

- ▶ The participants separated into 4 different groups based on the descriptions of the side effects of “Suproxin”.
  - ▶ Epinephrine / Informed - This group of participants were informed that the side effects of “Suproxin” included shaking hands, increased heart rate, shake, flushed in the face (same effects as Epinephrine).
  - ▶ Epinephrine / Misinformed - This group of participants were informed that the side effects of “Suproxin” included numbness of feet, itchiness and headaches (not same effects as Epinephrine).
  - ▶ Epinephrine / Ignorant - As the above two groups, given Epinephrine (told it was Suproxim) but not told of any side effects.
  - ▶ Placebo - This group were actually injected with a placebo (said it was Suproxim) and not told of any side effects (there shouldn't be any side effects).

# Findings - Part 1.



Warning – (e.g. Epinephrine Informed) - little emotional experience

No warning - (Epinephrine Ignorant and Epinephrine Misinformed) emotional reaction

Predicted by James-Lange theory (bodily reactions are experienced as emotions)

Not predicted by Cannon-Bard theory (the cortex separately activates emotion and bodily reactions)

# Part 2

- ▶ But - effect of confederate behaving in angry or happy manner?
- ▶ Those feeling the physiological changes (with no explanation for it) much more likely to report feeling angry when in the presence of an 'angry' confederate - and feeling happy when in the presence of a 'happy' confederate
- ▶ Overall their important study supported their own research hypotheses.
  - ▶ If a person experiences a state of arousal for which they have no immediate explanation, they will label this state and describe their feelings in terms of the cognitions available to them at the time.
  - ▶ If a person experiences a state of arousal for which they have an appropriate explanation (e.g. 'I feel this way because I have just received an injection of adrenaline'), then they will be unlikely to label their feelings in terms of the alternative cognitions available.
  - ▶ If a person is put in a situation, which in the past could have made them feel an emotion, they will react emotionally or experience emotions only if they are in a state of physiological arousal.



# Criticism of Schacter's theory.

- ▶ Is Physiological Arousal non-specific?
- ▶ Levenson et al (1990) - Facial Expressions = Different Autonomic responses.
- ▶ Cacioppo et al (2000) - Positive vs Negative Emotions.
  - ▶ Although subcategories of positive emotions = same physiological responses
  - ▶ Subcategories of negative emotions = same physiological responses

# Autonomic Involvement in Emotion.

- ▶ Sympathetic system activates the body during arousal.
  - ▶ Increase Heart Rate.
  - ▶ Respiration Rate.
  - ▶ Sweat Gland Activity.
  - ▶ Shut down Digestion.
  - ▶ Constricts peripheral blood vessels = Increase in Blood Pressure.
  - ▶ Release of hormones in Stress (Cortisol).

# Autonomic Involvement in Emotion.

- ▶ Parasympathetic system generally reduces activity at the end of arousal.
  - ▶ Decreased heart rate.
  - ▶ No goose bumps.
  - ▶ Eye Pupils constricted.
  - ▶ Respiratory rate decreased.
  - ▶ Although Digestion is stimulated.

# Muscular Involvement in Emotions.

- ▶ Facial Expressions.
  - ▶ Smiling, Fear, Frown etc.
- ▶ Fleeing.
- ▶ Attacking.
- ▶ Bodily Tension.
  - ▶ Tense Muscles, Migraines etc.

# Emotions.

- ▶ Plutchik (1994) - 8 basic emotions groups in four pairs of opposites.
  - ▶ Joy/Sadness
  - ▶ Affection/Disgust
  - ▶ Anger/Fear
  - ▶ Expectation / Surprise.
- ▶ Not all researchers agree with this.

# Keltner and Ekman (2000).

## The Seven Universal Facial Expressions of Emotion



# Do distinct brain circuits mediate emotions?

## 1. Electrical stimulation of the brain

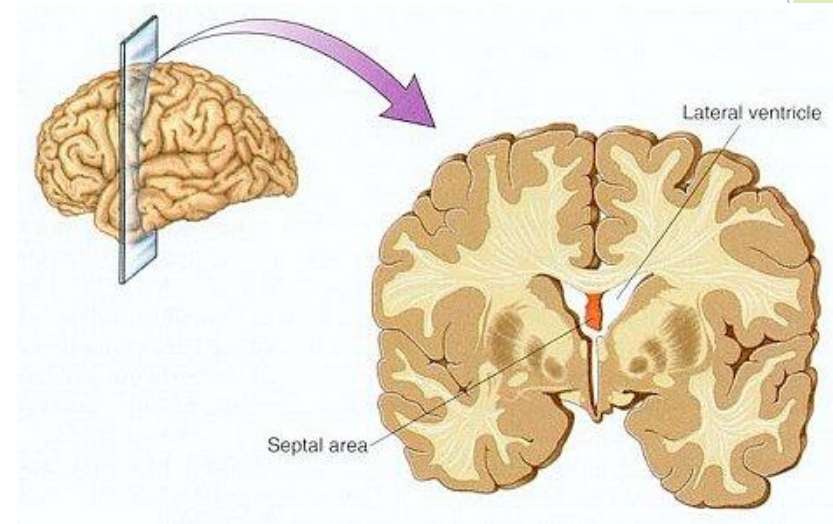
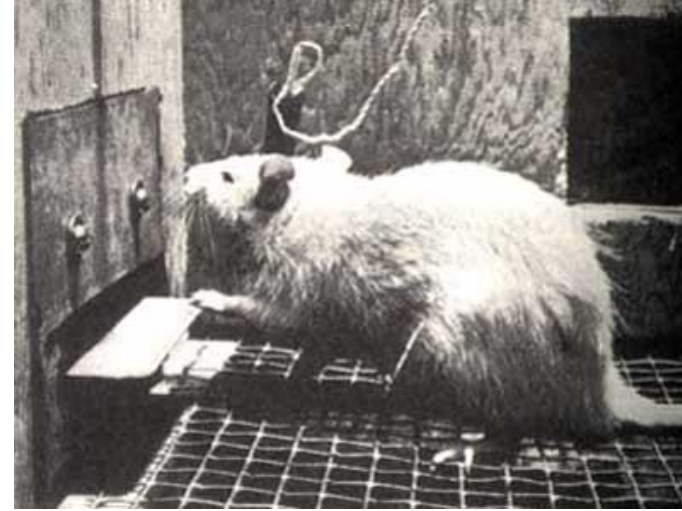
Olds and Milner (1954) rats  
electrical stimulation to  
the septum

