Do other animal species have human-like emotions?

Professor Keith Kendrick

Babraham Institute

Do other animal species have human-like emotions?





Human and animal emotions: are they the same ?

'To understand, as far as is possible, the source or origin of the various expressions which may be hourly seen on the faces of the men around us, not to mention our domesticated animals, ought to possess much interest for us.'


4


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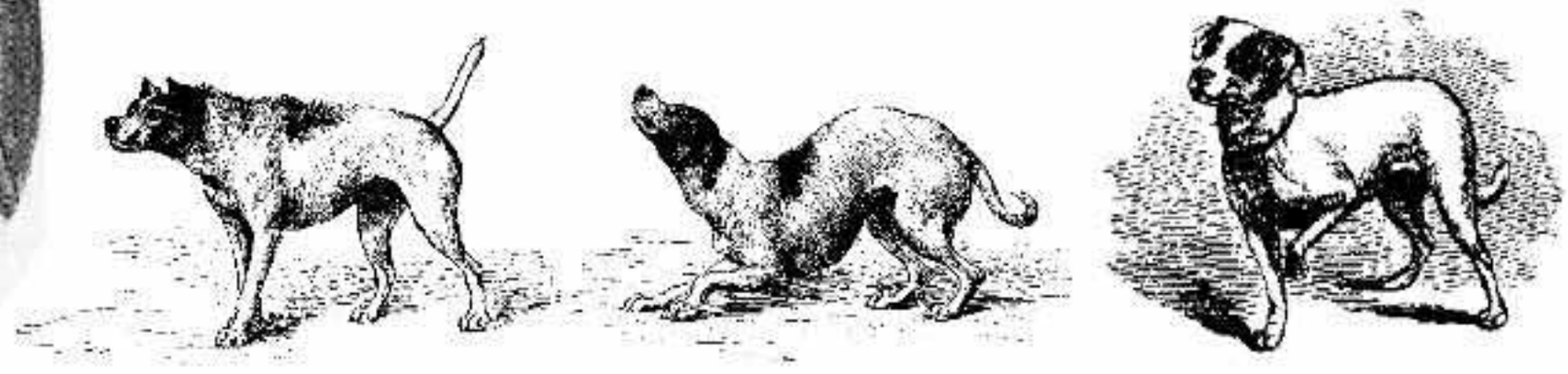
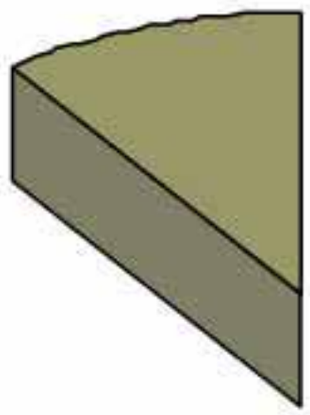


Charles Darwin 'The Expression of the Emotions in Man and Animals'

Communication

For both humans and other animals the majority of what we communicate is our emotional state



10% spoken words

Communication

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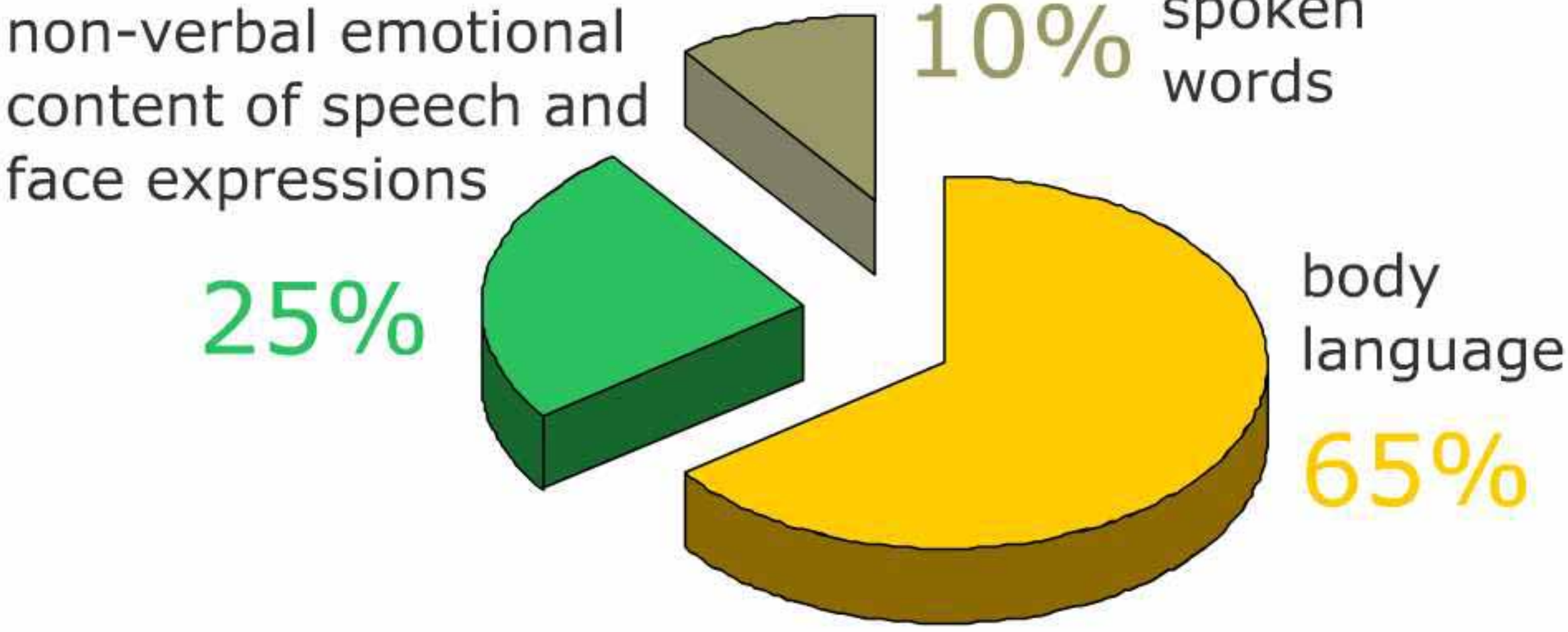
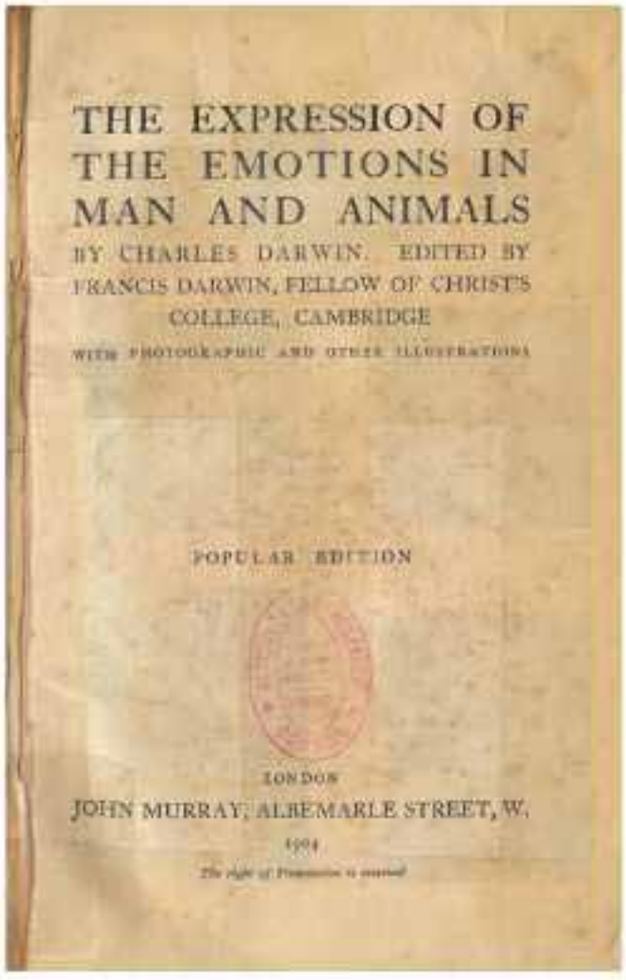


90% of communication is about how we are feeling now!

Evolution, Anecdote and Experience say "yes"

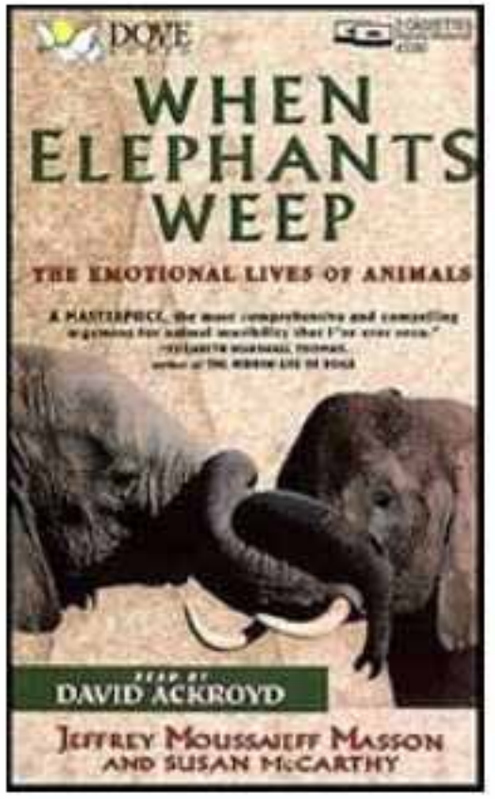
Charles Darwin
'.....the philosophy of our subject has well deserved the attention which it has already received from several excellent observers, and that it deserves still further attention, especially from any able physiologist.'
'The Expression of the Emotions in Man and Animals'


THE EXPRESSION OF THE EMOTIONS IN MAN AND ANIMALS
BY CHARLES DARWIN. EDITED BY FRANCIS DARWIN, FELLOW OF CHRIST'S COLLEGE, CAMBRIDGE
WITH PHOTOGRAPHIC AND OTHER ILLUSTRATIONS
POPULAR EDITION
LONDON
JOHN MURRAY, ALBEMARLE STREET, W.
1904

Evolution, Anecdote and Experience say "yes"

Jeffrey Masson and Susan McCarthy

'When Elephants Weep' (1994)



Evolution, Anecdote and Experience say "yes"

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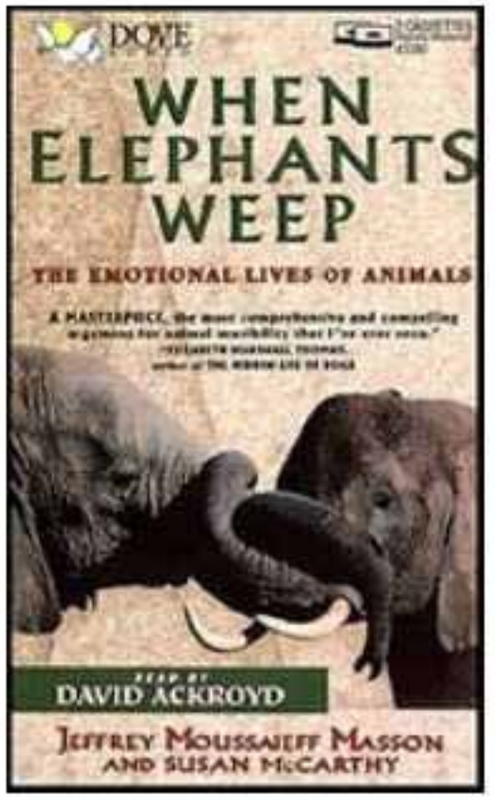
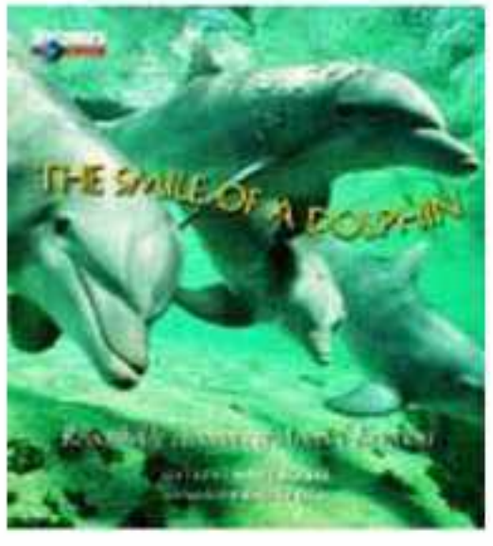
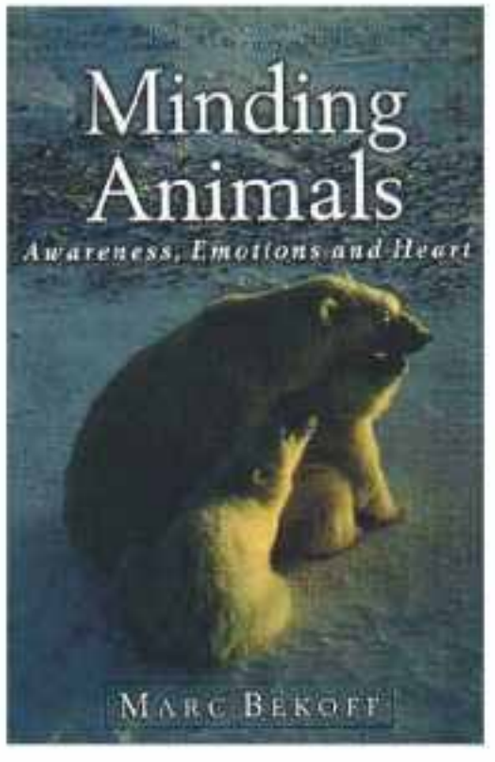


Marc Bekoff
'The Smile of a Dolphin:
Remarkable Accounts of Animal Emotions'
(2000)

'Minding Animals:
Awareness, Emotions and Heart'
(2002)





Beware of anthropomorphic delusions

Descartes

Beware of anthropomorphic delusions

Emotional responses can be entirely automatic and unconscious

The experience of feelings implies consciousness and animals may have only limited capacity for this

Defining emotions

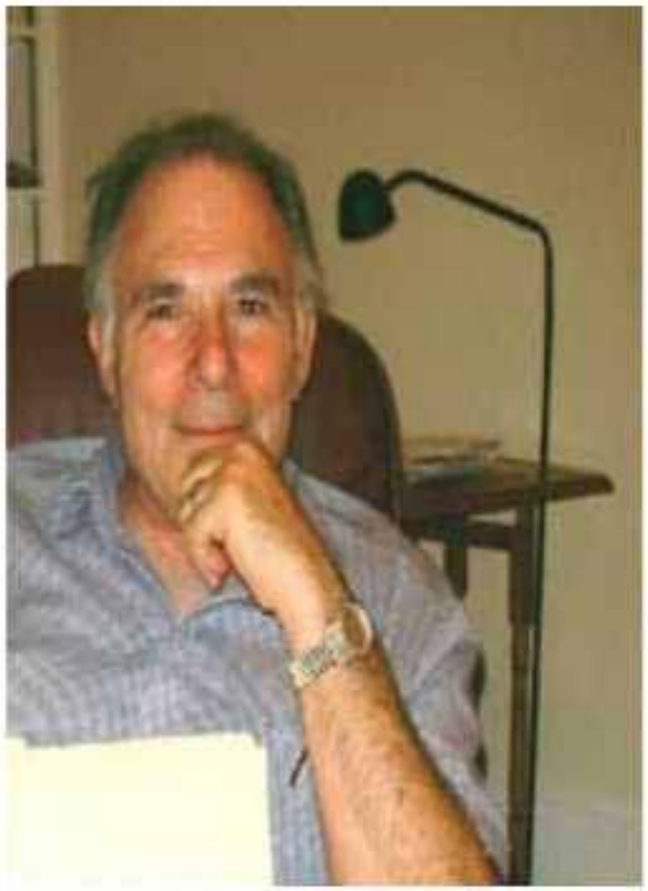
'A moving of the mind or soul; excitement of the feelings, whether pleasing or painful; disturbance or agitation of mind caused by a specific exciting cause and manifested by some sensible effect on the body'
Webster's Revised Unabridged Dictionary (1913)

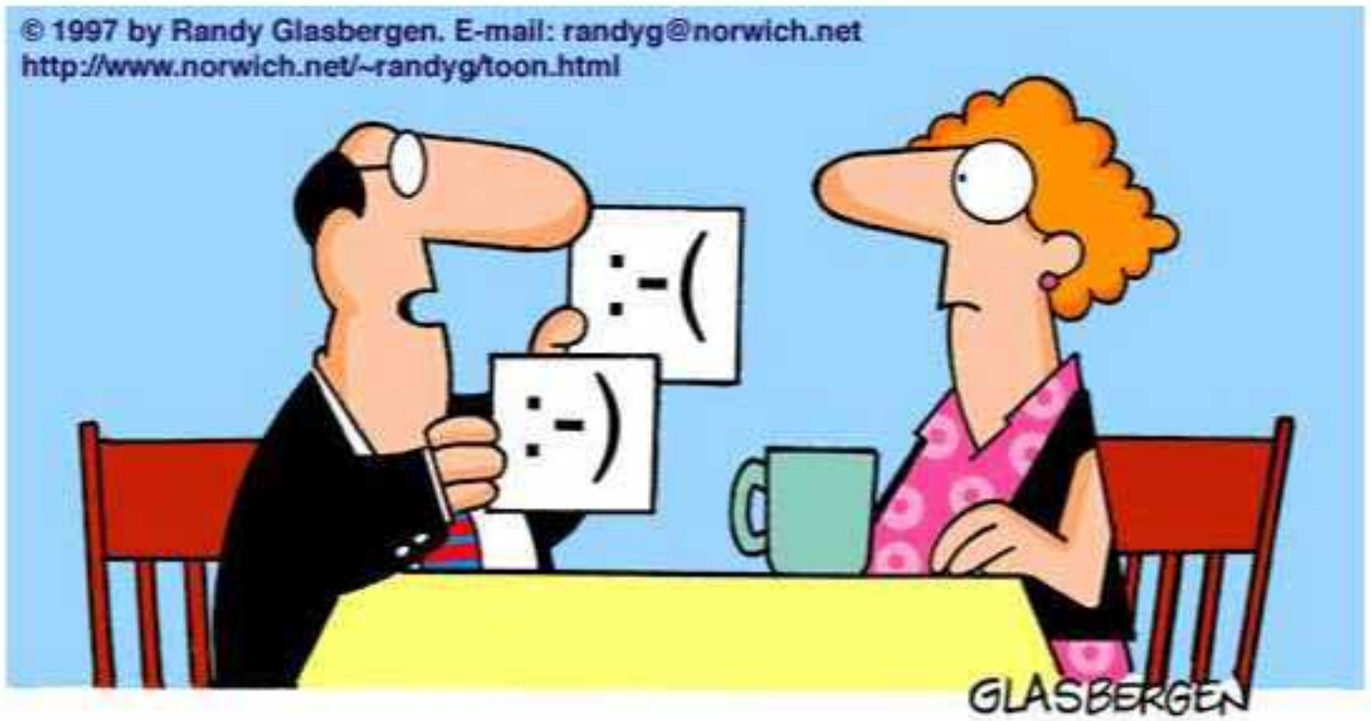
In humans over 100 different emotional states have been claimed

Defining emotions

Primary emotions:

Paul Ekman



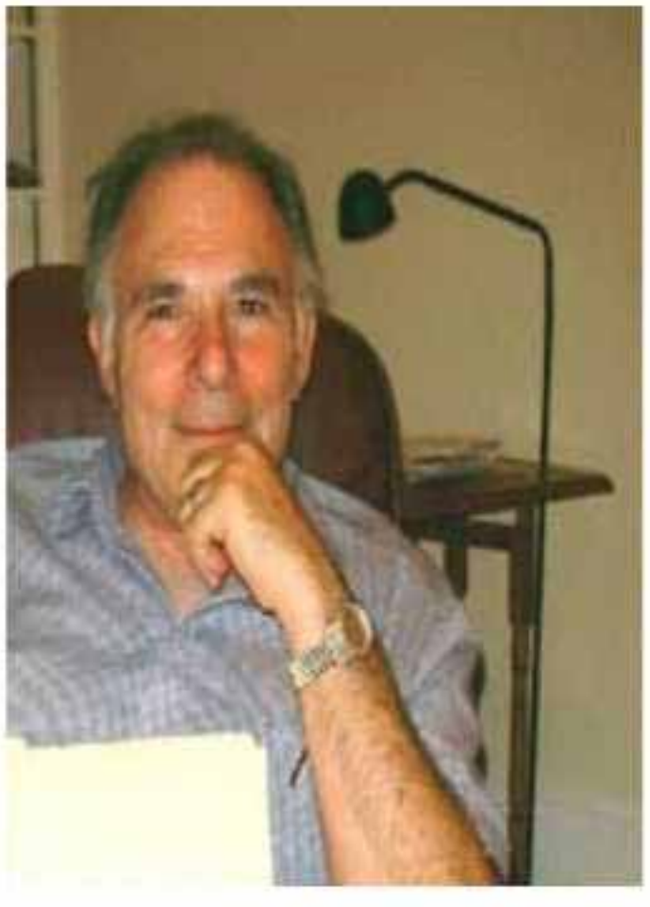


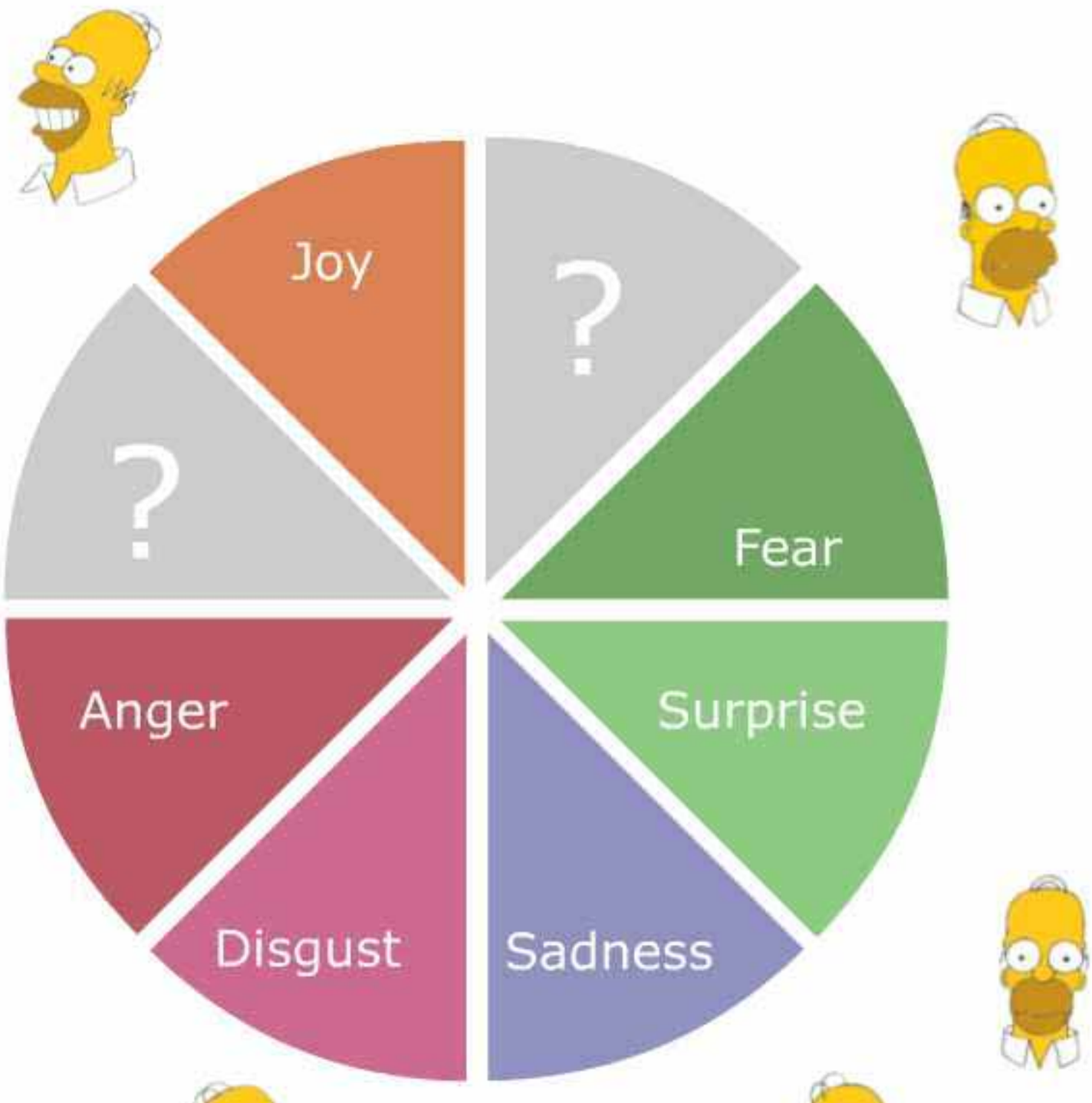
"You always complain that I don't know how to show my emotions, so I made these signs."

