MRCPsych (Part 1)

Emotion and motivation

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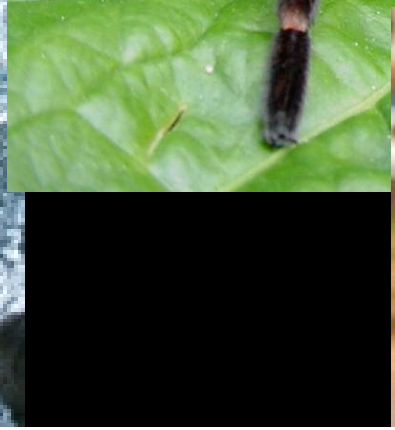
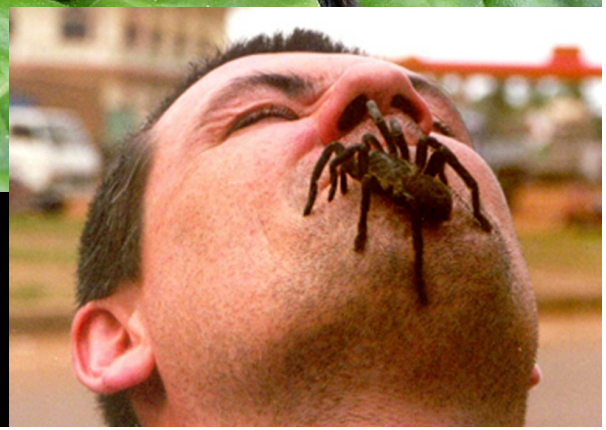
Tuesday 25 March 2004, 2pm
Fulbourn Hospital, Fulbourn, Cambridge





Emotions: a Doomsday device?

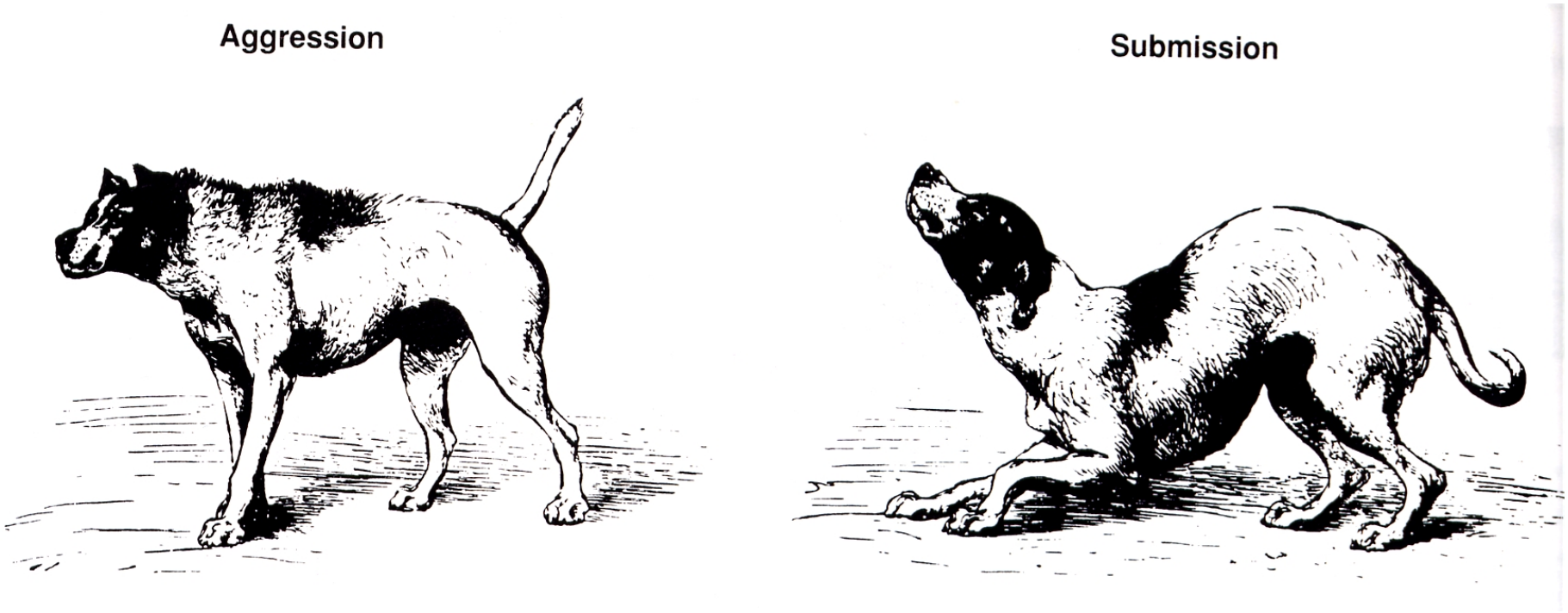
Kubrick (1964) 'Dr Strangelove'

Convincing others that you're not rational

Kubrick (1980) 'The Shining'

Autonomic changes are hard to fake

Theories about the evolution of emotions



Darwin (1872)

Measuring emotions

Emotions have several components; all can be measured.

- *subjective*
- *behavioural*
- *physiological*

Subjective components cannot be measured in animals, but clever behavioural techniques can still give us clues to their internal mental state.

Universal facial expressions: innate, primary emotions?

Ekman et al. (1972); Ekman & Friesen (1975)

Theories of emotion

The James–Lange theory of emotion (1)

Common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike.

The hypothesis here to be defended says that this order of sequence is incorrect… [instead] we feel sorry because we cry, angry because we strike, afraid because we tremble…

Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colourless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we could not actually feel afraid or angry.

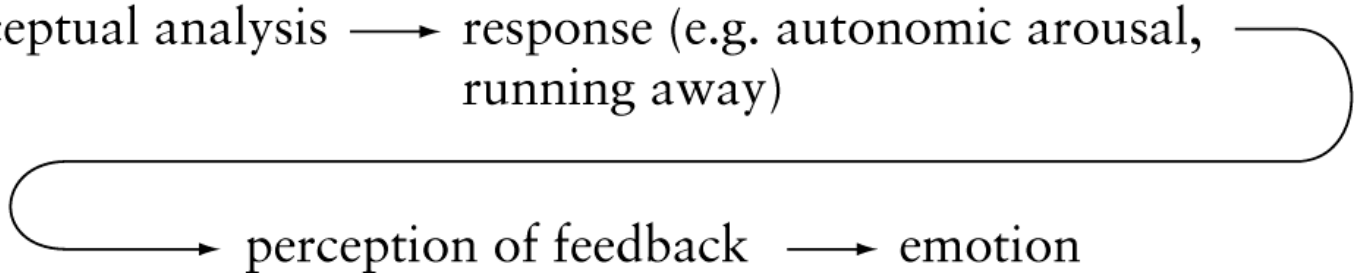
James (1884)

The James–Lange theory of emotion (2)

Traditional view

event → perceptual analysis → emotion → response

James–Lange

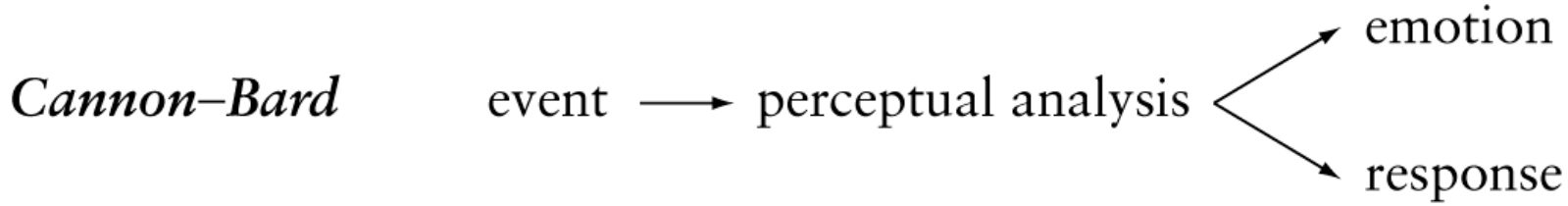


James (1884); Lange (1885)

The Cannon–Bard theory of emotion

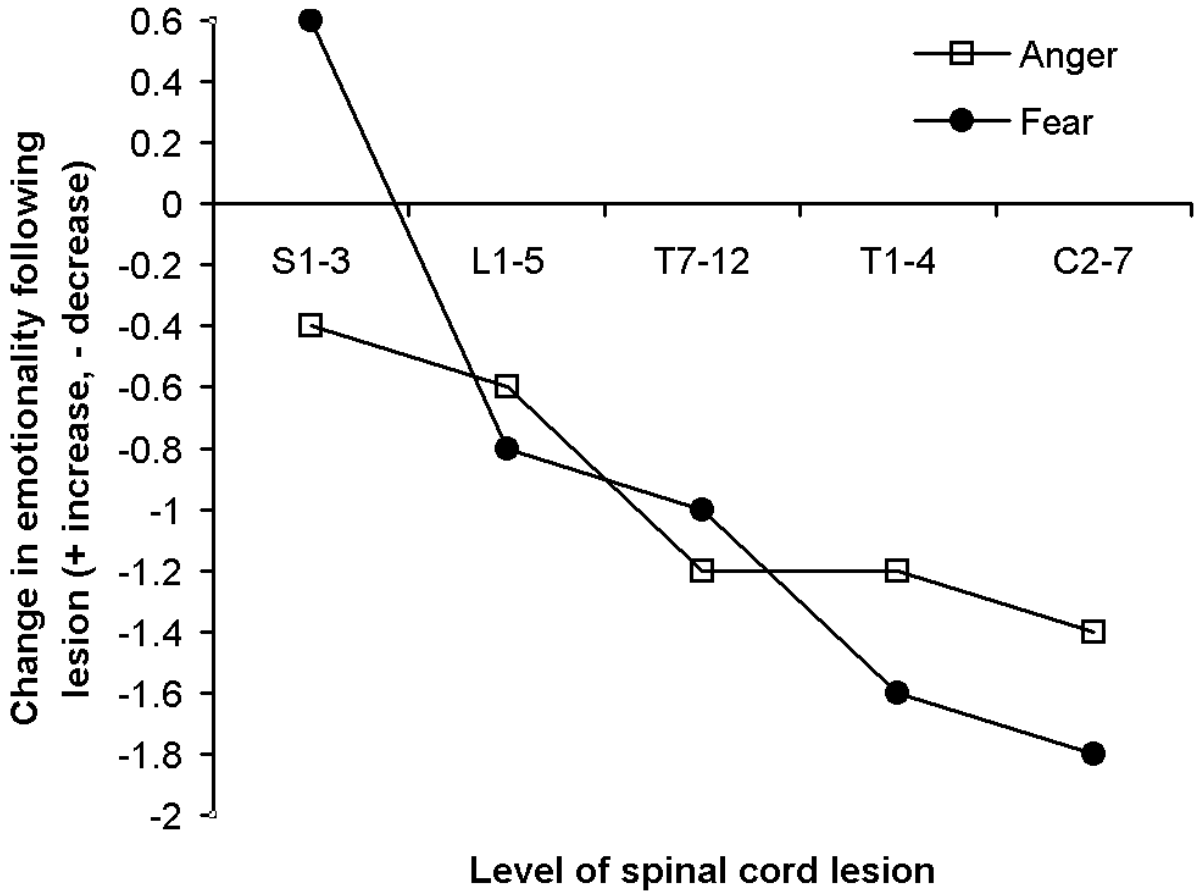
Objected to James–Lange theory on five grounds:

1. **separation of viscera from CNS** did not impair 'emotional' responses in animals (Sherrington, Cannon);
2. the same visceral changes occur in **different emotional states;**
3. the viscera are relatively **insensitive** (e.g. to surgery);
4. visceral changes are **too slow** to account for emotions (some affective reactions over in 0.8s; many autonomic responses slower);
5. **artificial induction** of visceral changes does not induce emotional experience (Marañon, adrenaline injection).



Cannon (1927); Bard (1934)

Subjective feelings following spinal cord lesions



"It's a sort of cold anger. Sometimes I act angry when I see some injustice. I yell and cuss and raise hell, because if you don't do it sometimes, people will take advantage of you. But it just doesn't have the heat to it that it used to have. It's a mental kind of anger."

Hohmann (1966)

Visceral changes distinguish emotions (1)

Subjects participated in a fictitious experiment on hypertension and were

(1) given electric shocks ('faulty apparatus') → ***fear***

(2) insulted by a 'technician' → ***anger***

Ax (1953)

Visceral changes distinguish emotions (2)

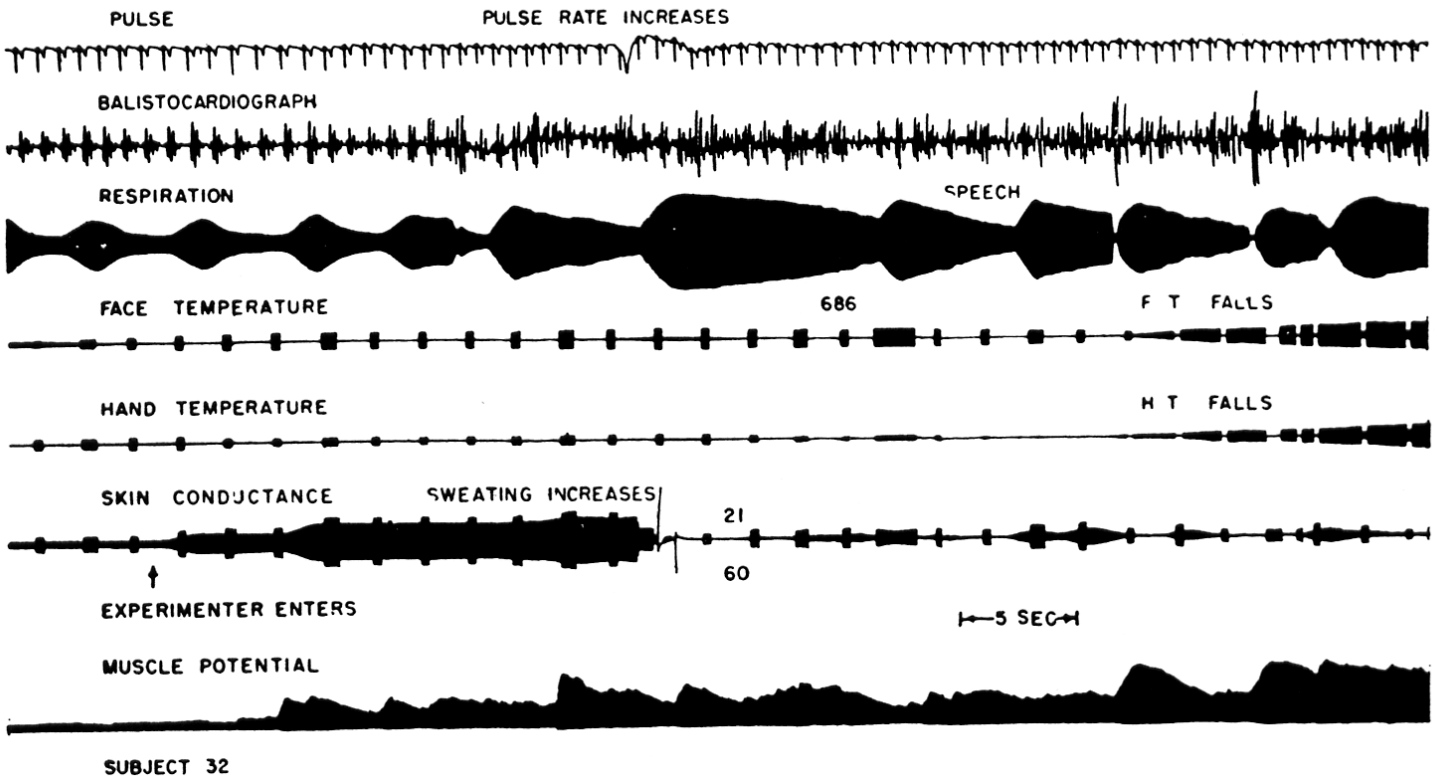


Fig. 1. The variables recorded in this study. The Grass eight-channel electroencephalograph was used as the main recorder and amplifier. Since the Grass has only *A. C.* amplifiers, modulated *A. C.* envelopes were used for all continuous variables.

Note also speed of skin conductance change (in general, this can be quite fast).

Ax (1953)

Visceral changes distinguish emotions (3)

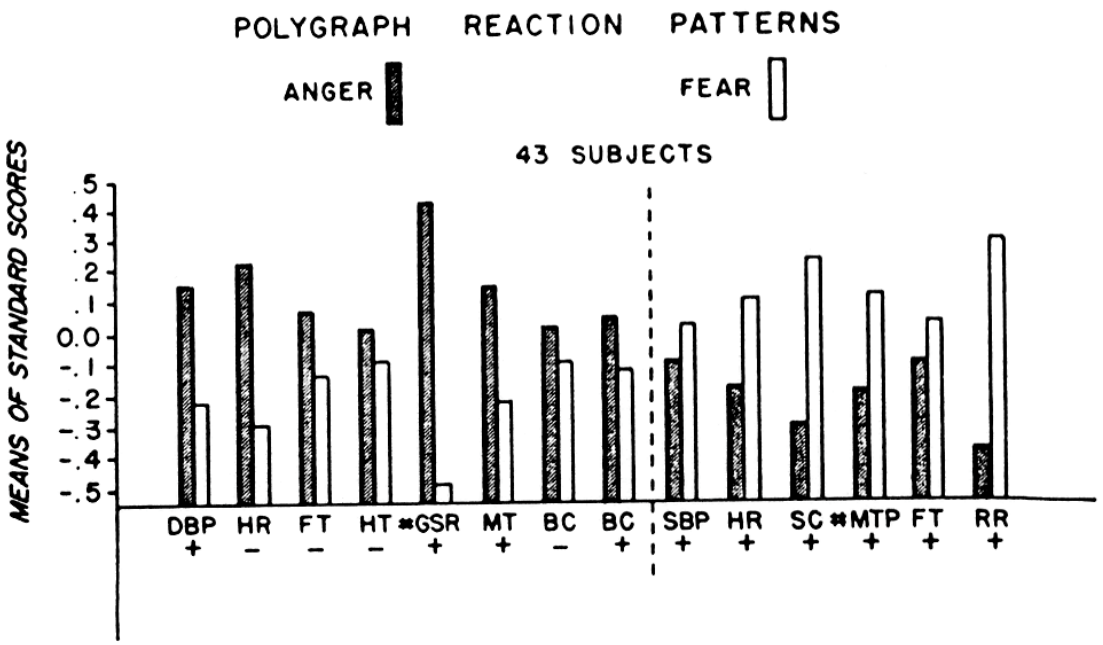


Fig. 2. The polygraph reactions, in standard score units, to the two stress situations called "anger" and "fear."

Anger and fear differentiated by change in diastolic blood pressure, heart rate, skin conductance changes, muscle tension, respiratory rate...

