260-2017-10-23-emotion-reward

Rick Gilmore

2017-10-22 18:23:38

Happiness Is...

Happiness-You're A Good Man, Charlie Brown (Lyrics)

Today's Topics

- Biology of emotion
- Happiness/pleasure
- Quiz 3 Friday

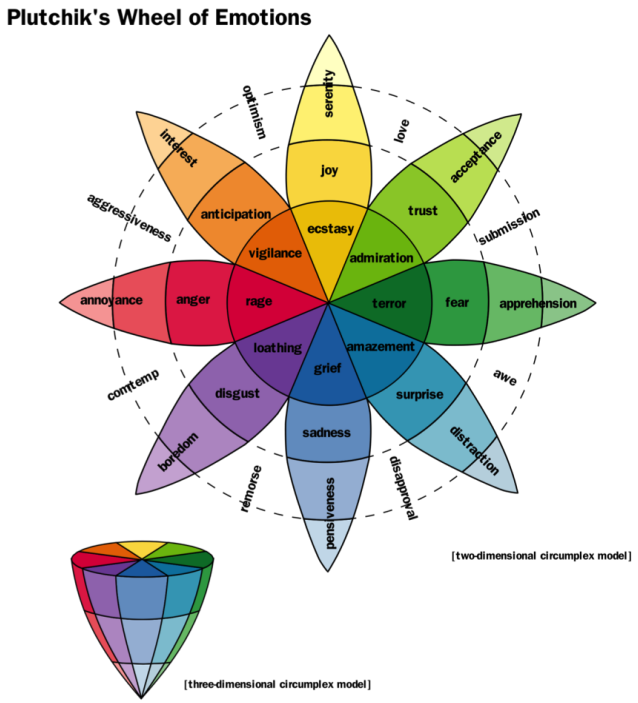
Biology of Emotion

- What is emotion?
- What are the types of emotions?
- Biological systems involved in emotion

What is emotion?

- Feelings
- Physiological state
- Actions (now)
- Propensity to act (in the future)

What are the different types of emotions?



(Plutchik 1980)

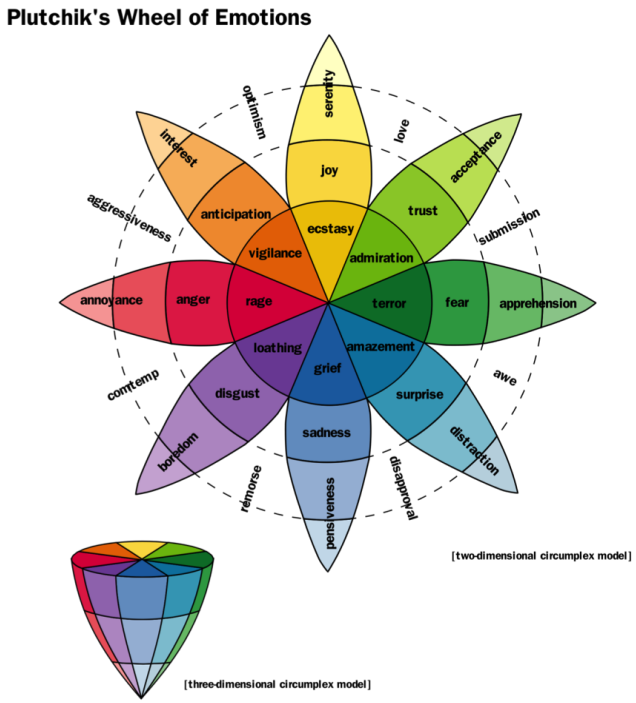
Emotions

- Vary in valence
  - Positive/negative
- Vary in intensity (arousal)
- Vary in action tendency
  - Approach/avoid

Emotions (can) serve biological goals

- Ingestion
- Defense
- Reproduction
- Affiliation

Plutchik



(Plutchik 1980)