Brain self-stimulation

Heath ( 1972)

This region of the brain

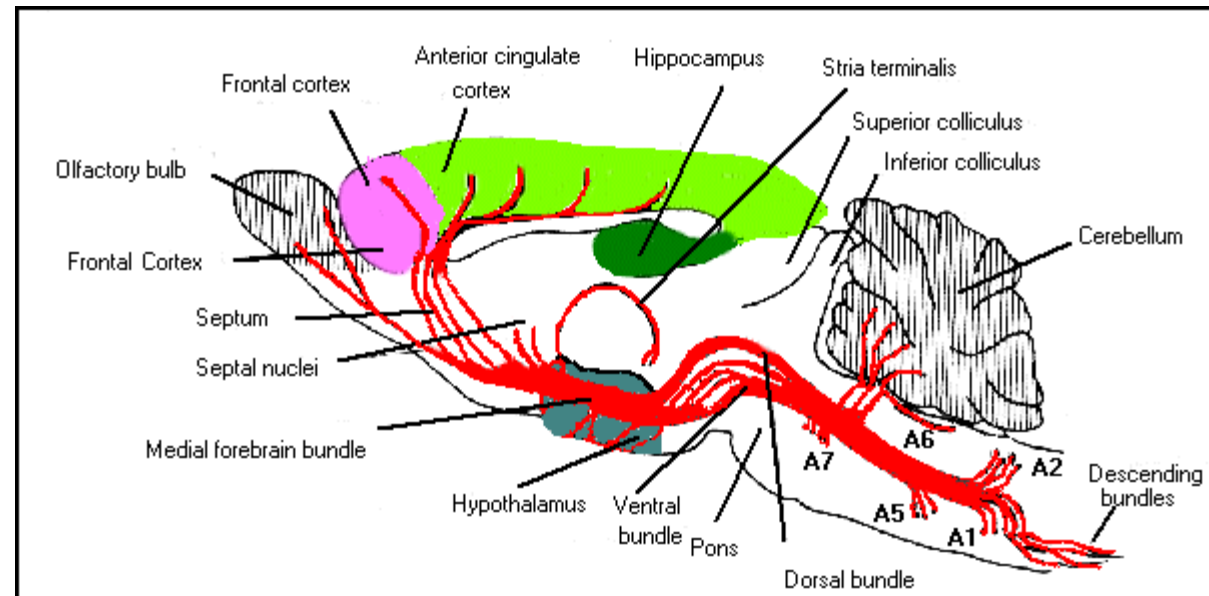
- pleasure or warmth
- or even sexual stimulation



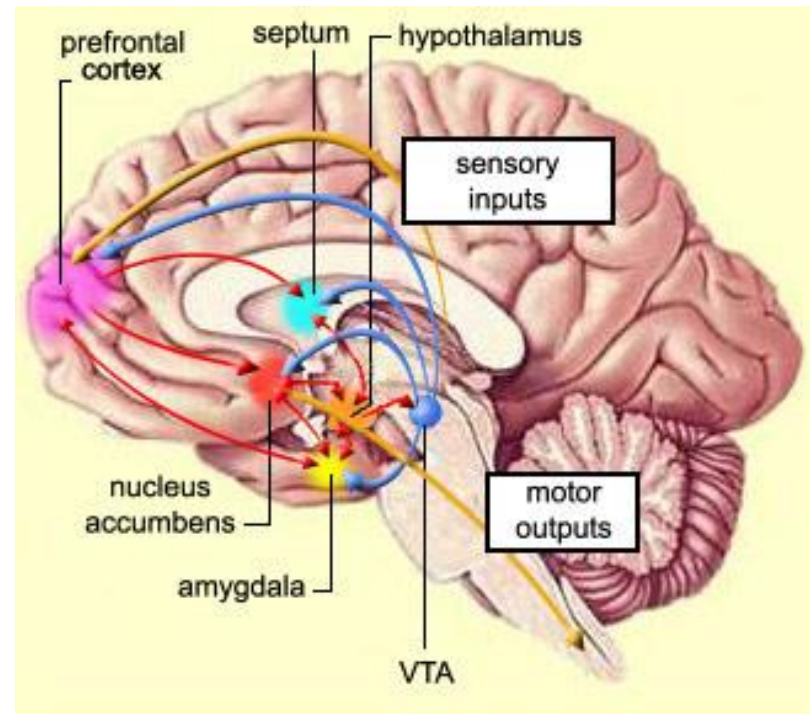
- ▶ However, Olds (1962) completed a detailed mapping study of the reward value of various regions of the brain. Reward value could be determined by the rate at which the rat delivered shocks to its brain. In certain regions of the hypothalamus, for example, the animal would self-stimulate at a rate of 2,000 responses per hour (1958). The mapping study identified the general region of the medial forebrain bundle and lateral hypothalamus as the most reliable regions.