Defining emotions

Primary emotions:

Paul Ekman





Defining emotions

Primary emotions:

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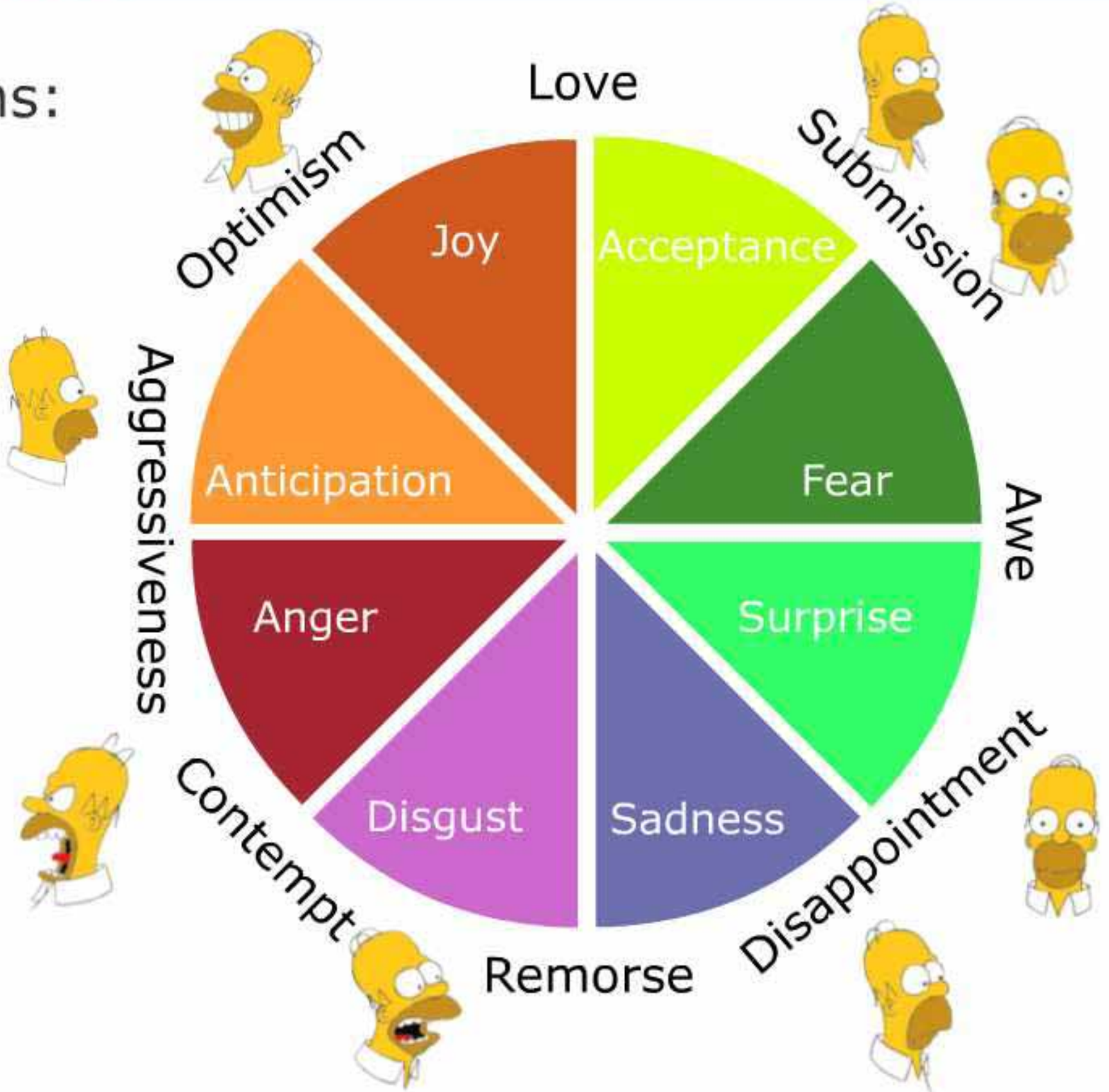
Robert Plutchik



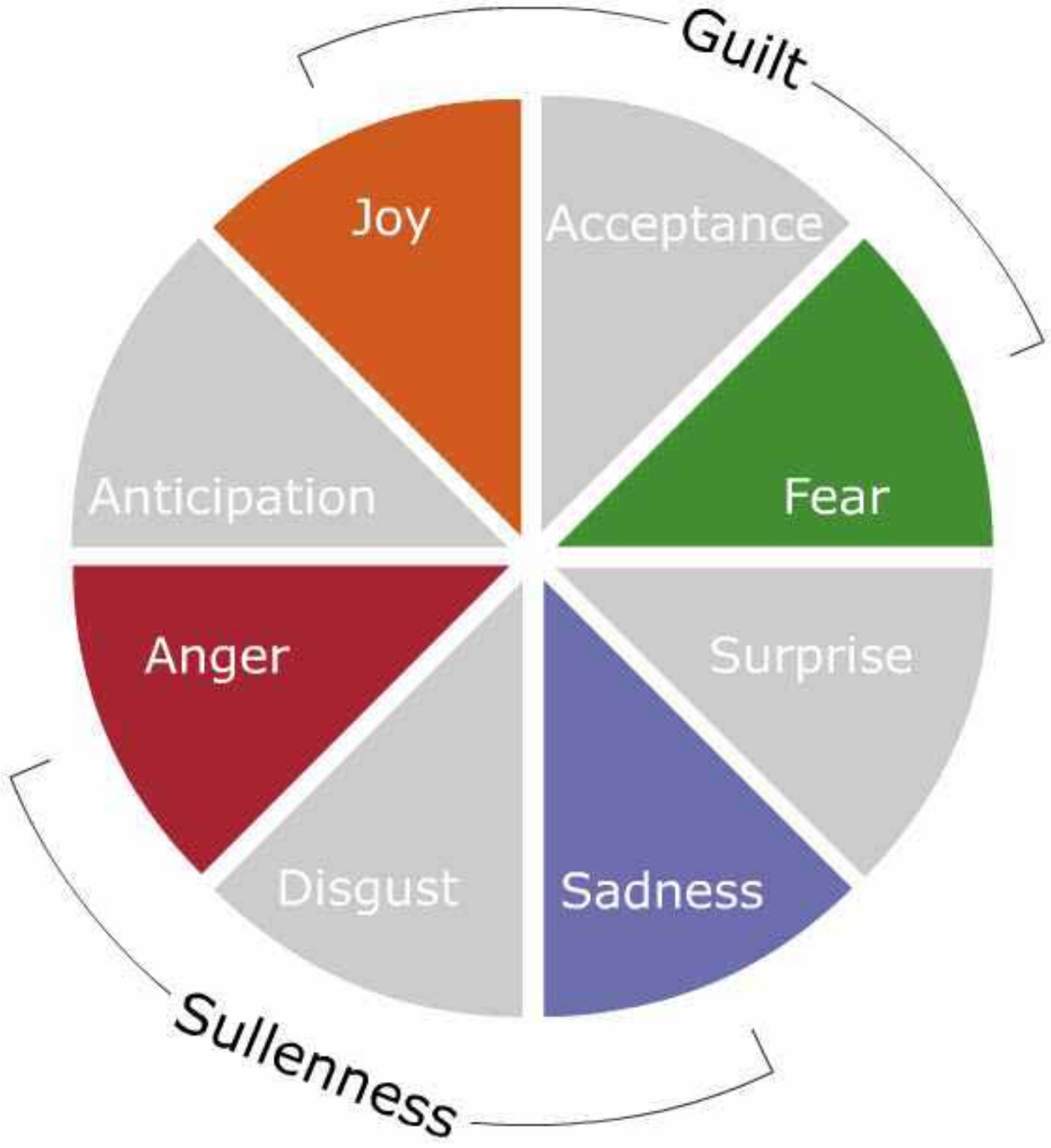
Primary dyads

Defining emotions

Primary emotions:

Paul Ekman

Robert Plutchik



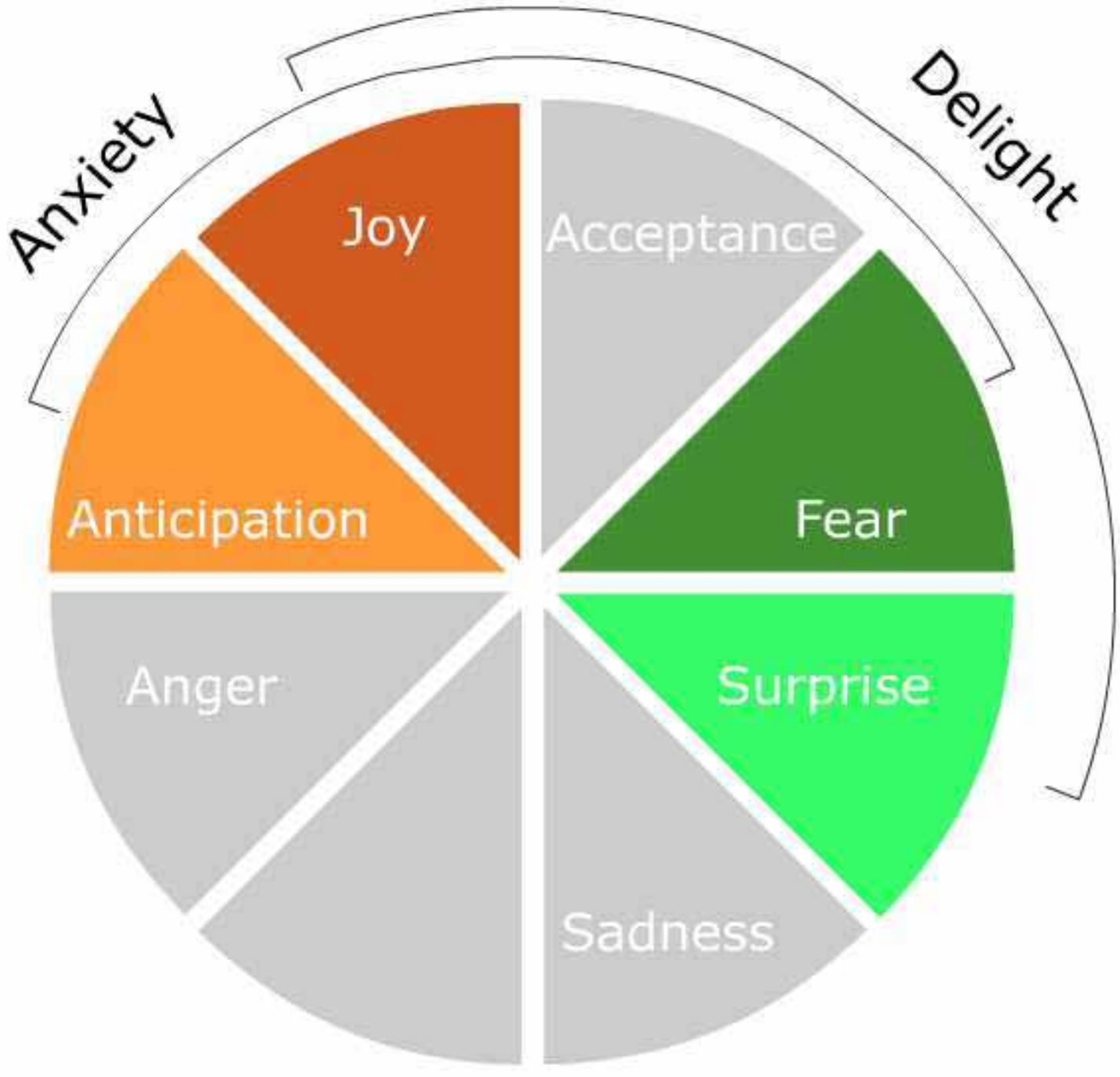
Secondary dyads

Defining emotions

Primary emotions:

Paul Ekman

Robert Plutchik



Tertiary dyads

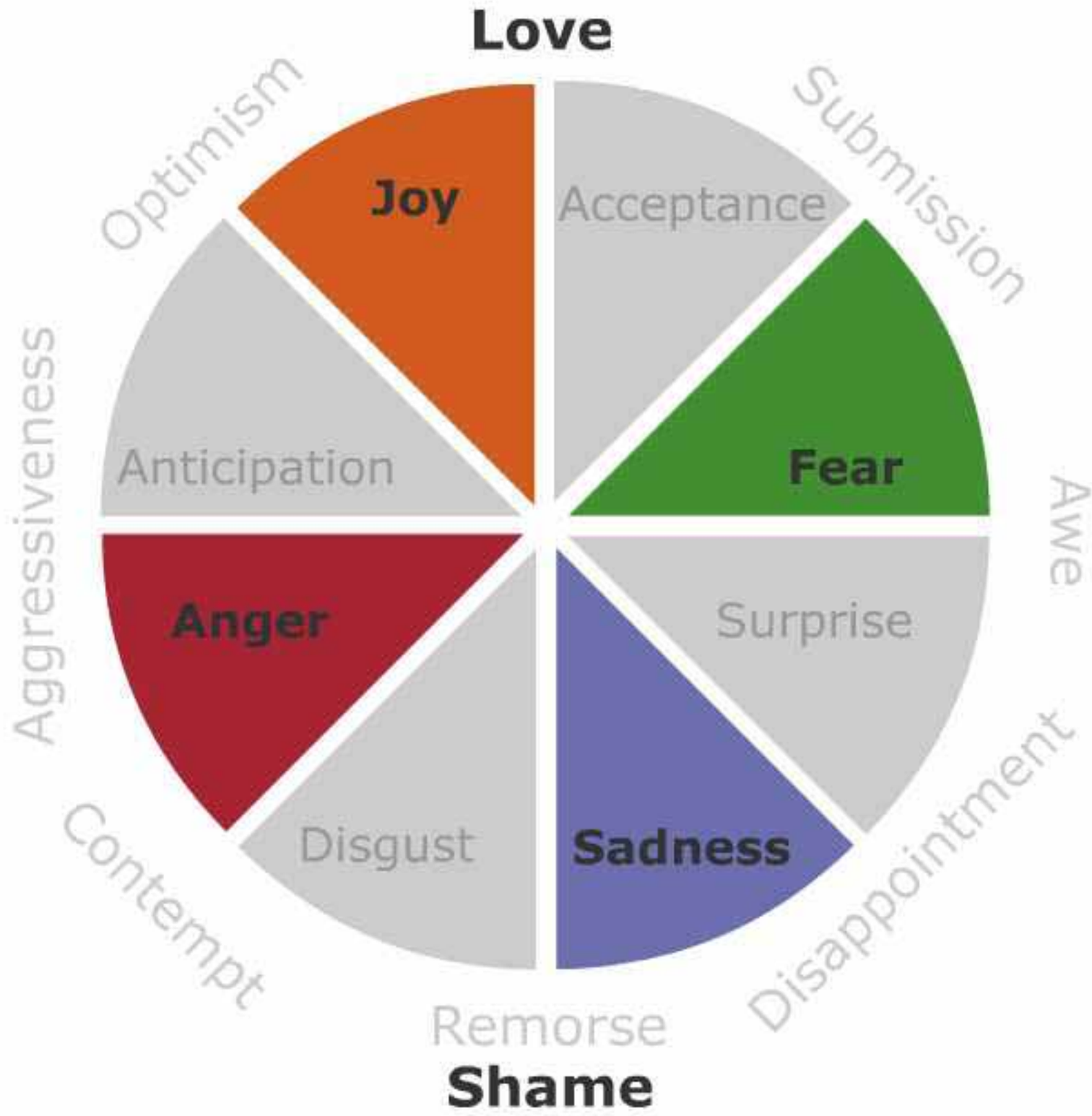
Defining emotions

Primary emotions:

Paul Ekman

Robert Plutchik

This lecture



What are emotions and why do we have them ?

Emotions move us !

Do we act because we feel
- or do we feel because we act ?

What are emotions and why do we have them ?

Emotions move us !

Do we act because we feel
- or do we feel because we act ?

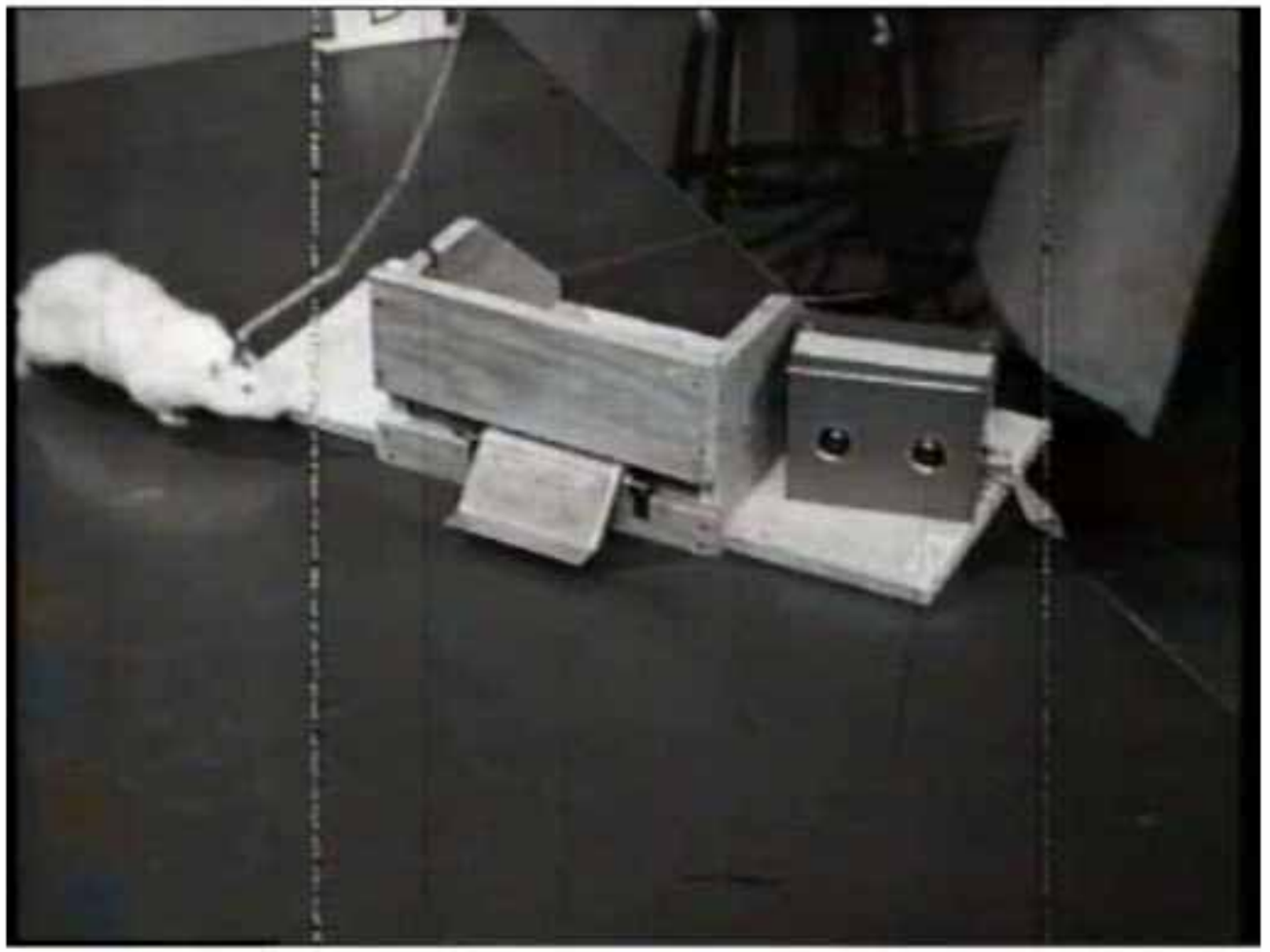
Sensory cue - emotional response - emotional state - feeling

What are emotions and why do we have them ?

So what makes us feel 'good' or 'bad' ?

The brain's basement pleasure palaces and room 101

James Olds



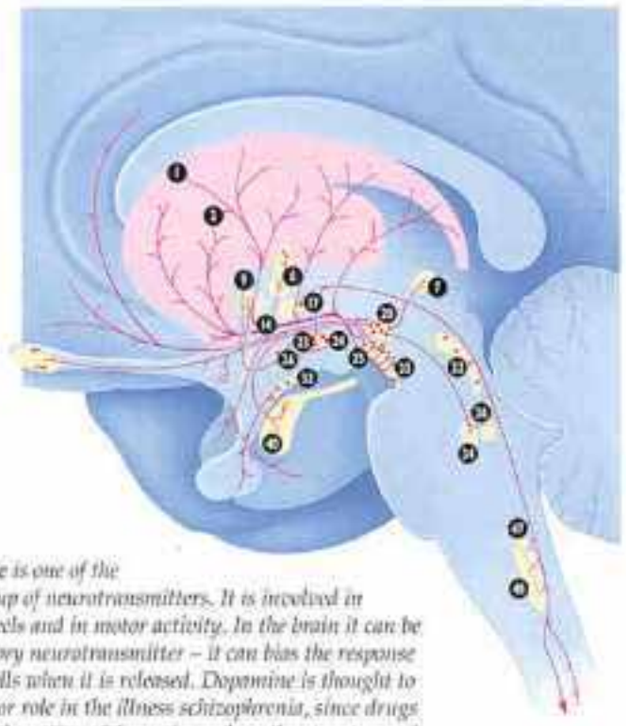
What are emotions and why do we have them ?

So what makes us feel 'good' or 'bad' ?

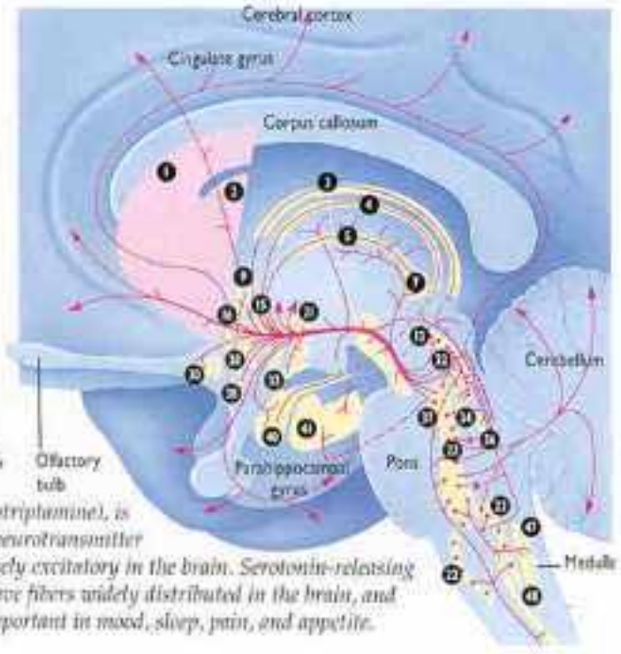
The brain's basement pleasure palaces and room 101

Drugs, dopamine, serotonin, and endogenous opioids

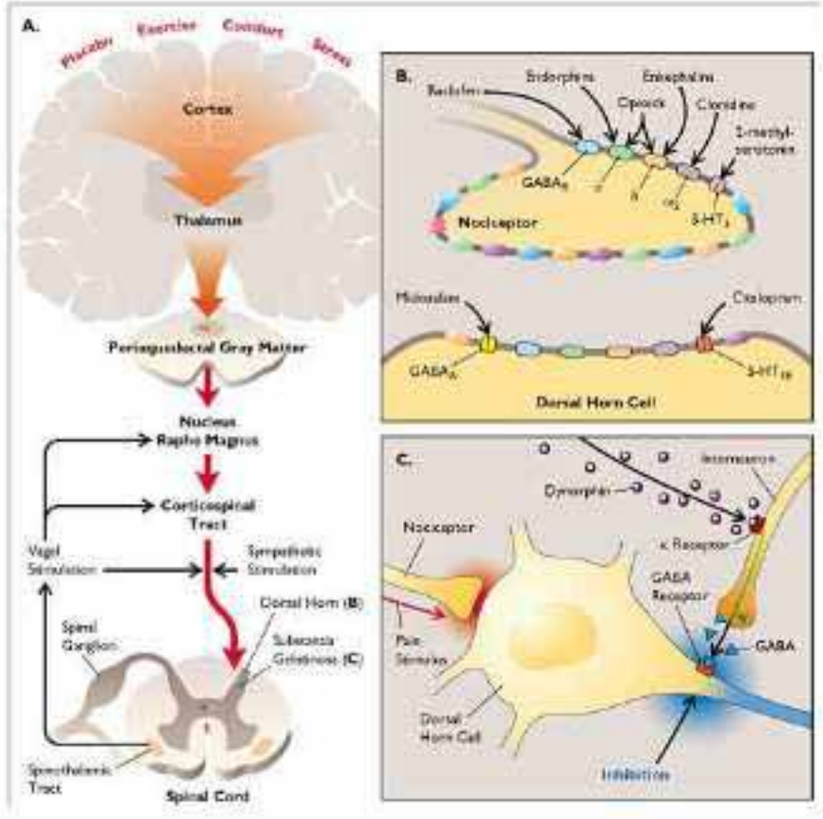
in the
gnals.