Biological goals served by

- Anger
- Fear
- Disgust
- Trust
- Sadness
- Happiness

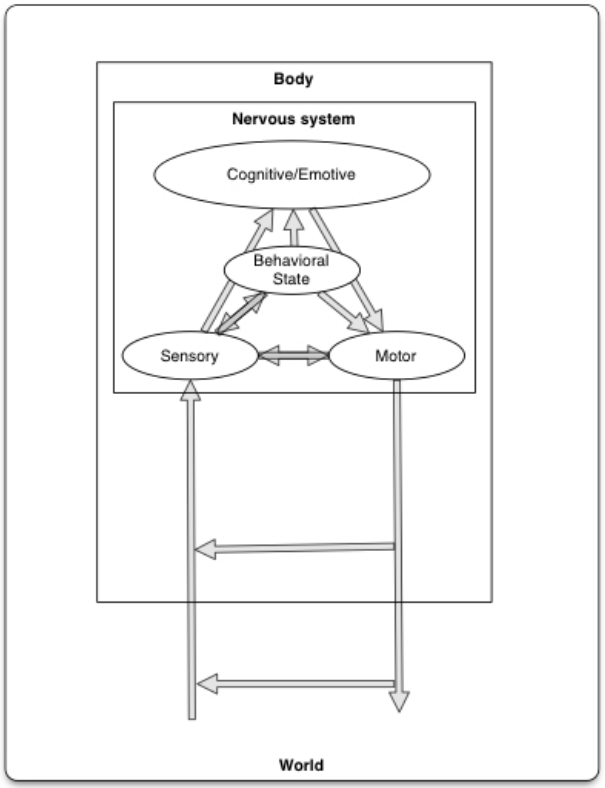
Do emotions serve biological goals?

- Shame
- Guilt
- Pride
- Embarrassment
- Regret

Are 'social' goals ?

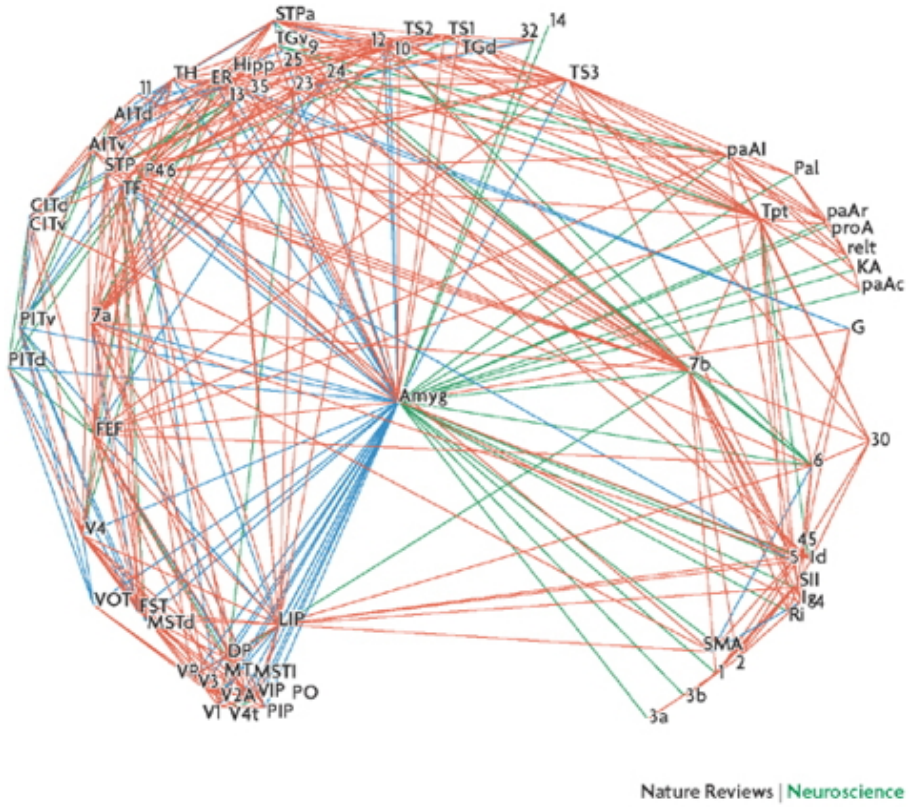
- Darwinian view:
- If influence on reproductive outcomes, **yes**.
- Do 'social' goals – shame, pride, etc. – influence reproductive success?