Ax (1953)

Autonomic responses to relived emotions/facial expression (1)

Professional actors asked to
(1) relive emotions;
(2) create emotional expressions step-by-step

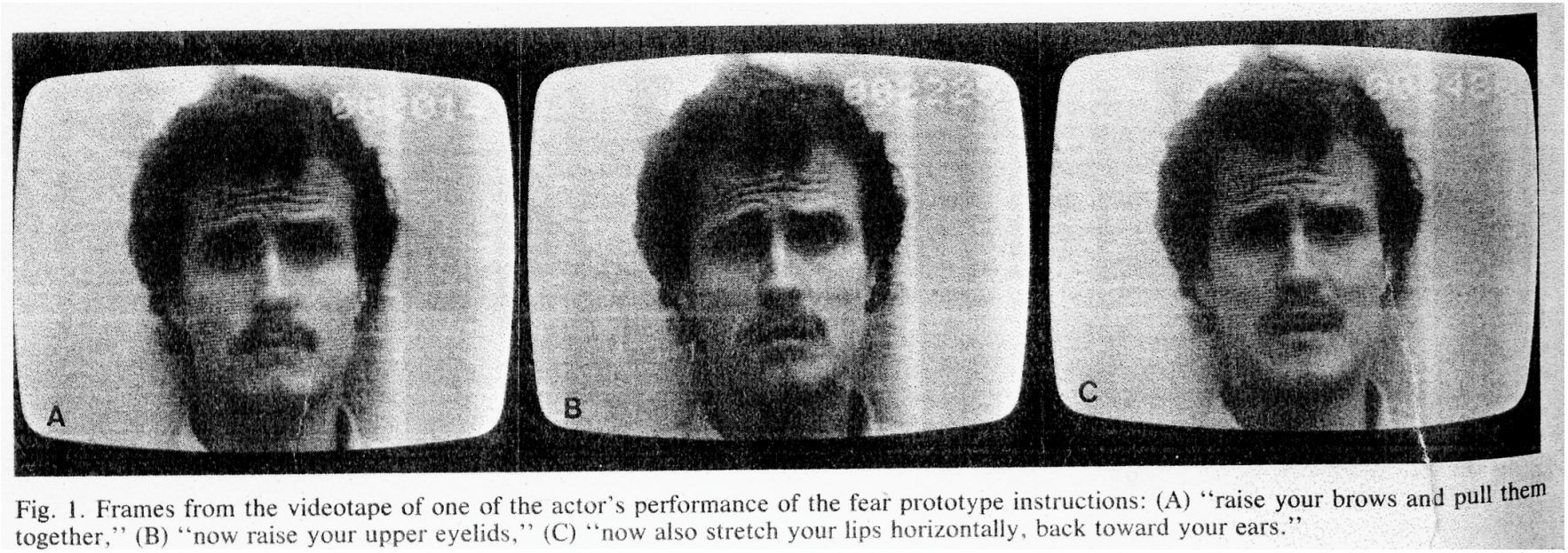
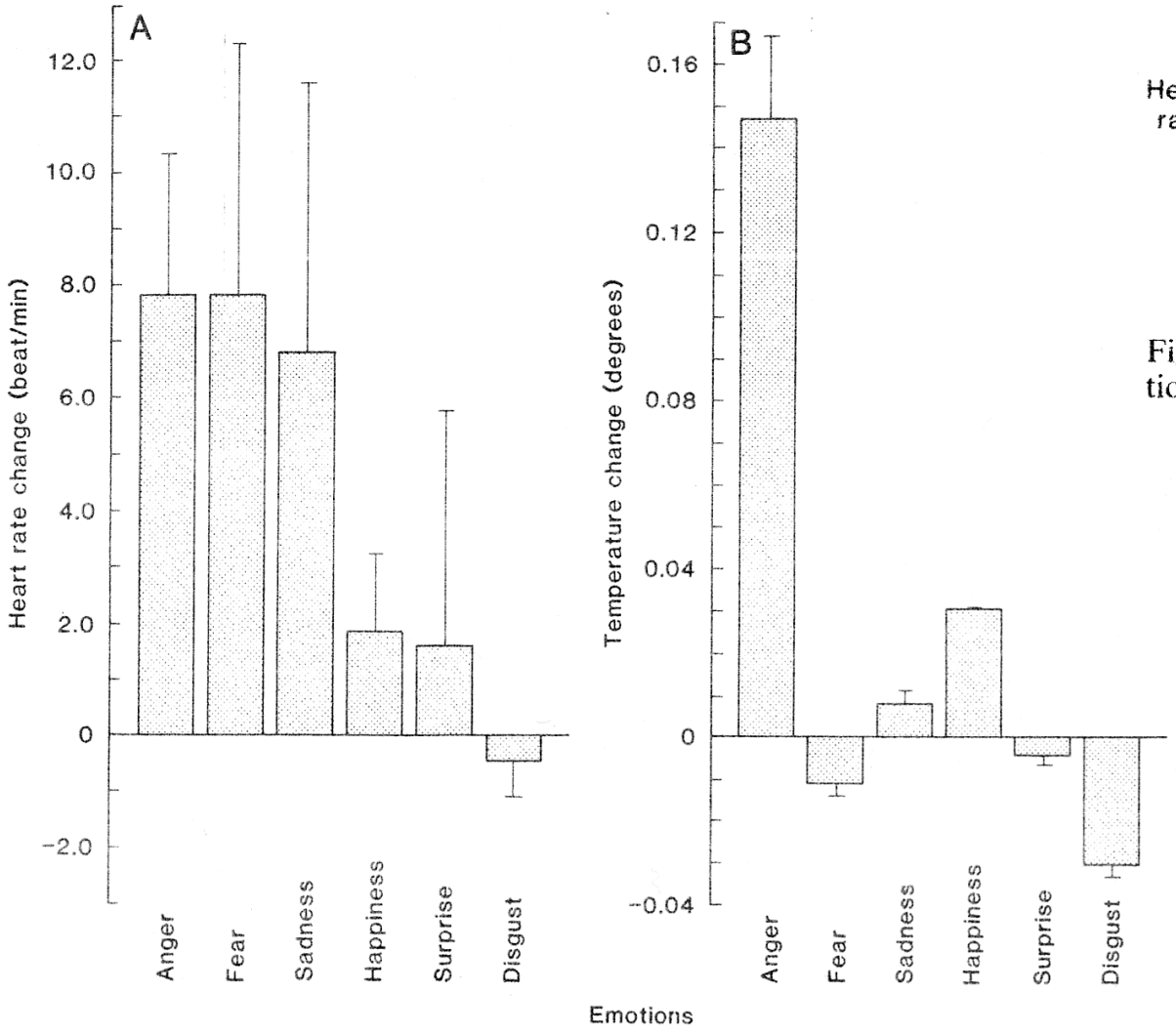


Fig. 1. Frames from the videotape of one of the actor's performance of the fear prototype instructions: (A) "raise your brows and pull them together," (B) "now raise your upper eyelids," (C) "now also stretch your lips horizontally, back toward your ears."

Ekman et al. (1983)

Autonomic responses to relived emotions/facial expression (2)



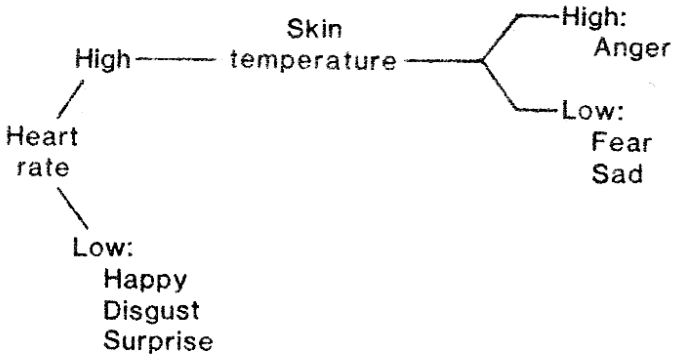


Fig. 2. Decision tree for discriminating emotions in direction facial action task.

e.g. anger and fear both increase heart rate; anger (but not fear) causes an increase in finger temperature (peripheral vasodilation)

Ekman et al. (1983)

Emotional interpretation of peripheral feedback

Naïve subjects asked to move muscle groups one by one (for a 'facial muscle experiment').

Occasionally, they made smiles or frowns, without (apparently) being aware of this.

They described themselves as happier whilst smiling, angrier whilst frowning, etc.

They also rated cartoons they'd seen while smiling as being funnier.

***Note:** autonomic as well as skeletal muscle feedback? (Ekman, previous slide.)*

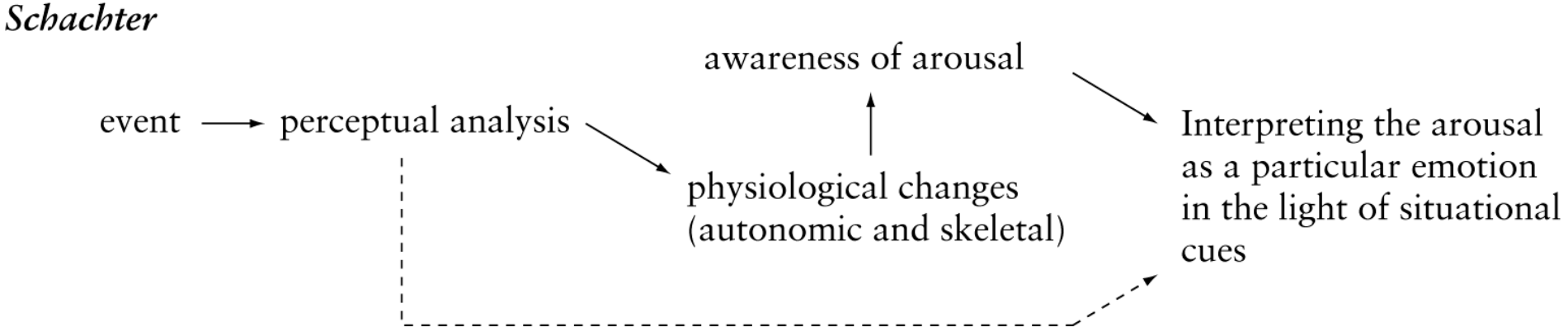
Laird (1974)

Schachter's cognitive labelling theory of emotion

Suggested that

- emotional experience *does* depend on bodily changes;
- physiological changes precede emotion;
- bodily changes are *not solely* responsible for emotion;
- arousal must be *interpreted*.

Two-factor theory (arousal + interpretation).



Schachter (1964)

Unlabelled arousal can become euphoria or anger

Drug condition:

- *Epinephrine informed (arousal, but attributed)*
- *Epinephrine ignorant* ***(unattributed arousal)***
- *Epinephrine misinformed* ***(unattributed arousal)***
- *Placebo*

Interaction with stooge:

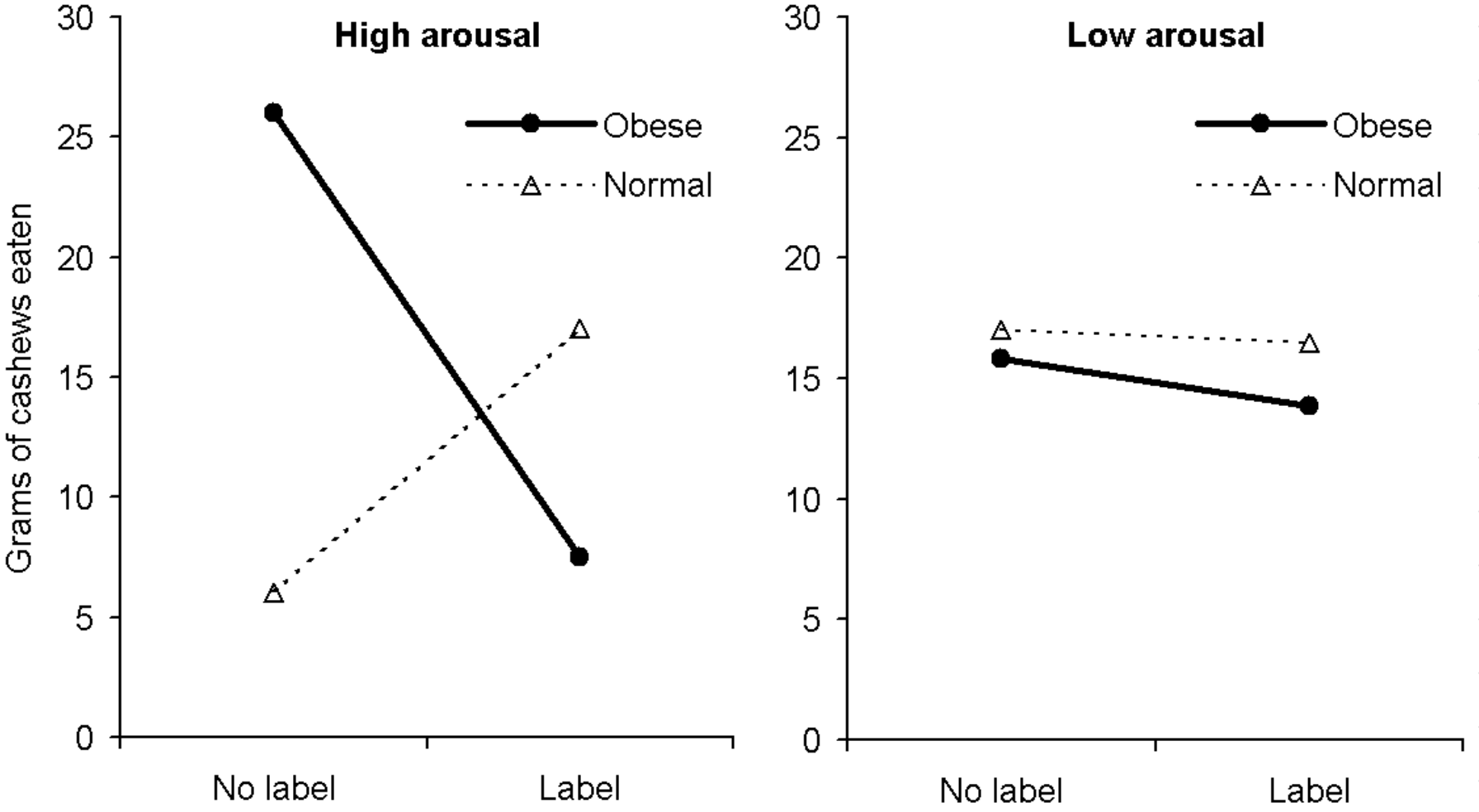
- *Euphoria*
- *Anger*

Self-report results (higher scores indicate greater euphoria; lower scores indicate anger).

	Condition	
Group	Euphoric stooge	Angry stooge
Epi informed	0.98	1.91
Epi ignorant	1.78	1.39
Epi misinformed	1.90	*not performed*
Placebo	1.61	1.63

Schachter & Singer (1962)

Unlabelled arousal and eating behaviour



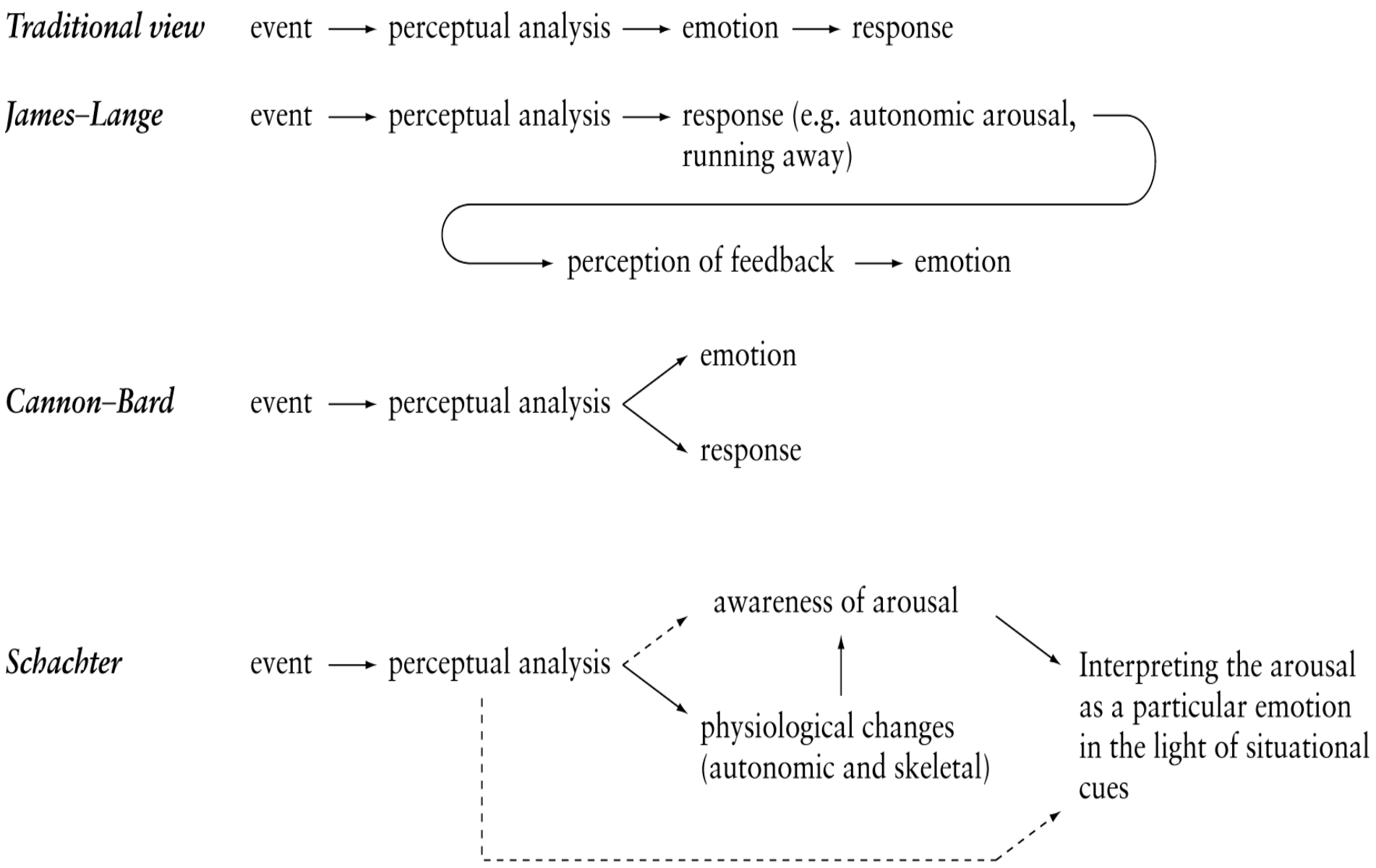
Slochower (1976)

Vancouver, British Columbia, Canada

Arousal on the Capilano Suspension Bridge, Vancouver

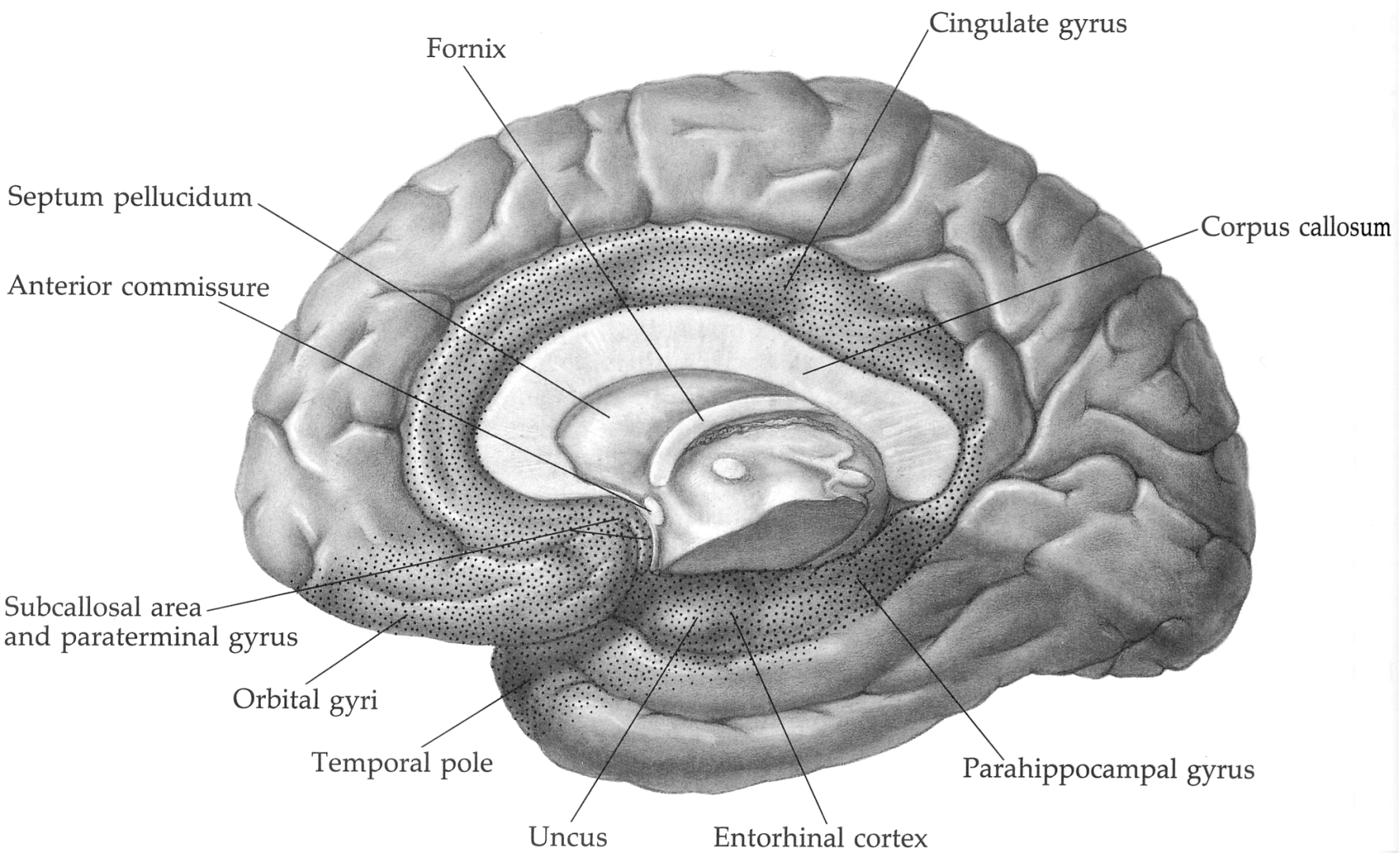
Dutton & Aron (1974)