***Dopamine** is one of the amine group of neurotransmitters. It is involved in arousal levels and in motor activity. In the brain it can be a modulatory neurotransmitter – it can bias the response of nerve cells when it is released. Dopamine is thought to play a major role in the illness schizophrenia, since drugs that block the action of dopamine reduce the symptoms of the illness, and drugs that enhance its action can induce symptoms similar to those of schizophrenia.*



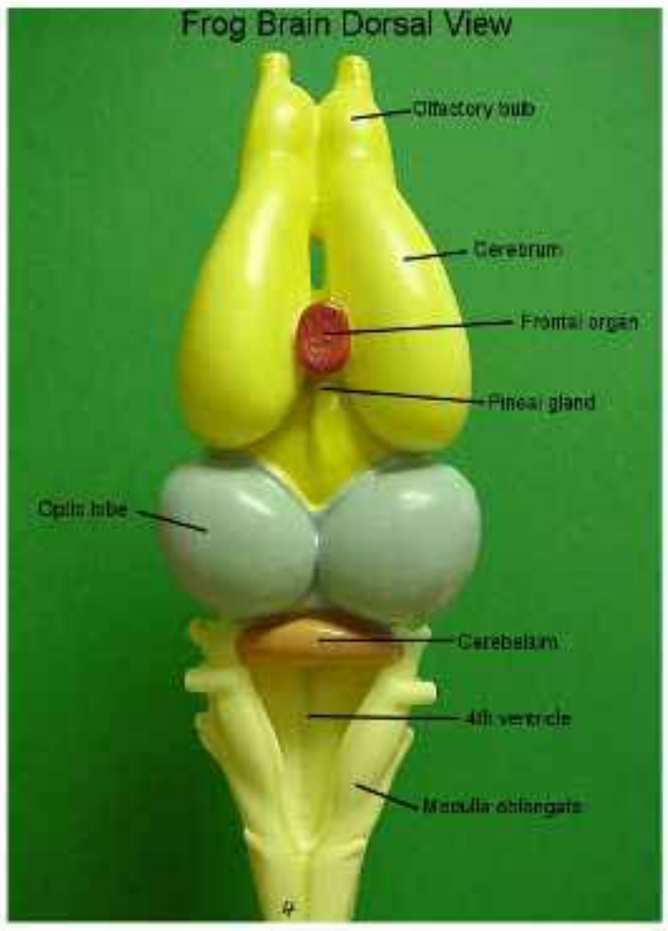
Serotonin, or 5-HT (5-hydroxytriptamine), is an amine neurotransmitter that is largely excitatory in the brain. Serotonin-releasing neurons have fibers widely distributed in the brain, and 5-HT is important in mood, sleep, pain, and appetite.



What are emotions and why do we have them ?

Activity in the neocortex penthouse

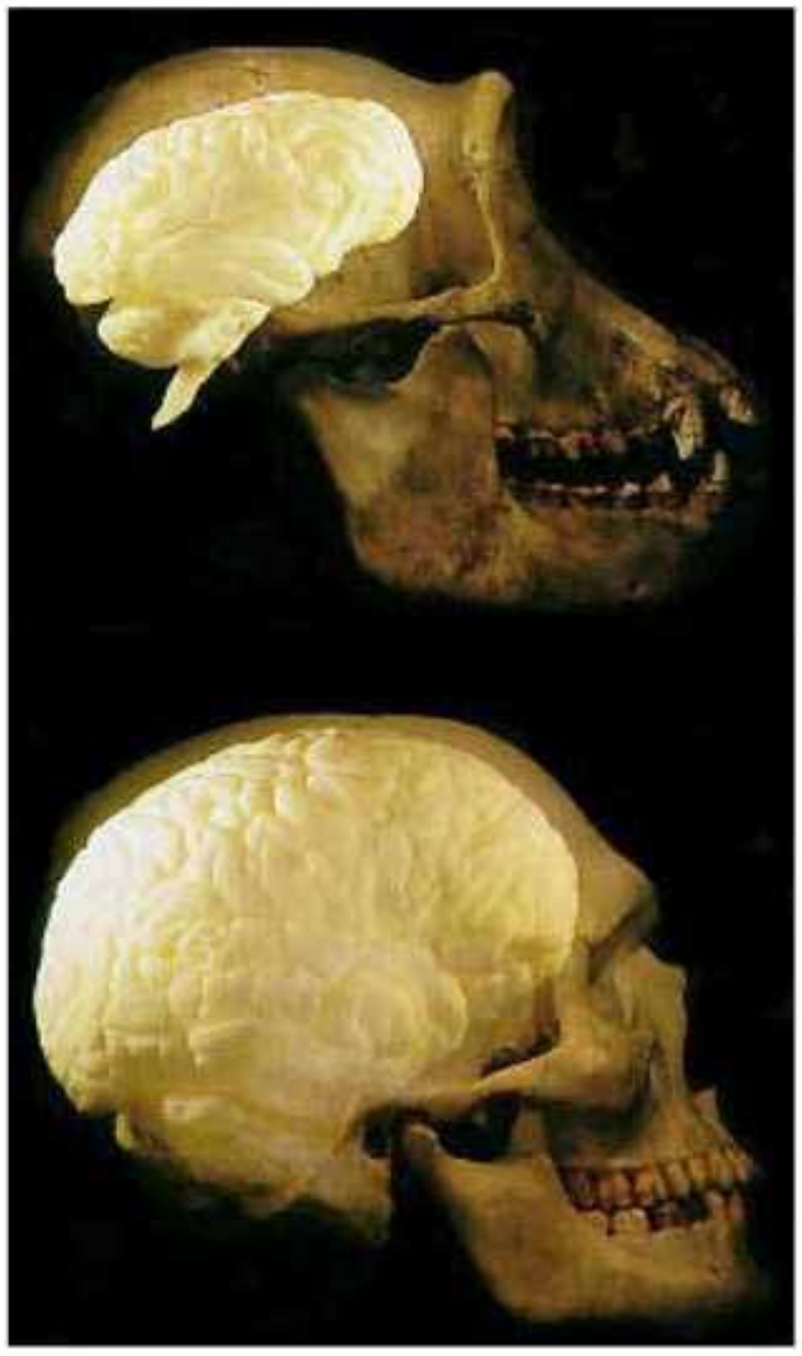
Frog



Rat

Sheep

Chimpanzee



Human

What are emotions and why do we have them ?

Activity in the neocortex penthouse

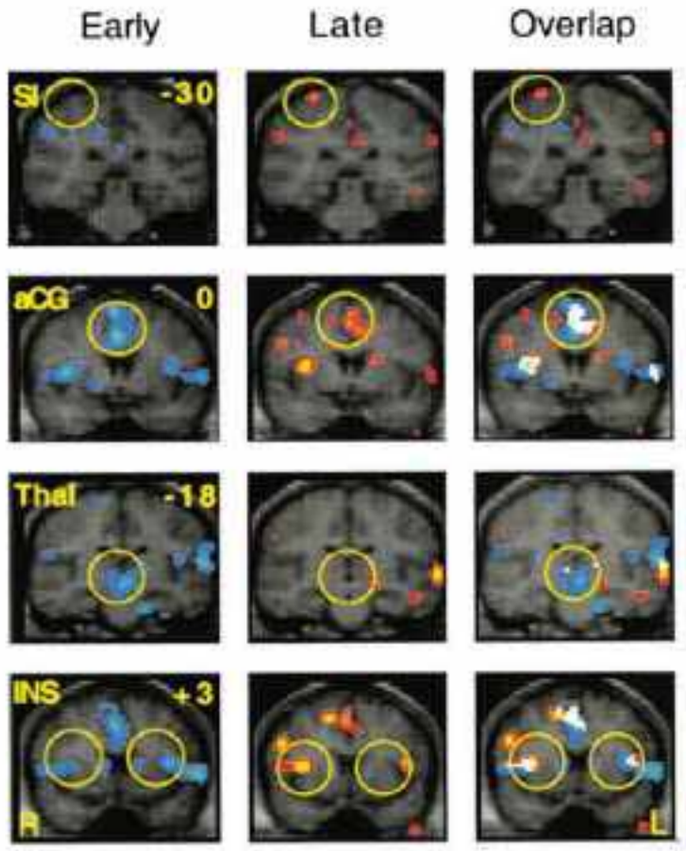
"If cognition allows us to grasp the building blocks of life and how they can be organised, emotions are often the cement that binds them together into permanent structures"

What are emotions and why do we have them ?

Pleasure and pain may be part of the same spectrum

Spinoza

Bentham



MRI images
Becerra *et al*
Neuron 2001

What are emotions and why do we have them ?

Pleasure and pain may be part of the same spectrum

Emotional interpretations of the same cues can be very different

What are emotions and why do we have them ?

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Emotional interpretations of the same cues can be very different

What makes us happy or sad may not have the same effect on another animal

What are emotions and why do we have them ?

Pleasure and pain may be part of the same spectrum

Emotional interpretations of the same cues can be very different

What makes us happy or sad may not have the same effect on another animal

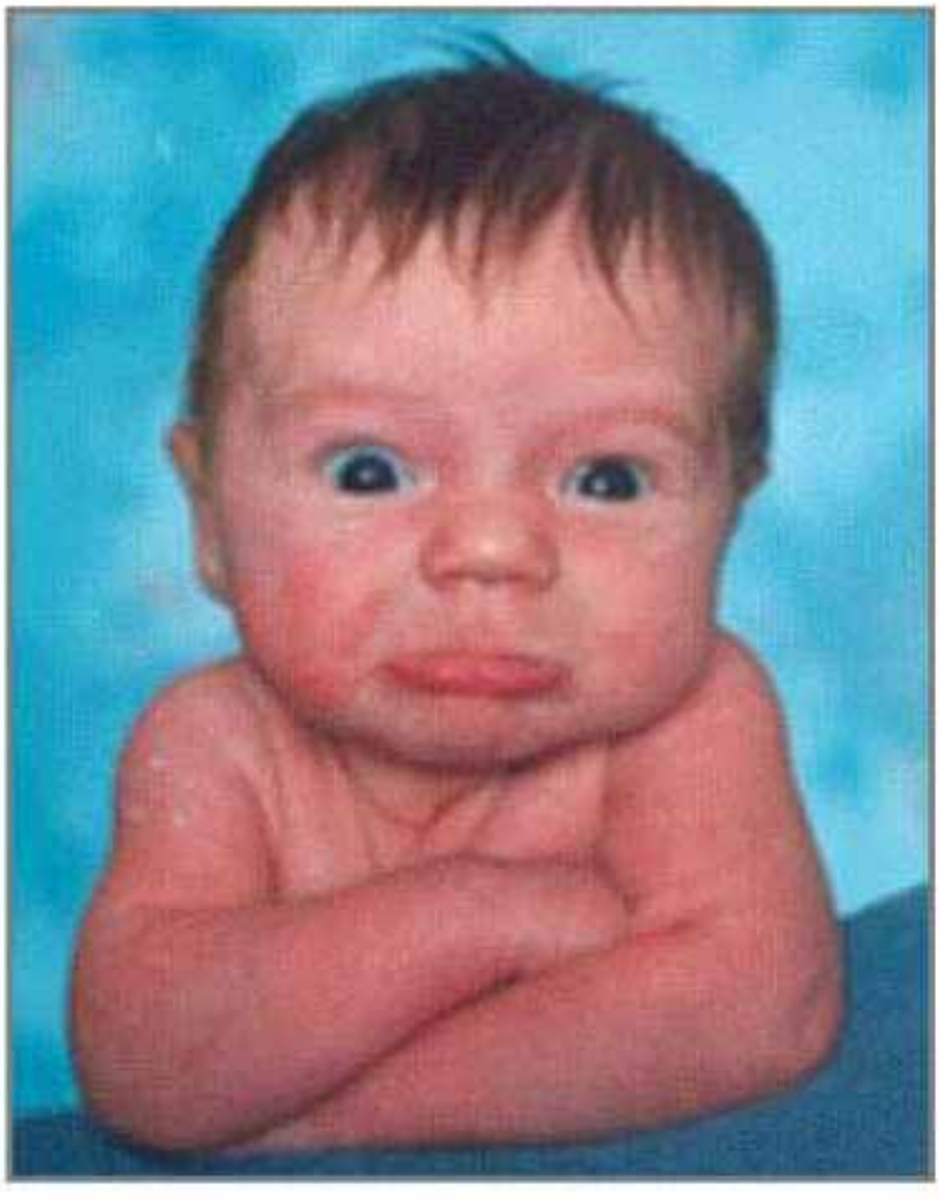
What functions do emotions serve ?

Survival mechanism: fight, freeze or flight

They don't necessarily need consciousness

What function do feelings serve ?

They help to interpret and deal with your emotions



What function do feelings serve ?

They help to interpret and deal with your emotions

Better learning and planning

What function do feelings serve ?

They help to interpret and deal with your emotions

Better learning and planning

Better integration into complex social environments

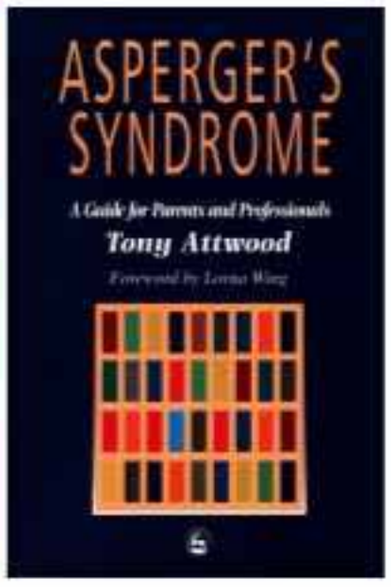
What function do feelings serve ?

They help to interpret and deal with your emotions

Better learning and planning

Better integration into complex social environments

Problems with interpreting and experiencing emotions



What function do feelings serve ?

Other social mammals also have complex social environments

The case of Alexithymia

The case of Alexithymia

Many human psychosomatic and personality disorders are associated with an inability to recognise, experience and describe feelings

The case of Alexithymia

Many human psychosomatic and personality disorders are associated with an inability to recognise, experience and describe feelings

Avoid internal emotional conflict by relying on action to express emotion

The case of Alexithymia

Many human psychosomatic and personality disorders are associated with an inability to recognise, experience and describe feelings

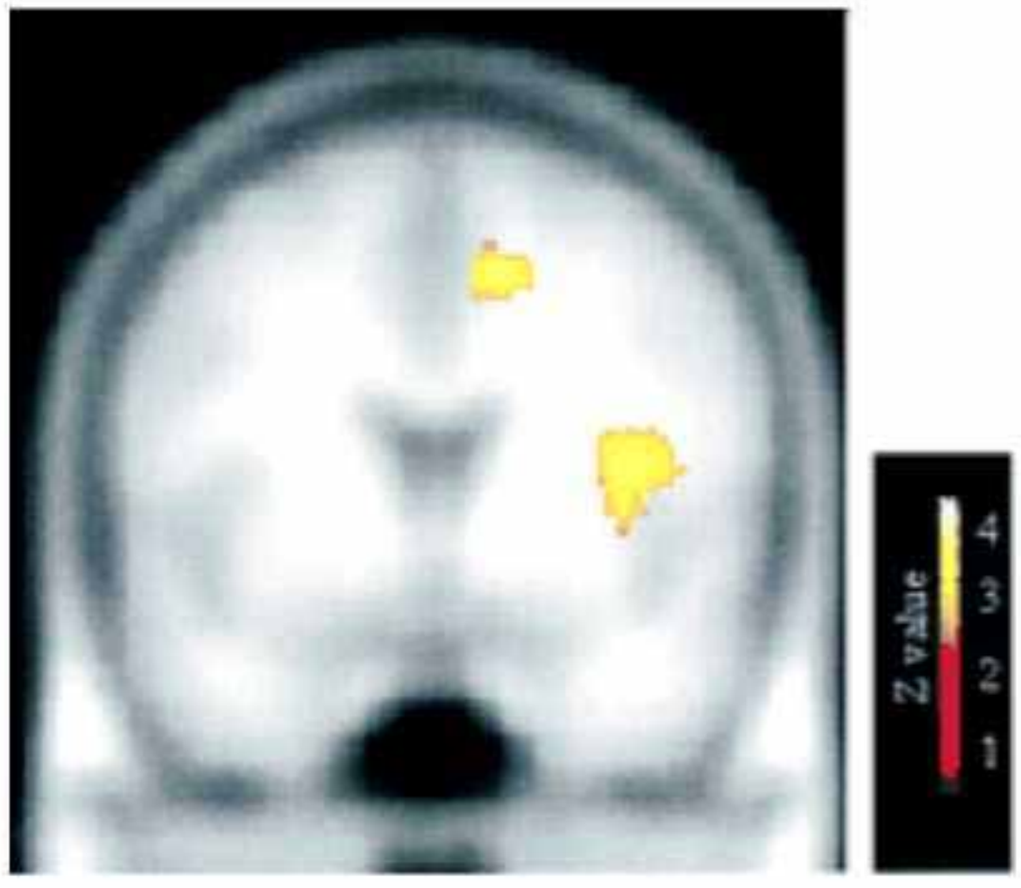
Avoid internal emotional conflict by relying on action to express emotion

This can often take the form of self-harm

The case of Alexithymia

Reduced activation in the right brain hemisphere in response to viewing angry and sad faces

(Kano *et al*, 2003)



The case of Alexithymia

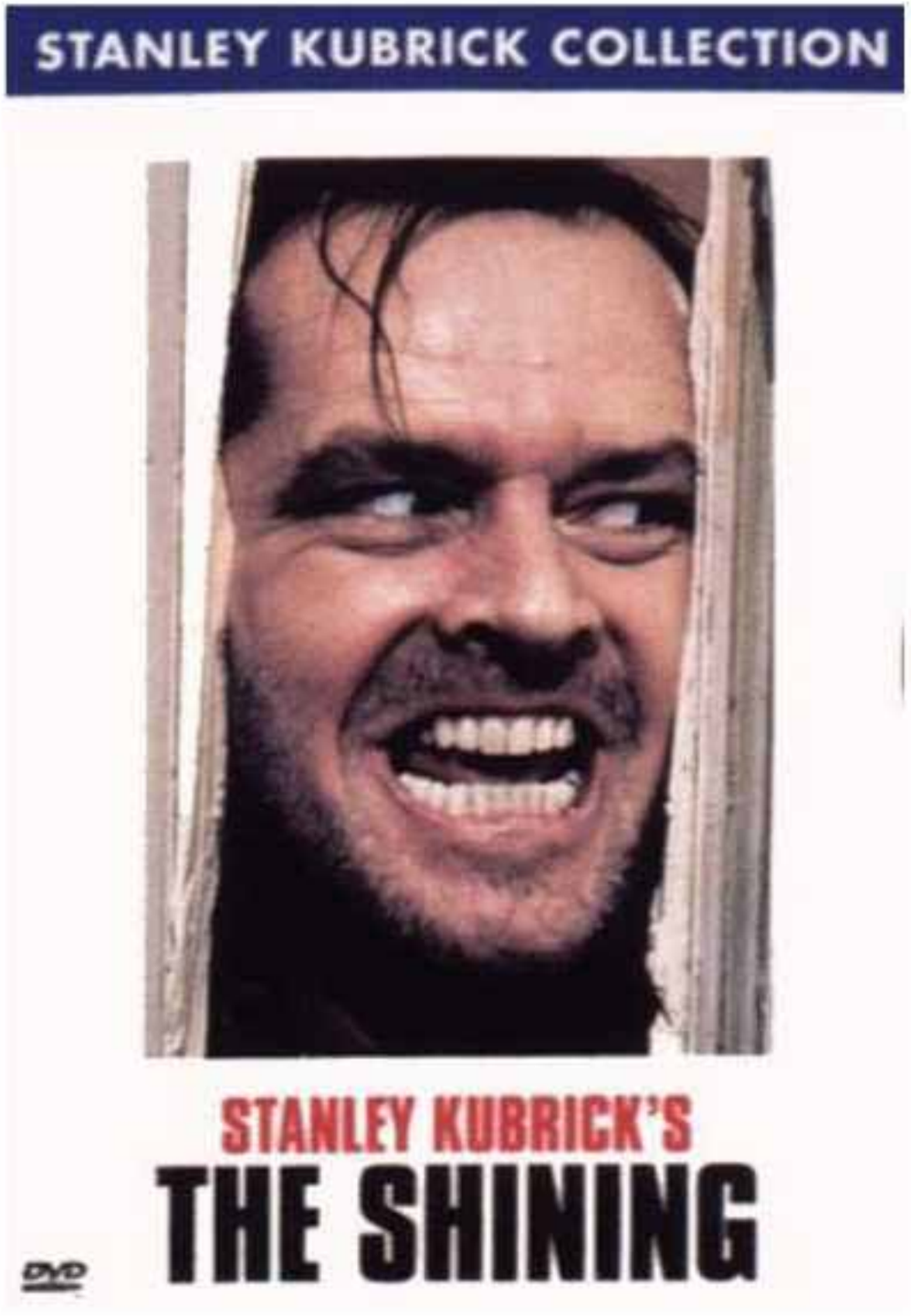
Reduced activation in the right brain hemisphere in response to viewing angry and sad faces

(Kano *et al*, 2003)

Other animals resort to self-mutilation or destructive behaviour as an emotional release valve

The case of Alexithymia

Fear


STANLEY KUBRICK COLLECTION
STANLEY KUBRICK'S
THE SHINING
DVD

Fear

Highly important survival tool for most animals

Fear

Highly important survival tool for most animals

Joseph Le Doux

'The Emotional Brain' 1994 and 'Synaptic-Self' 2002

Fear

Highly important survival tool for most animals

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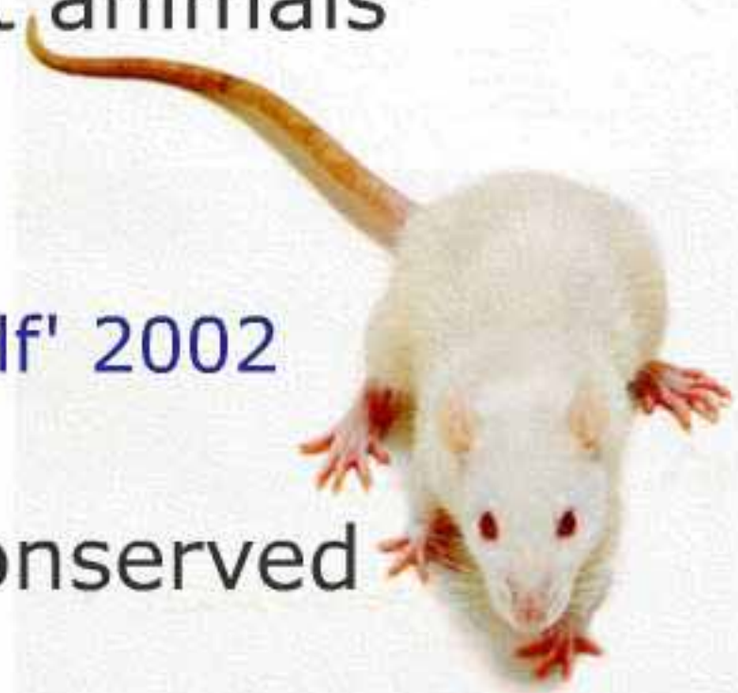
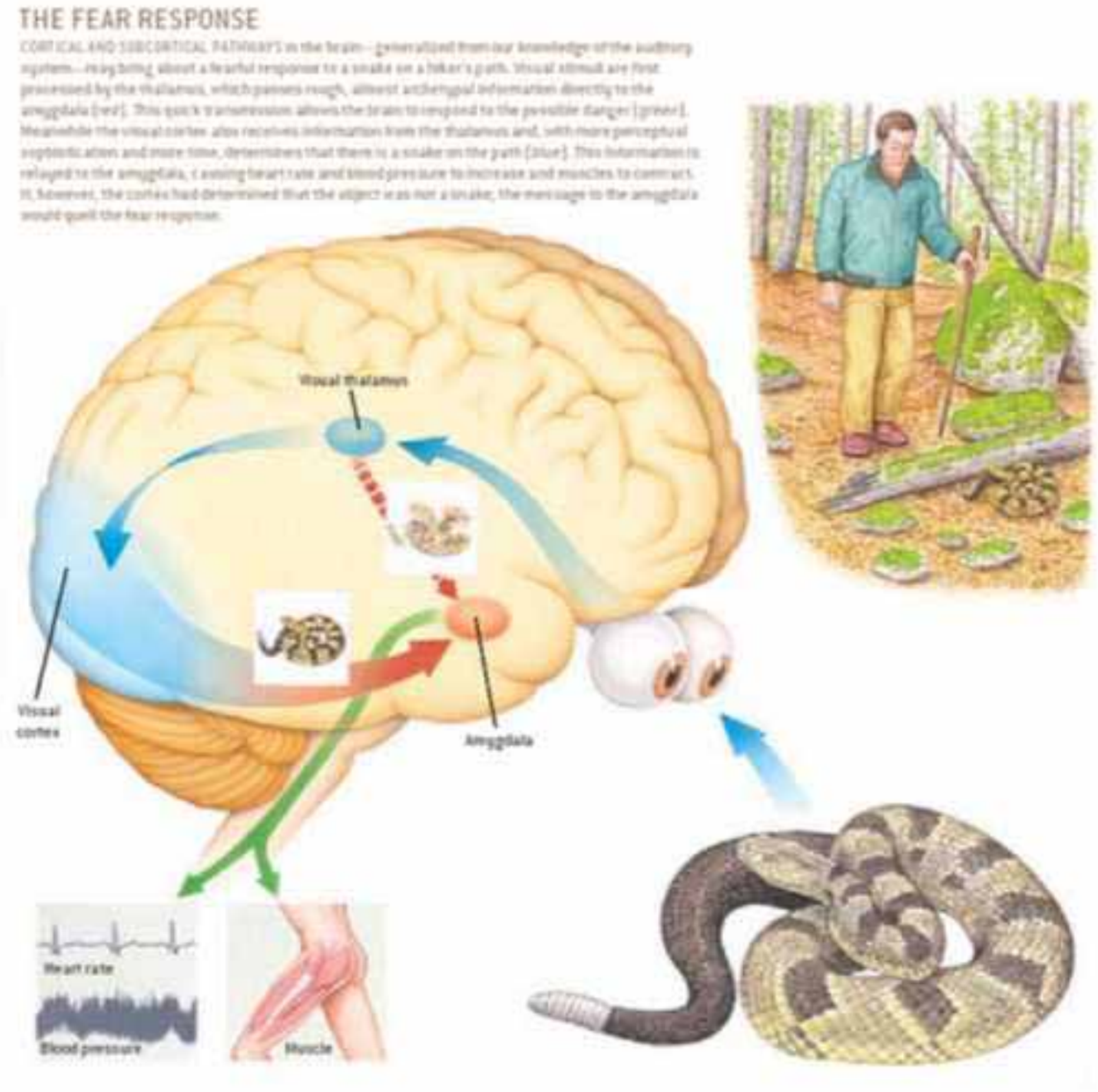