## Subsequent studies

- ▶ positive brain sites are concentrated in the hypothalamus and extend into the brainstem
- ▶ The medial forebrain (large bundle of axons that ascends from midbrain through the hypothalamus) - many sites that yield strong self-stimulation behaviour - and excites an extensive set of forebrain regions



One important target - nucleus accumbens



One theory - electrical stimulation taps into the circuits mediating more customary rewards, (White and Milner, 1992)

Growing theory - drugs of abuse are addictive because they activate these neural circuits (Renaldi and Beninger, 1994)

## 2. Brain lesions affect emotions

### ***Decorticate rage***

Removal of cortex in dogs

- sudden intense rage



Findings suggested - these types of emotional behaviours must be organized at a subcortical level

Cerebral cortex helps to inhibit emotional responsiveness

# Frontal Lobotomy (Removal of the Frontal Lobe).

- ▶ Fulton and Jacobsen (1935).
  - ▶ Becky and Lucy (two chimpanzees).
  - ▶ Becky - Frustrational emotions - Tantrums, rolling on the floor and defecating when performing badly in a task (resulting in no reward).
  - ▶ However, in non-reward based situations, the authors described Becky as pacified, joined a happiness cult.
- ▶ Magoun and Ranson (1937) - on Moodle.
  - ▶ Cats.
  - ▶ Examples of behaviour change - Aversion to other cats (regularly spitting on them)
  - ▶ Emotional / Aggression towards dogs.
  - ▶ Pronounced affection to their observer

## ***Neural circuit of emotion***

(Papez, 1937)

Brain autopsies

Destruction of interconnected pathways in brain would impair emotional processes

The interconnected regions ('Papez circuit') include:

Mammillary bodies of hypothalamus

Anterior thalamus

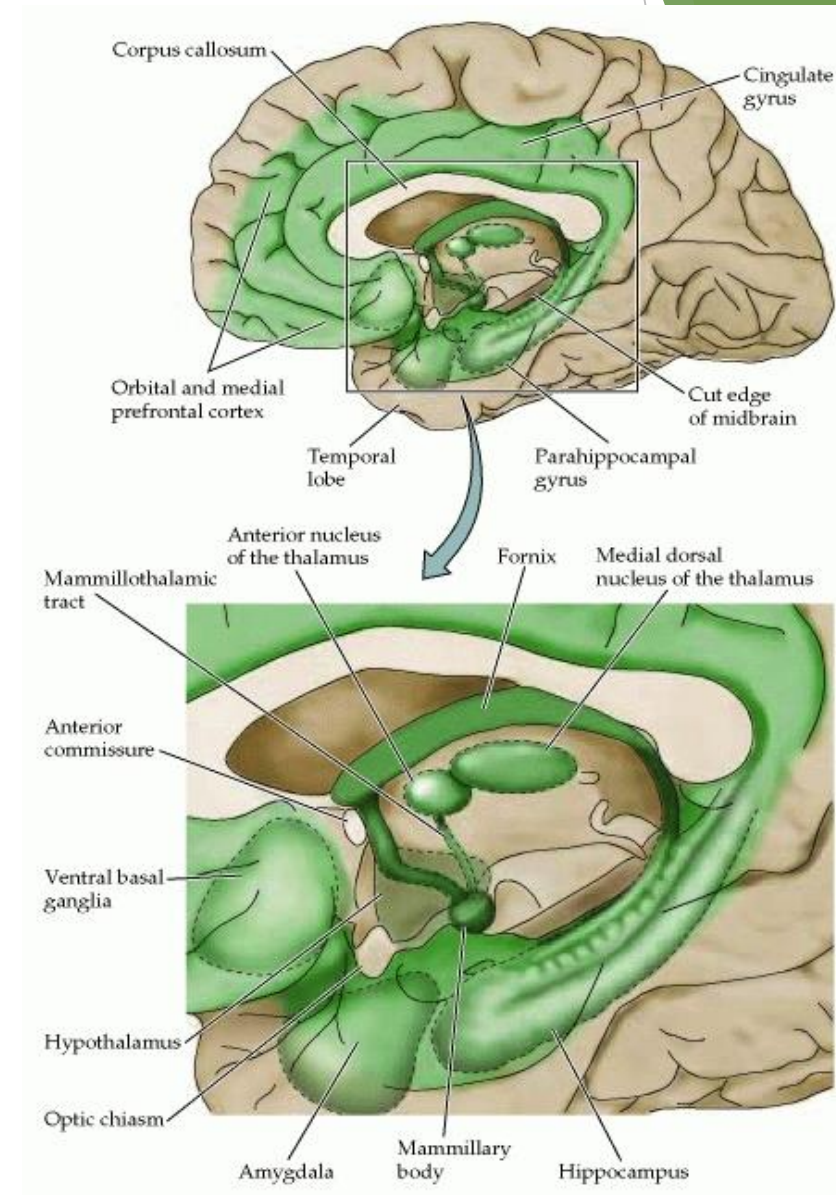
Cingulate cortex

Hippocampus

Fornix

Later MacLean (1949) suggested amygdala and several other regions interact with circuit

- Limbic System.



# The Papez Circuit

- ▶ Papez (1937)
- ▶ The **Papez circuit** of the brain is one of the major pathways of the limbic system and is chiefly involved in the cortical control of emotion.
- ▶ The Papez circuit plays a role in storing memory.

## Papez attempted to build an anatomical model of emotion Hypothalamus, Hippocampus, Cingulate Gyrus, Anterior Thalamus

- ▶ James Papez proposed that there is an ‘emotion system,’ lying on the medial wall of the brain, that links the cortex with the hypothalamus...Papez believed that the experience of emotion was determined by activity in the cingulate cortex and, less directly, other cortical areas. Emotional expression was thought to be governed by the hypothalamus. The cingulate cortex projects to the hippocampus, and the hippocampus projects to the hypothalamus by way of the bundle of axons called the fornix. Hypothalamic effects reach the cortex via a relay in the anterior thalamic nuclei.