Summary of theories



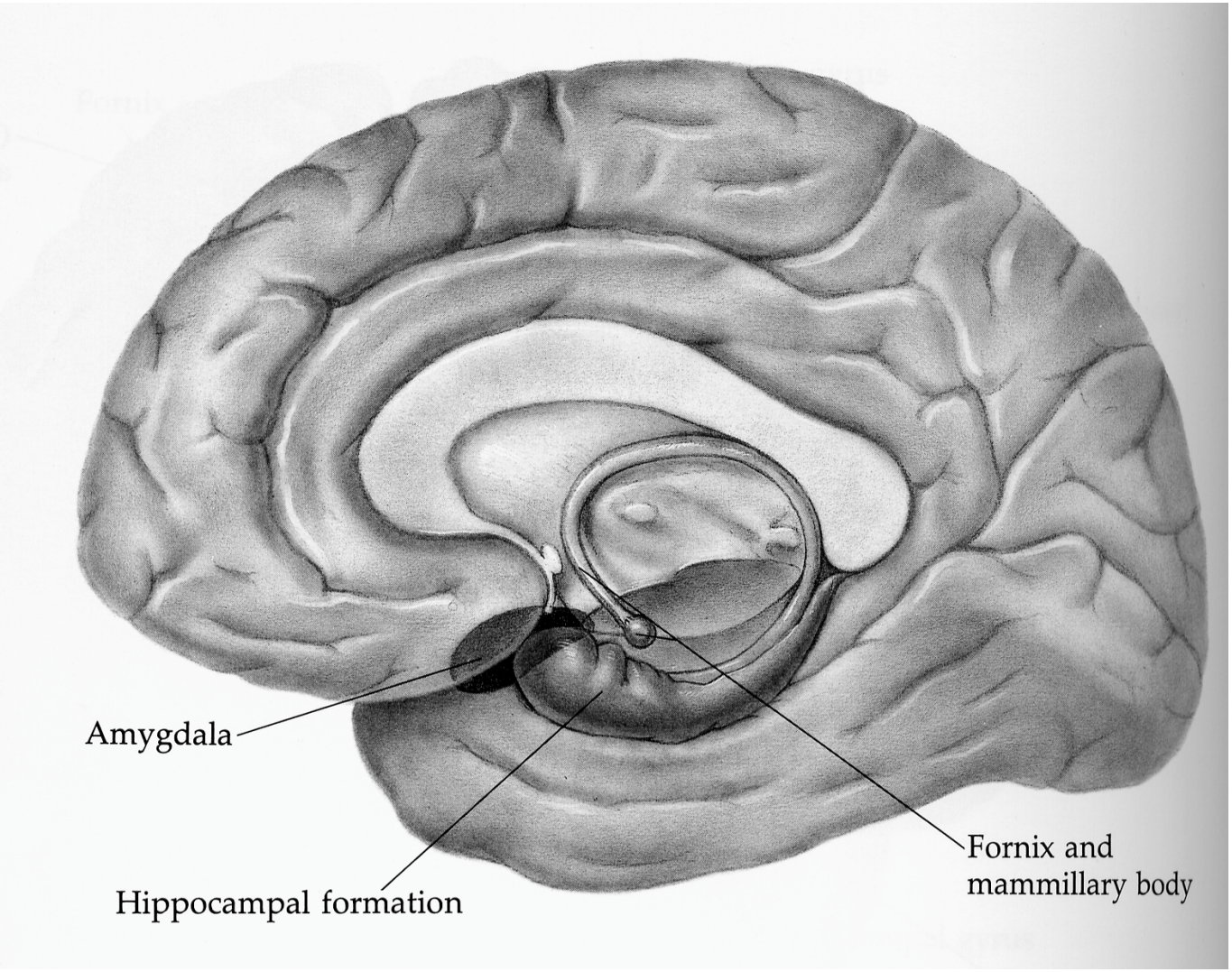
The limbic system

The ‘limbic lobe’: limbic cortex



Broca (1878); picture from Martin (1991)

The medial temporal lobe: hippocampus, amygdala, fornix

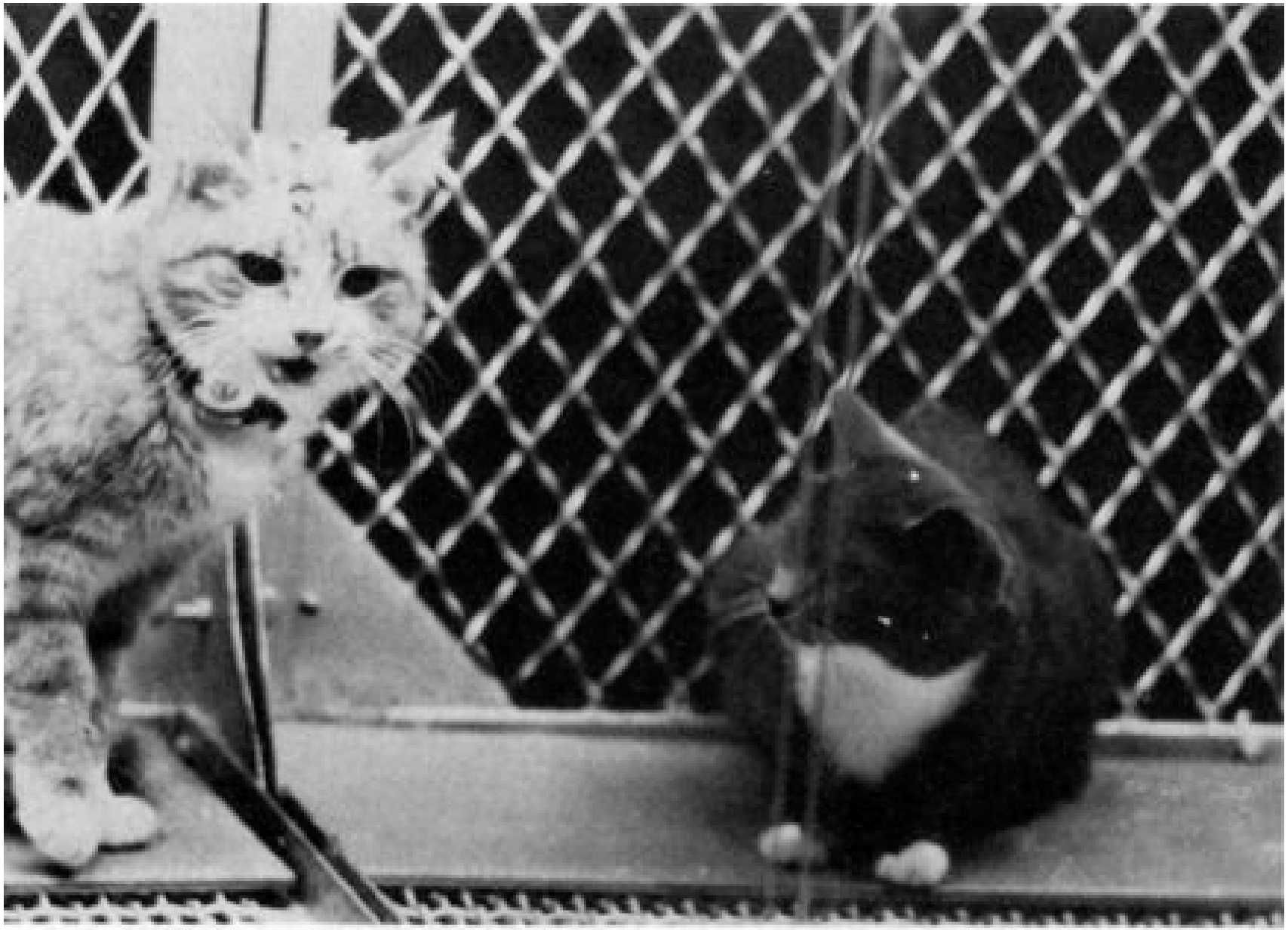


Early work: rage and the hypothalamus

Hypothalamic stimulation in cats. At rest...

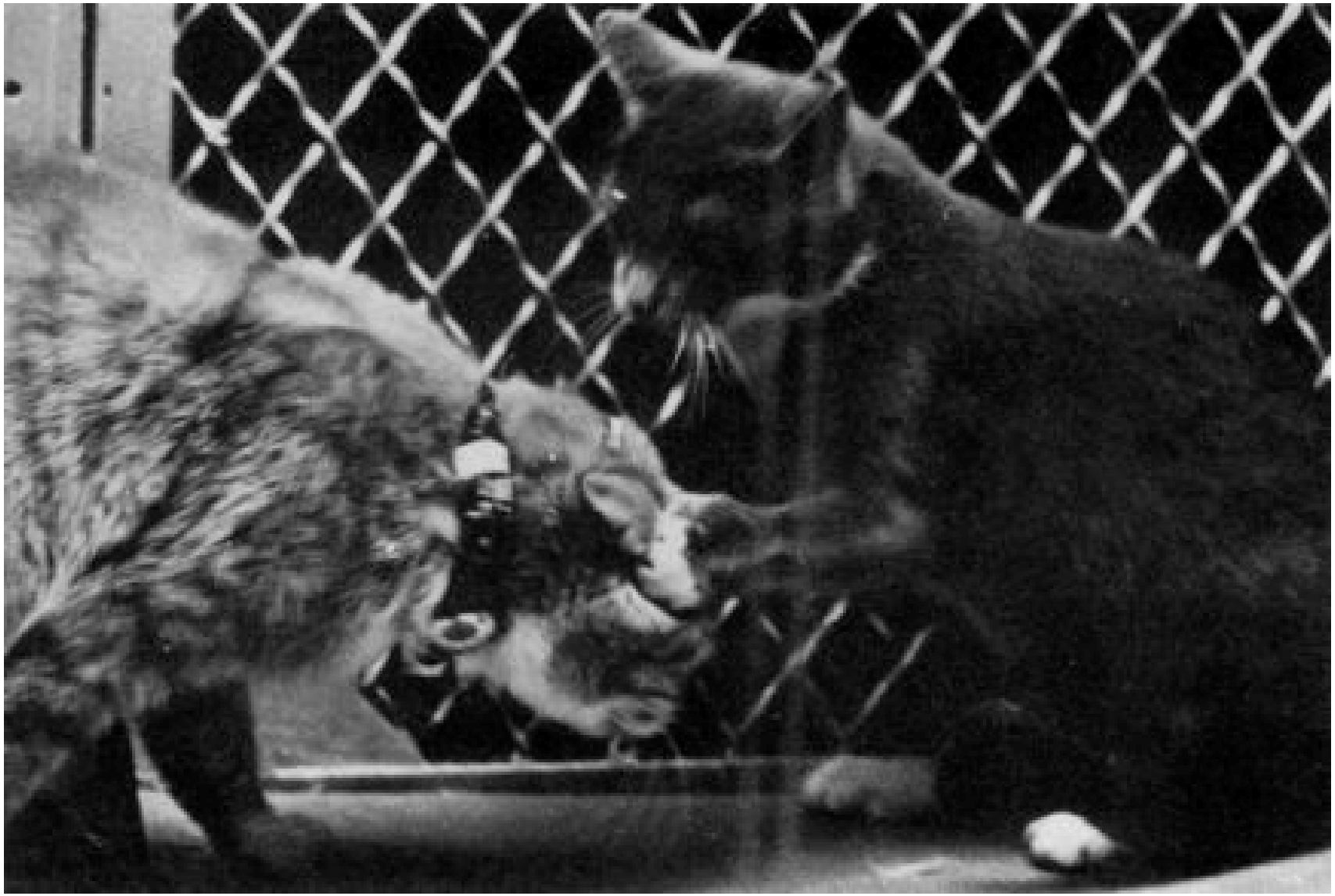
Hess (1932) / Delgado (1969)

‘Sham rage’ following anterior hypothalamic stimulation (1)



Hess (1932) / Delgado (1969)

‘Sham rage’ following anterior hypothalamic stimulation (2)

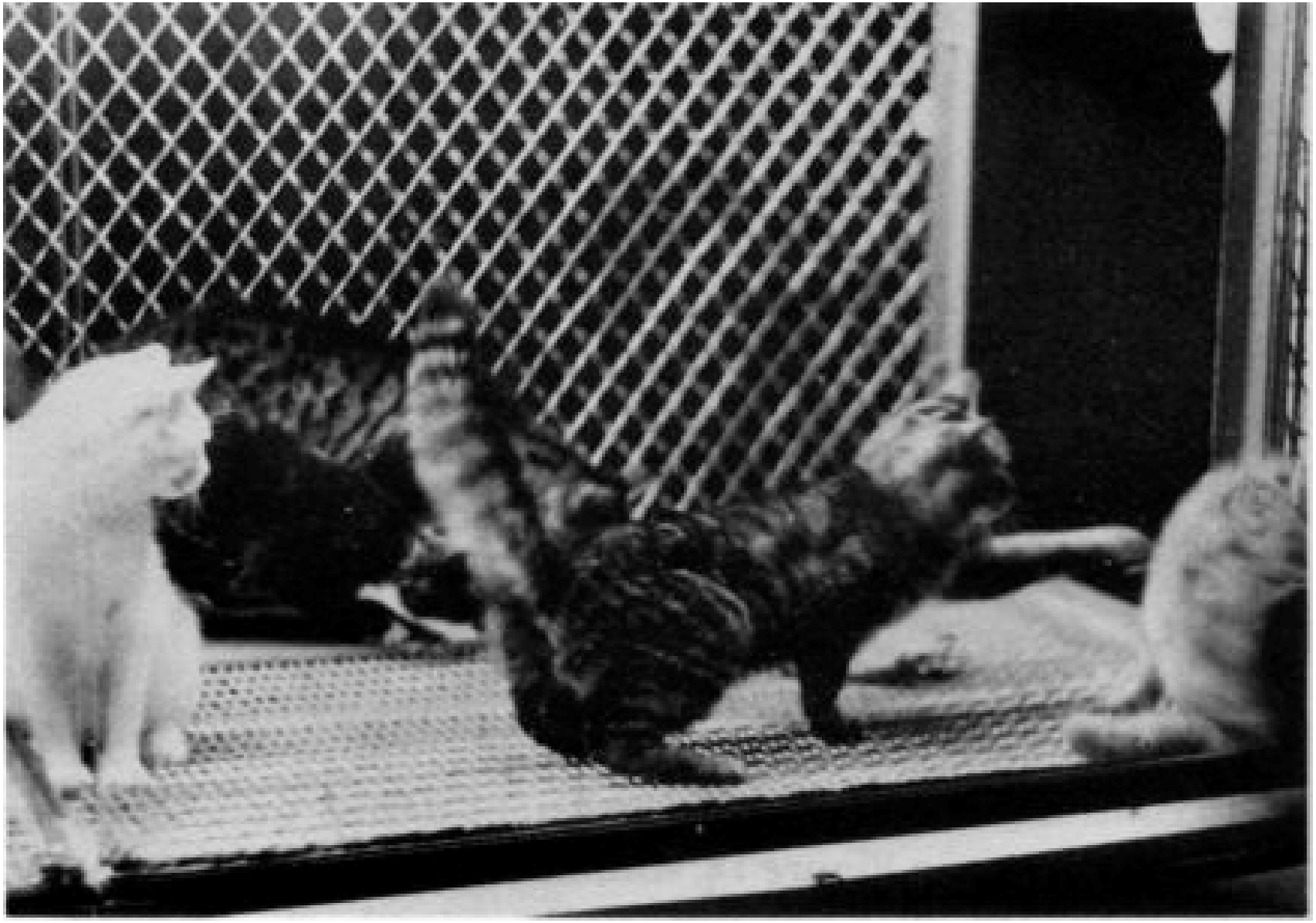


Hess (1932) / Delgado (1969)

‘Directed rage’ following lateral hypothalamic stimulation (1)

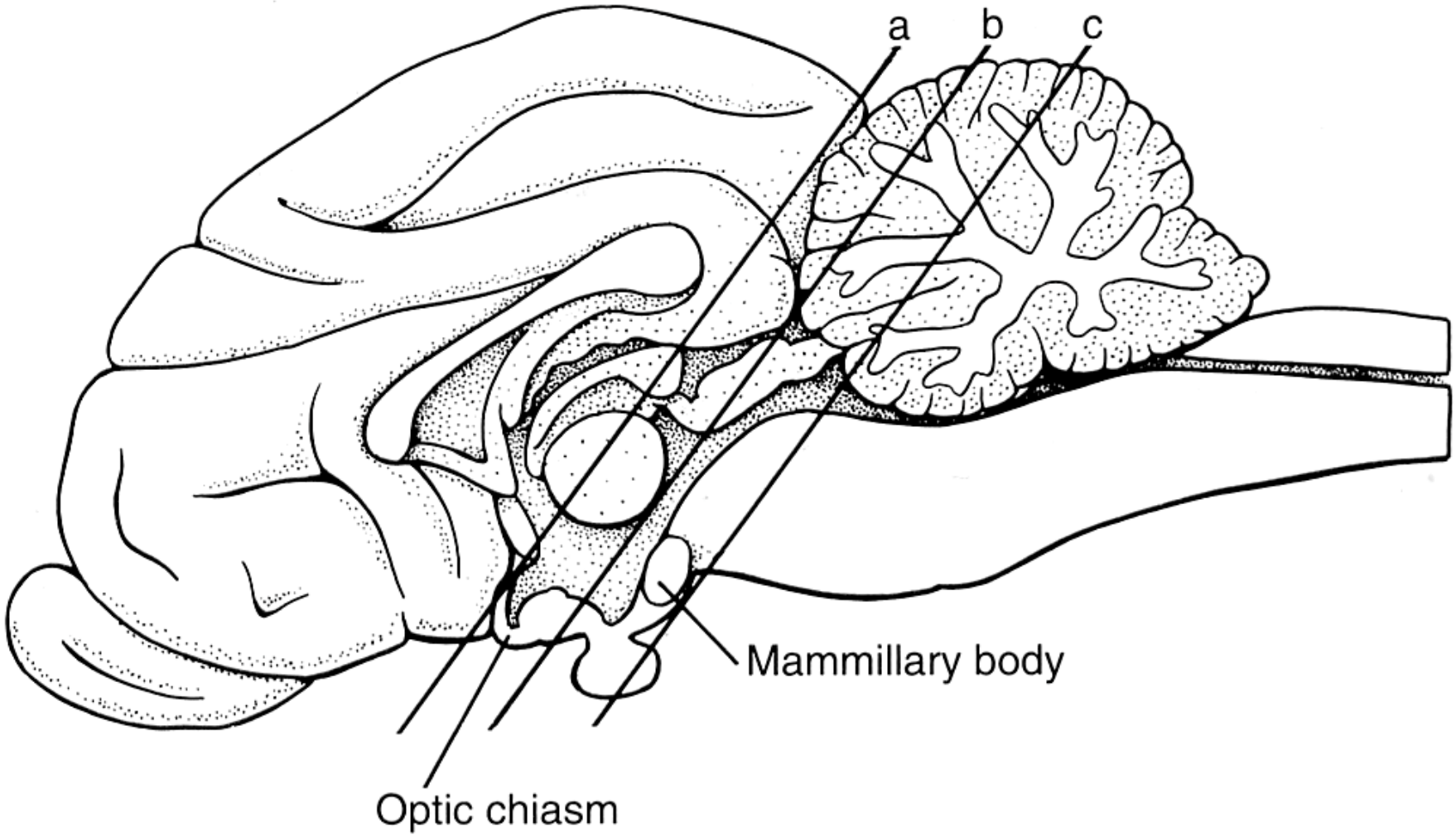
Hess (1932) / Delgado (1969)