Brain fear processing system highly conserved

Fear

The basic anatomy of the fear response

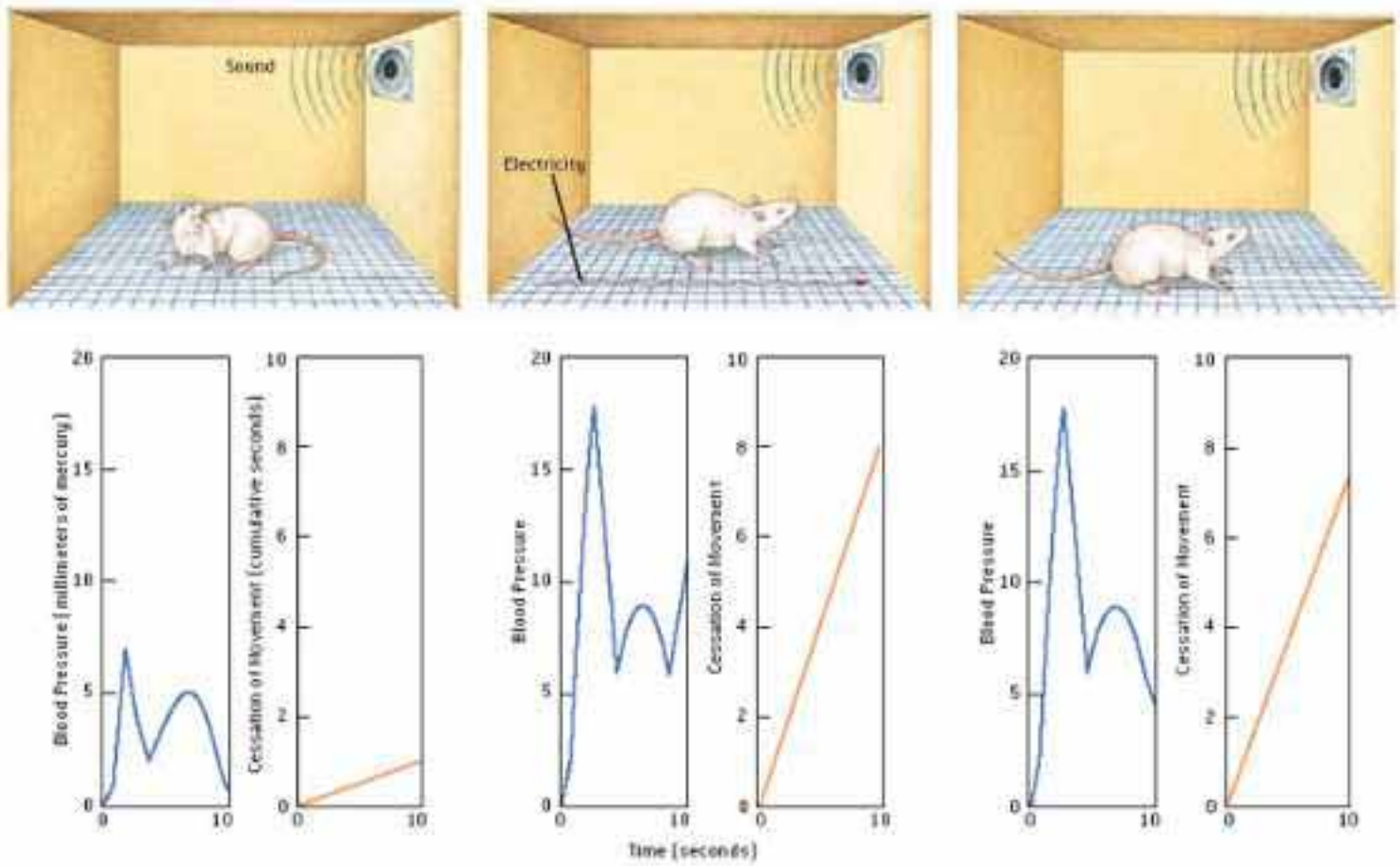


Le Doux *et al* Scientific American 2003

Fear

The basic anatomy of the fear response

Conditioned fear responses



CLASSICAL FEAR CONDITIONING can be induced by pairing a sound and a mild electric shock to the foot of a rat. In one set of experiments, the rat hears a sound (*left*), which has little effect on the animal's blood pressure or patterns of movement. Next, the rat hears the same sound, coupled with a foot shock (*center*). After several such pairings, the rat's blood pressure rises at the same time that the animal freezes for an extended period when it hears the sound. The rat has been fear-conditioned (*right*): sound alone achieves the same physiological changes as did sound and shock together.

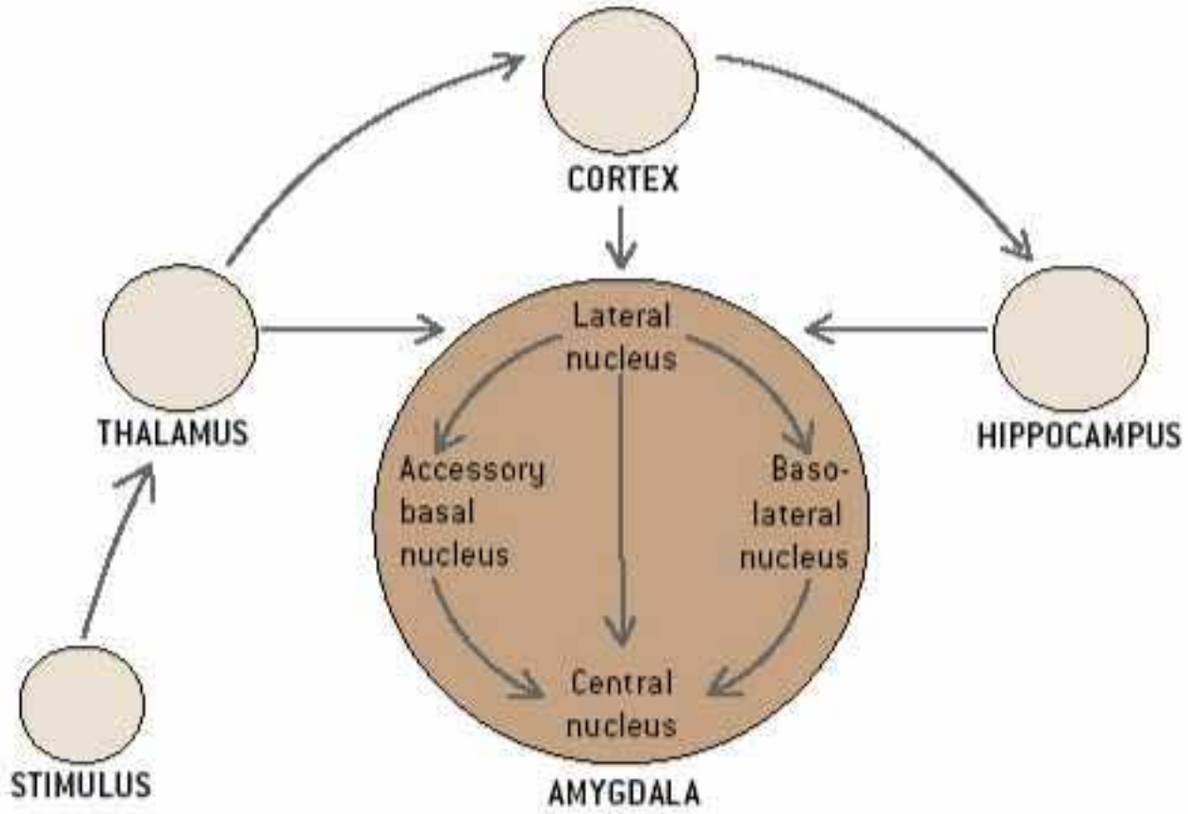
Le Doux *et al* Scientific American 2003