## ***Klüver-Bucy syndrome (1938)***

Removal of large portions of the temporal lobes of monkeys – dramatic behaviour change

- Showed neither fear nor aggression after surgery
- Ate more
- Frequent mounting behaviour – hypersexuality

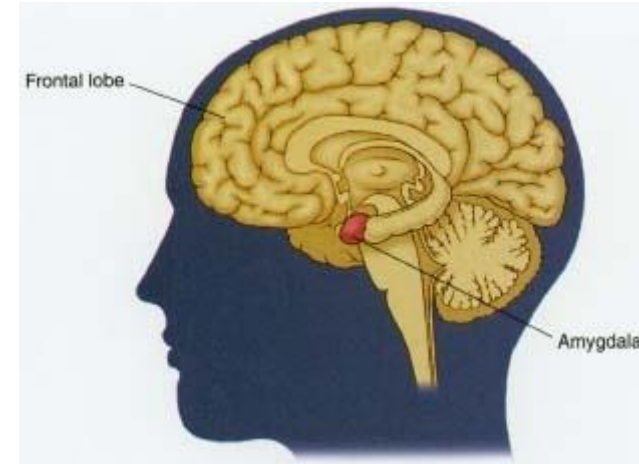
Results not from lesions in cerebral cortex only

Deeper regions of the temporal lobe implicated - including parts of limbic system

Further research - brain lesions in amygdala - decreased anxiety in monkeys

Found that fear is mediated by circuitry that includes the amygdala

The amygdala is located at the anterior medial portion of each temporal lobe



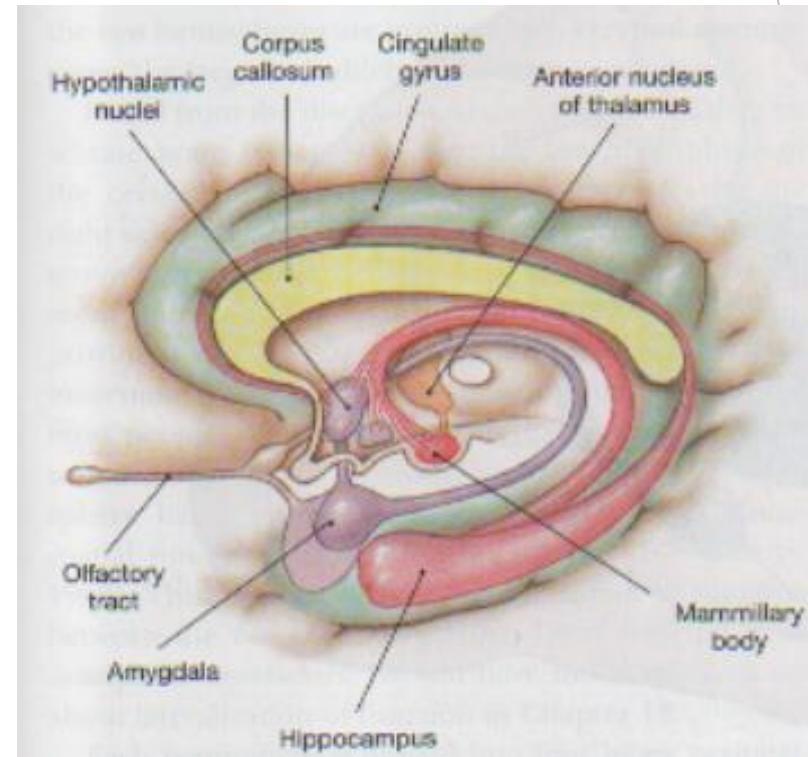
Composed of about a dozen different nuclei - each with a distinctive set of connections

In Kluver Bucy syndrome the entire amygdala was lesioned  
- but same effect - lesions in central nucleus of the amygdala

- ▶ but what about the Amygdala?
- ▶ McLean (1949)
  - ▶ Expanded Papez's theory to incorporate the Amygdala.
  - ▶ Papez-McLean Circuit OR
  - ▶ THE LIMBIC SYSTEM

# The Limbic System

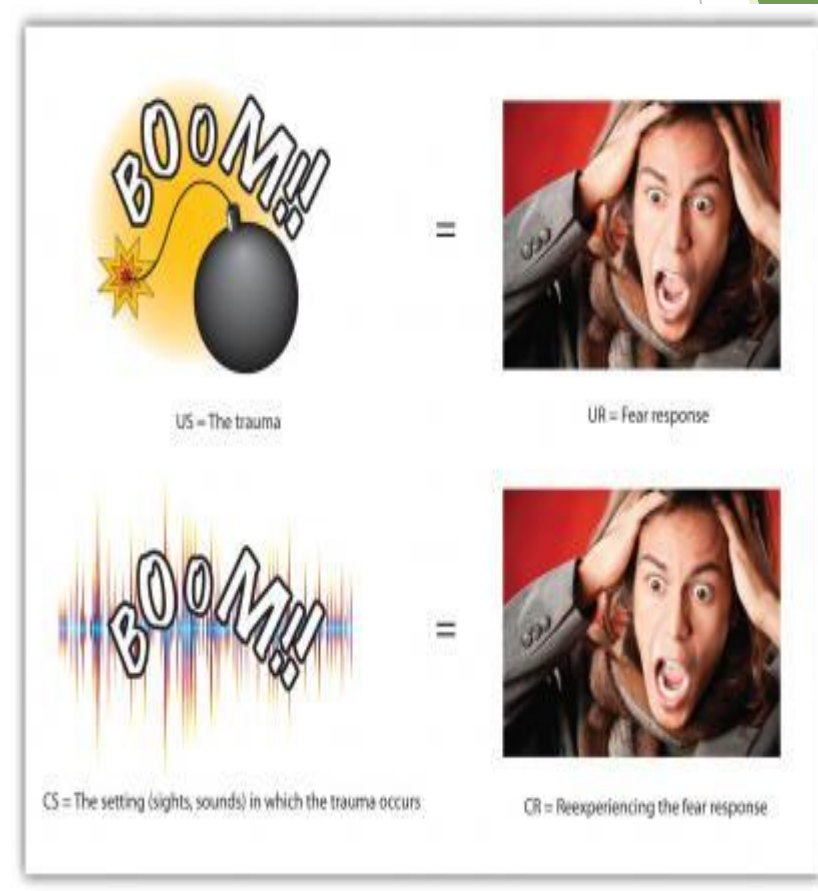
Limbic system is a functional collection of structures that regulate higher activities such as memory and emotion.