Is emotion different from cognition?



(Swanson 2012)

Is emotion different from cognition?



(Pessoa 2008)

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Emotion as "computing"

- Input
- Processing/evaluation
- Output

Emotion as "computing"

- **Input**
- Processing/evaluation
- Output

Emotion as "computing"

- Input
  - External
  - Internal

External Input

Cole, P., Gilmore, R.O., Scherf, K.S. & Perez-Edgar, K. (2016). The Proximal Emotional Environment Project (PEEP). Databrary. Retrieved October 31, 2016 from https://nyu.databrary.org/volume/248.

Emotional "computing"

- Input
- **Processing/evaluation**

Emotional "computing"

- Input
- Processing/evaluation
    - Current state + past states (memory)
    - Food/non
    - Threat/non
    - Mate/non; offspring/non

Emotional "computing"

- Input
- Processing/evaluation
- **Output**

Emotional "computing"

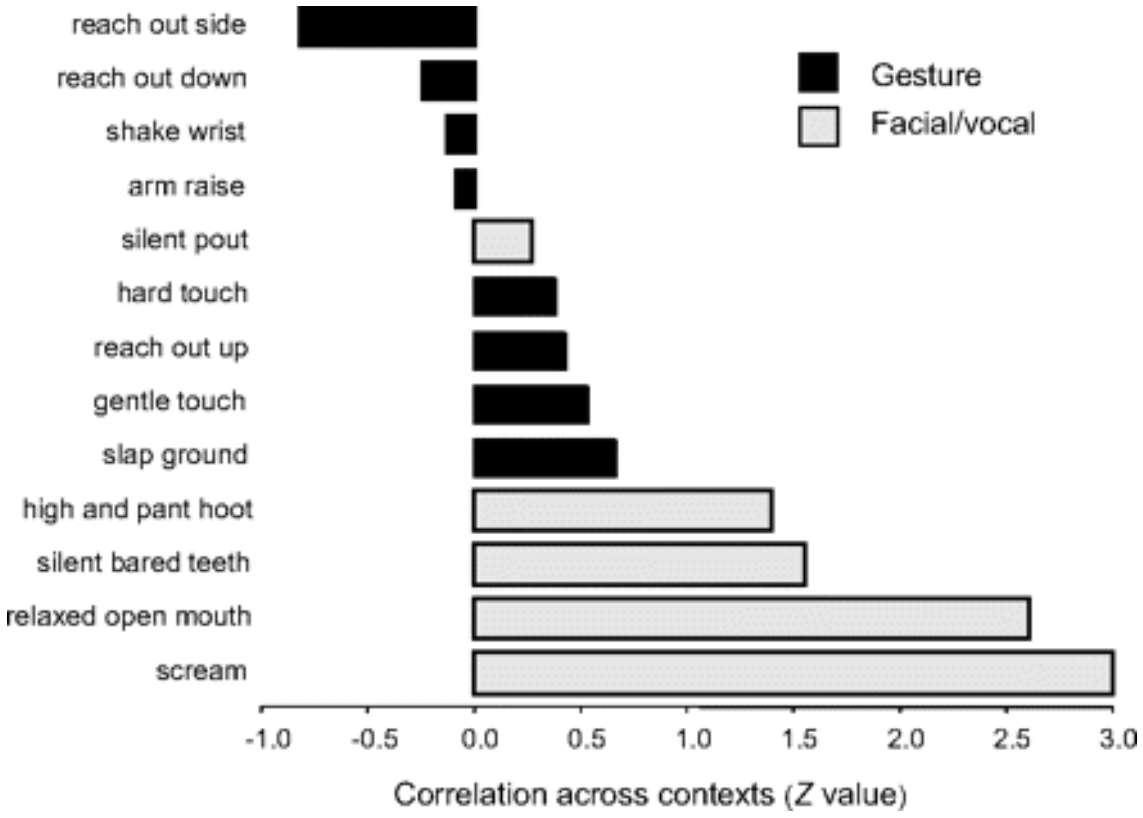
- Output
  - Physiological state
    - Autonomic nervous system
    - Hormones