‘Directed rage’ following lateral hypothalamic stimulation (2)



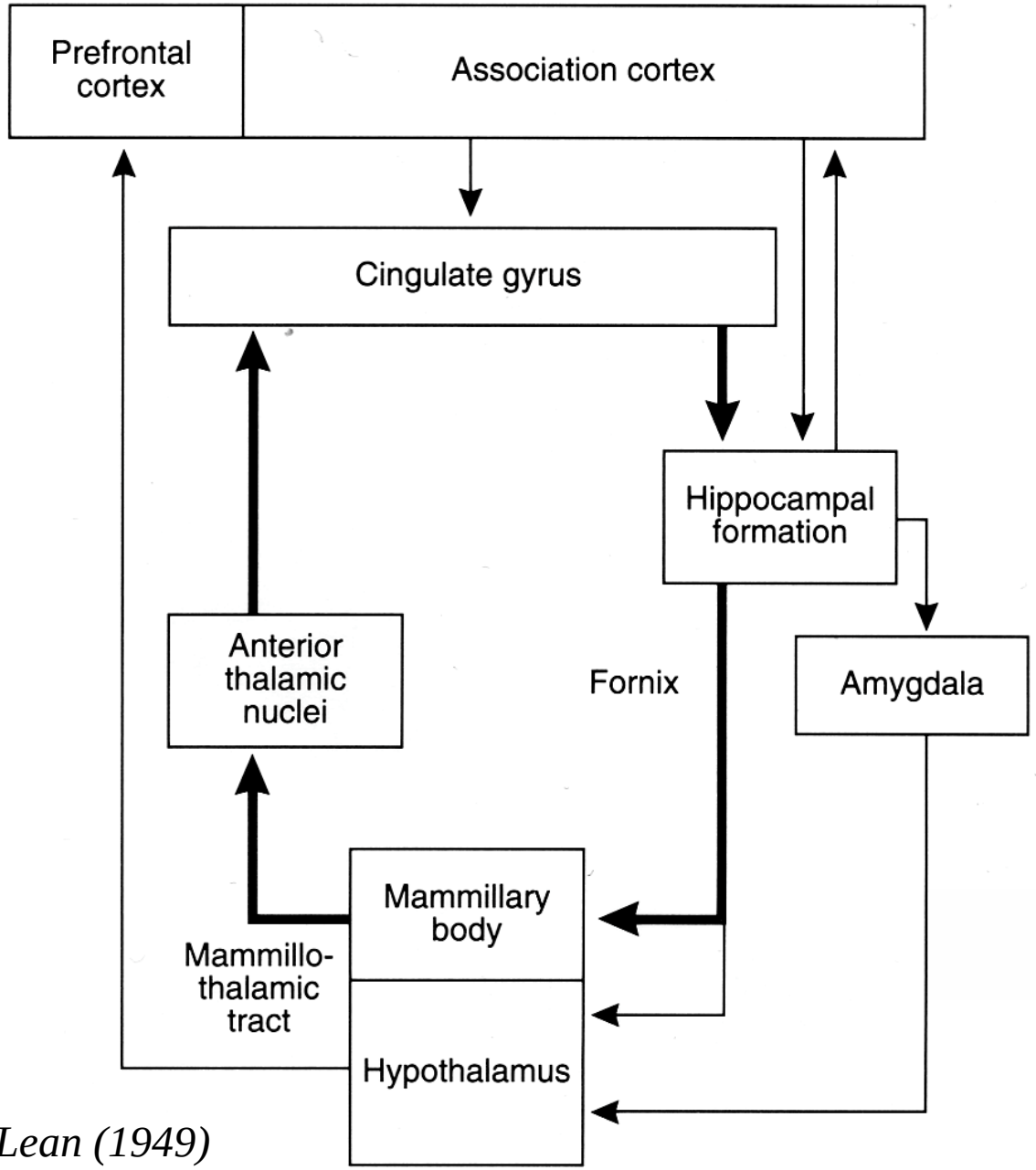
Hess (1932) / Delgado (1969)

The posterior hypothalamus was required for ‘sham rage’



Bard (1928)

Papez's 'circuit of the emotions' (bold) and later additions



Papez (1937); MacLean (1949)

The amygdala

Klüver–Bucy syndrome

Bilateral temporal lobe resections in monkeys caused

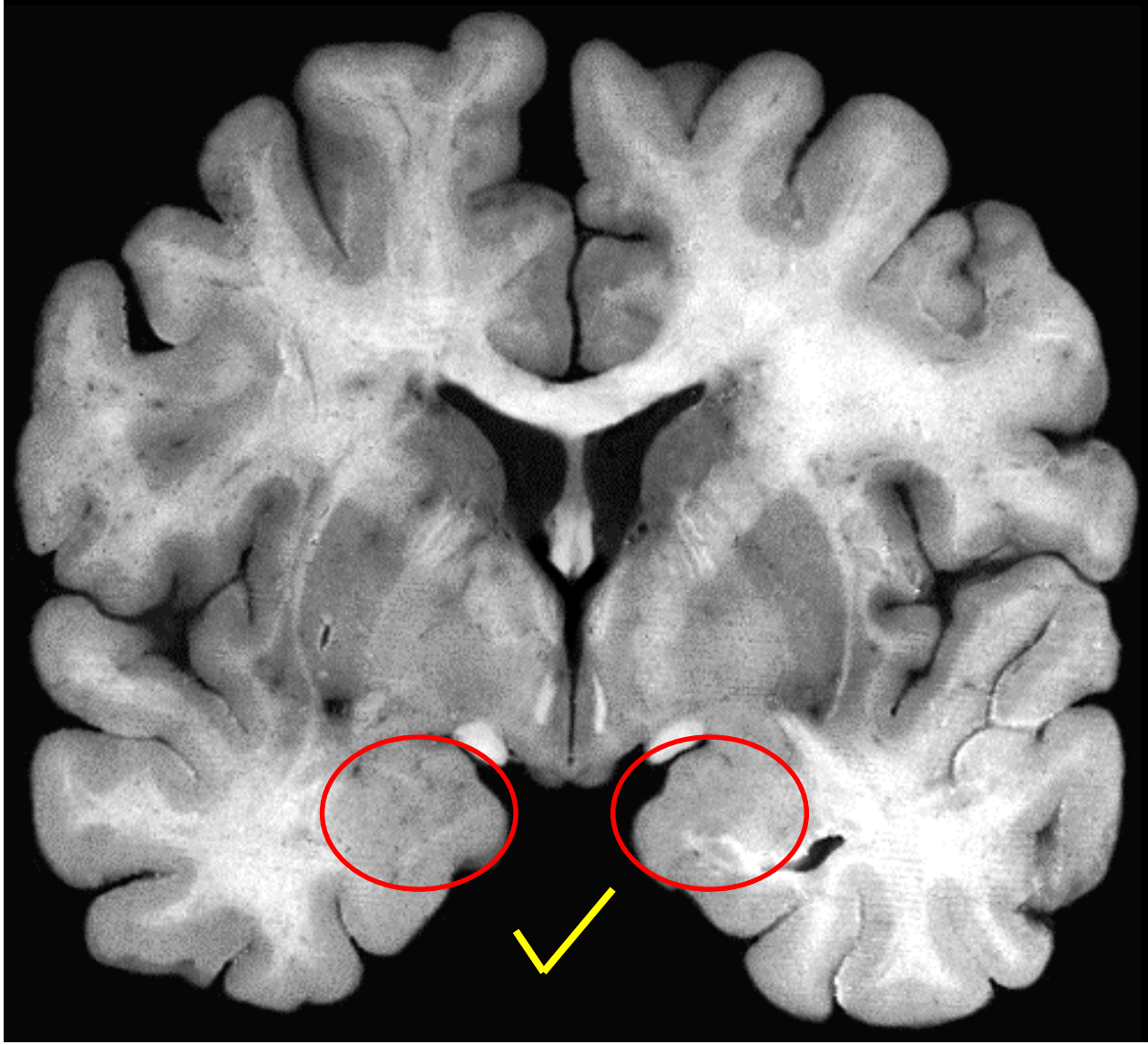
- *tameness*
- *emotional unresponsiveness*
- *visual recognition problems*
- *hyperorality*
- *hypersexuality*

Klüver–Bucy syndrome has also followed similar damage in humans.

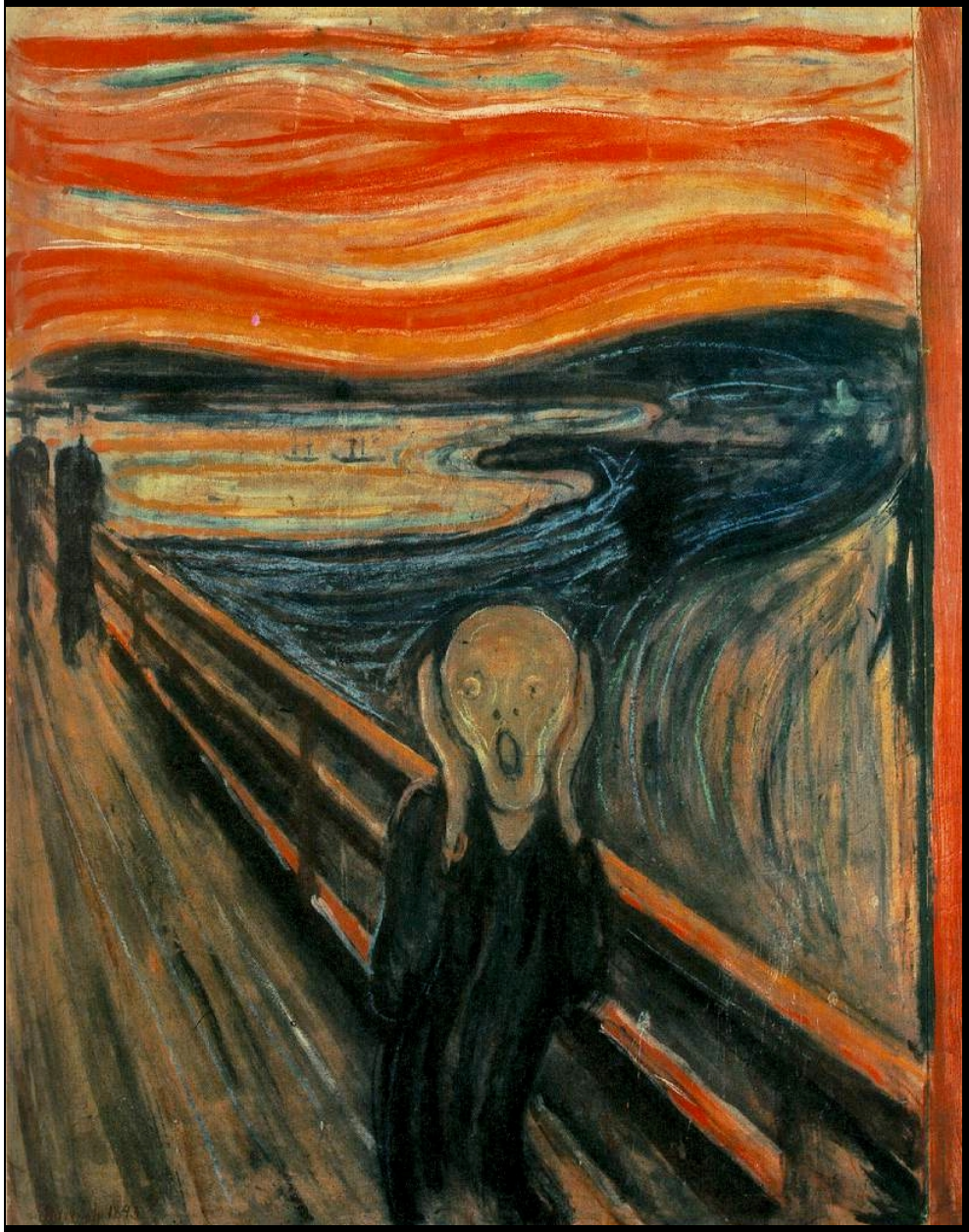
Pavements beware.

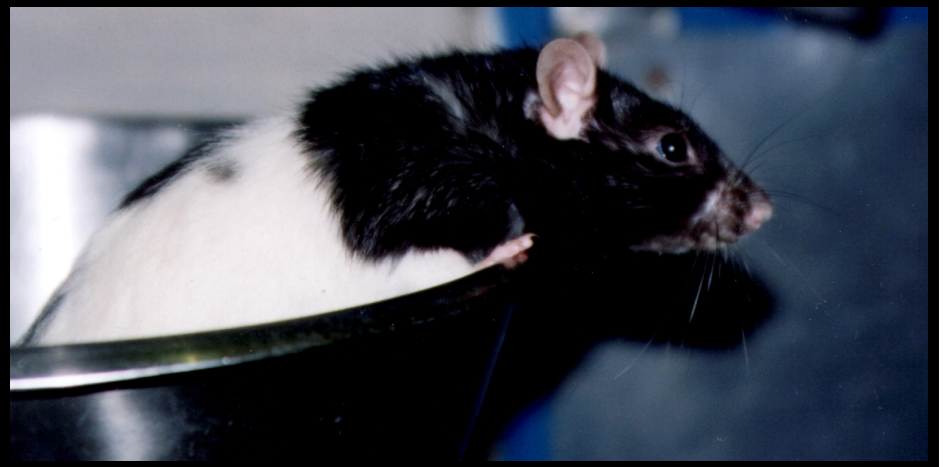
Klüver & Bucy (1937); Terzian & Dalle Ore (1955)