- The amygdala does seem to be closely associated with the feeling of **fear**, but removal of the amygdala seems to disinhibit feelings of **lust** and **curiosity**.

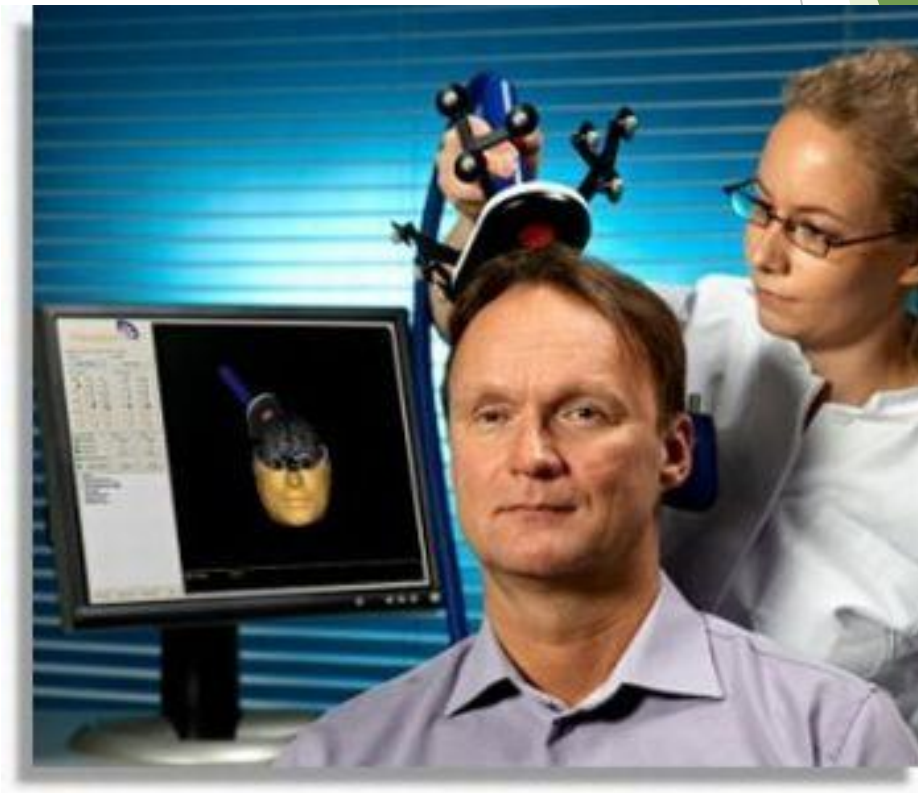
# Studies into Fear Response.

- ▶ Fear = Emotion that is relatively easy to research (LeDoux, 1995).
  - ▶ Classical Conditioning.
- ▶ Learned fears are notoriously slow to extinguish.
- ▶ Temporal Lobe seizure (including Amygdala) in Humans (Engel, 1992).
  - ▶ Intense fear as a warning before a seizure.



# Studies into Fear Response.

- ▶ Stimulation of temporal lobe can elicit fear in some patients.
- ▶ Pet Scans - blood flow to Amygdala increases.
- ▶ Facial expressions and damaged Amygdala.



Neural circuitry has been implicated regarding other emotions

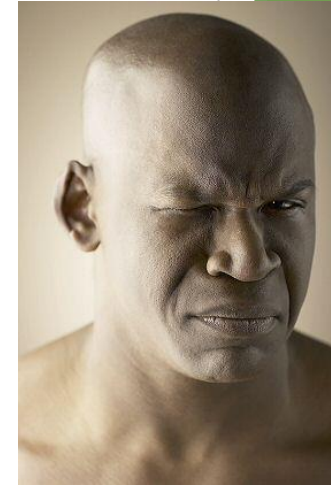
## ***Disgust***

*Functional Magnetic Resonance Imaging*)

Man with damage in insula and putamen

- poor at recognising disgust in other people
- could still recognize other emotions