Emotional "computing"

- Output
  - Actions
    - Locomotion or freezing
    - Facial expression
    - Vocalization
    - Gestures, body posture

(Pollick and Waal 2007)

Are non-human animals consistent in their use of emotion-expressing actions?



(Pollick and Waal 2007)

Are different emotions processed differently in humans?

- Autonomic responses related to feelings
- Autonomic specificity: emotions autonomically unique vs. autonomically identical? (Levenson 2003)
- Belief in idea stronger than evidence

Biological systems involved in specific emotions

- Happiness

Components of happiness

- Aristotle
- Hedonia
  - Pleasure
- Eudaimonia
  - Life satisfaction
  - Relates to motivation

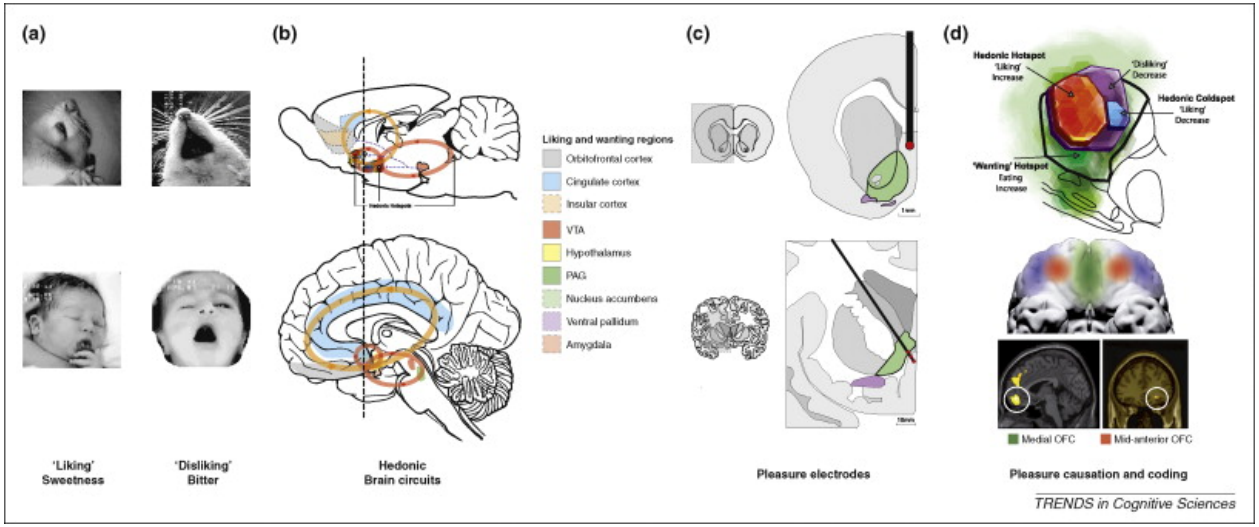
"Computing" 'happiness'

- Inputs
  - External
  - Internal
- Processing
- Outputs
  - Feelings
  - Actions

Brain mechanisms

- Circuits for signaling pleasure and pain
- Similarities across animal species
- Dopamine and endogenous opioid neurotransmitter systems involved

Neuroanatomy of 'happiness'