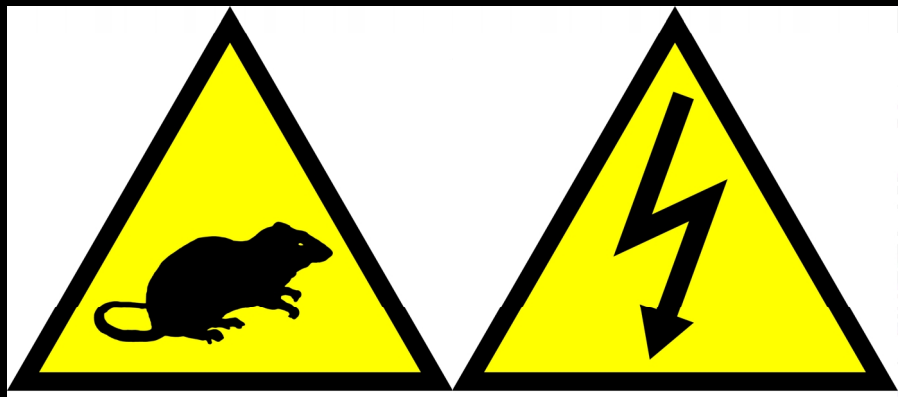
The amygdala



Aversive conditioning and the amygdala





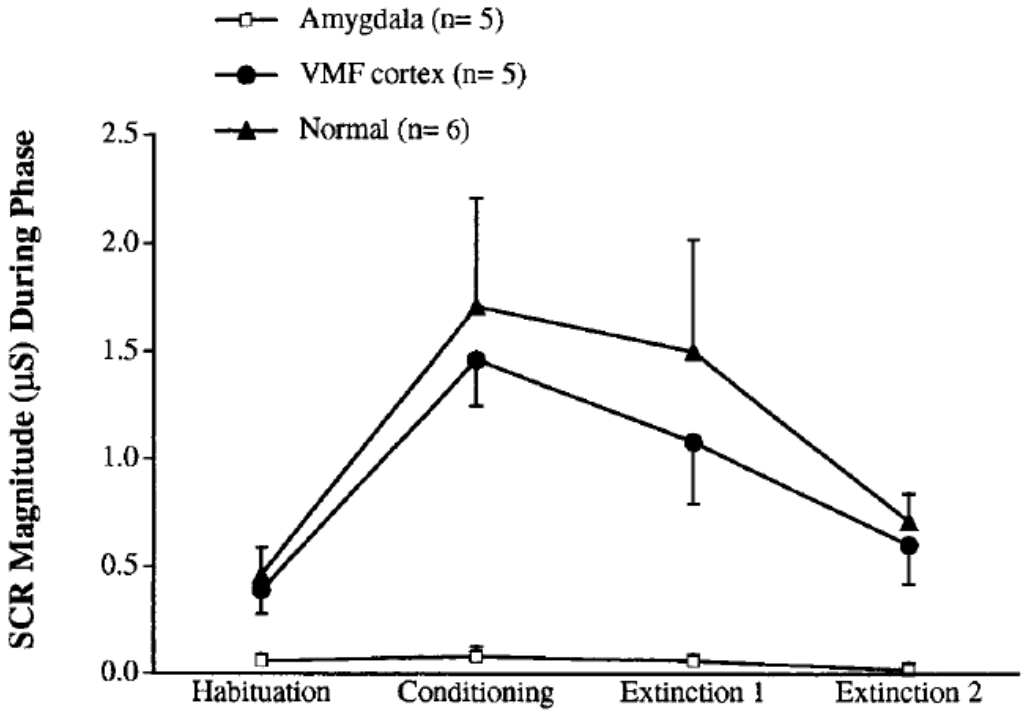


Rats

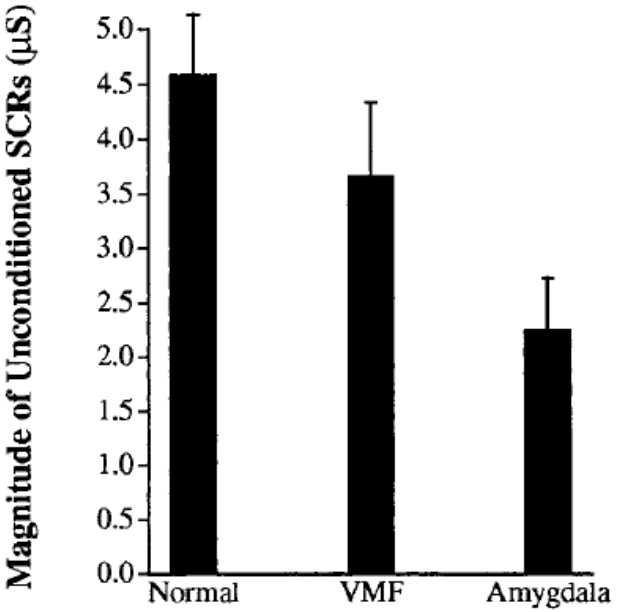
Danger
High voltage

Conditioned SCRs impaired by amygdala lesions in humans

Conditioned responses



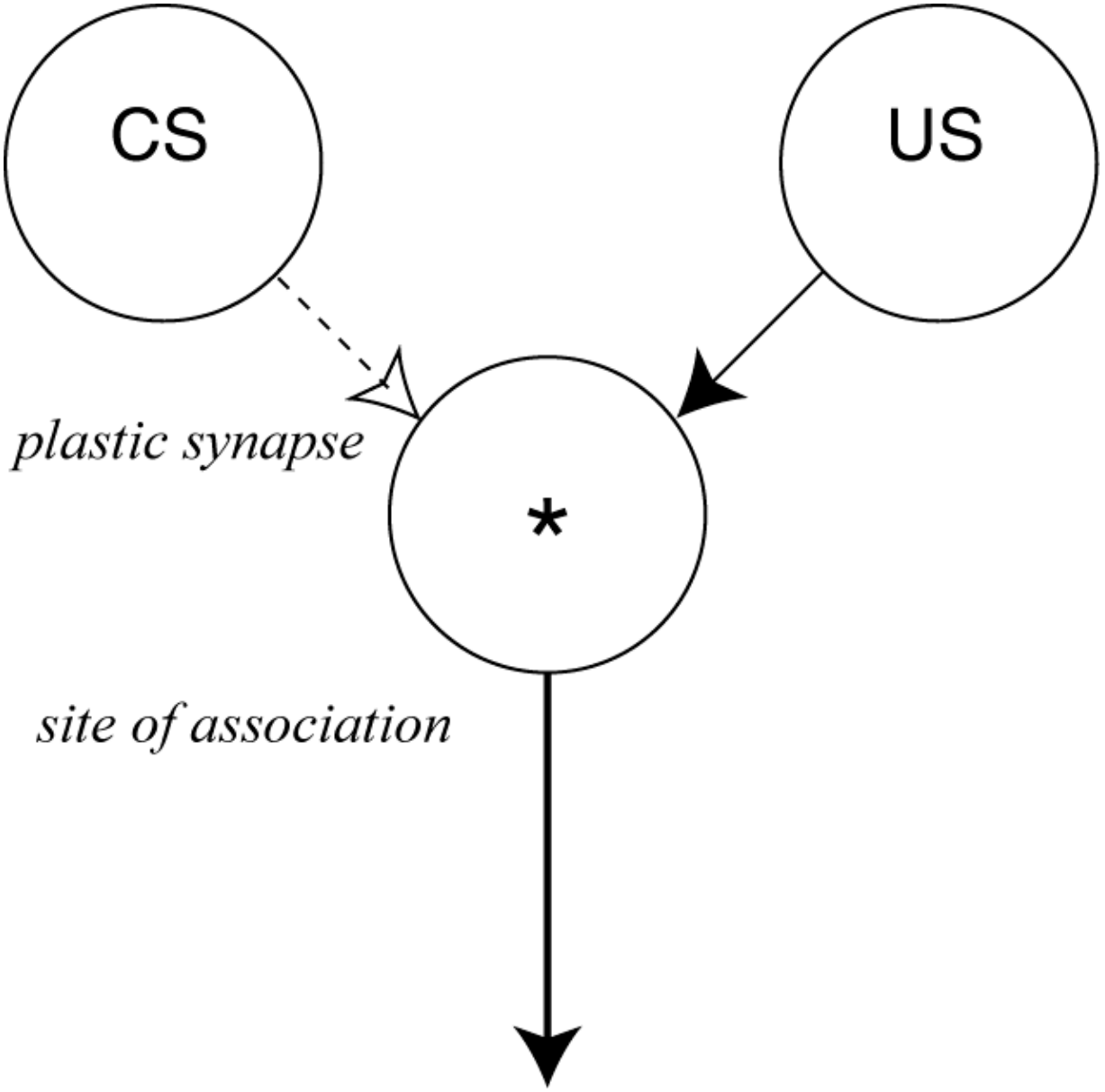
Unconditioned responses



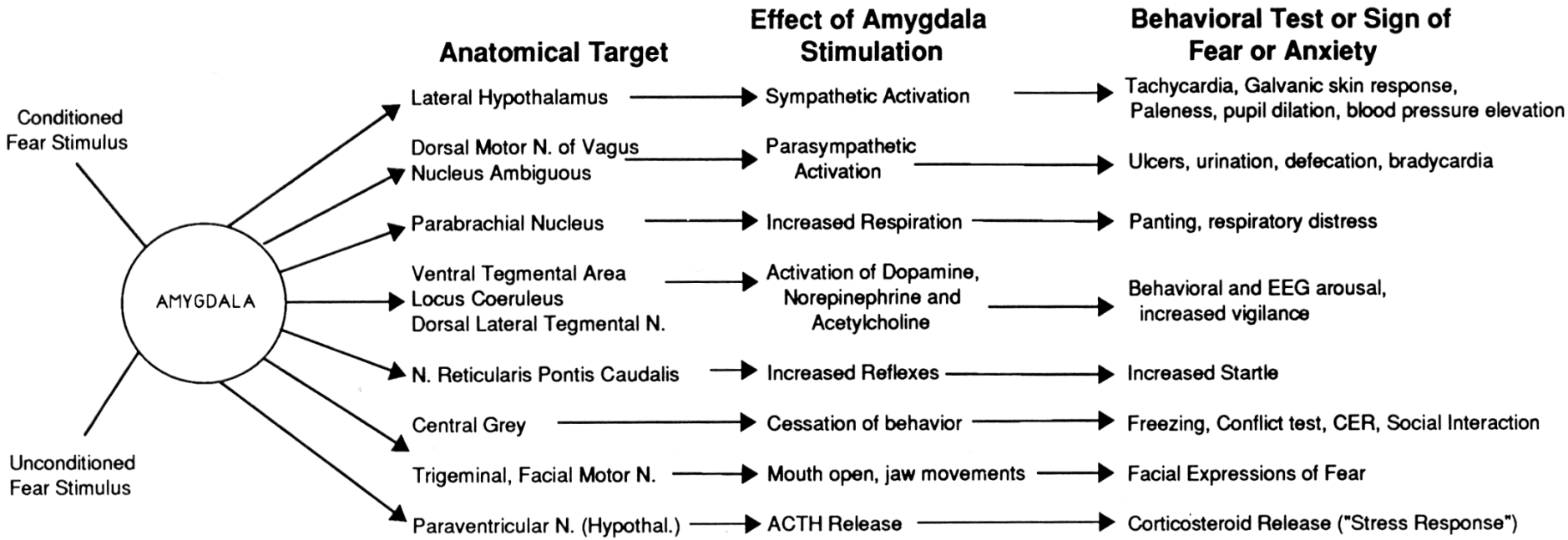
blue slide (CS) → foghorn (US)

Bechara et al. (1999)

A cellular mechanism of Pavlovian conditioning

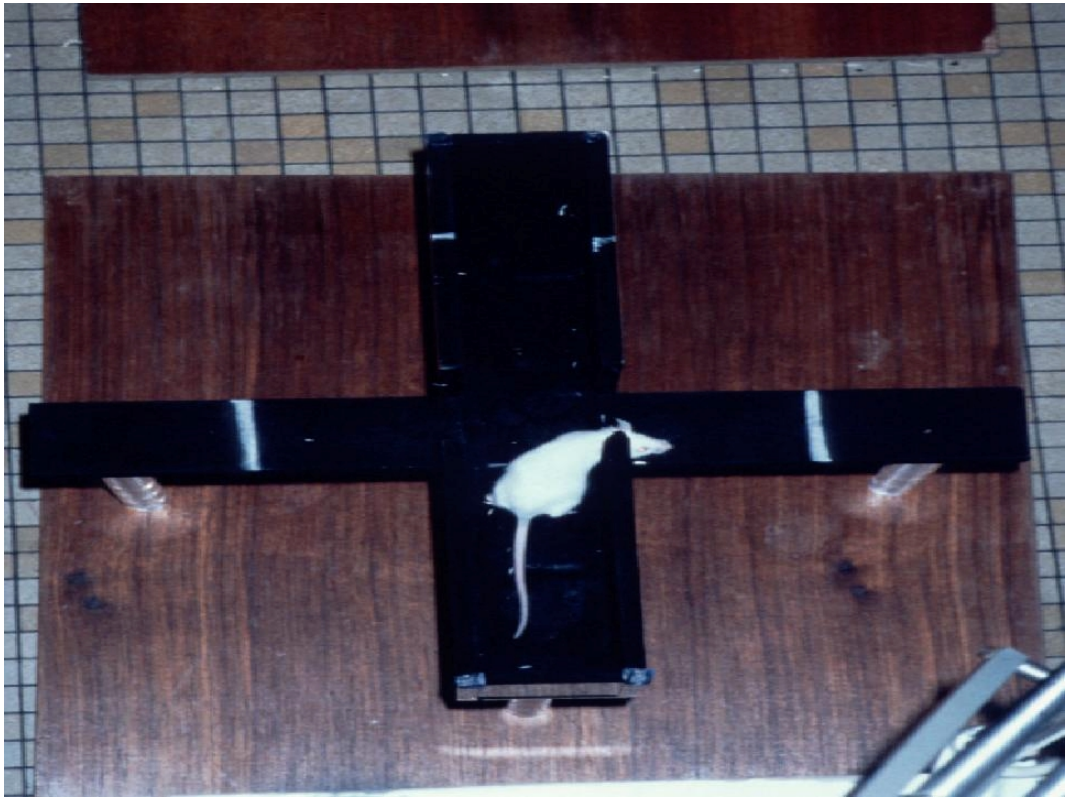


The CeA controls hypothalamic and brainstem targets



Davis (1992)

Anxiolytic drugs and the amygdala



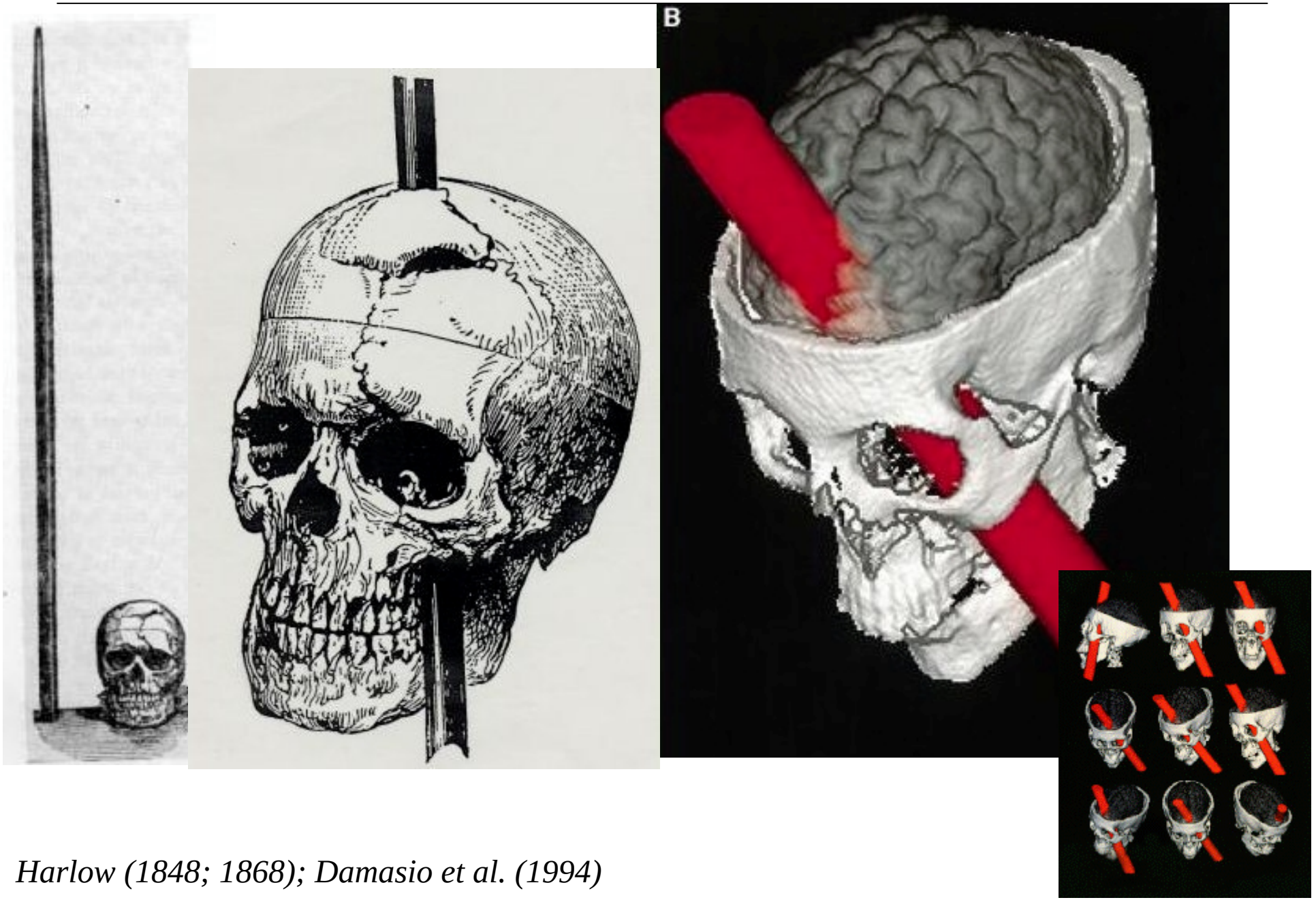
Memory modulation and the amygdala

1963 and 2001

Appetitive conditioning and the amygdala

Orbitofrontal cortex

Orbitofrontal damage: the case of Phineas Gage



Harlow (1848; 1868); Damasio et al. (1994)

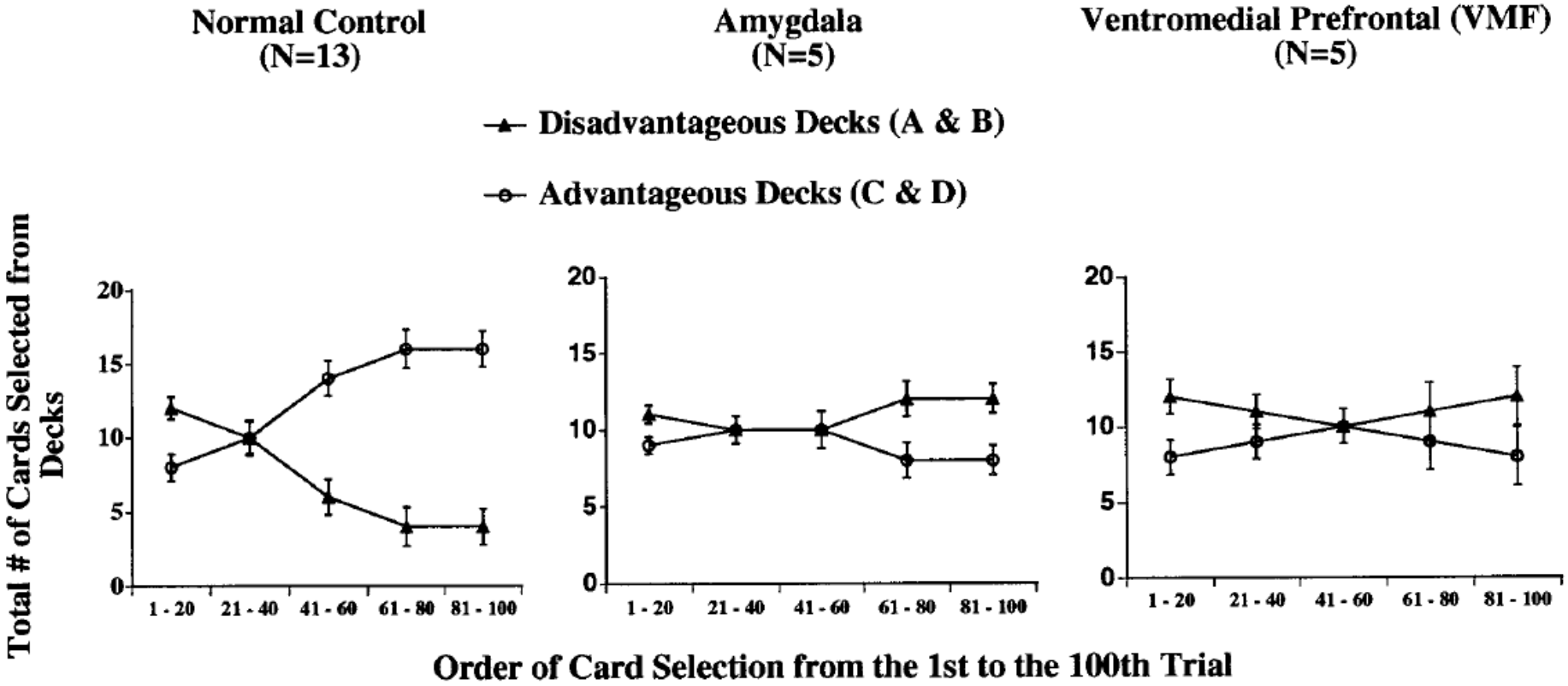
Orbitofrontal damage: the case of Phineas Gage

Earl Miller (a prefrontal cortex researcher) with the tamping iron

The Iowa gambling task

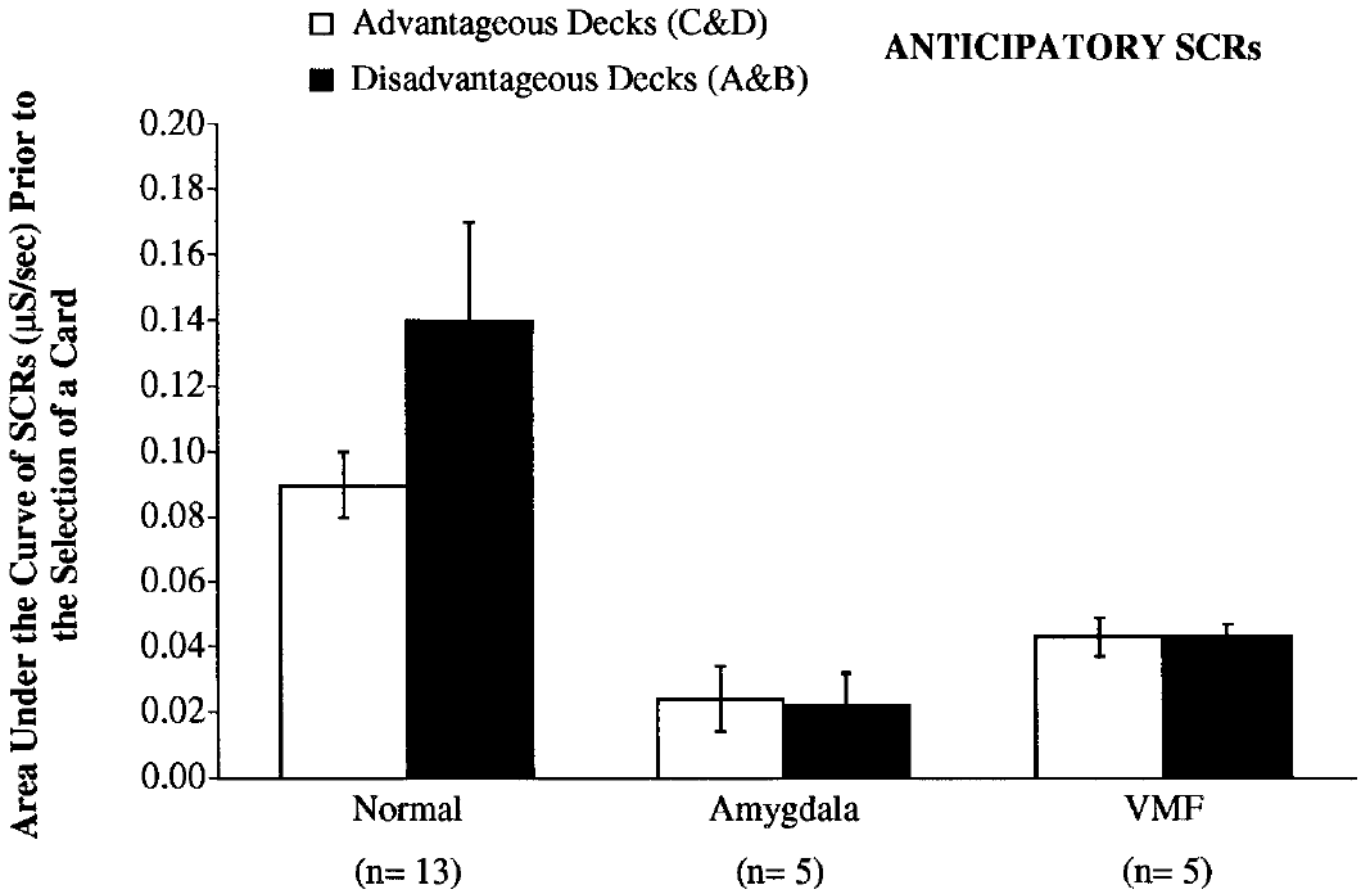
Bechara et al. (1994)