Fear

The basic anatomy of the fear response

Conditioned fear responses

High and low roads of the fear response



Le Doux *et al* Scientific American 2003

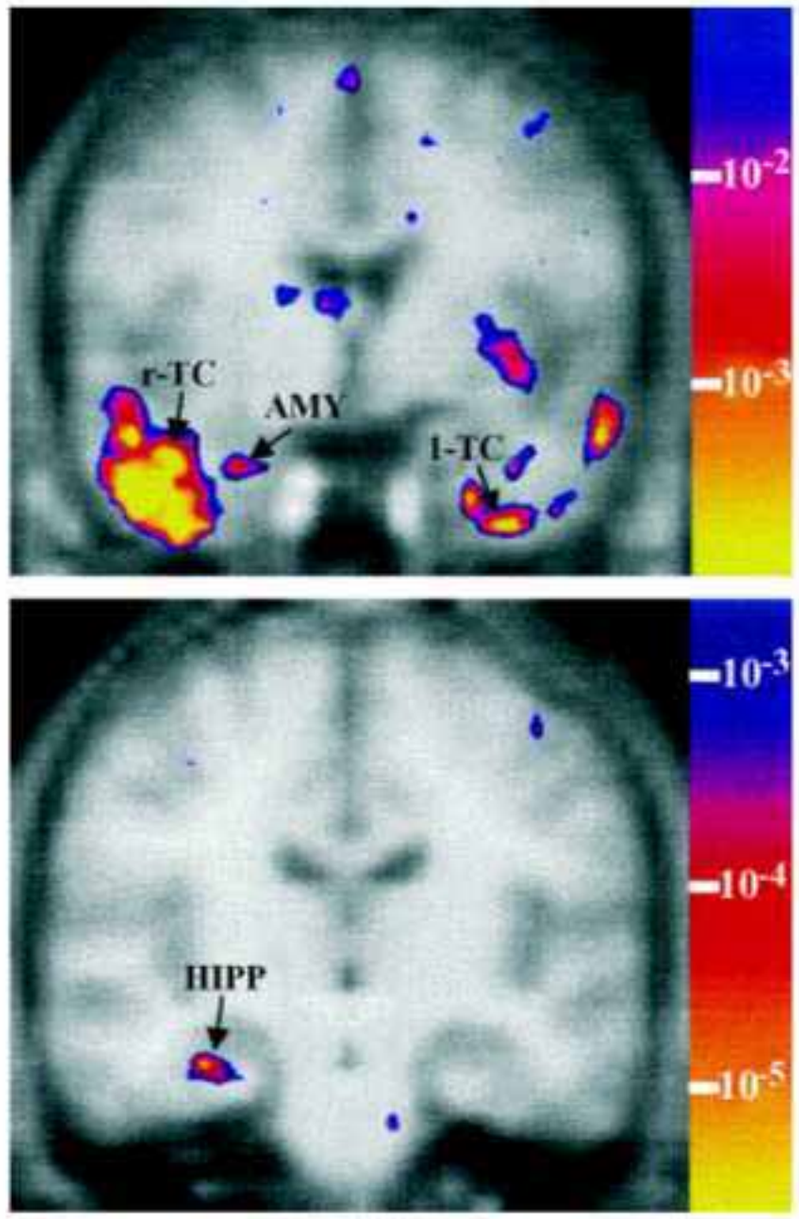
Fear

Kluver-Bucy Syndrome

Fear

Kluver-Bucy Syndrome

Faces and fear

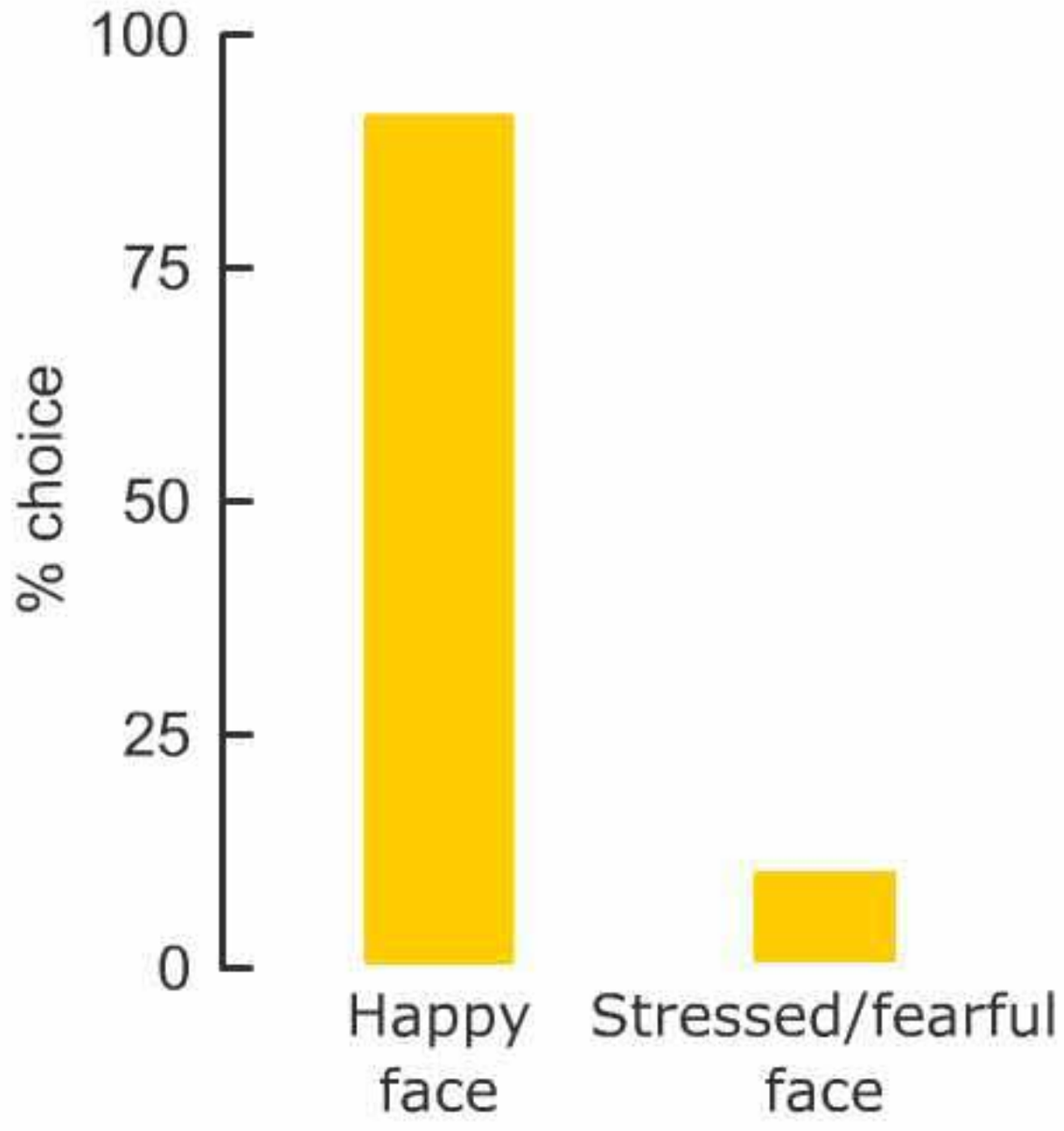


Fischer *et al*
Brain Res. Bull. 2003

Fear

Kluver-Bucy Syndrome

Faces and fear



Fear

Kluver-Bucy Syndrome

Faces and fear

Reduced fear by sight of a friendly face

Fear

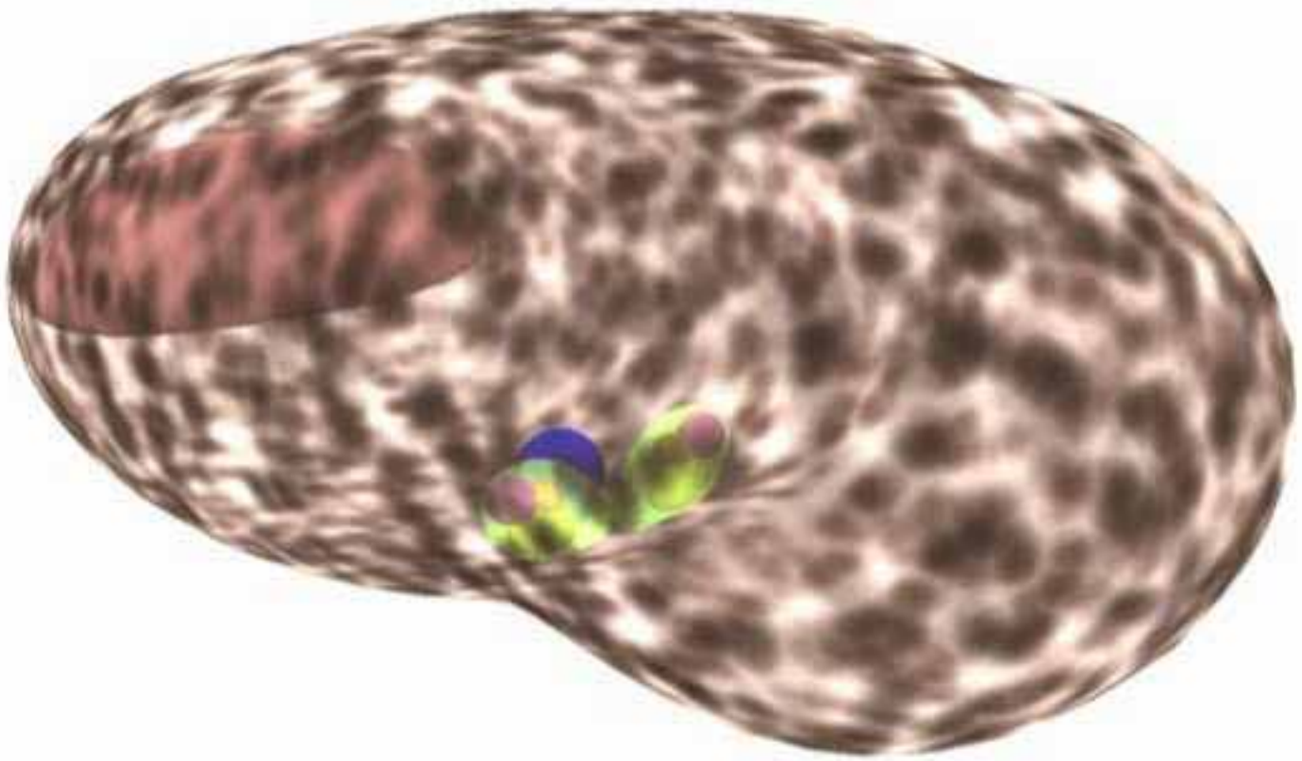
Kluver-Bucy Syndrome

Faces and fear

Reduced fear by sight of a friendly face

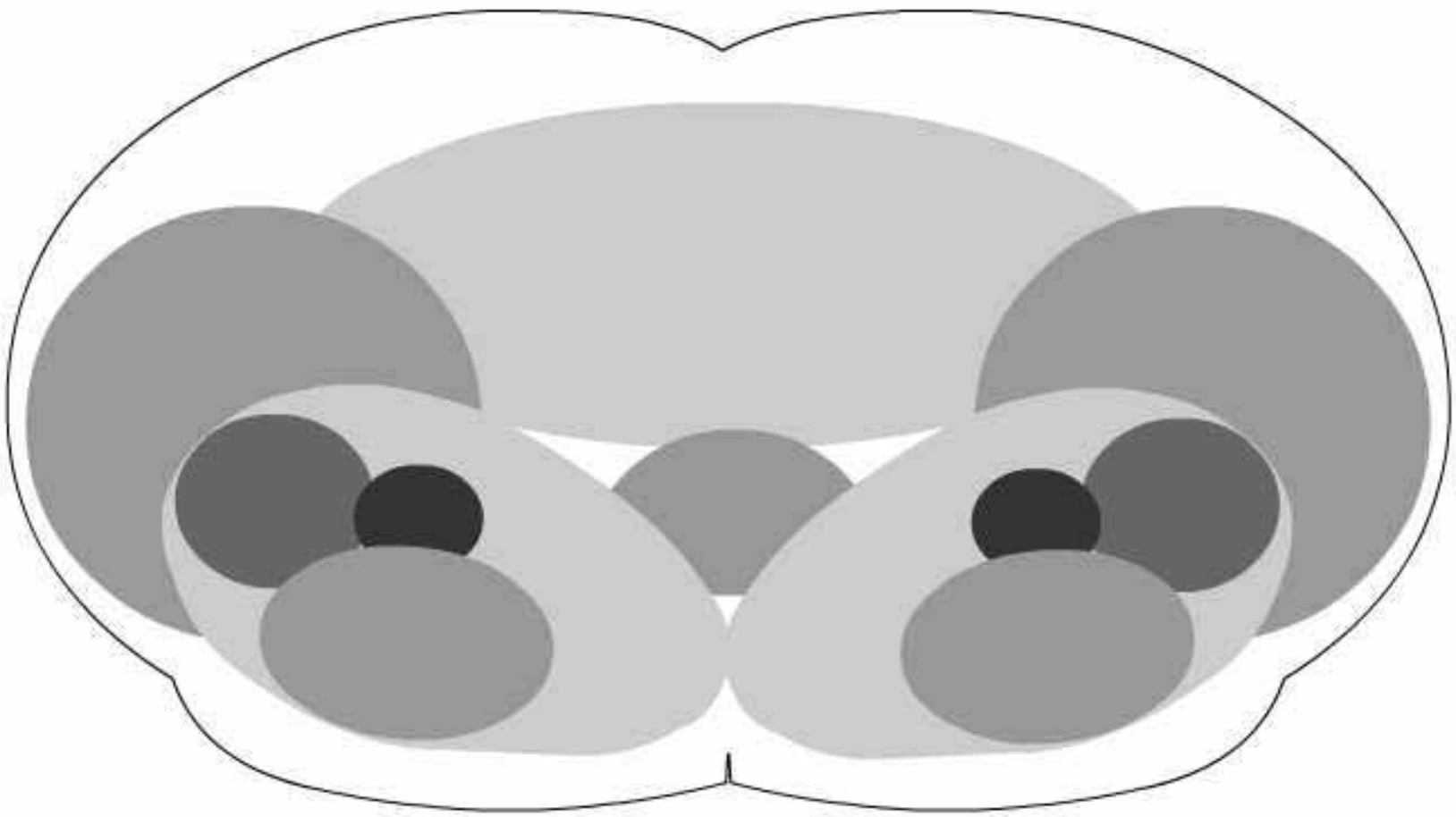
Fear

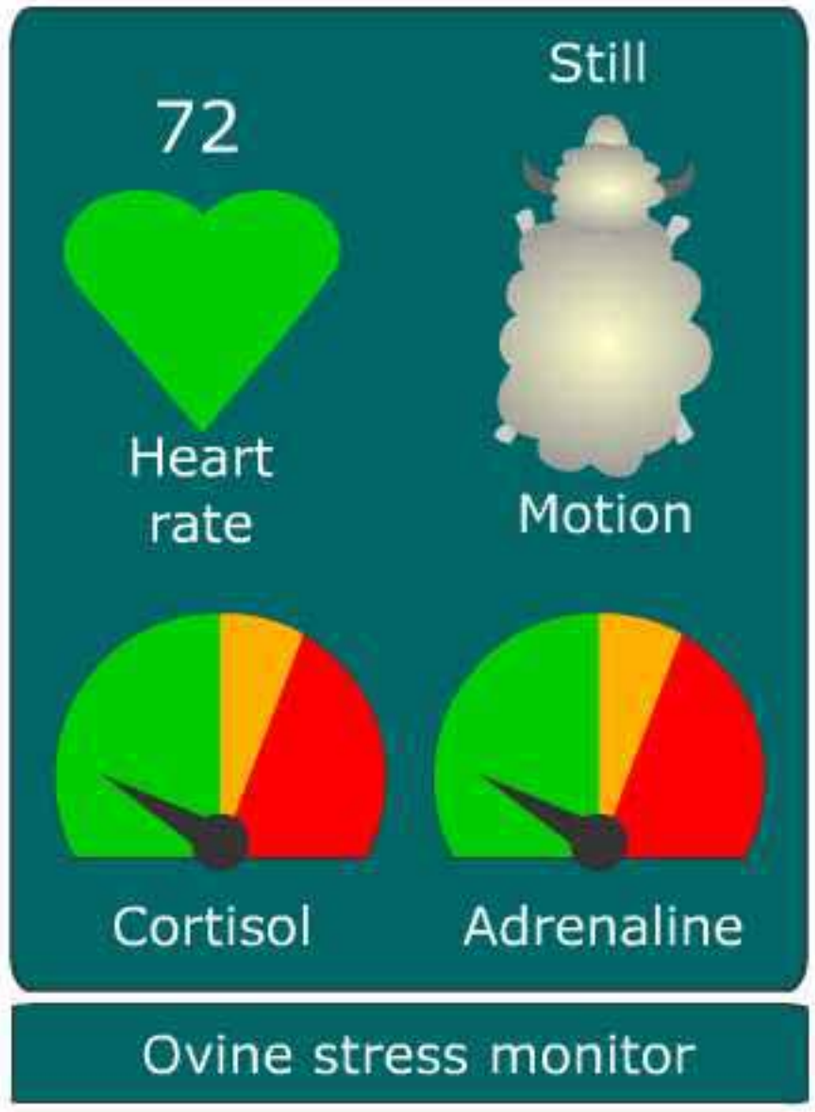
Sheep brain



Fear

Sheep in flock

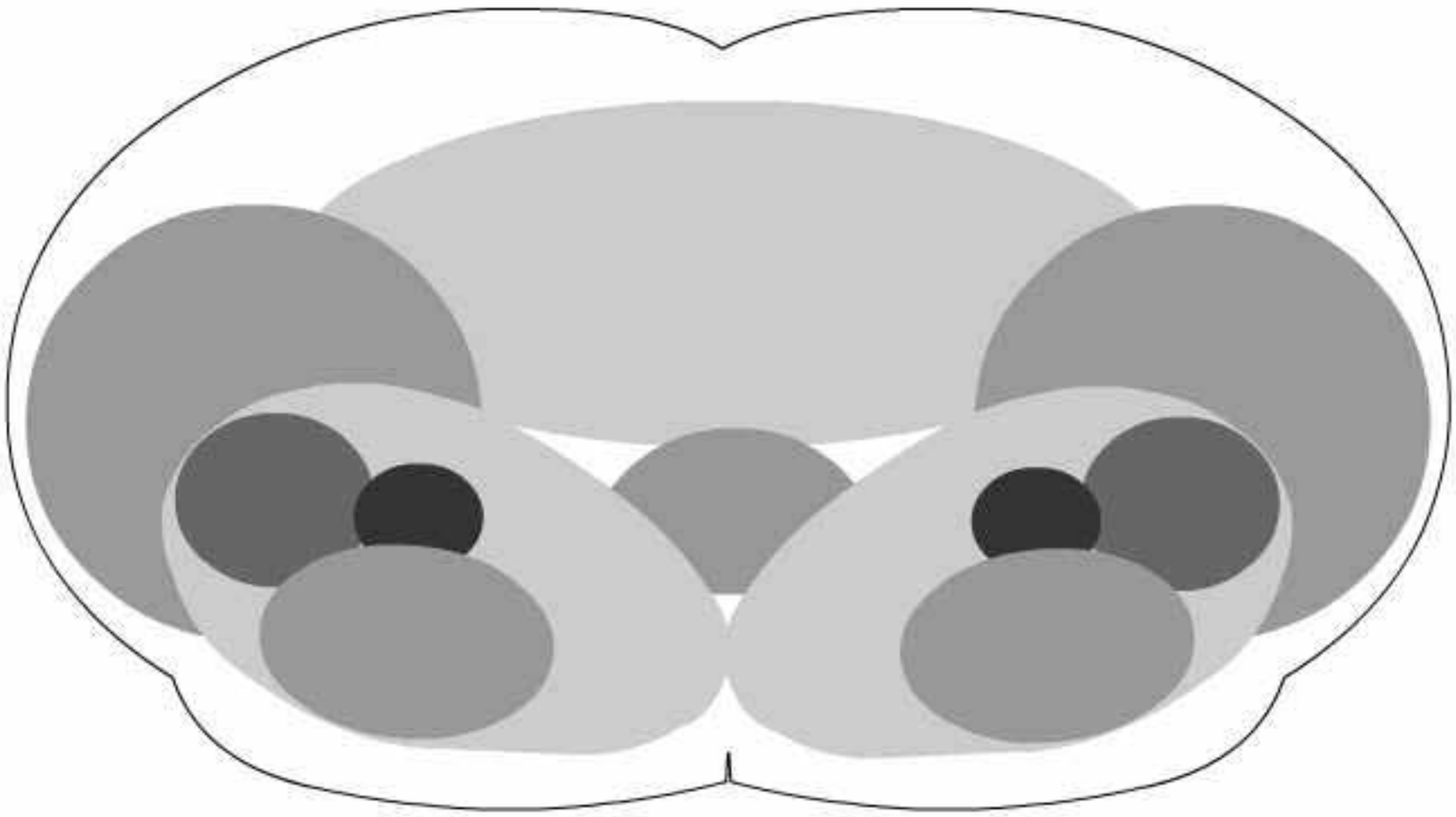


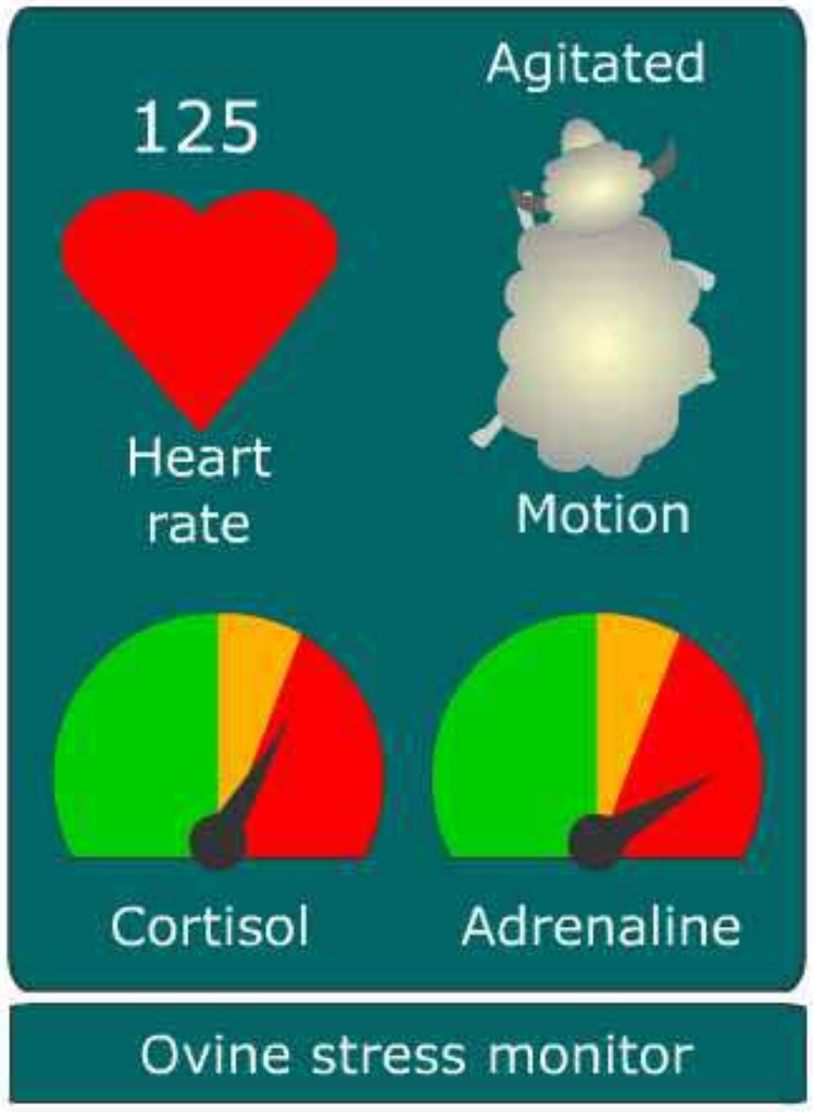


da Costa *et al*
Proc. Roy. Soc. 2004

Fear

Social isolation

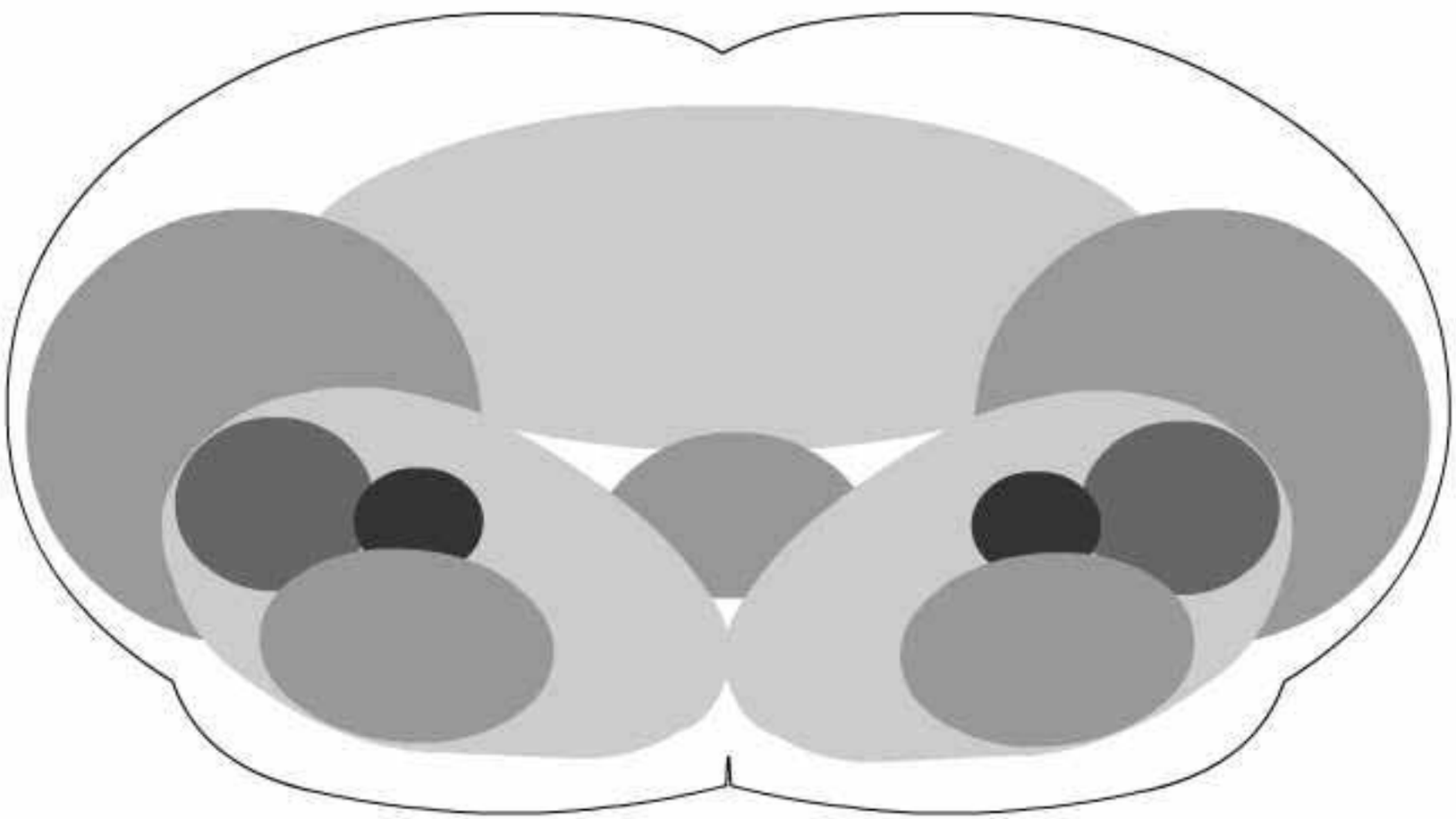


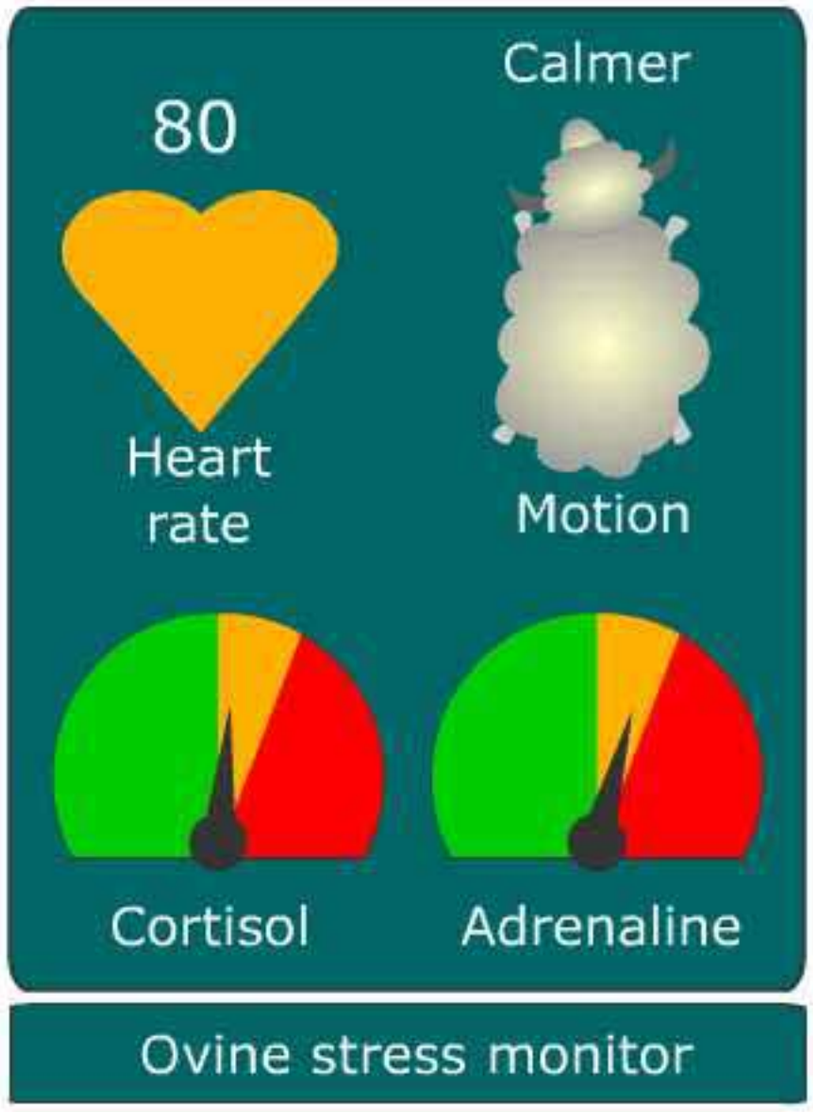


da Costa *et al*
Proc. Roy. Soc. 2004

Fear

Sheep faces visible





da Costa *et al*
Proc. Roy. Soc. 2004

Fear

Effects of constant anxiety - social stress

Fear

Effects of constant anxiety - social stress

Drugs and anxiety - benzodiazepines and opioids

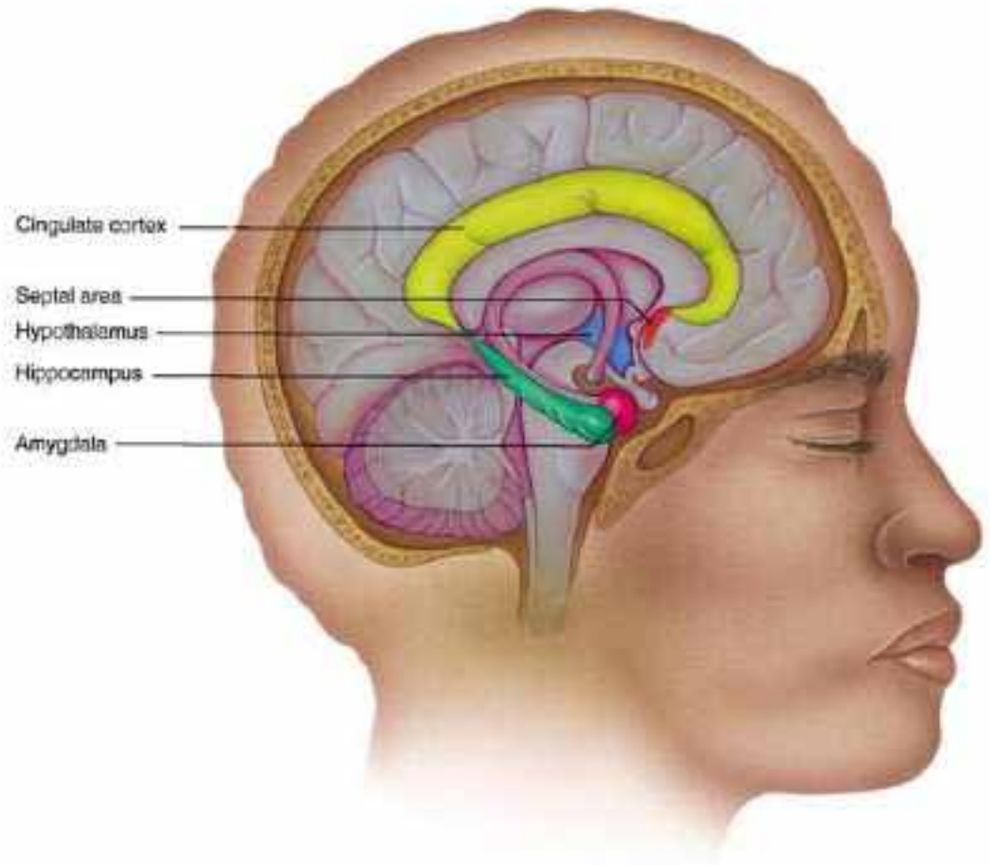
Anger and jealousy

Enhance survival by both promoting and reducing aggression

Anger and jealousy

Enhance survival by both promoting and reducing aggression

Animal studies - limbic system (septum and amygdala), hypothalamus and brainstem involved



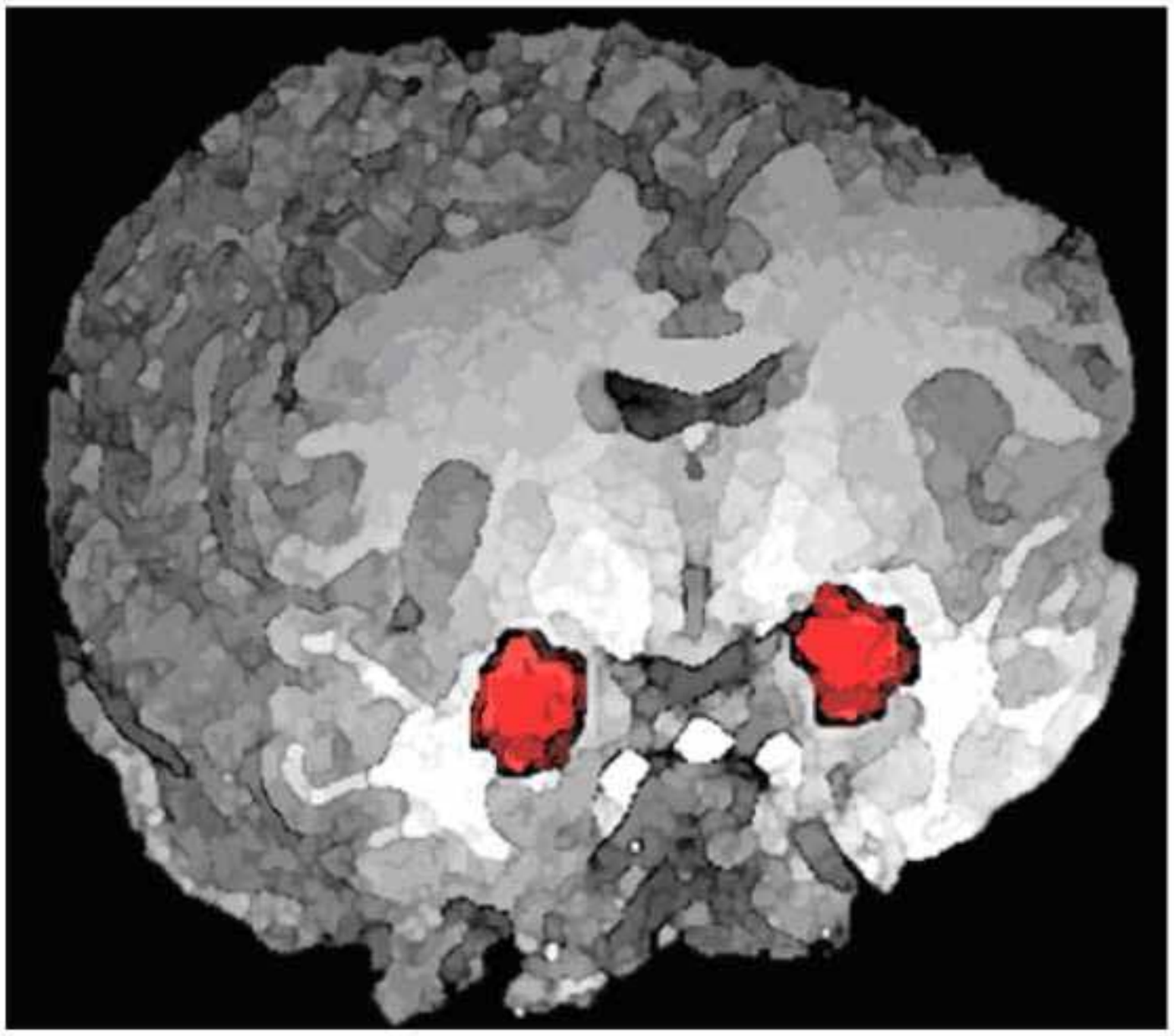
Anger and jealousy

Enhance survival by both promoting and reducing aggression

Animal studies - limbic system (septum and amygdala), hypothalamus and brainstem involved

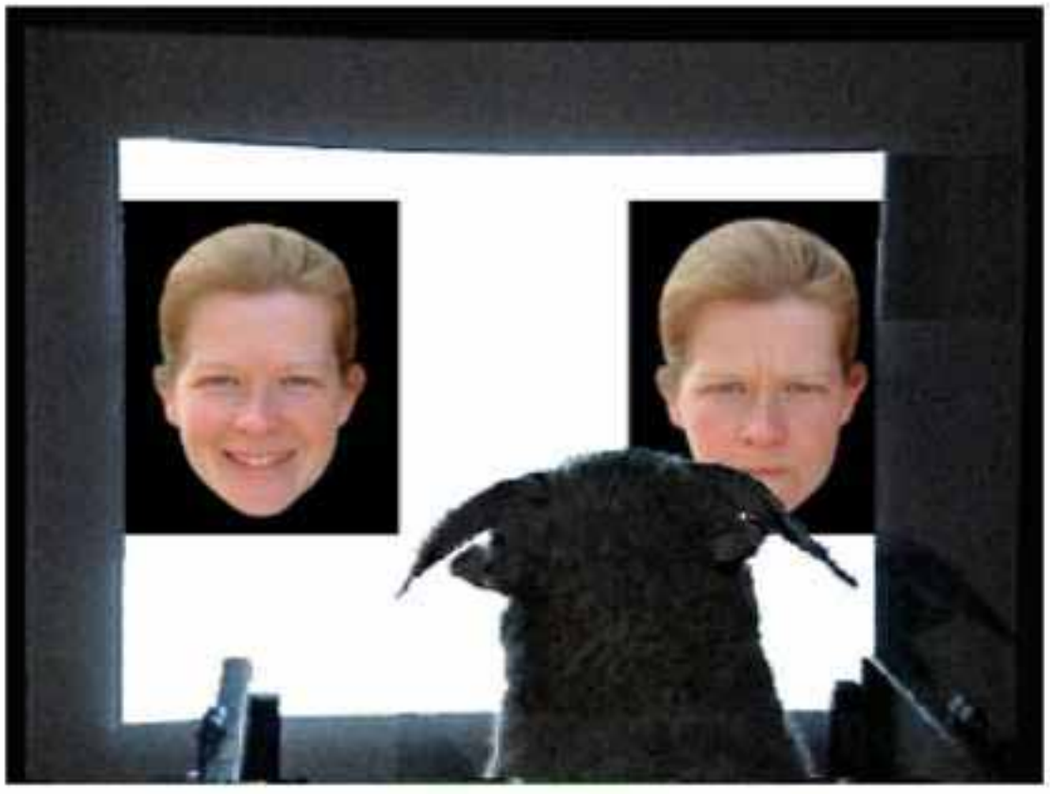
As with fear the frontal cortex is important for anger control

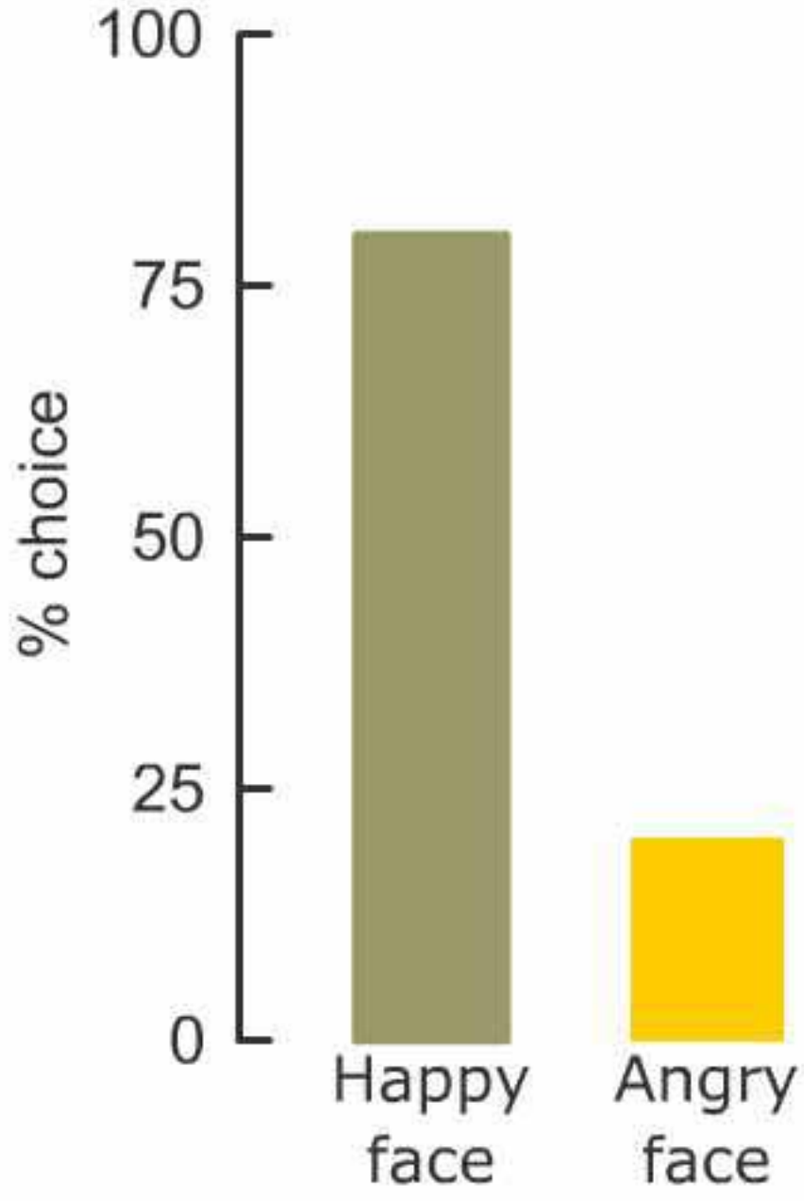
Faces and anger - the right amygdala



Anger and jealousy

Universal recognition of angry facial expressions ?