*(Calder et al, 2000)*



## ***Mirth leading to laughter***

Stroke damage to right frontal lobe

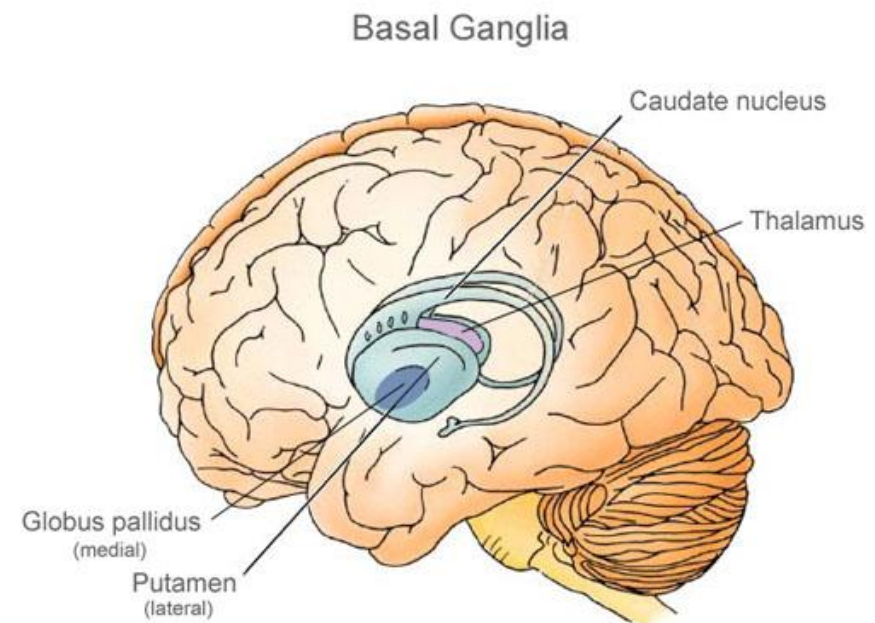
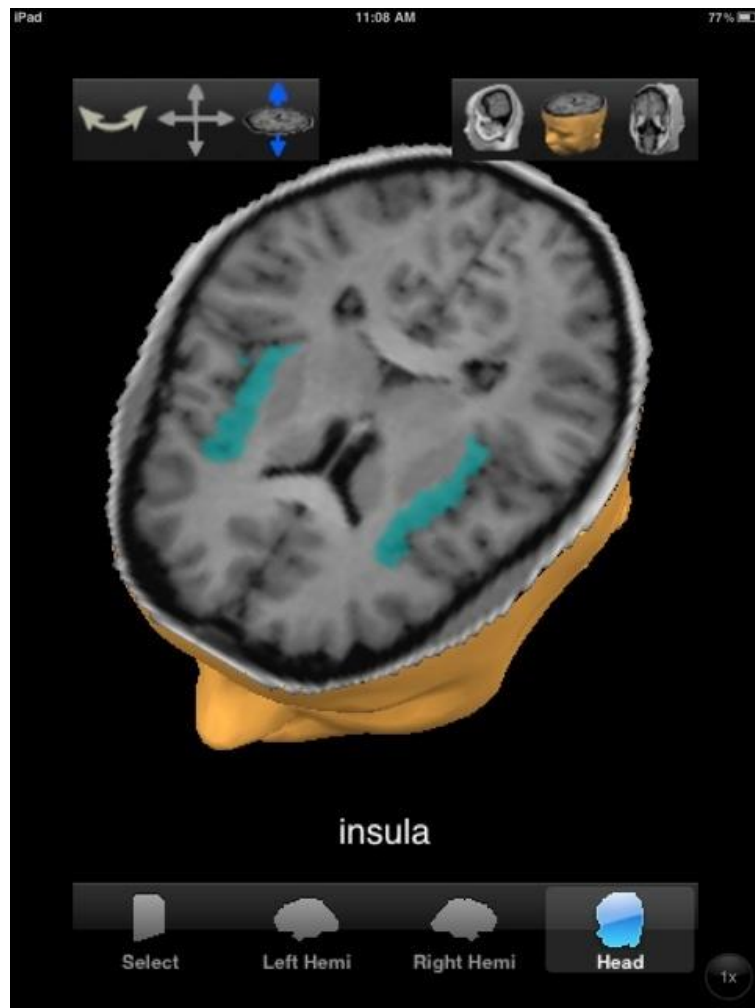
- stop finding anything funny

*(Shammi and Stuss, 1999)*



Prefrontal cortex of both hemispheres suggested to be active in humour  
*(Goel and Dolan, 2001)*

## ► Insula



# Emotional Syndromes.

- ▶ Starkstein and Robinson (1994).
- ▶ Left Hemisphere strokes = highest frequency of depression.
- ▶ Not related to Language deficits.
- ▶ Right Hemisphere Strokes = relatively the same emotionally.

# Depicting Emotions.

- ▶ Split Brain Patient (Stone et al, 1996).
  - ▶ Right Hemisphere better than Left at recognising facial expressions.
- ▶ Babies with Cataracts (Grand et al, 2003).
  - ▶ Left eye (Right Hemisphere) - impaired at recognising facial expressions (even years after removal).
  - ▶ Right eye (Left Hemisphere) - significantly better.

# Cerebral hemispheres process emotion differently

*Right hemisphere* - specialised to discern other people's emotions

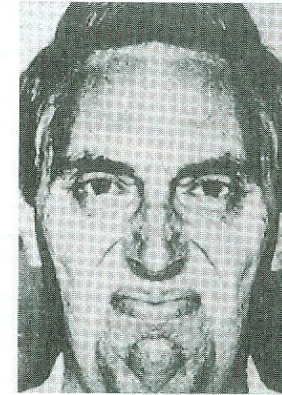
*Left side of face* - more expressive than right (Fridlund, 1988)

Borod et al (1997)  
meta analysis of 49 studies

Right cerebral hemisphere is dominant for the facial expression of emotion

Regardless of:  
posed or spontaneous expressions  
pleasant and unpleasant emotions

Applies to both sexes and all ages



(a) Left sides



(b) Original



(c) Right sides

# Different emotions - different regions of the brain

Which brain regions become more or less activated during emotional experience?  
(e.g. Canli et al, 2001; Damasio et al, 2000; Lane et al, 1999)