OFC and amygdala lesions on the Iowa gambling task (1)



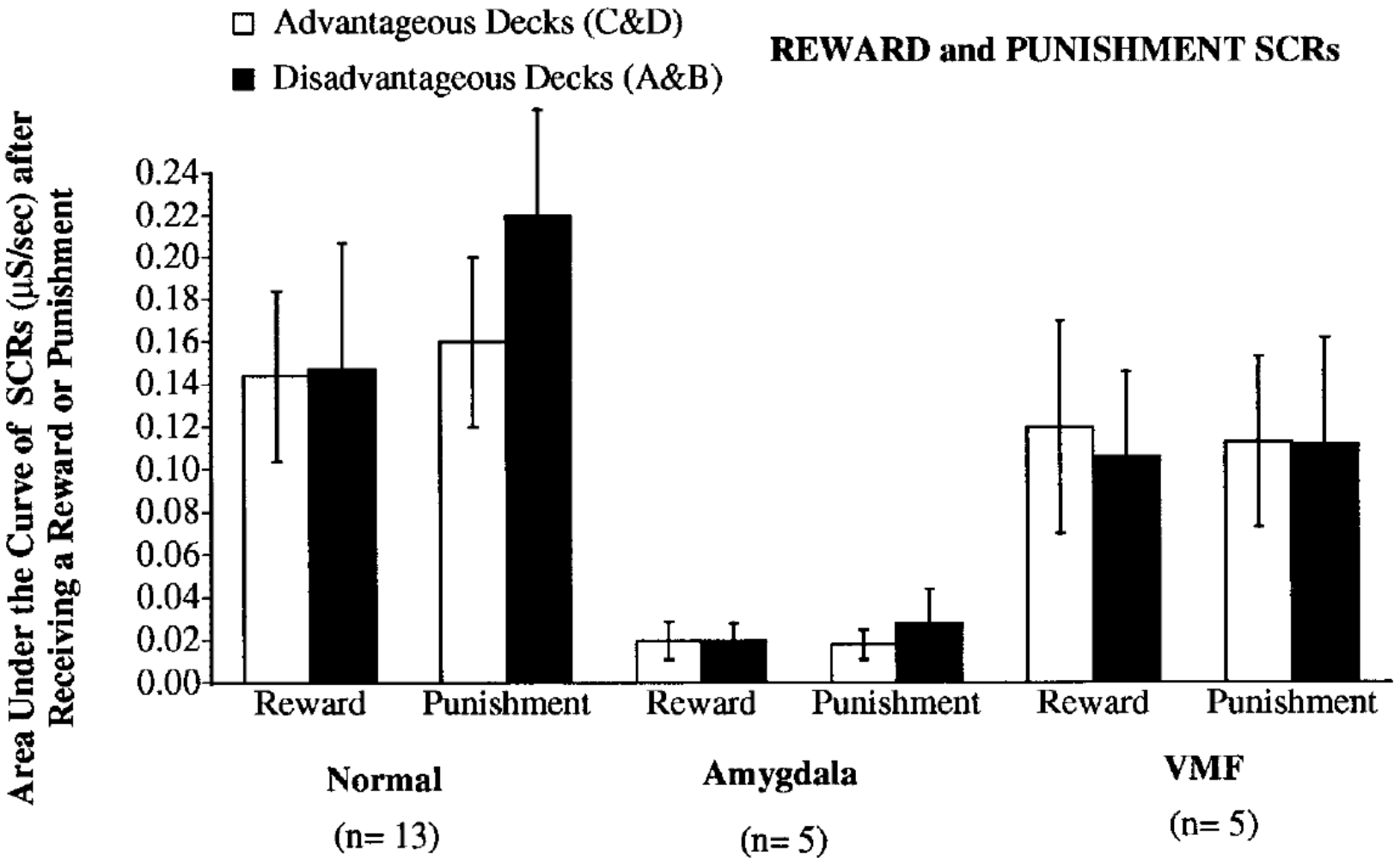
Bechara et al. (1999)

OFC and amygdala lesions on the Iowa gambling task (2)



Bechara et al. (1999)

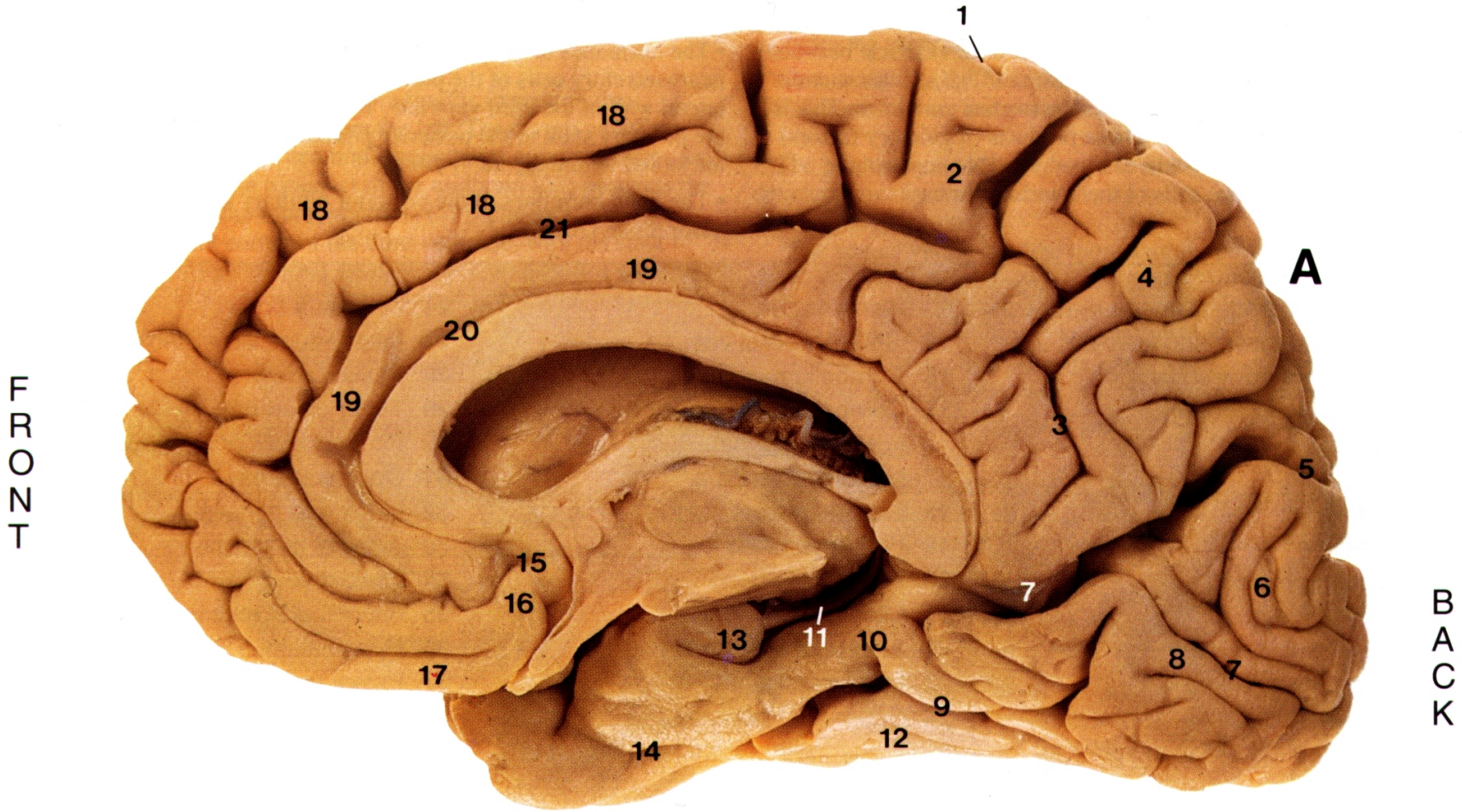
OFC and amygdala lesions on the Iowa gambling task (3)



Bechara et al. (1999)

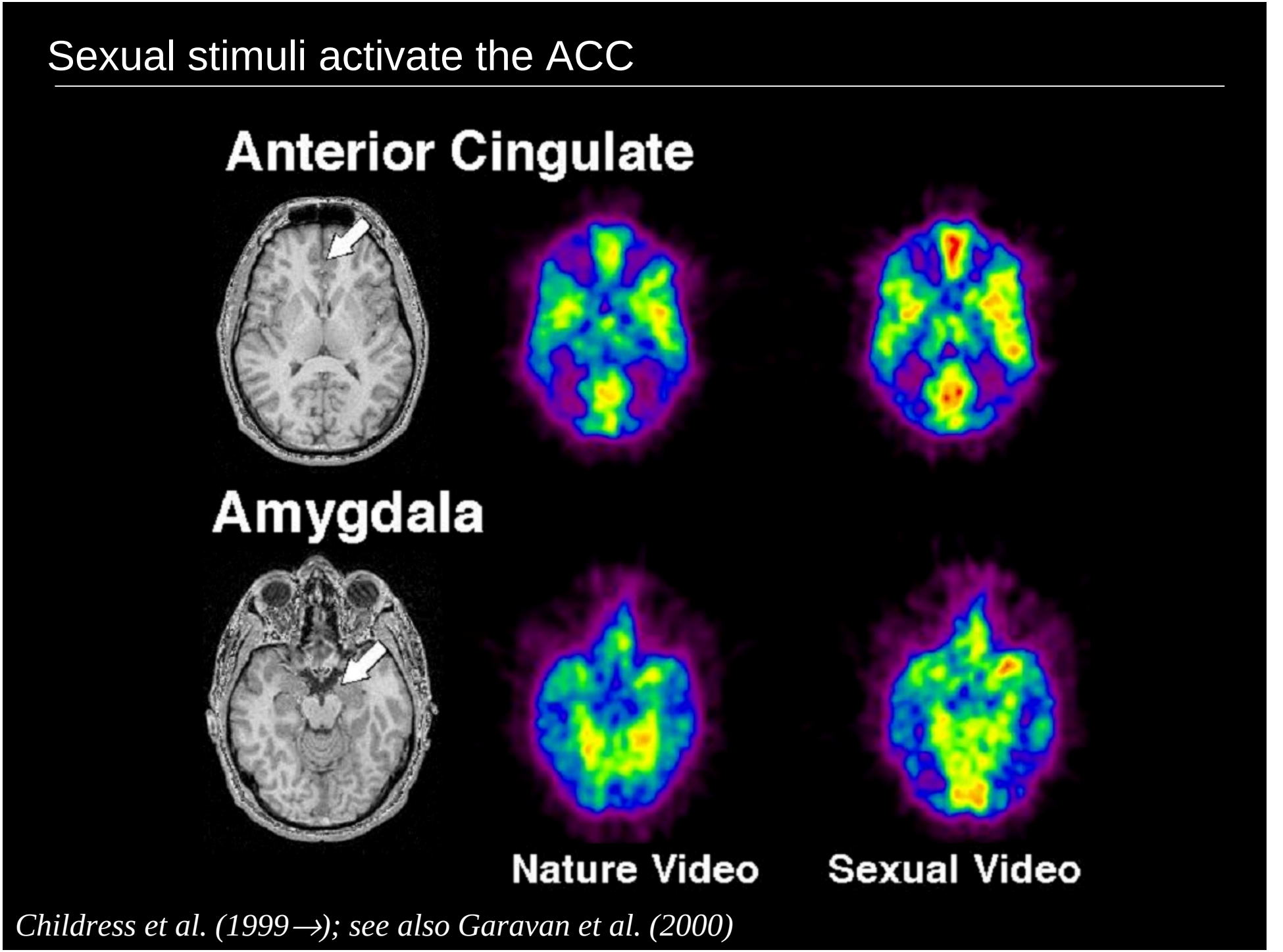
Anterior cingulate cortex

Cingulate cortex



(The numbers don't mean anything!)

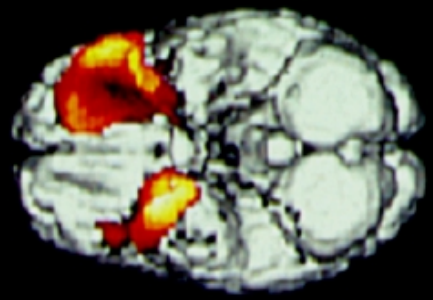
Sexual stimuli activate the ACC



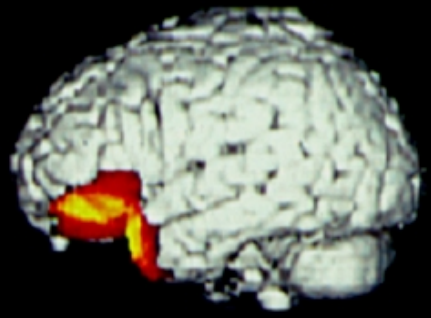
Childress et al. (1999→); see also Garavan et al. (2000)

Cue-induced cocaine craving activates the ACC and OFC

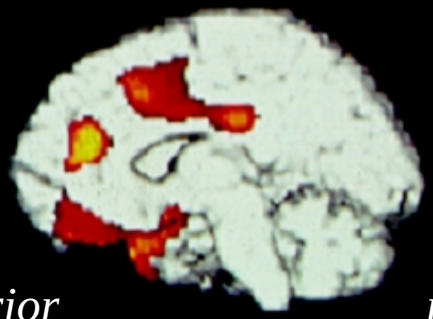
Cocaine addicts watching a cocaine video; activations correlated with subjective reports of craving



medial temporal lobe — amygdala



OFC



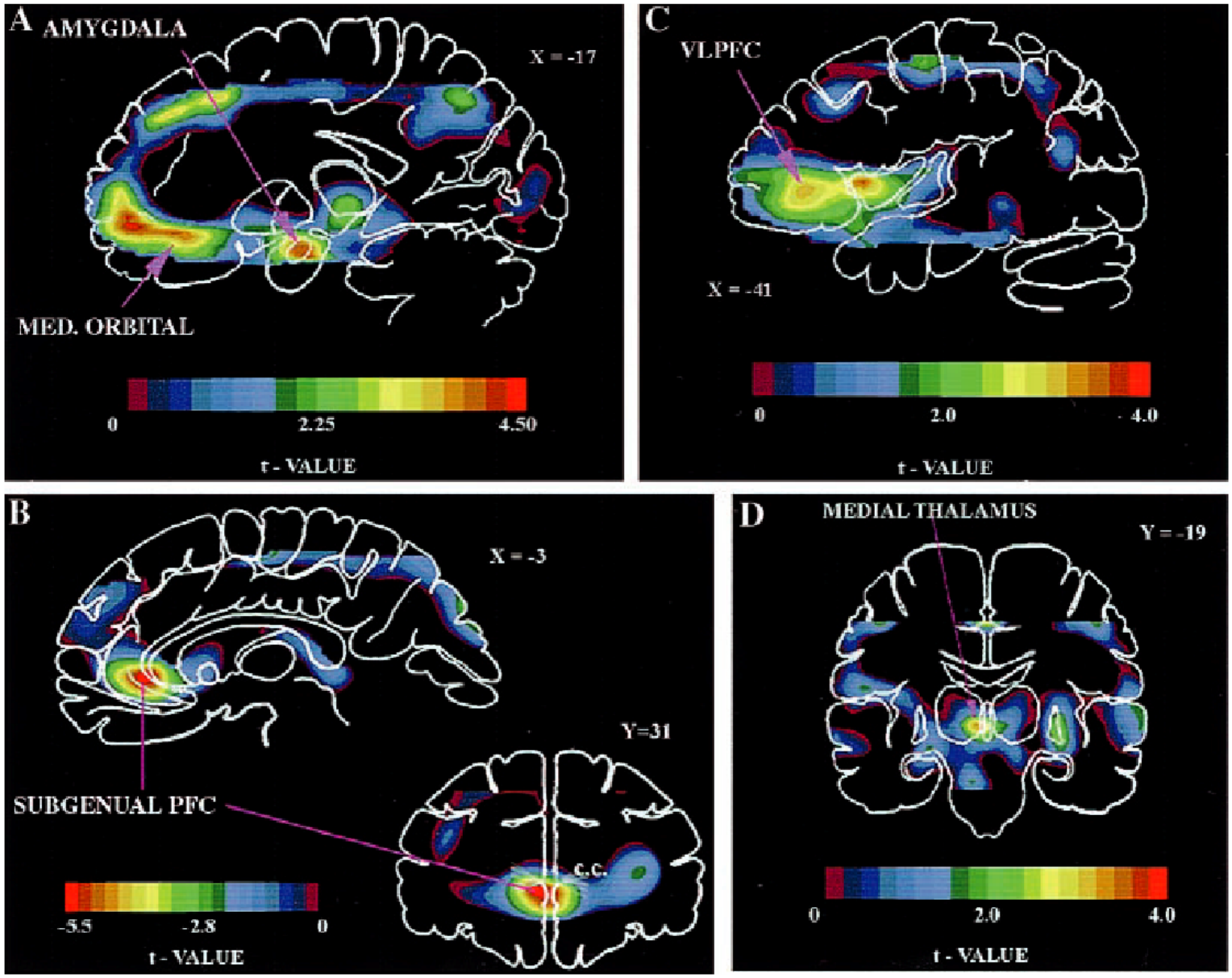
ACC

anterior *posterior*

Childress et al. (2000)