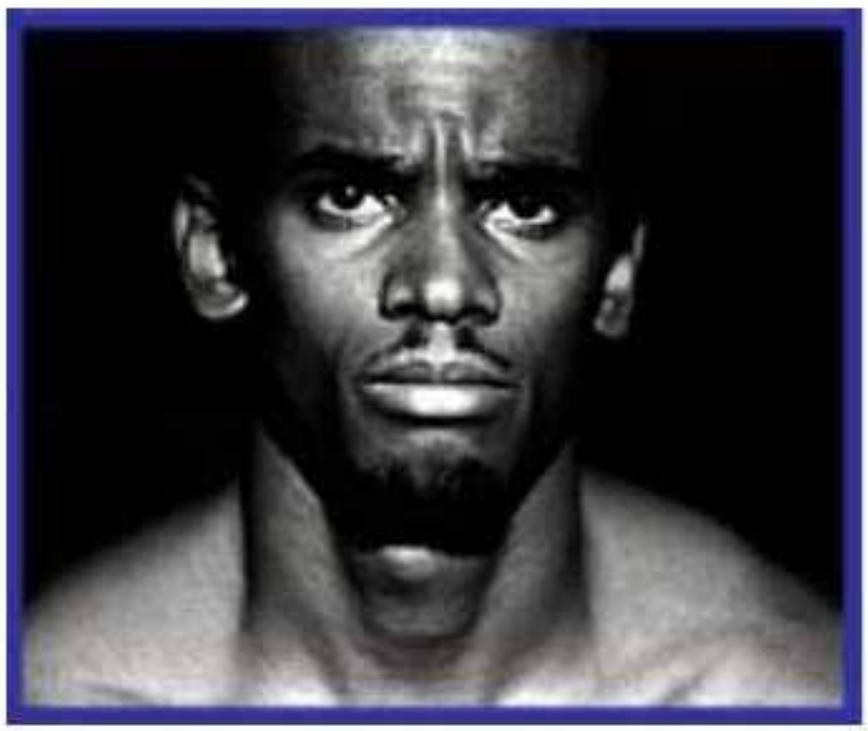




Anger and jealousy

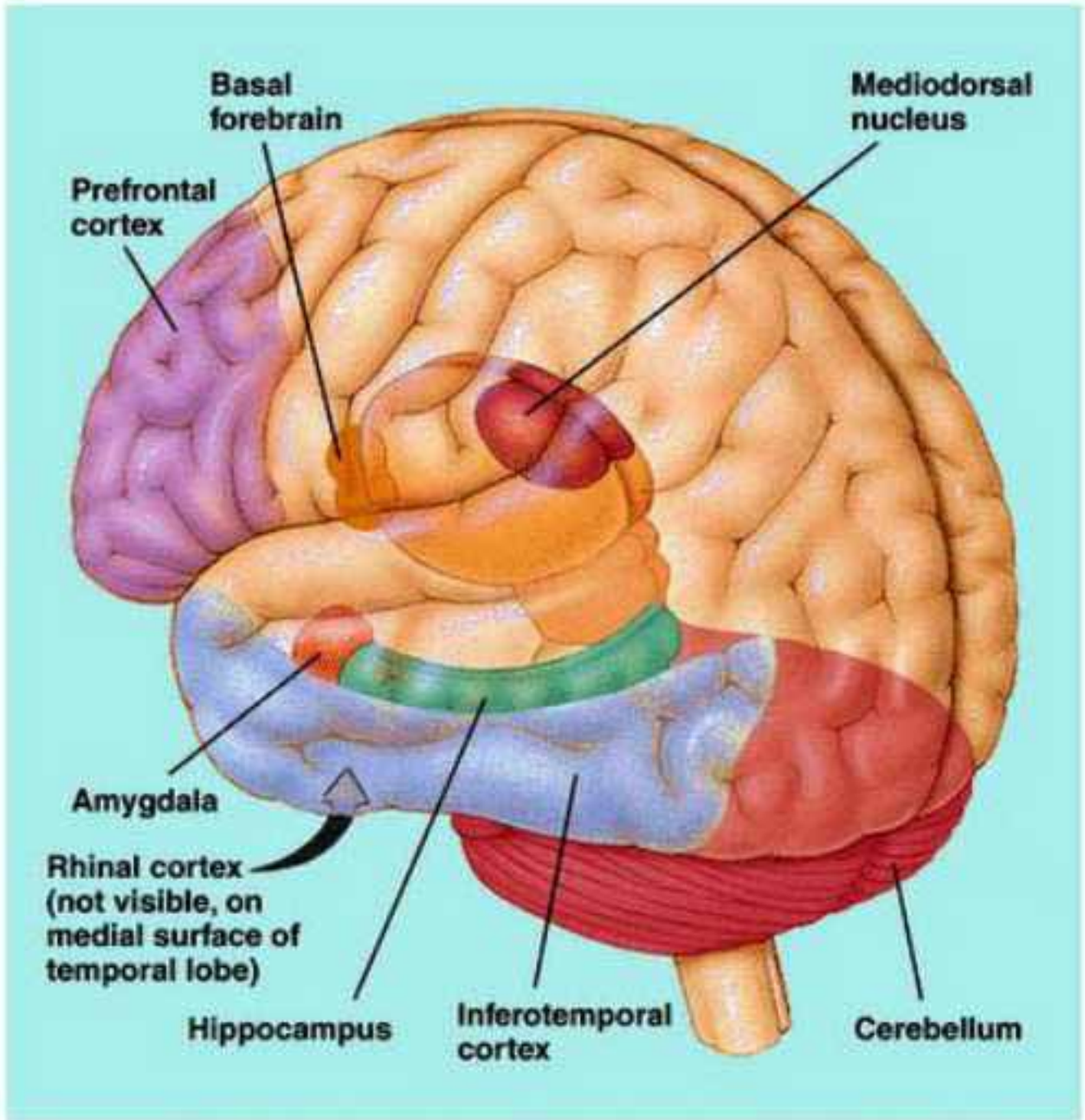
Sexual jealousy - the case of the jealous timber wolf

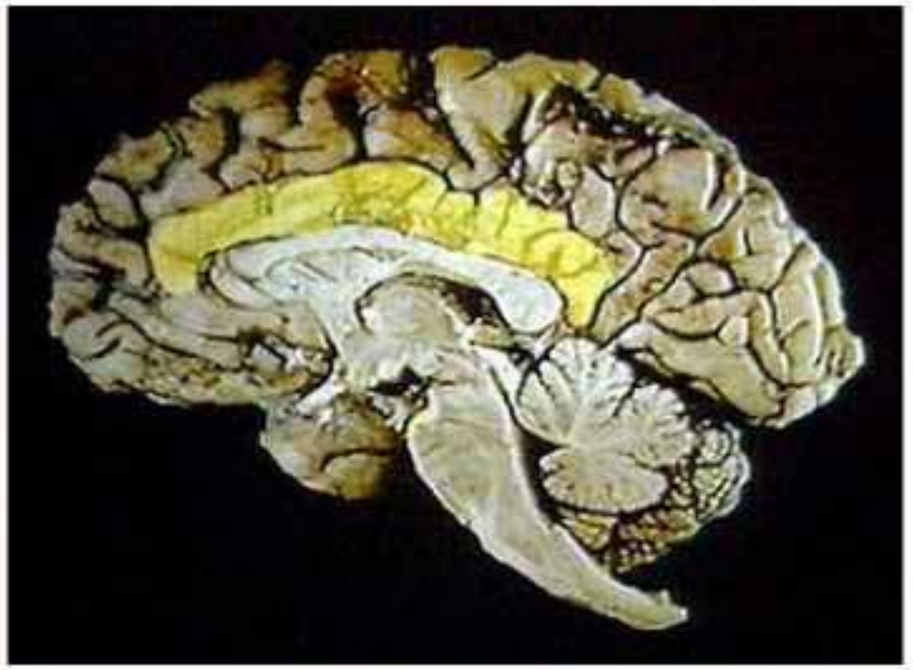
Sadness, grief and depression

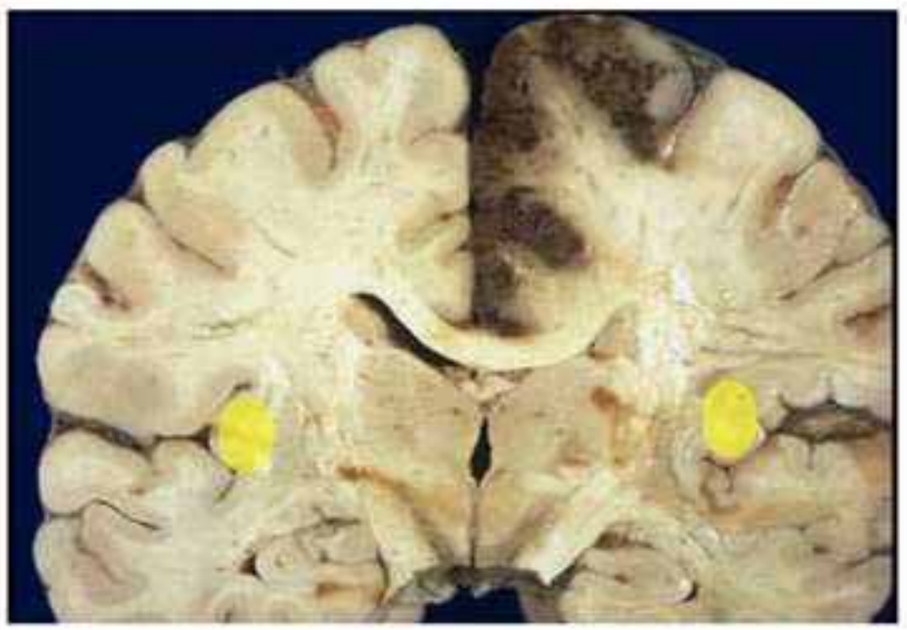


Sadness, grief and depression

Frontal, cingulate and insular cortices



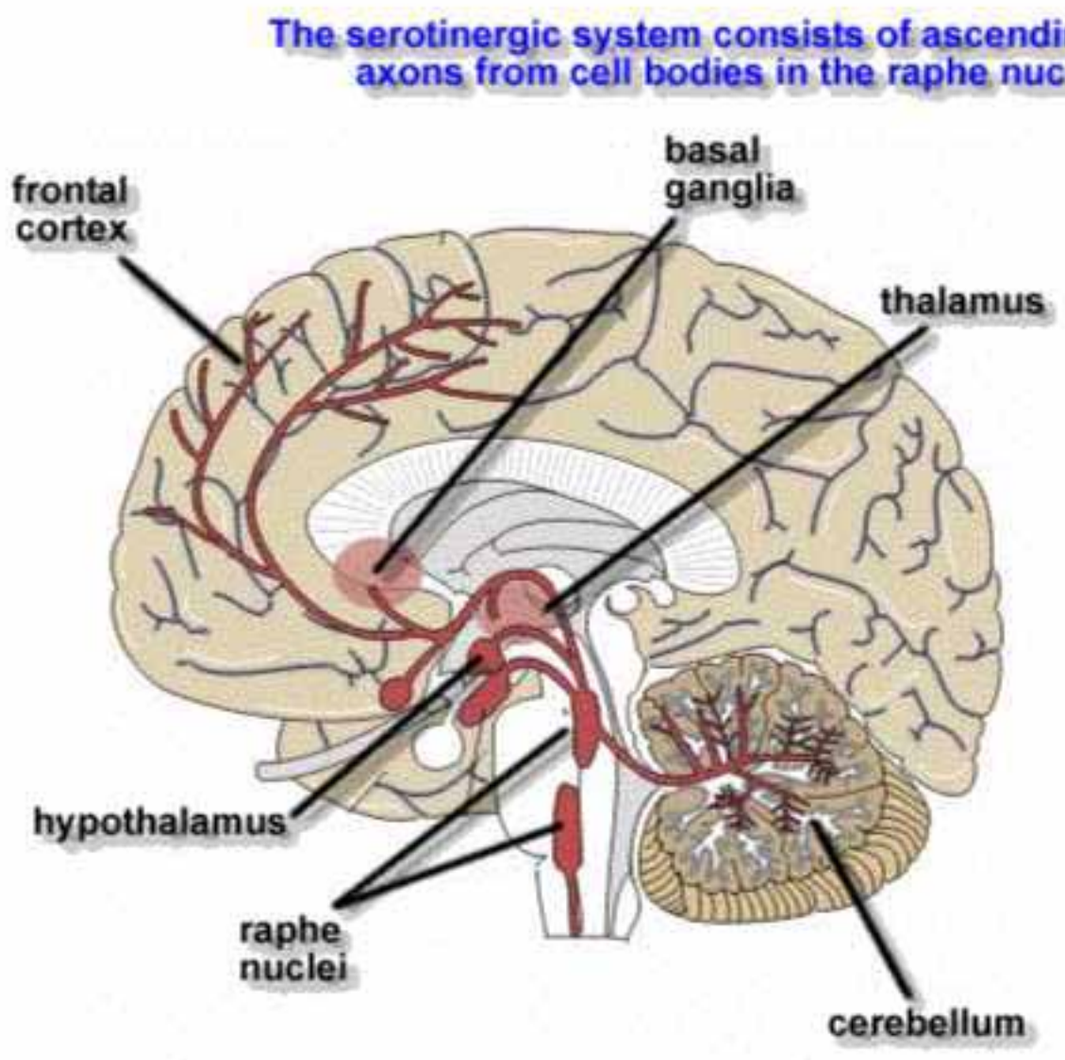


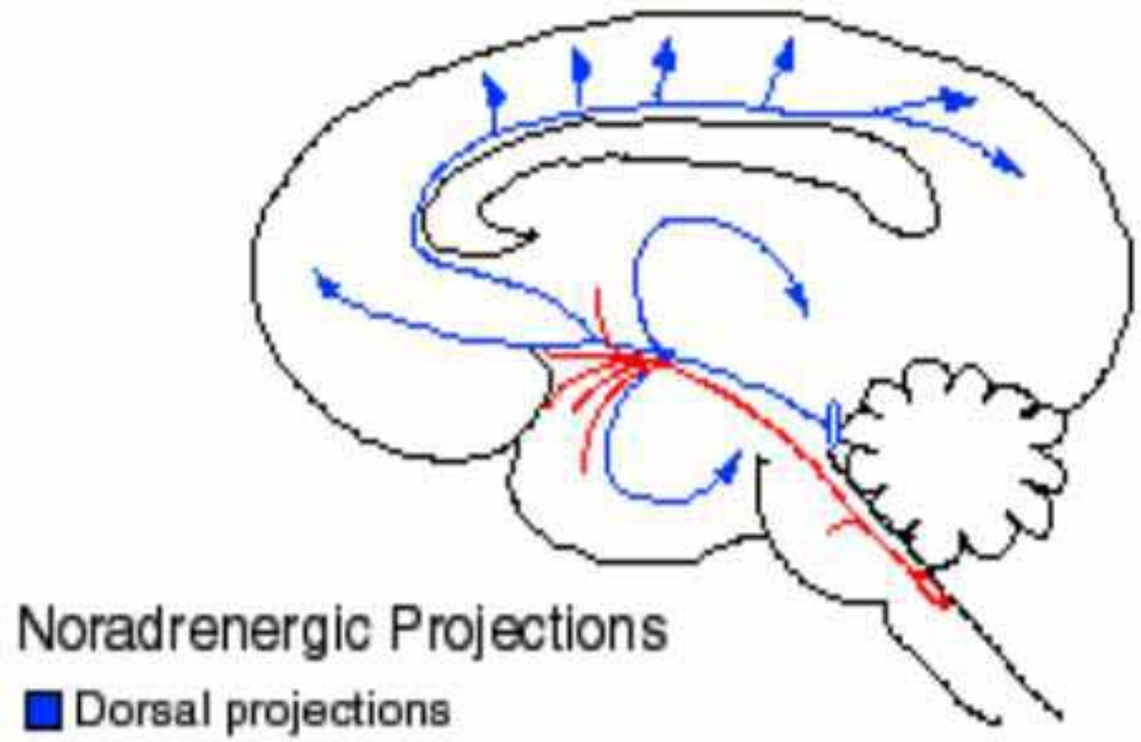


Sadness, grief and depression

Frontal, cingulate and insular cortices

Serotonin and noradrenaline deficiencies





Sadness, grief and depression

Frontal, cingulate and insular cortices

Serotonin and noradrenaline deficiencies

SSRIs (Sertraline ,PROZAC)
SNRIs (Venlafaxine)
NaSSAs (Mirtazapine)

Sadness, grief and depression

Frontal, cingulate and insular cortices

Serotonin and noradrenaline deficiencies

SSRIs (Sertraline ,PROZAC)
SNRIs (Venlafaxine)
NaSSAs (Mirtazapine)

Drugs are often effective in animals with depressive symptoms

Can animals experience grief ?

Great apes, dolphins, whales, elephants, dogs

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Great apes, dolphins, whales, elephants, dogs

When Elephants Weep (Masson and McCarthy)

Can animals experience grief ?

Great apes, dolphins, whales, elephants, dogs

When Elephants Weep (Masson and McCarthy)

Chimpanzees

Can animals experience grief ?

Mothers and infants







Can animals experience grief ?

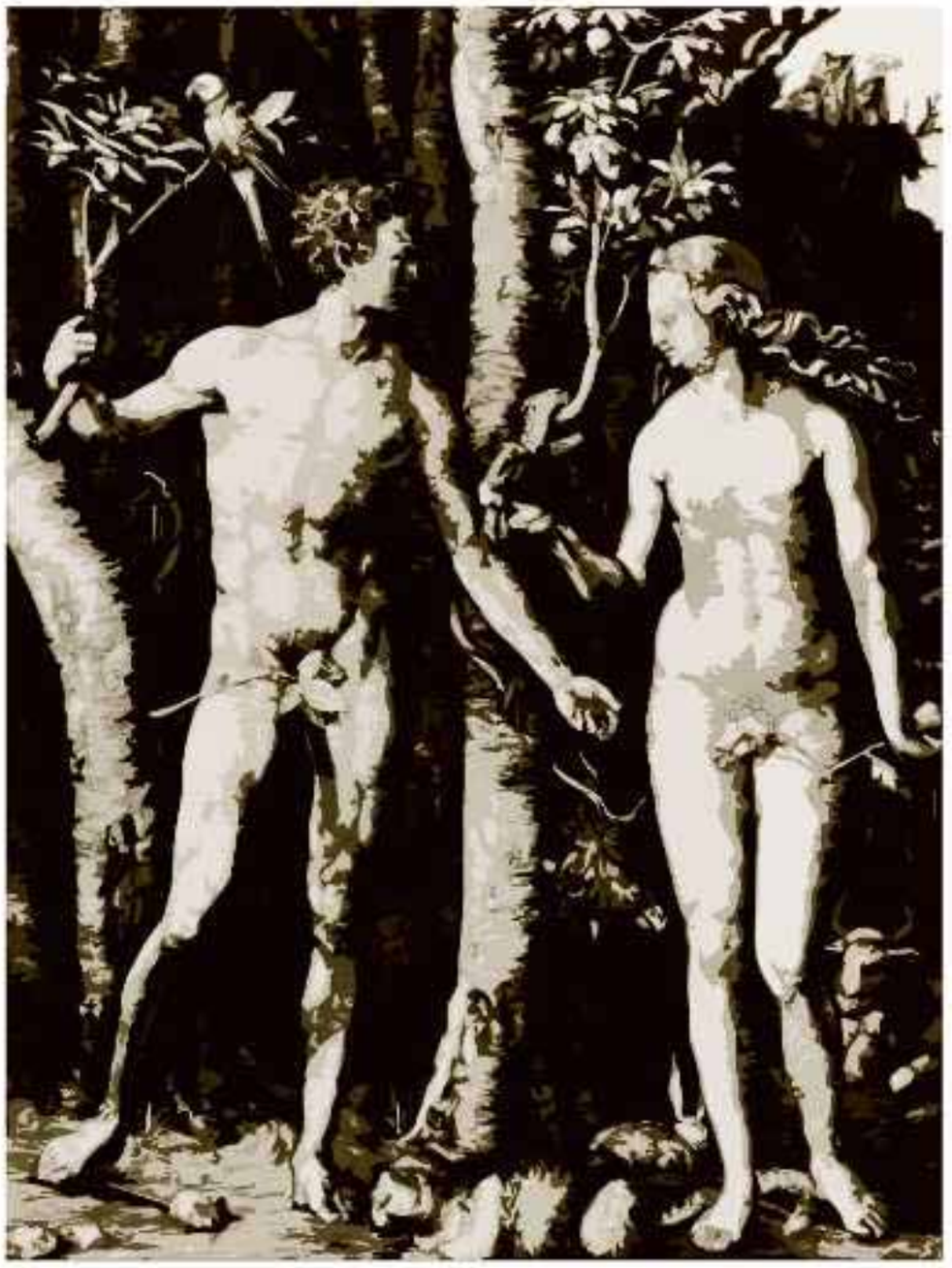
Mothers and infants

Dogs and their human owners

Shame and guilt

Moral emotions - unique to humans ?

May be just learned
anticipation of punishment



Shame and guilt

Moral emotions - unique to humans ?