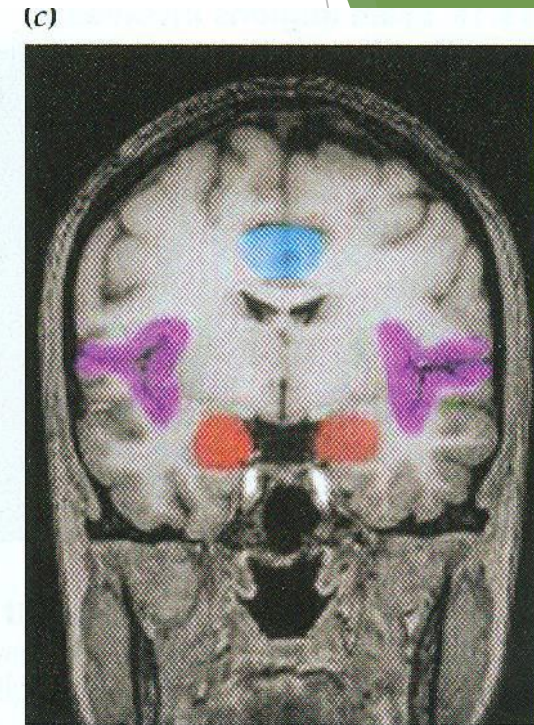
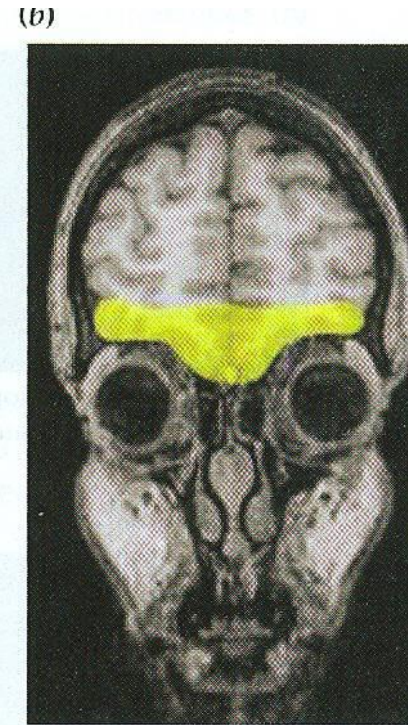
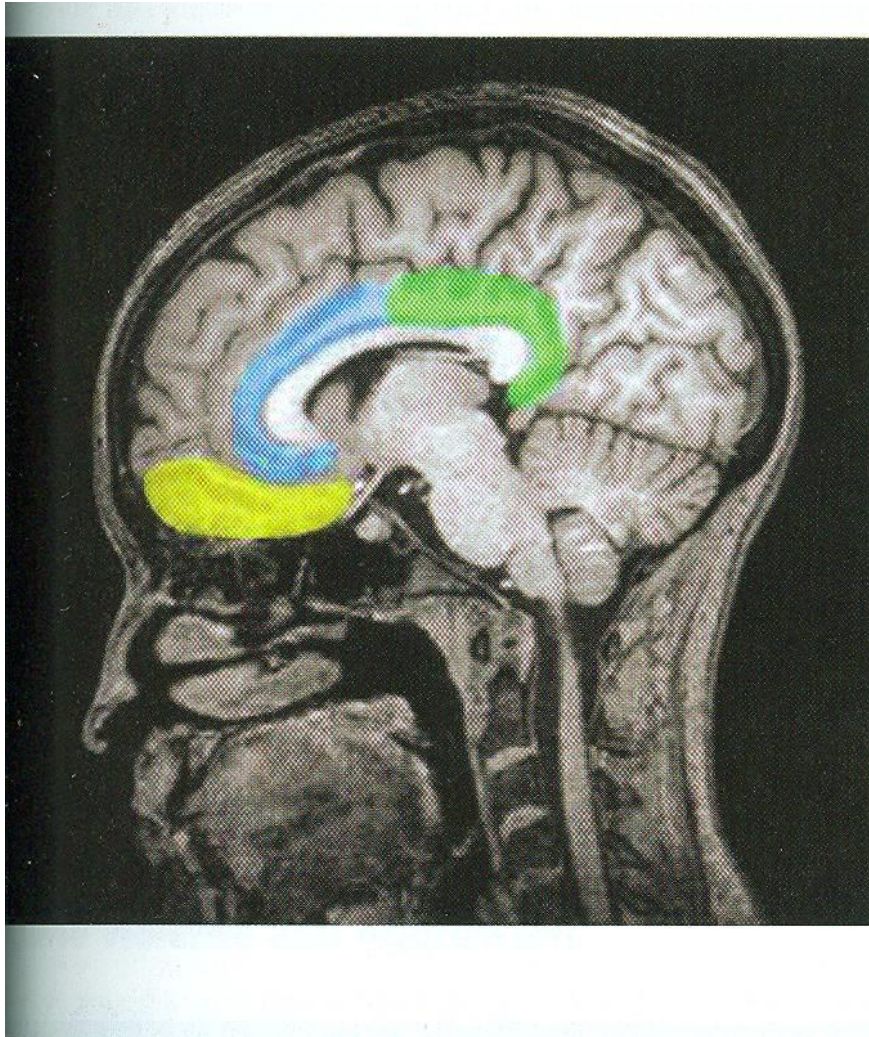
e.g. Love (Bartels and Zeki, 2000).

Increased bilateral activity in

- *insula* and *anterior cingulate cortex*
- *caudate* and *putamen* (sub-cortex)

Decreased activity in the *posterior cingulate* and the *amygdala*  
And in the *right prefrontal cortex*

A unique network of brain areas being responsible for the emotion of love



**15.14 Brain Regions Implicated in Emotions** The orbitofrontal portion of the prefrontal cortex (yellow), the anterior cingulate cortex (blue), the posterior cingulate cortex (green), the insula (purple), and the amygdala (red) have all been implicated in the experience of emotion. They are depicted here in (a) midsagittal, (b) anterior coronal, and (c) posterior coronal sections. (From Dolan, 2002.)