ACC hyperactivity in depression

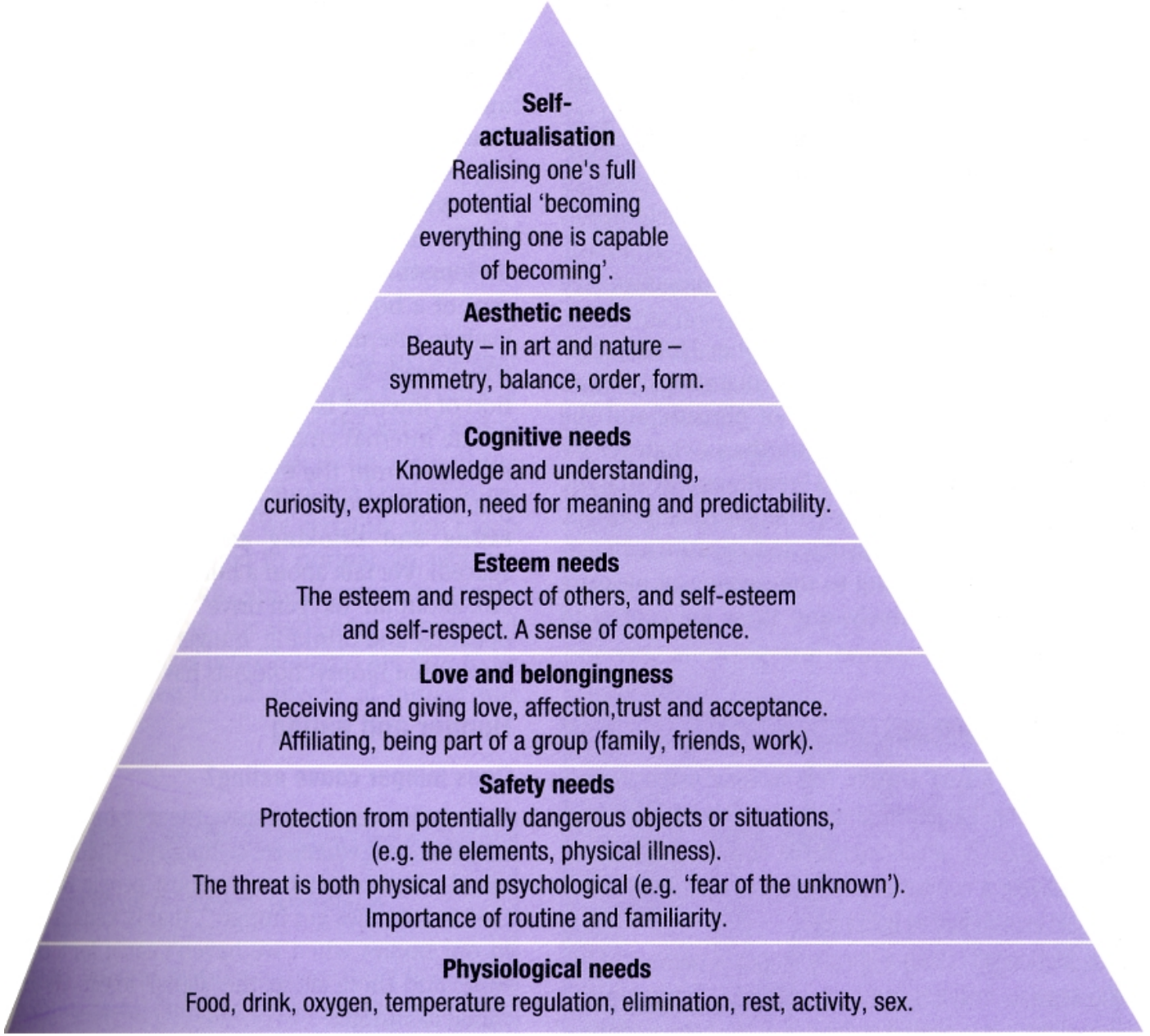
ACC



from Drevets (2000)

Motivation

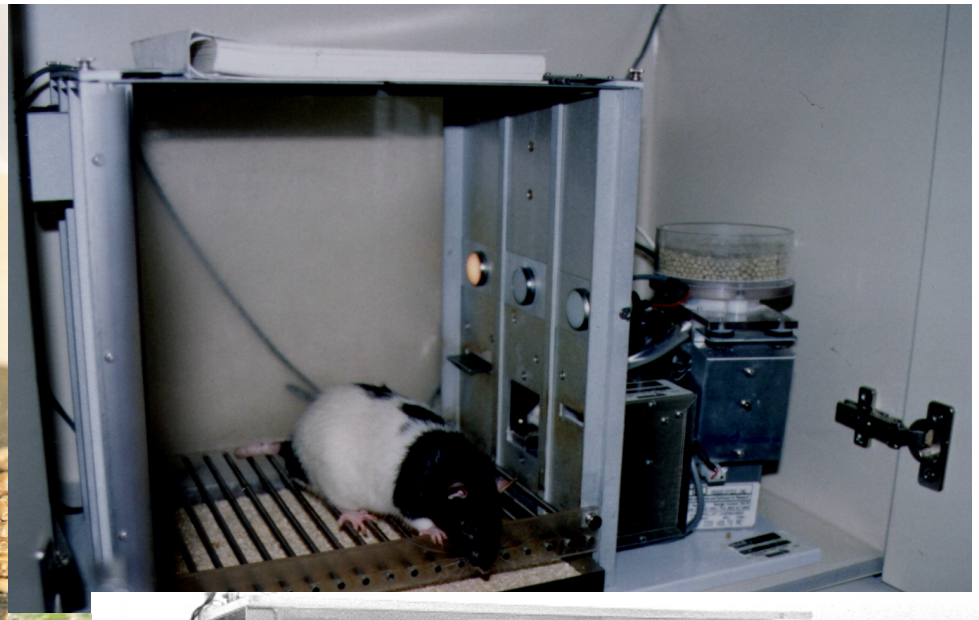
Maslow's 'hierarchy of needs' — not very helpful

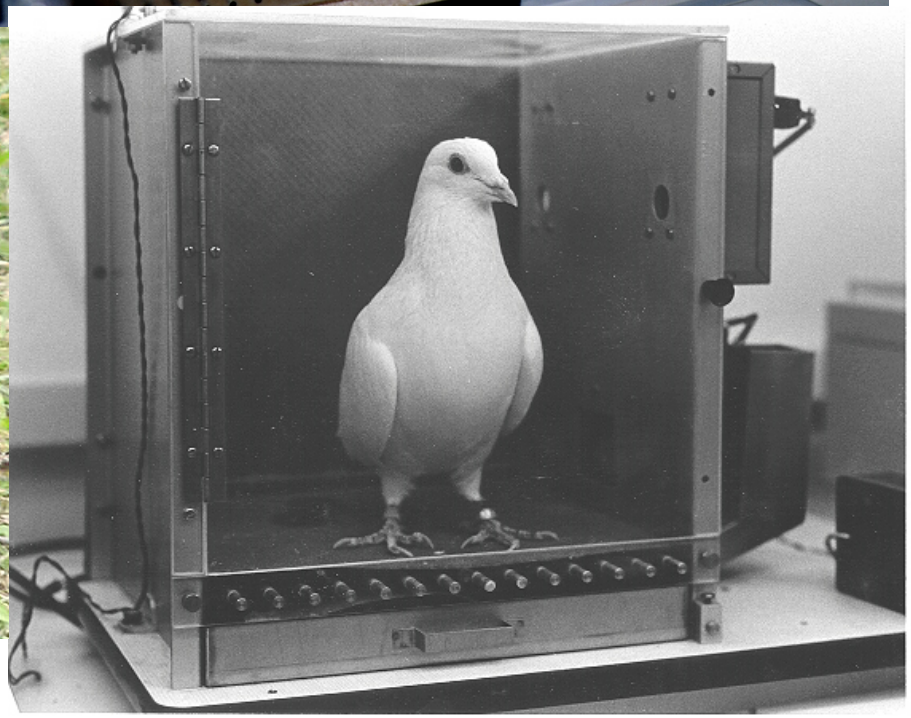


Maslow (1954)

Manigault (1909) 'The Rocket'

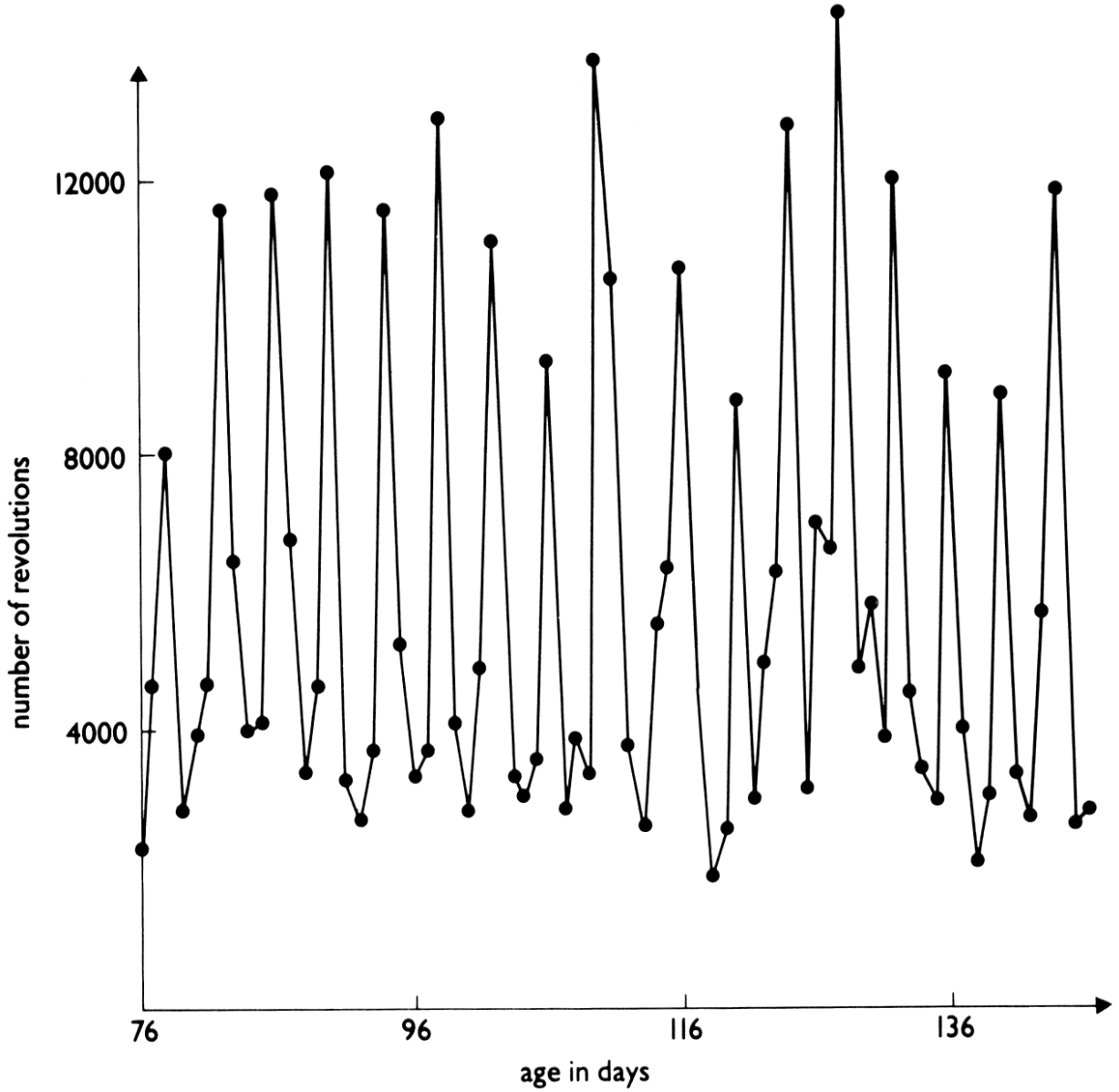
Behaviourism: positive and negative reinforcement





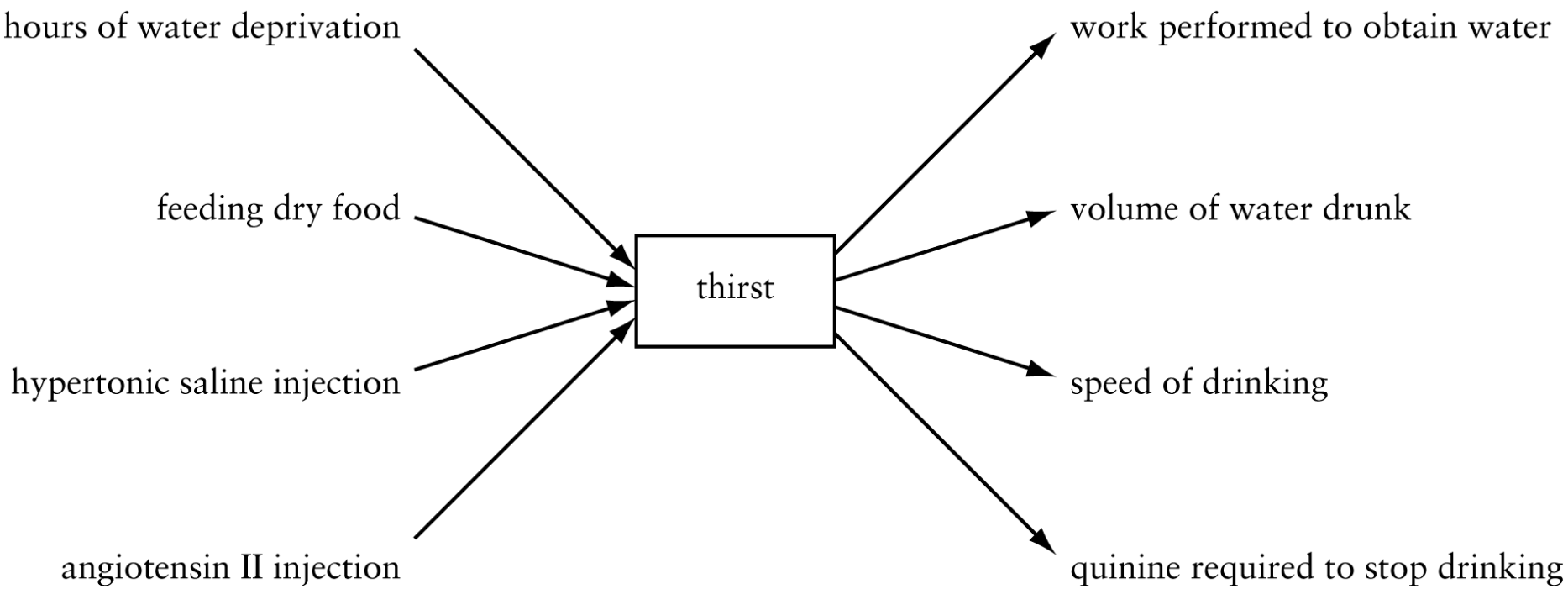
e.g. Skinner (1938)

Motivational states as hidden explanatory variables (1)

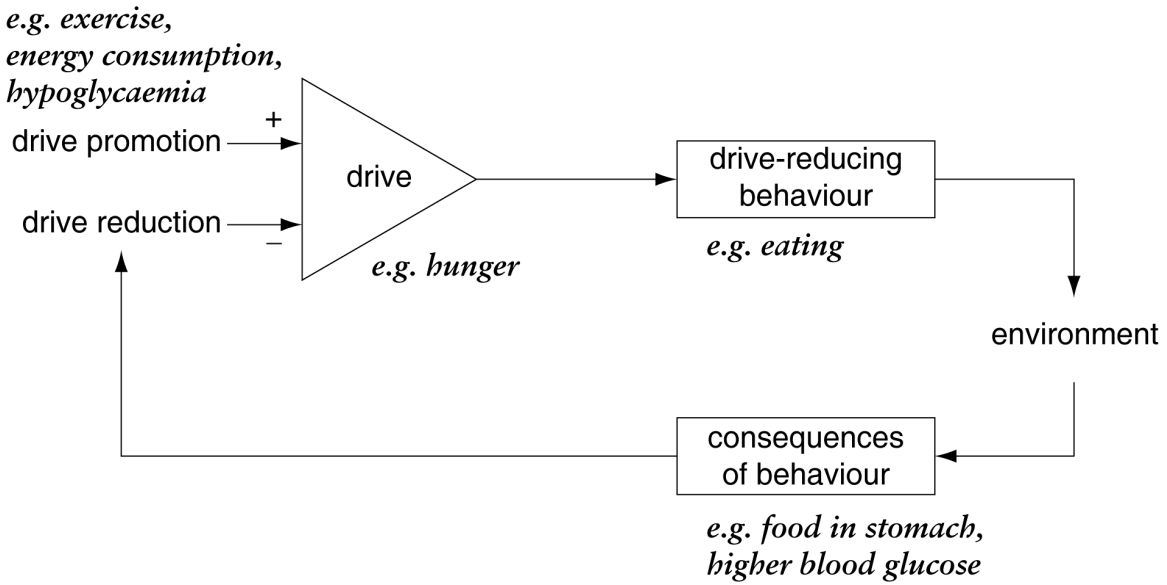


Richter (1927), wheel-running in a female rat

Motivational states as hidden explanatory variables (2)

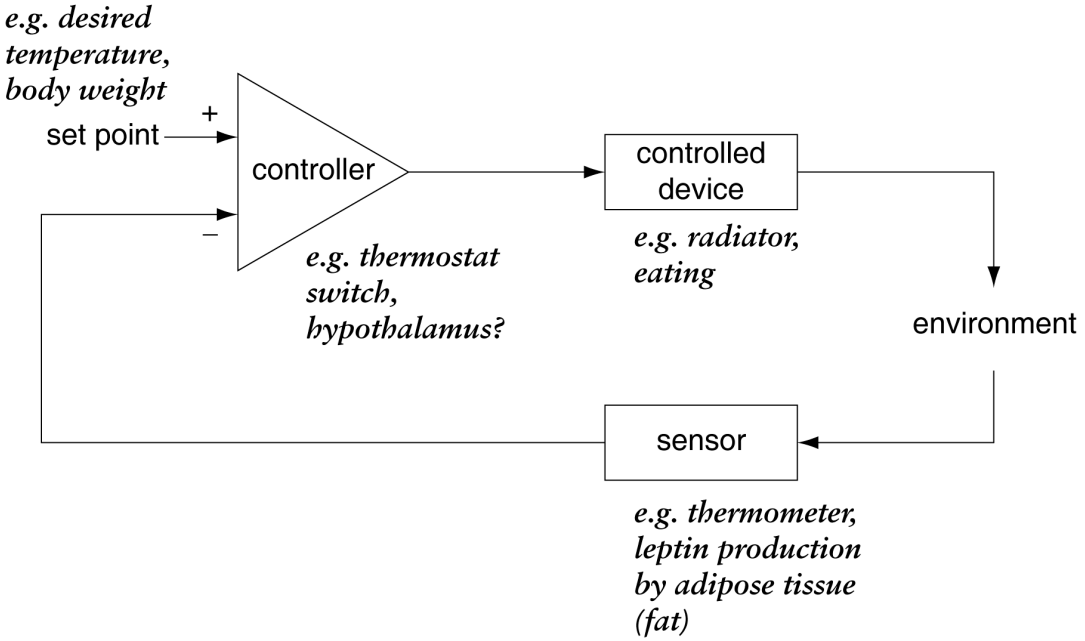


Motivational states, drives, homeostasis

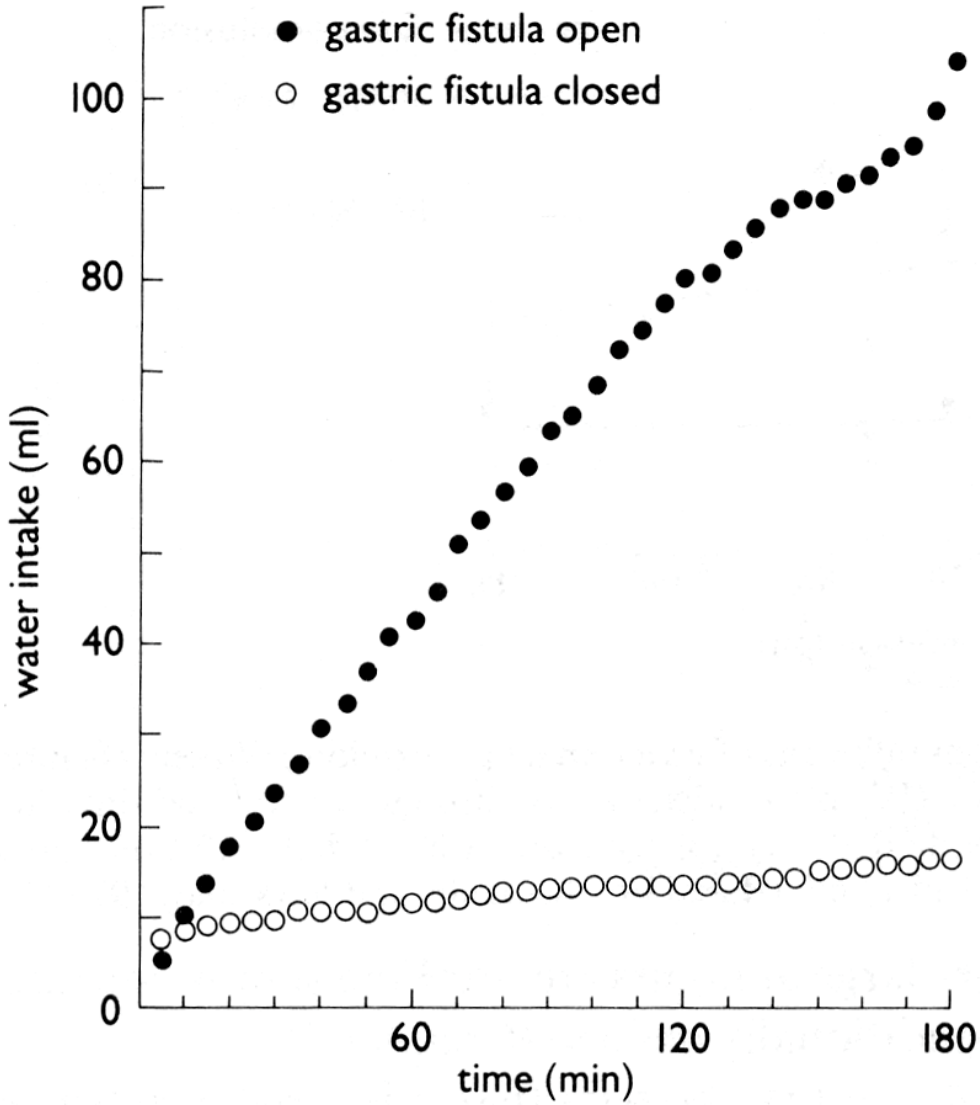


Hull (1943): events that reduce 'drives' are reinforcing.