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Not living up to the
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Shame and guilt

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expectations of others

Joy and Love

Not so easy to be considered as promoting survival

Smile and the world smiles with you

Joy and Love

Not so easy to be considered as promoting survival

Smile and the world smiles with you

Play

Joy and Love

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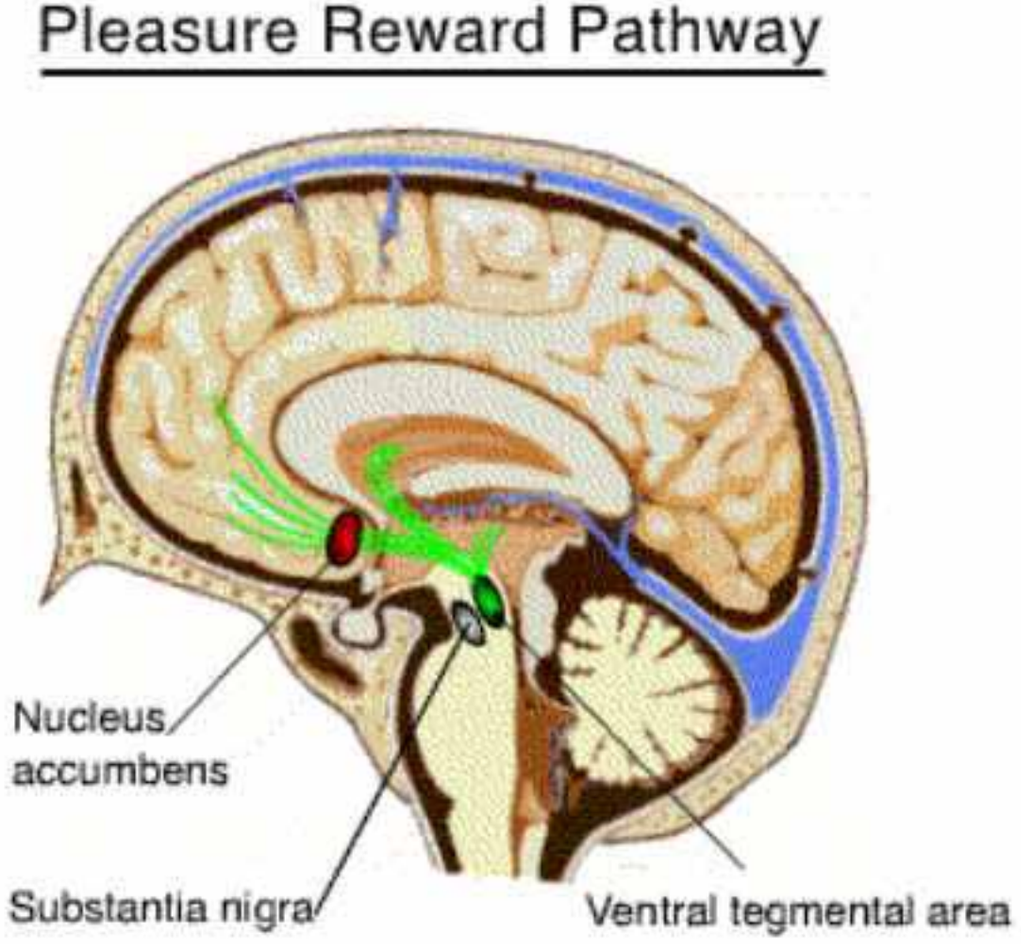


Joy and Love

Not so easy to be considered as promoting survival

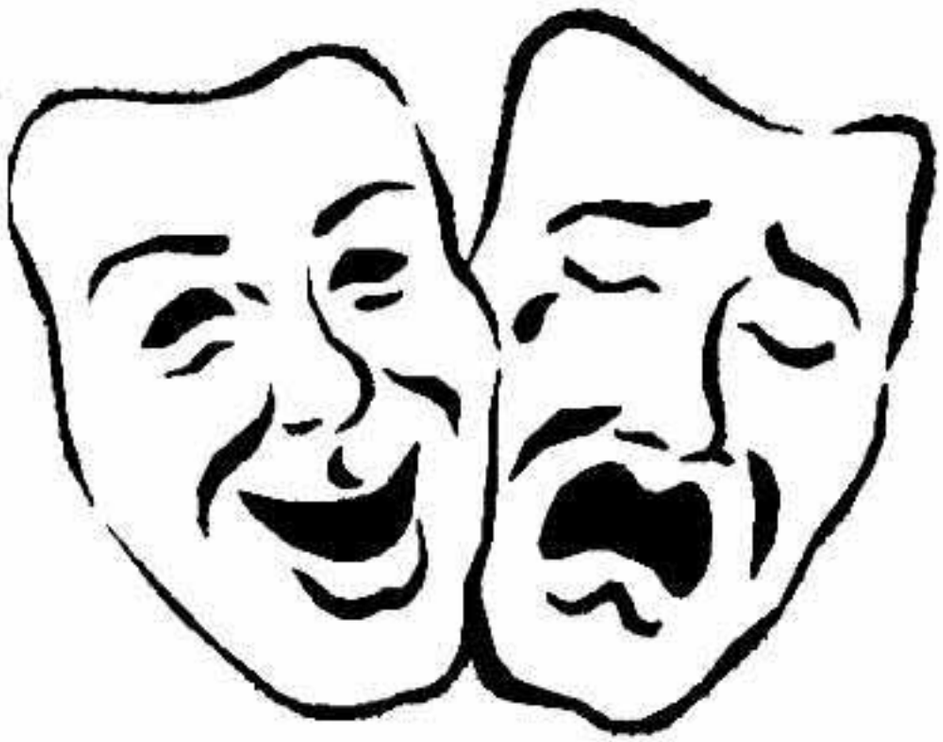
Smile and the world smiles with you

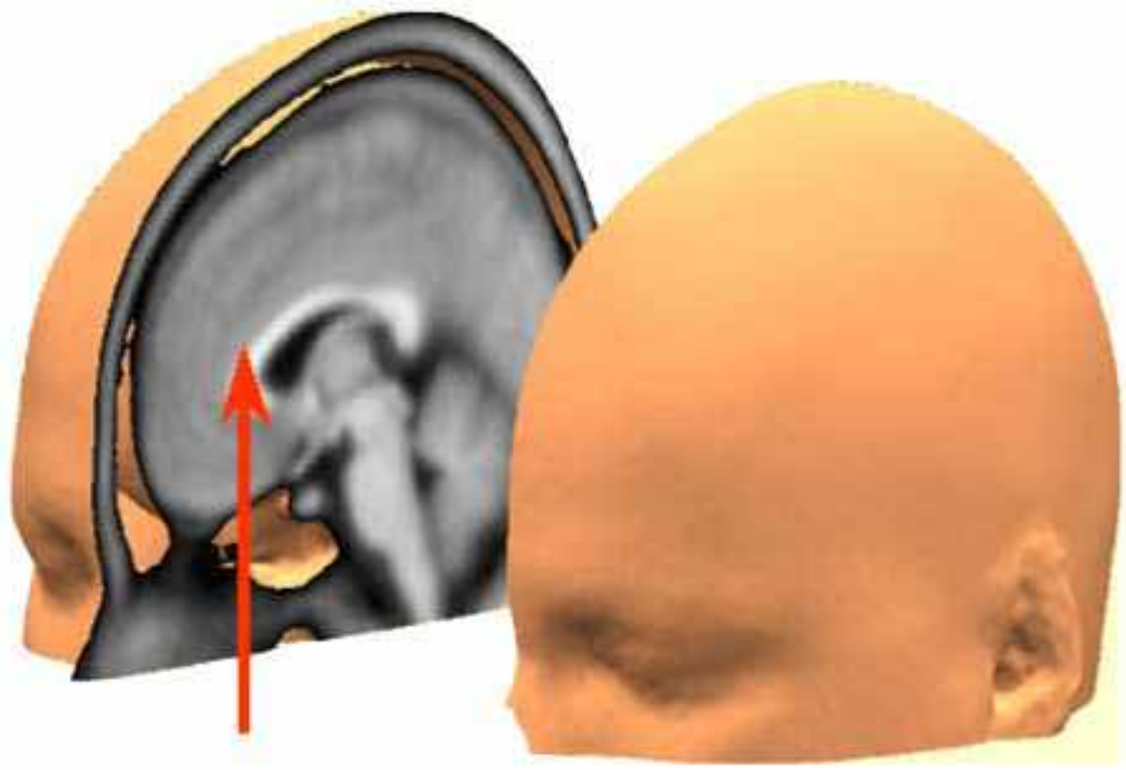
Play

Grooming and brain opioids

Joy and Love

The happy left brain vs the unhappy right one !





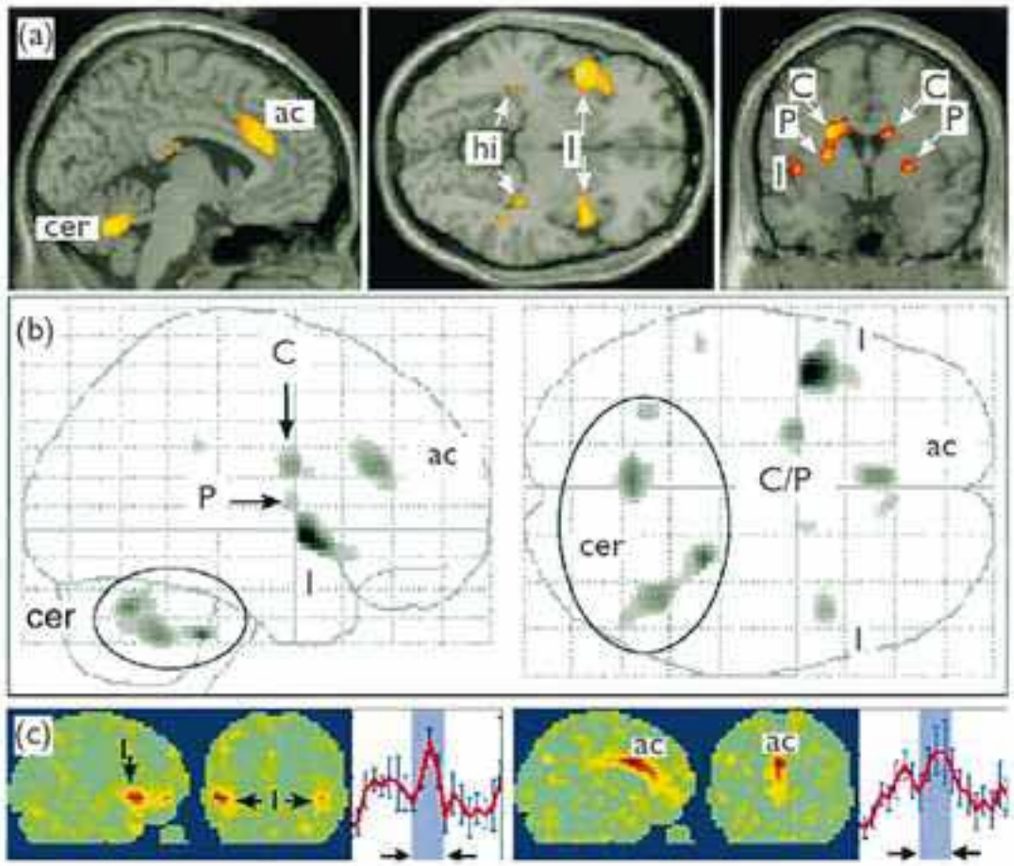
Joy and Love

The happy left brain vs the unhappy right one !

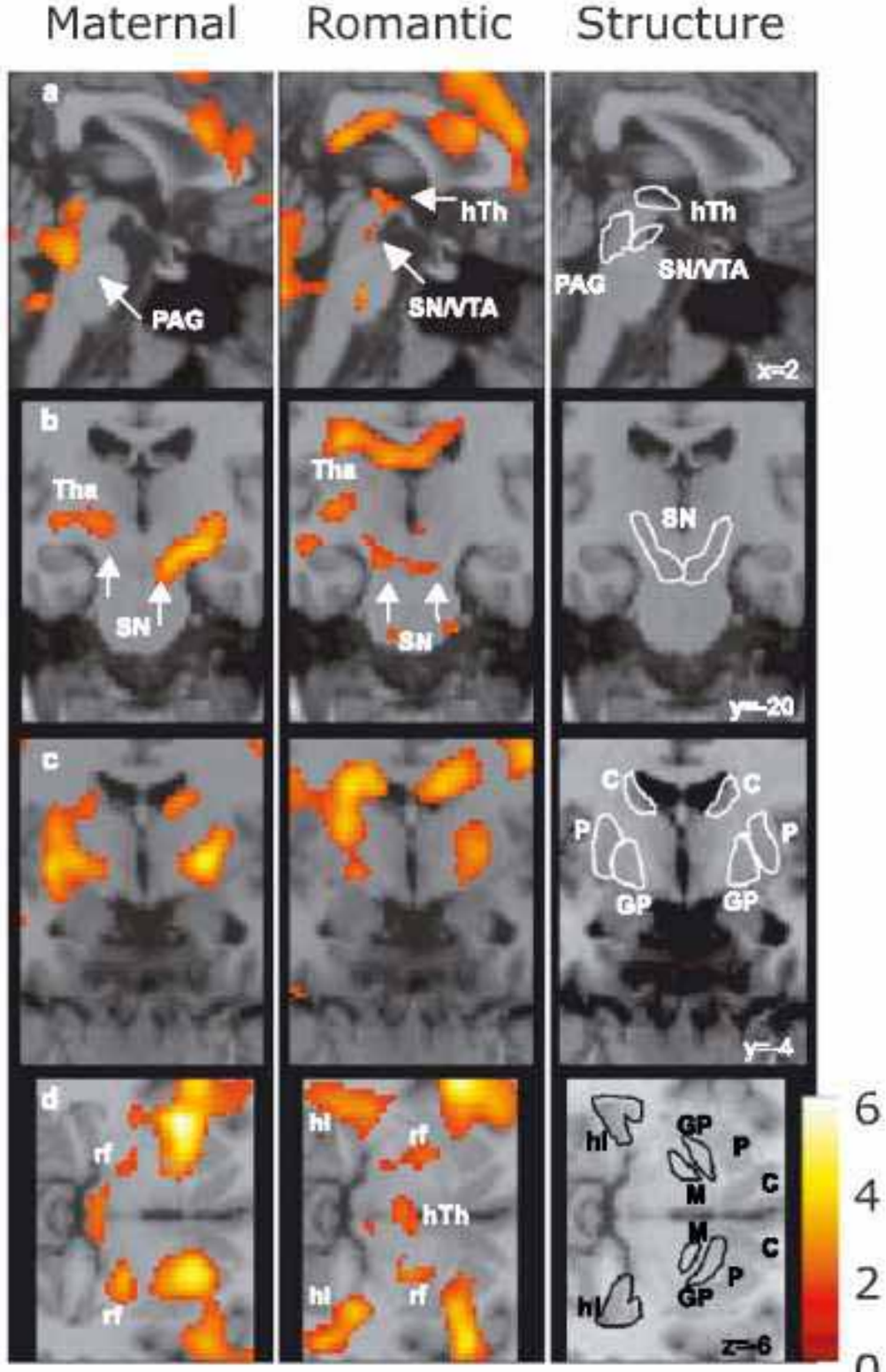
Is love really an emotion?

Joy and Love

Romantic and maternal love



Bartels & Zeki
Neuroreport 2000



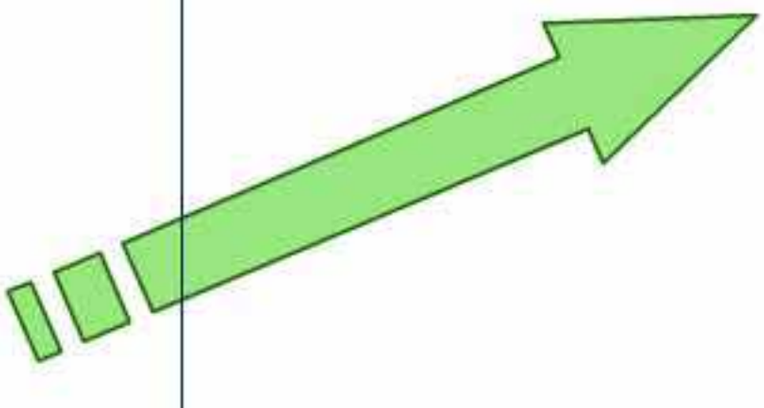
Neuroimage 2004

Joy and Love

Can other animals experience love?

Mother love - oxytocin, opioids and dopamine

Joy and Love

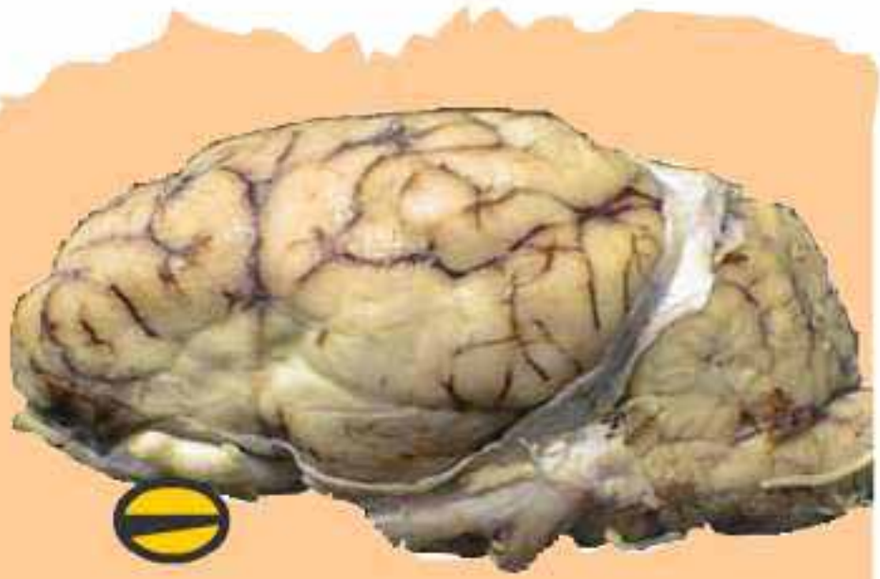


The impact of an attractive face

Joy and Love

The impact of an attractive face

Joy and Love

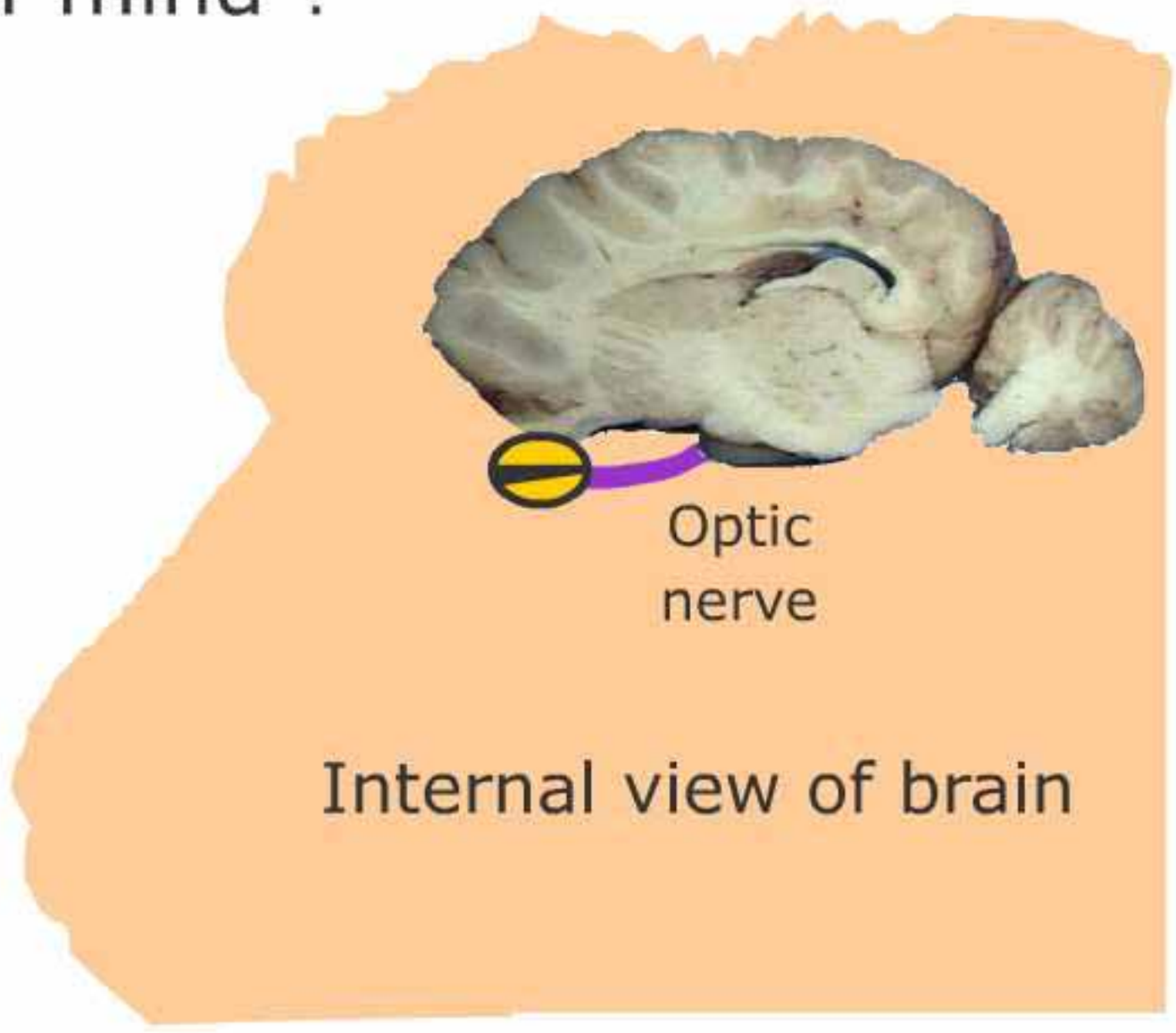


External view of brain

During oestrus - male attractive

Joy and Love

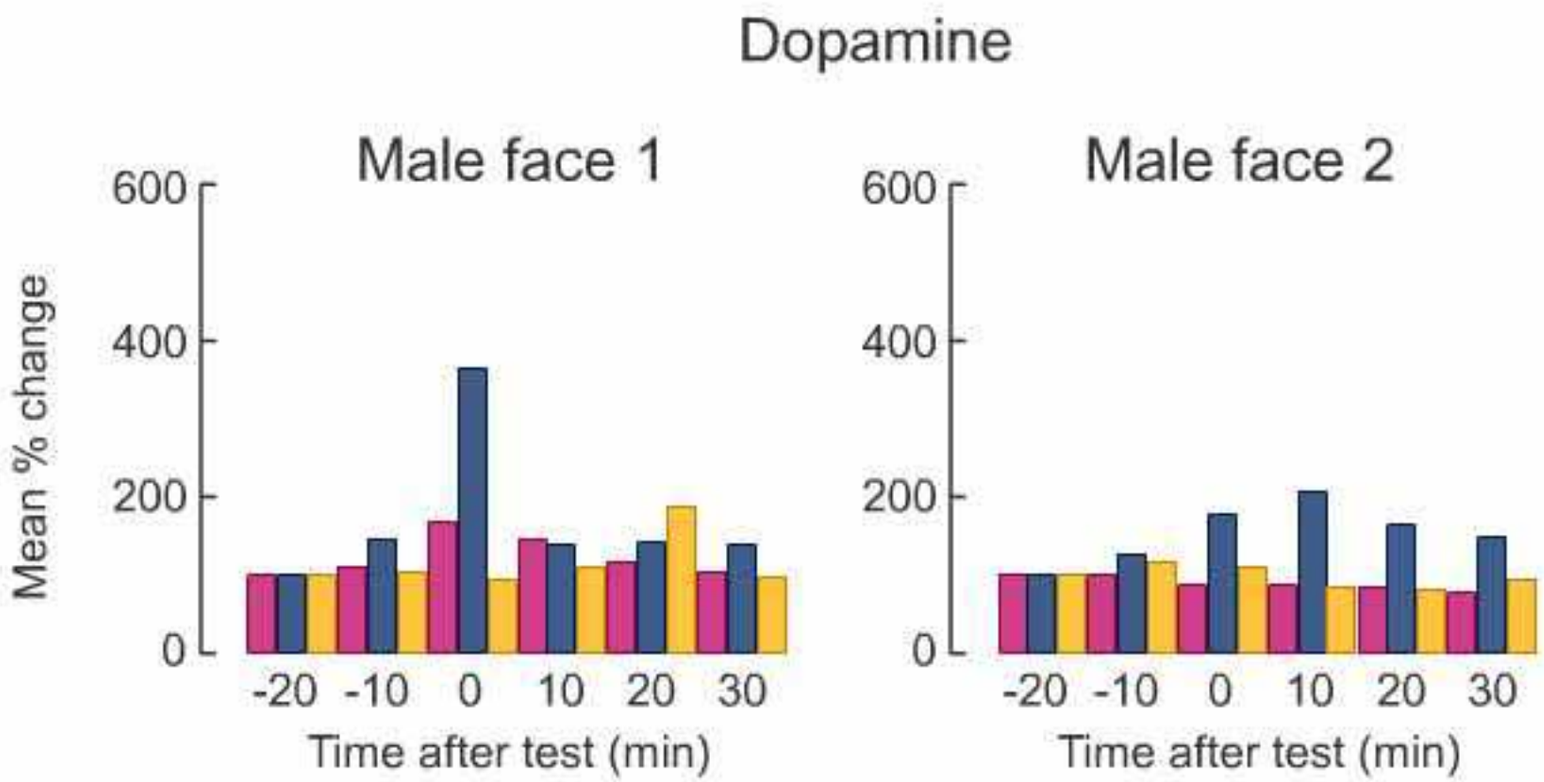
'In sight, but out of mind ?'