# More Recently.

- ▶ Cerebellum involved in a variety of Cognitive Processes.
  - ▶ Making Plans
  - ▶ Experiencing Emotion.
- ▶ Empathy (Singer et al, 2004).
  - ▶ Loved ones receiving pain stimulus.

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.

# Researching the Biological Basis of Emotions

# Evaluation of the Biological Basis of Emotion

- ▶ For example feeling nervous often feels similar to excitement
- ▶ One major criticism - we are not very good at detecting our levels of physiological arousal
- ▶ Cognition should play a major role in emotions too, as we appraise situations

# Measurement of Emotions

- ▶ Physiological events such as heart rate, breathing, electro-dermal activity and muscle tension, have all been used as physiological indicators of emotional arousal. Many of these are measured by a **polygraph**
- ▶ The problem here is that we cannot deduce easily *what* the emotion is being experienced from the physiological arousal input. All we can do is look at the levels of general arousal



- ▶ **self-report questionnaires** are a more specific way to measure the nature of the emotional experience
- ▶ Examples of questionnaires:
  - ▶ Positive and Negative Affect Schedule (PANAS)
- ▶ Problem - how do we know people are:
  1. Aware what they are feeling accurately
  2. Being honest with their answers!

# Reporting Emotions

## 2 Potential Problems

1. Our Language is poorly endowed with emotional terms - “love”, “anger”.
2. People are notorious at presenting themselves in a favourable light (L- Scale on EPQ).

# Neuroimaging

- So is neuroimaging the future when it comes to emotional research?



Damasio et al (2000) - brain activation  
during four different kinds of emotion

Insula, prefrontal cortex and cingulated  
cortex implicated

*Sadness, happiness, anger or fear* – also  
emotionally *neutral* episode

Measures of skin conductance and heart  
rate

Subjects rated intensity on a scale of 0 –  
4

Participant would signal as soon as  
he/she experienced the emotion



## Findings

In each case physiological responses preceded signal

Support for the James-Lange theory - some physiological responses precede the feeling of emotion

Also –significantly different patterns of brain activity accompanied the different emotions

And they show that there is no ‘happy brain region’ or ‘sad brain region’

- Cingulate Cortex activated in sadness, happiness and anger.

# Aggression

SSAP4006

# Aggression

- ▶ What is aggression?
- ▶ Does the picture represent an aggressive act?
- ▶ Males 5 times more likely to be arrested for Murder in the US.



# Androgens and Aggression.

- ▶ Aggressive behaviour is adaptive for gaining food and mates.
- ▶ Aggression markedly increases at sexual maturity (McKinney and Desjardins).
- ▶ Breeding seasons.

# Studies in Humans.

- ▶ Military veterans - testosterone related to antisocial behaviour (Dabbs and Morris, 1990).
- ▶ Satisfaction with family functioning and non-aggressive functioning - low levels of testosterone (Juliand and McKerny, 1979).
- ▶ Female convicts - testosterone linked to unprovoked violence (Dabbs and Hargove, 1997).

# But wait.....

- ▶ EXPERIENCE can alter hormone levels.....
- ▶ Alpha male contests (Bernstein and Gordon, 1974).
- ▶ Maybe a RESULT rather than a course of behaviour.
- ▶ Chess matches (Bernhardt, 1997).

# Another confounding variable.

- ▶ Dominance.
- ▶ Chess players and aggression, really??
- ▶ Castration Studies.
  - ▶ Is it against assaults or is it a lack of sexual drive.



# Serotonin and Aggression.

- ▶ Higley et al (1992).
  - ▶ 28 monkeys (not in captivity).
  - ▶ Rated aggressiveness based on observations and wounds.
  - ▶ Most aggressive had lowest levels of serotonin.
- 
- ▶ Mice
    - ▶ Minus serotonin receptor genes - less aggressive (Bouwknicht et al, 2001).

# Serotonin and Alcohol

- ▶ More recent studies have highlighted how Alcohol can cause an initial increase in Serotonin levels.
- ▶ However excessive drinking causes Alcohol to interfere with tryptophan the Amino Acid needed to produce Serotonin

# The Depressed Drunk

- ▶ A common symptom for some people at the end of a night of binge drinking.
- ▶ Suicide rates and drinking habits.
- ▶ Does everyone experience this?



# In humans.

- ▶ Diminished Serotonin activity is seen in humans who become violent with Alcohol (Virkkunen and Linnoila, 1993).
- ▶ US marines expelled for violence (Brown et al, 1979).
- ▶ Children who torture animals (Kruesi, 1979).



- ▶ Mark and Ervin (1970).
  - ▶ Temporal lobe seizure.
  - ▶ Habitually aggressive criminals have abnormal EEG's.
  - ▶ Dyscontrol Syndrome.
- ▶ Devinsky and Bear (1984).
  - ▶ Limbic system seizures.
  - ▶ Aggression after.
  - ▶ No sociological factors linked to aggression.

# Psychopaths.

- ▶ Pet Studies (Raine et al, 1998).
  - ▶ Reduced activity of prefrontal cortex (reasoned judgment).
  - ▶ May impair the ability to resist impulses.
- ▶ Follow up study (Raine et al, 2000).
  - ▶ Physically smaller prefrontal cortex

# Discussion point.

- ▶ How much do you think Aggression and Violence is due to Biological implications?
- ▶ How much of role to social implications play.
- ▶ Could an serotonin enhancement programme play an important role in an intervention? (Hollander, 1999).