Homeostasis (a term coined by Cannon). Negative feedback.



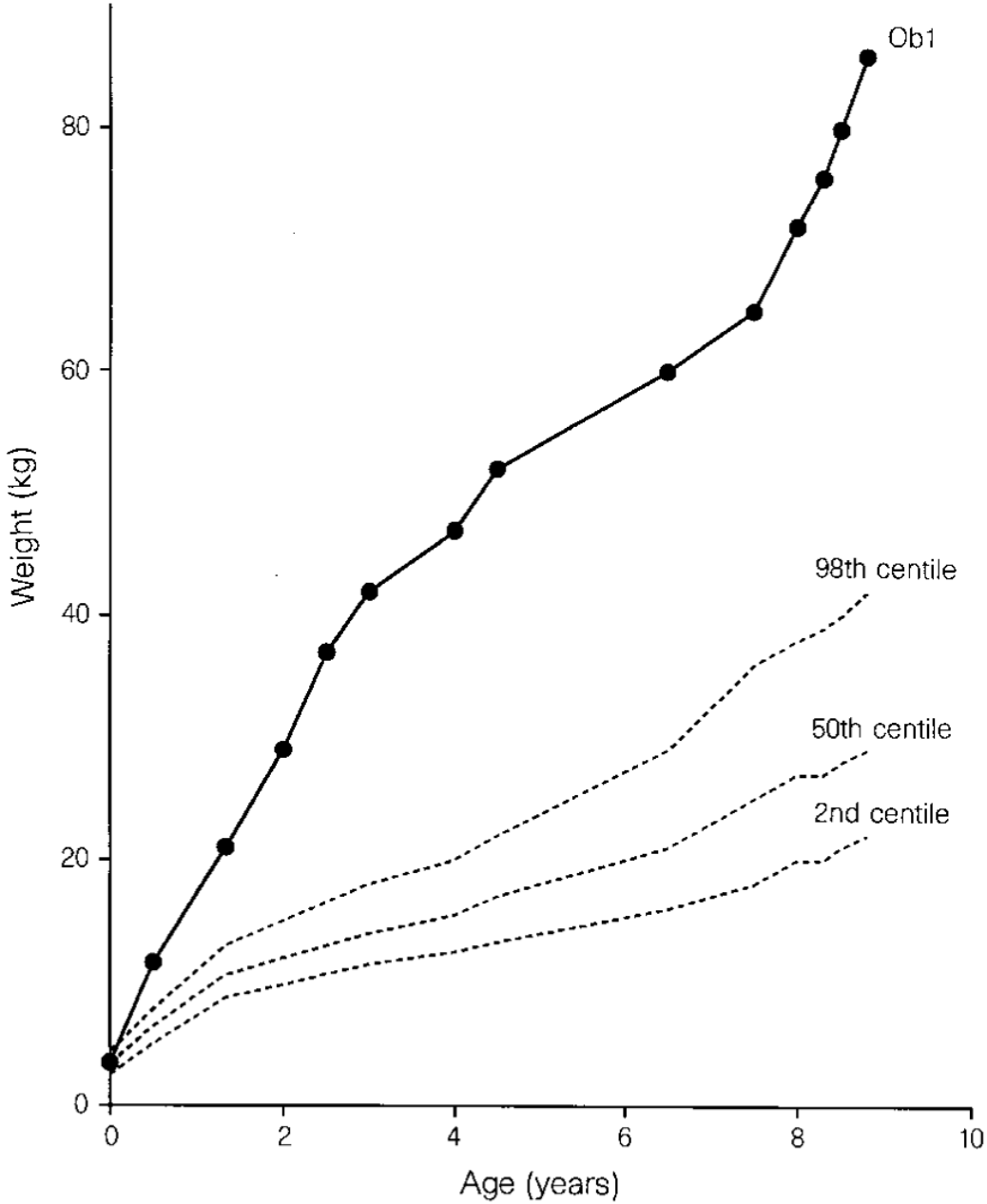
Homeostasis in action? Sham drinking



Rolls & Rolls (1982)

Humans with leptin deficiency get a bit chunky, too

8 year-old girl.
1.37 m tall (75th centile).
86 kg. BMI of 46.
Mobility severely impaired.

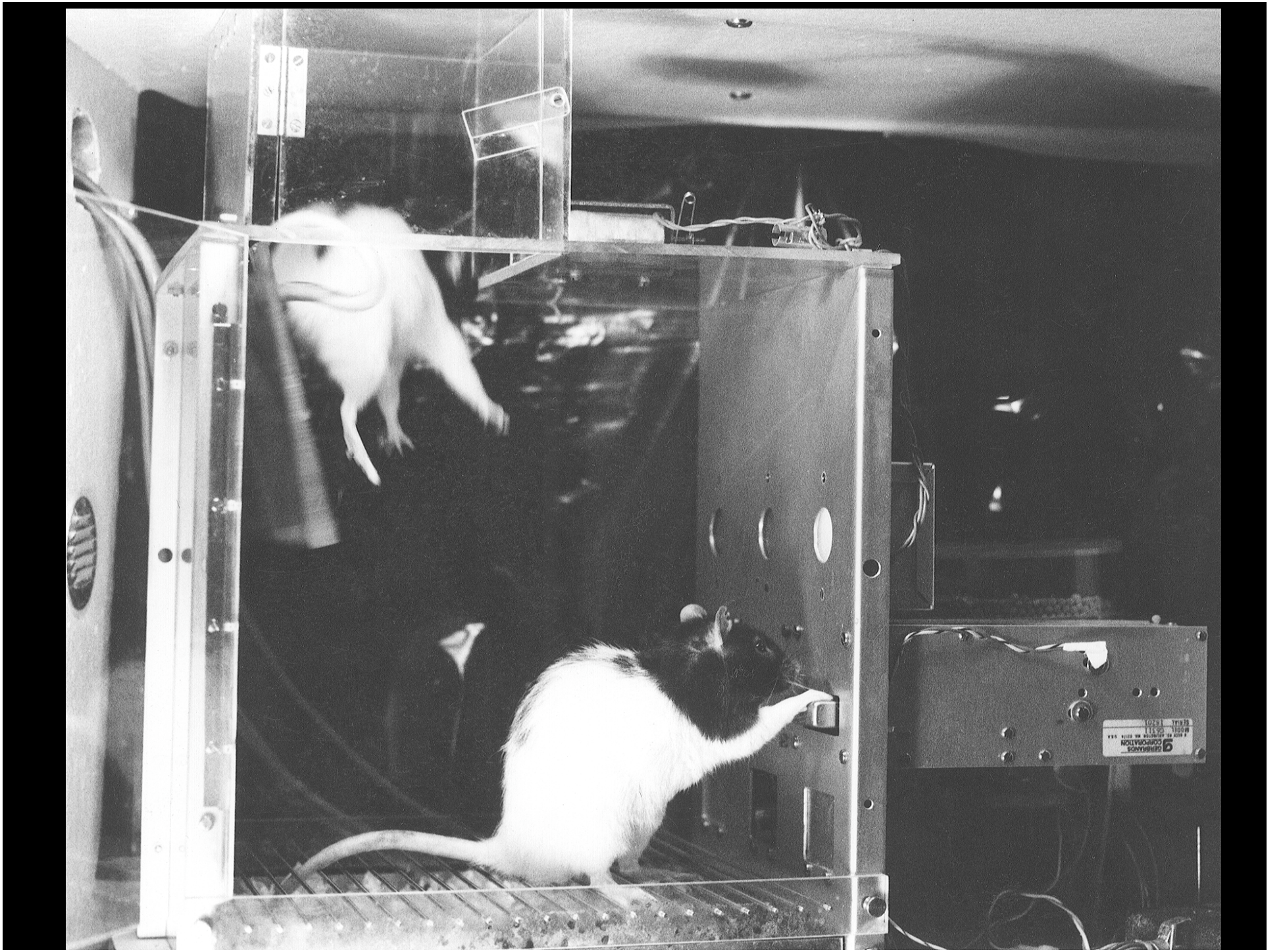


Montague et al. (1997)

Rodents that eat all the pies

Hetherington & Ranson (1939); Coleman & Hummel (1969)

Left: rat with ventromedial hypothalamic lesion; above: mice with leptin or leptin-receptor deficiency

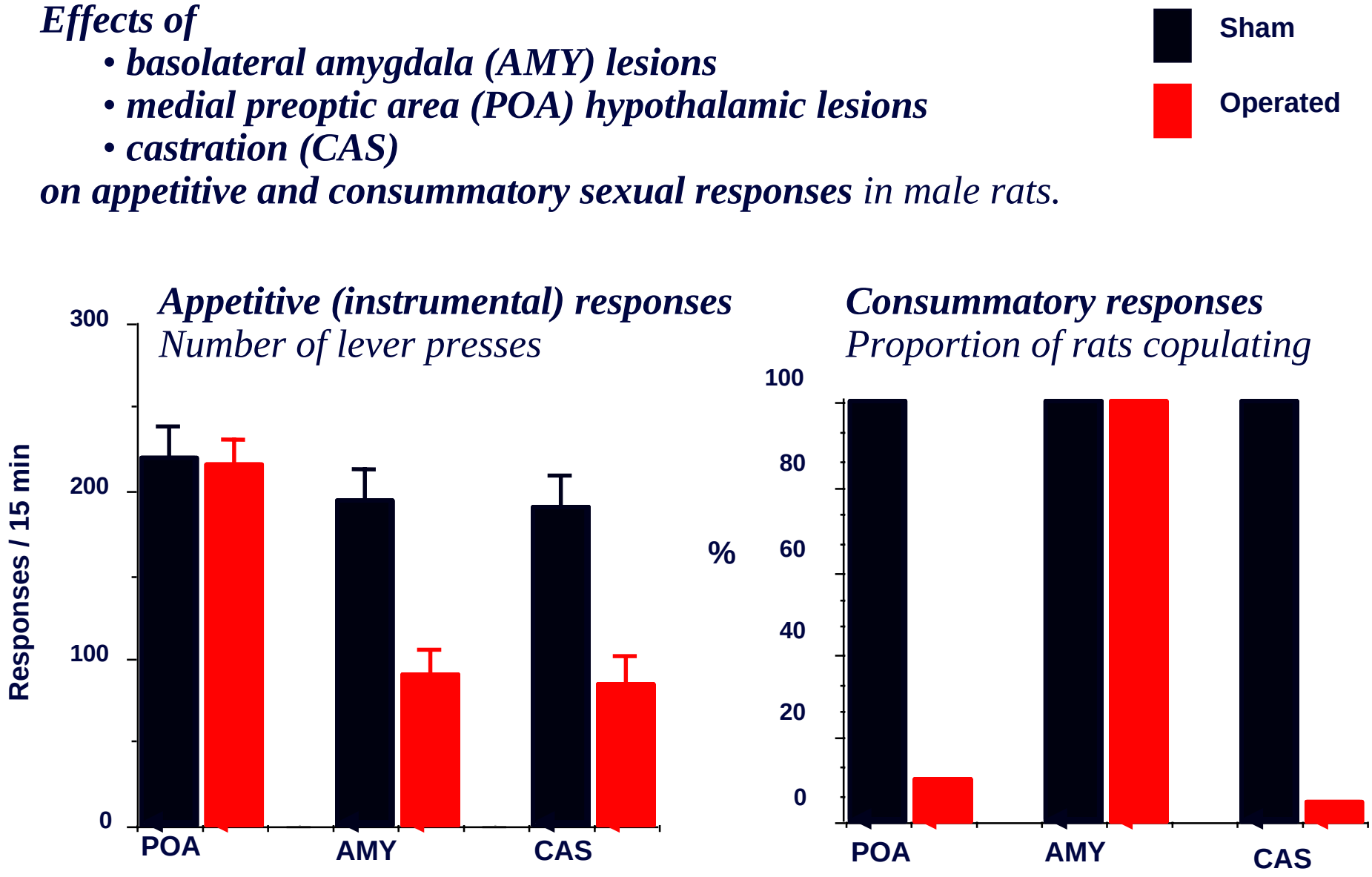


Double dissociation of appetitive / consummatory behaviour

Effects of

- ***basolateral amygdala (AMY) lesions***
- ***medial preoptic area (POA) hypothalamic lesions***
- ***castration (CAS)***

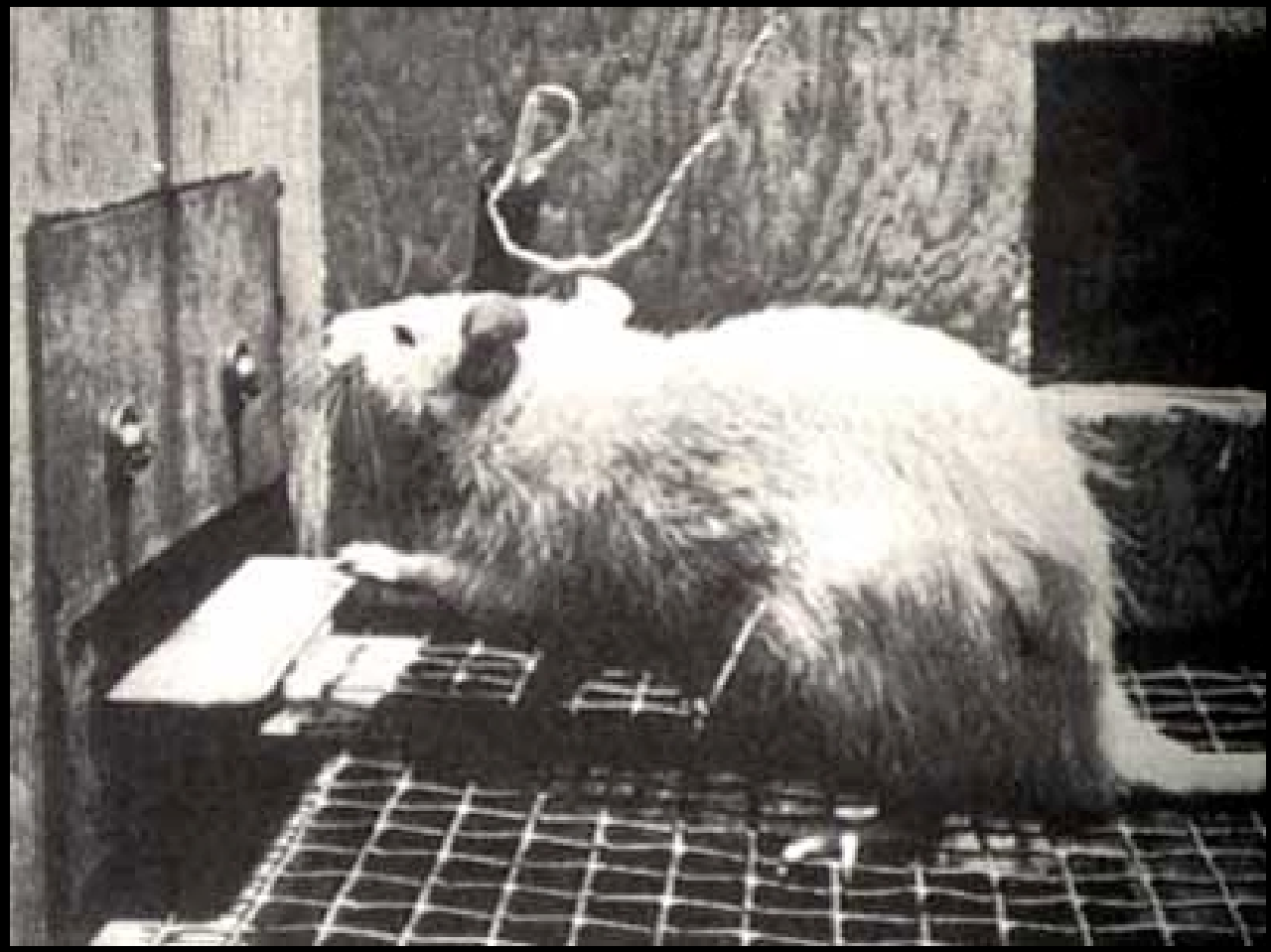
on appetitive and consummatory sexual responses *in male rats.*



Everitt & Stacey (1987); Everitt, Cador & Robbins (1989)

Not all motivation is obviously homeostatic

Electrical intracranial self-stimulation (ICSS)



The mind is its own place, and in itself, can make heaven of Hell, and a hell of Heaven.

(Satan, in John Milton's *Paradise Lost*, book 1, ll. 254–5)

Olds & Milner (1954)

Remote-controlled rats

Talwar *et al.* (2002). *Nature* 417: 37

Motivated behaviour: an overview

- Reinforcement must be defined carefully to avoid circular arguments. Theories (Skinner, Hull, Premack, Timberlake). Motivational states are internal 'hidden' variables that help to explain behaviour.
- Apparently goal-directed behaviour is complex; several representations / processes contribute. For example, rats pressing levers encode
    - the instrumental (action–outcome) contingency;
    - the value of the outcome as an instrumental goal;
    - the (dissociable) 'hedonic' value of the outcome;
    - direct stimulus–response 'habits';
- … and is influenced by Pavlovian processes including conditioned reinforcement and Pavlovian–instrumental transfer.
- Motivational state affects several of these processes.
- Once your goals have been obtained, consummatory behaviour takes over; this is organized by the hypothalamus.