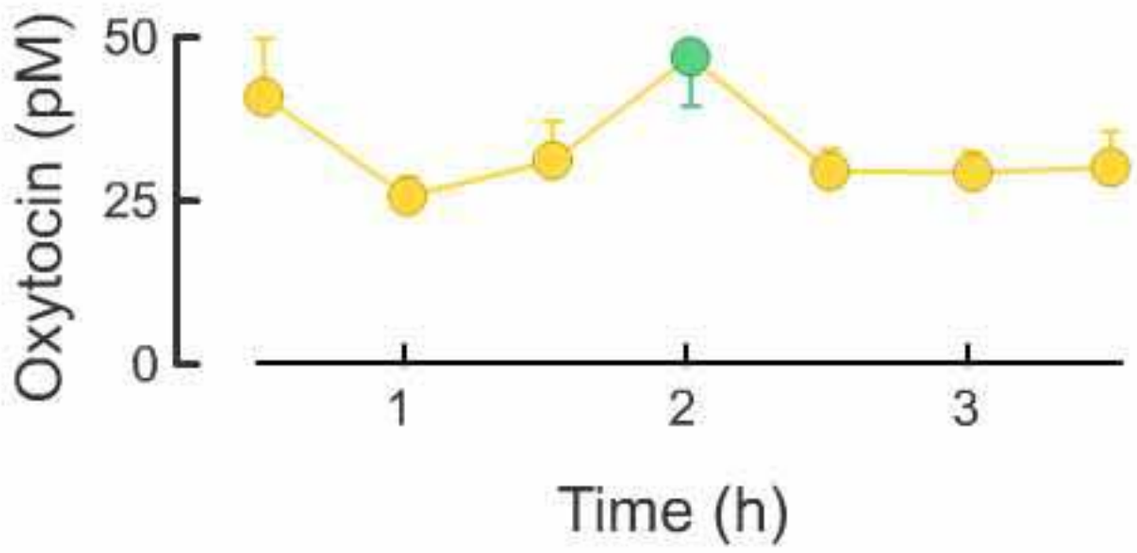
Internal view of brain

Not during oestrus - male not attractive

Joy and Love

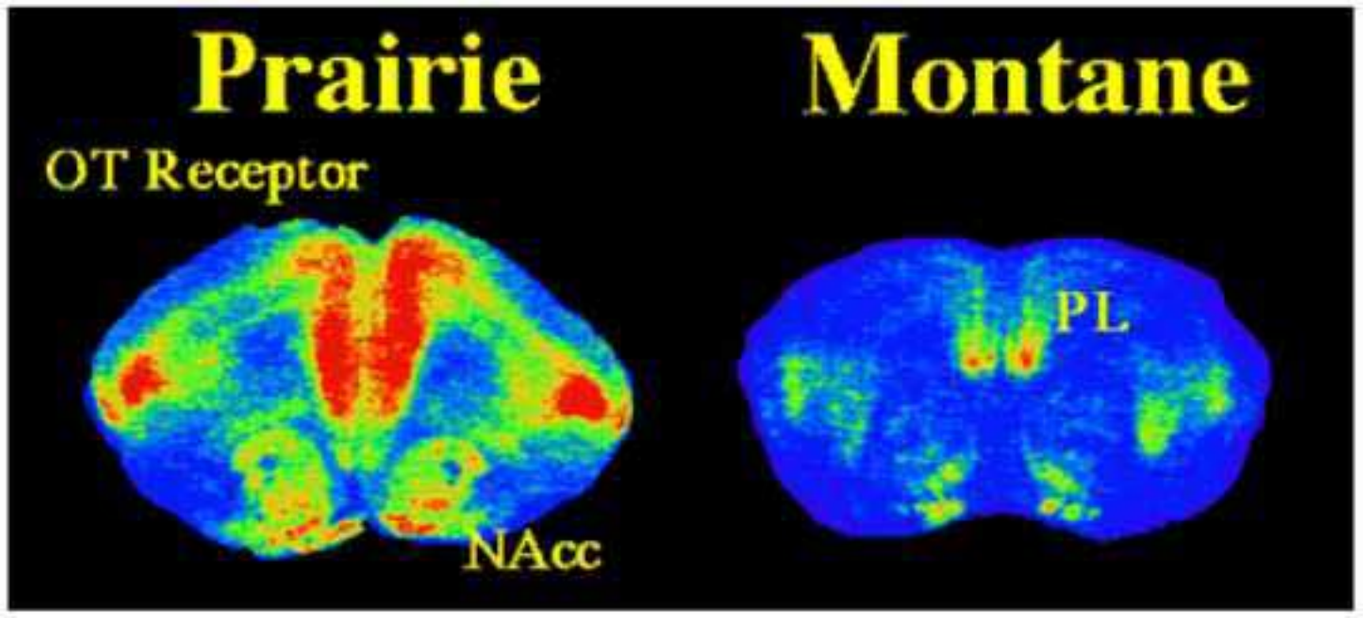


Fabre-Nys *et al*
Eur. J. Neurosci.1997



Joy and Love

Monogamous voles



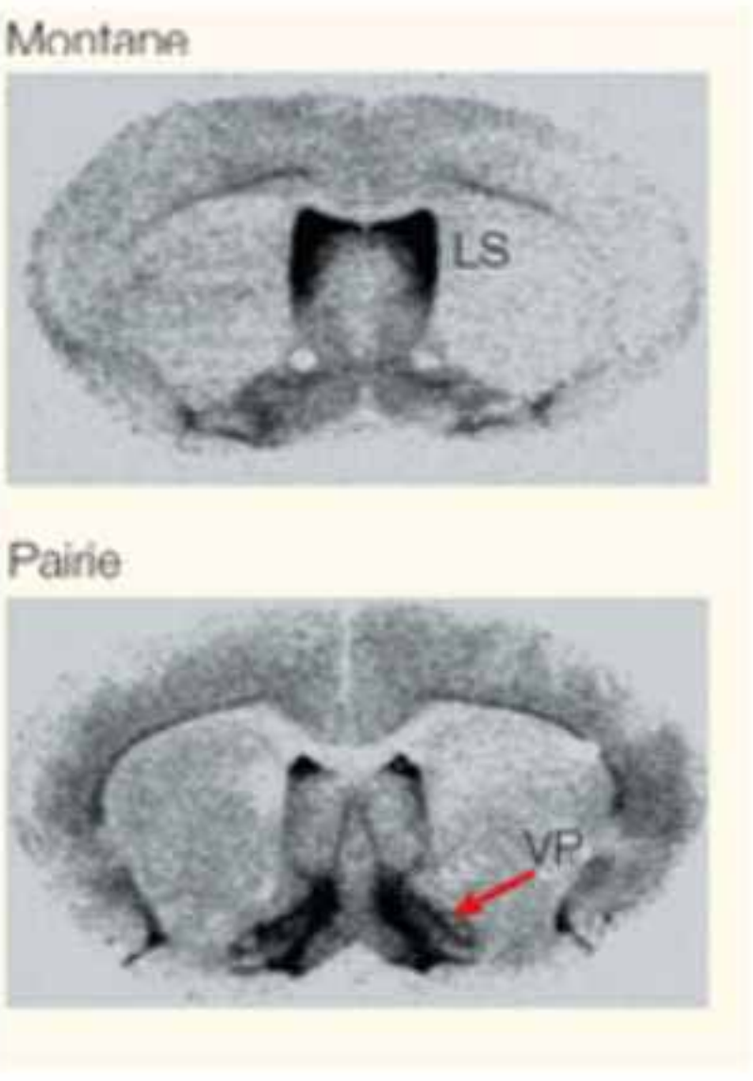
Joy and Love

Monogamous voles

Love chemistry may be slightly different in male voles

Cys-Tyr-Phe-Gln-Asn-Cys-Pro-Arg-Gly-NH_2

Vasopressin



Young *et al* 2001

Joy and Love

Monogamous voles

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Page 26

Daily Mail, Thursday, August 19, 1999

Science finds a way to cure the love rats

All over: Jagger and Jerry

SCIENTISTS could be on the verge of finding a cure for love rats, it emerged yesterday.

Research on rodents has shown that a genetic tendency to infidelity can be reversed – and the effects on philanderers of the human kind may be just as drastic.

Sadly, it is a discovery that has come too late for the long-suffering Jerry Hall.

The latest success of genetic

By JENNY HOPE
Medical Correspondent

engineering might have allowed the former model, who never quite managed to get Mick Jagger to a legally-recognised altar, to have kept him by the fireside instead.

Scientists have managed for the first time to turn promiscuous, anti-social animals into friendly and faithful mates.

An American team achieved the transformation by inserting a gene from a monogamous species into a polygamous one.

The finding may also be important in treating such human disorders as autism, schizophrenia and Tourette's syndrome – a condition where sufferers spout obscenities in public.

The study, carried out at Emory University, in Atlanta, built on previous research involving voles.

Larry Young and his colleague Thomas Insel had already studied the monogamous prairie voles and their cousins the montane (hill-dwelling) voles, which have many mates.

'After mating, the male prairie vole forms a strong social bond. He prefers to be with that mate to the exclusion of all others,' said Dr Young.

'That pair nests together. When she has her babies he spends as much time with those babies as she does. He defends the nest. They stay together for the next litter and the next and the next.'

But montane voles behave in a

'He takes off to search for another'

vastly different manner – even though their genetic make-up is 99 per cent identical to that of their prairie vole cousins.

'When the montane vole mates, he immediately takes off and searches for another female,' said Dr Young.

The researchers managed to identify the DNA sequence that separated the two types of vole.

It is responsible for regulating how much of the peptide hormone vasopressin is released into the brains of animals, including humans. Vasopressin plays a role in male behaviours, including aggression, communication, sexual activity and social memory.

In the new study, scientists took a vasopressin receptor gene from a monogamous vole and inserted it into a polygamous mouse.

To their surprise, the resulting 'new mice' formed close relationships with females, says a report in the science journal Nature. Mice were used first because it is easier to change their genetic make-up.

The next step is to see whether genetic implants will also make the montane moles more faithful.

Dr Young said much more research would be needed to determine whether genetic manipulation could help treat antisocial disorders in humans.

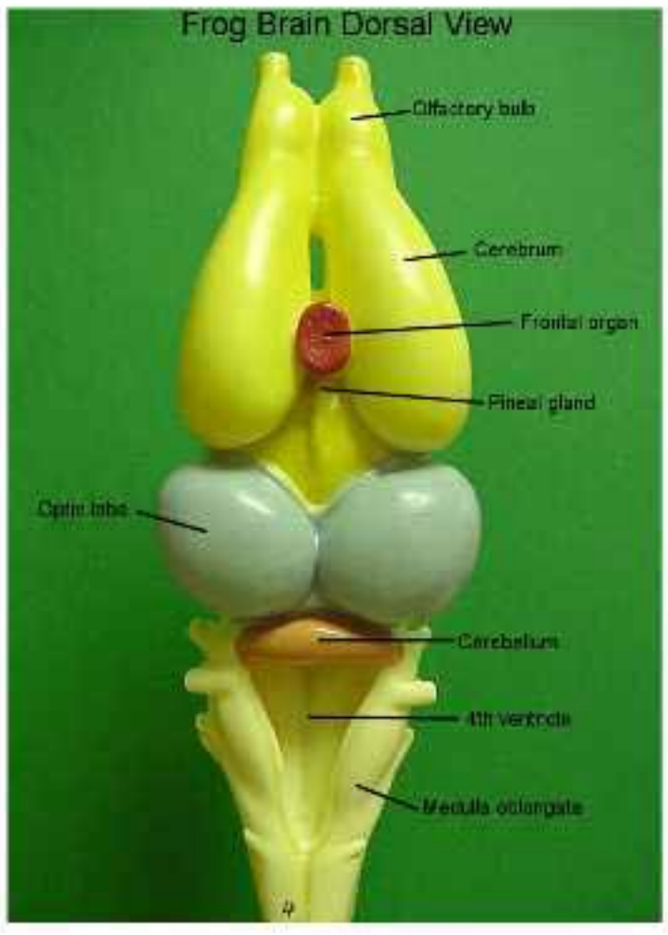
He warned: 'In human cultures we may find that experience and values have a lot more to do with behaviour.'

In other words, the human love rats may not want to be cured.

Humans and animal emotions: the differences

Capacity for consciousness, self-awareness and language

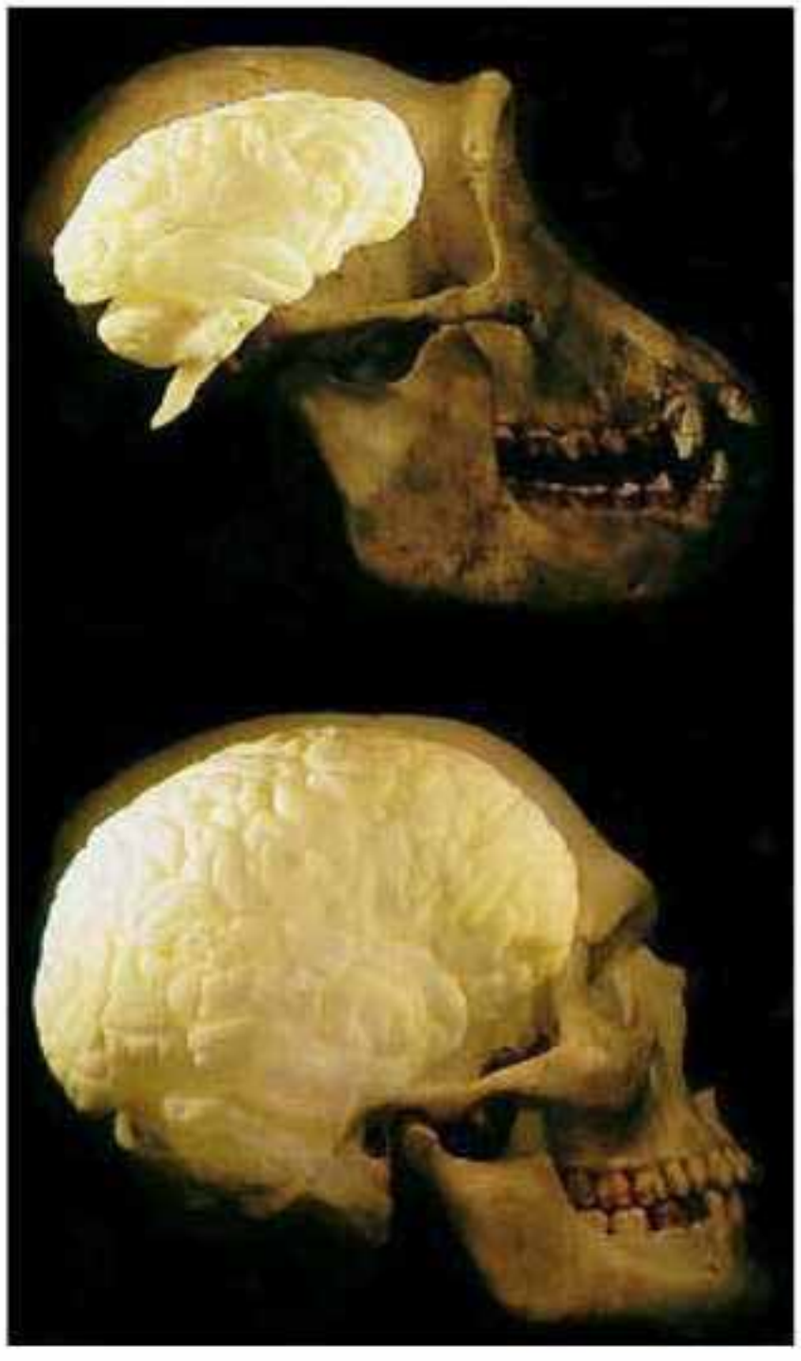
Frog



Rat

Sheep

Chimpanzee

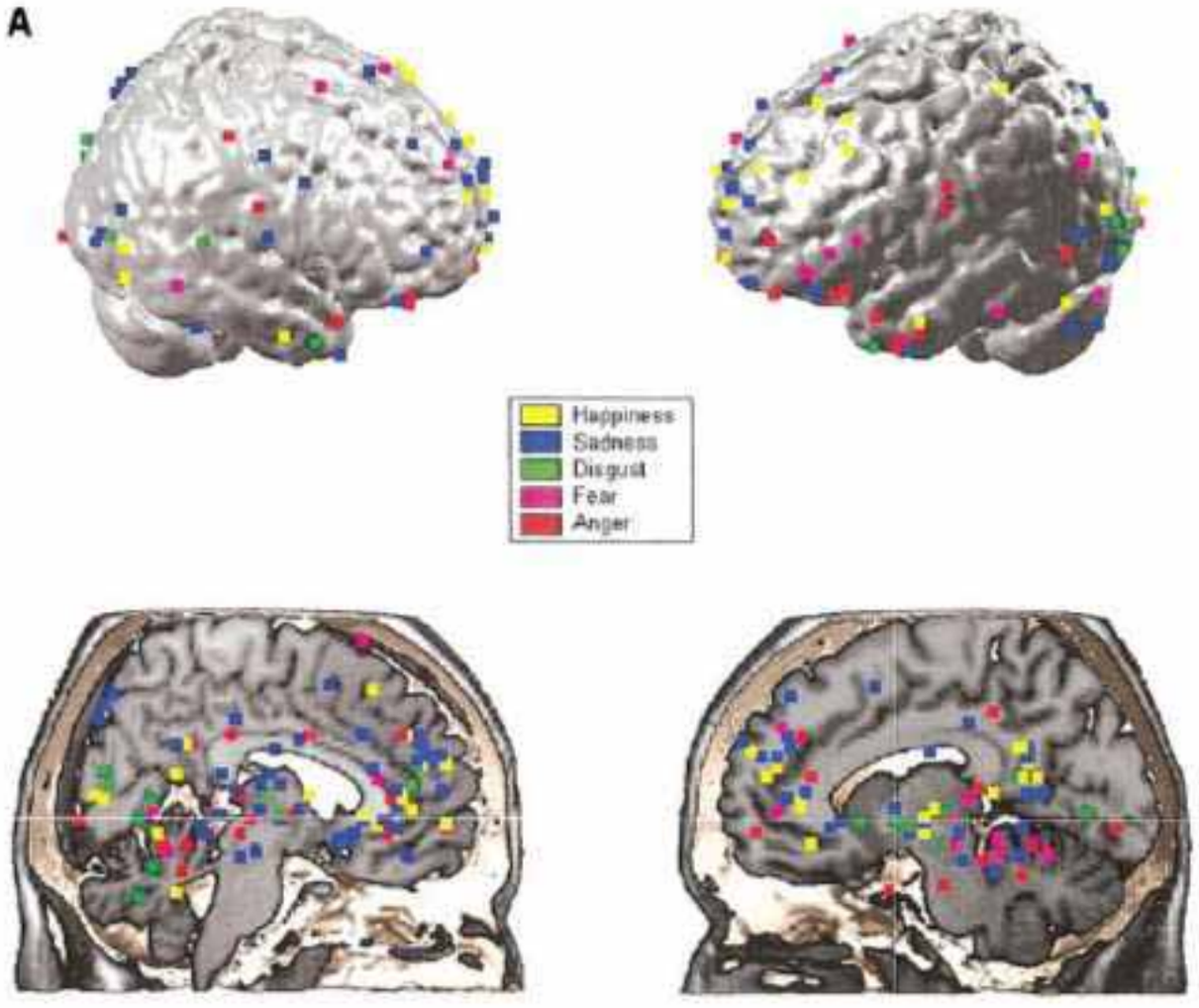


Human

Humans and animal emotions: the differences

Capacity for consciousness, self-awareness and language

Expansion of our time-domains, self-reflection and moral sense



Luan Phan *et al*
Neuroimage 2001

Humans and animal emotions: the differences

Capacity for consciousness, self-awareness and language

Expansion of our time-domains, self-reflection and moral sense

Human and animal emotions: the same thing?

So do other animals have feelings as well as emotional responses?

Yes - but probably less intense and varied and sporadic rather than continuous

Limited capacity for self-generated emotions and feelings

Mainly in response to directly perceived external events

One boy and his dog

A tale of two brains - one boy and his dog

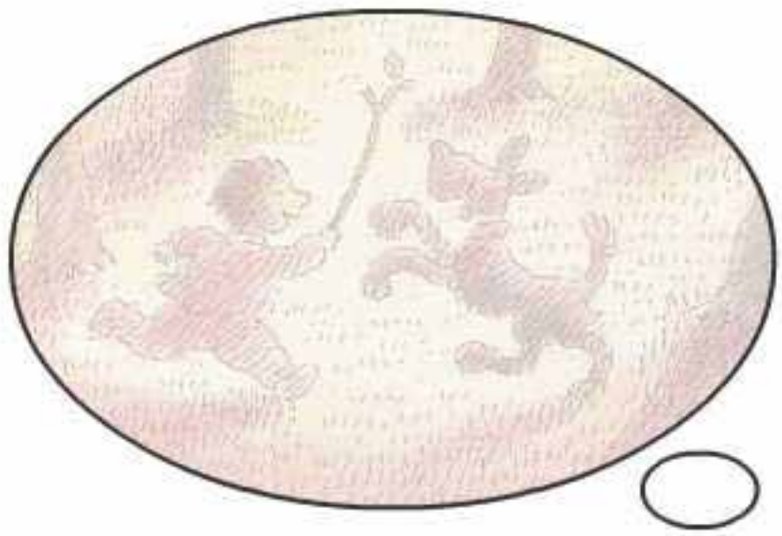
Boy is separated from dog

A tale of two brains - one boy and his dog

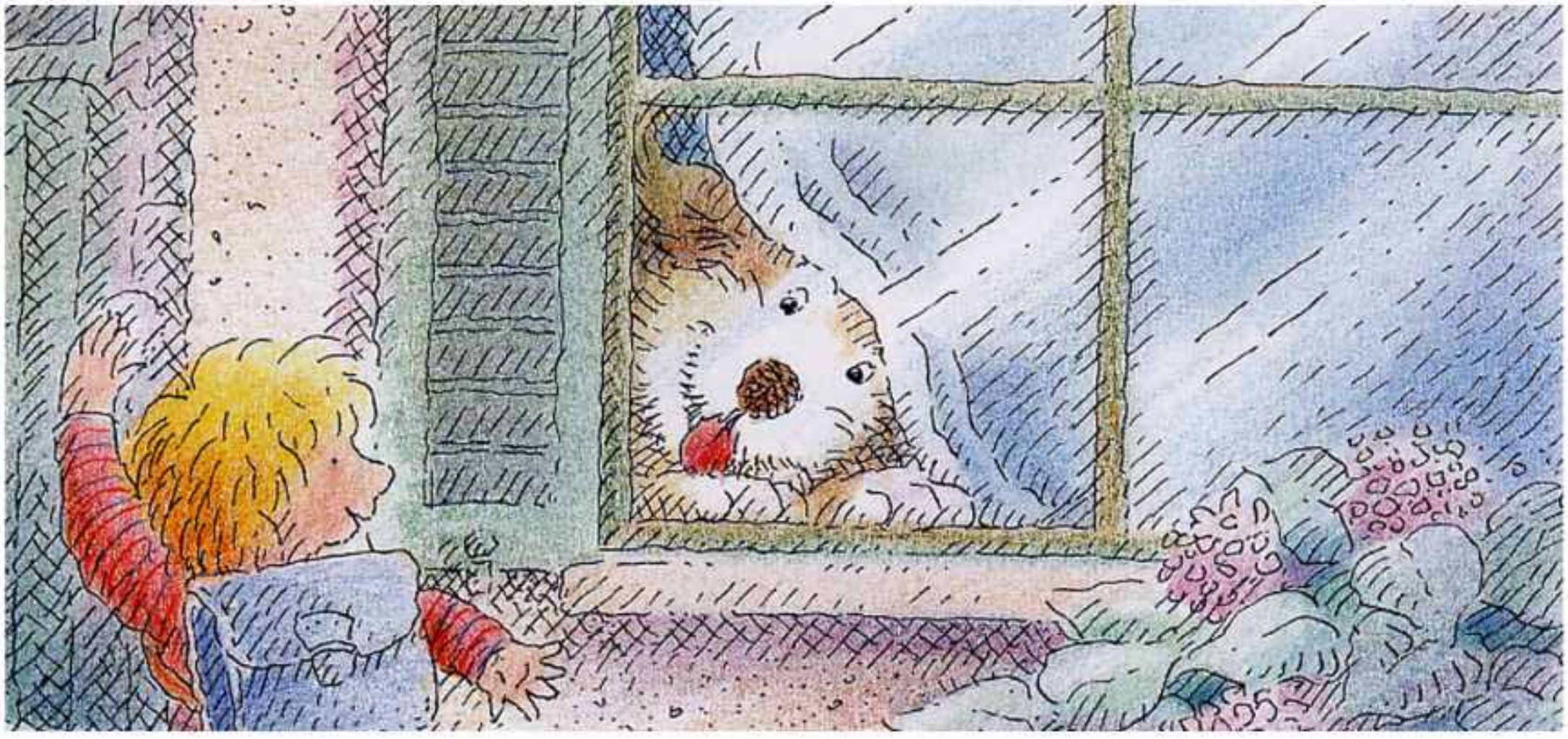
Boy thinks about dog all the time

A tale of two brains - one boy and his dog

Dog thinks about boy only some of the time



Boy returns



A tale of two brains - one boy and his dog

Boy and dog are reunited

...and finally

'Is it not monstrous that this player here,
But in a fiction, in a dream of passion,
Could force his soul so to his own conceit,
That, from her working, all his visage wann'd;
Tears in his eyes, distraction in's aspect,
A broken voice, and his whole function suiting
With forms to his conceit? And all for nothing!'
(Shakespeare - Hamlet, Act 2 Scene 2)

At least other animals may not try to deceive us!