(Kringelbach and Berridge 2009)

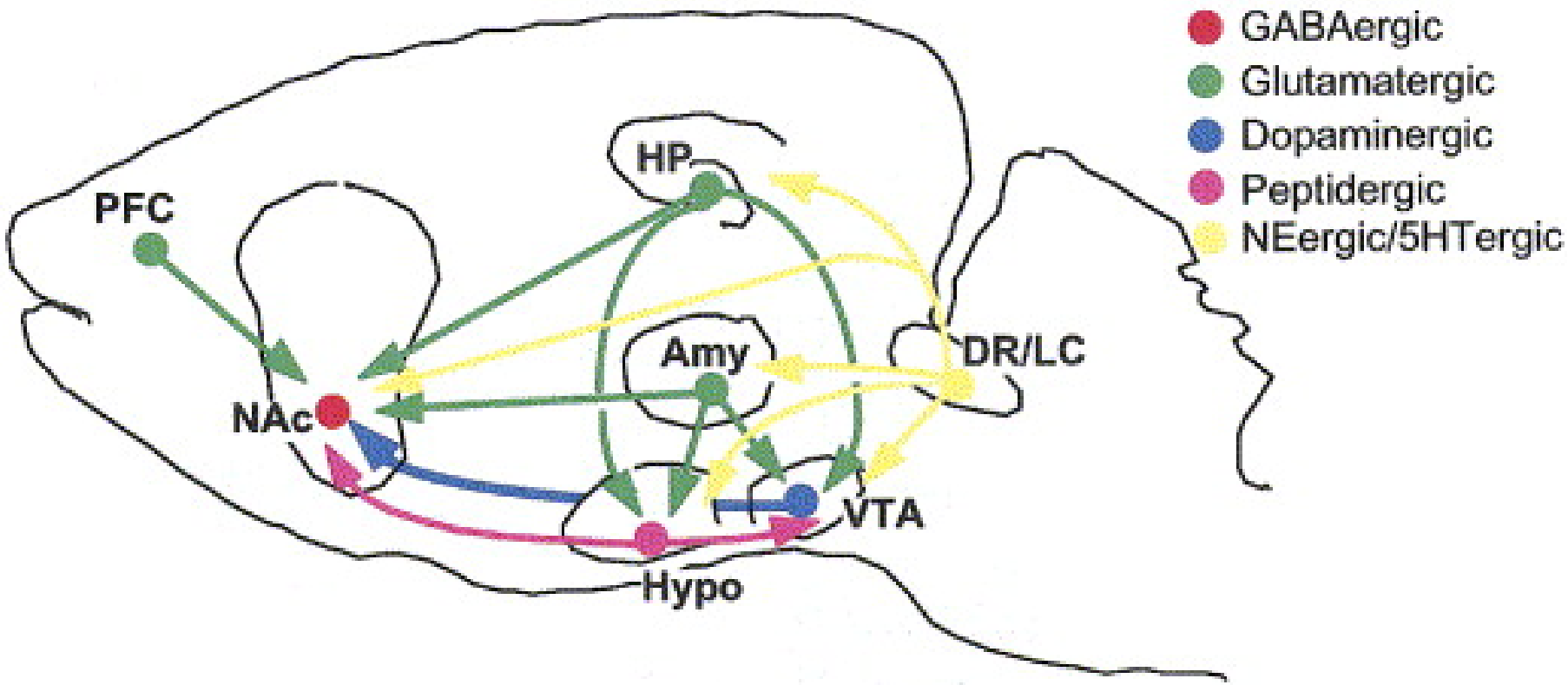
Rewards

- A reinforces (makes more prevalent/probable) some behavior
- Milner and Olds (Milner 1989) discovered 'rewarding' power of electrical self-stimulation
- (Heath 1963) studied effects in human patients.

Electrical self-stimulation

Brain Mechanisms of Pleasure and Addiction

"Reward" circuitry in the brain

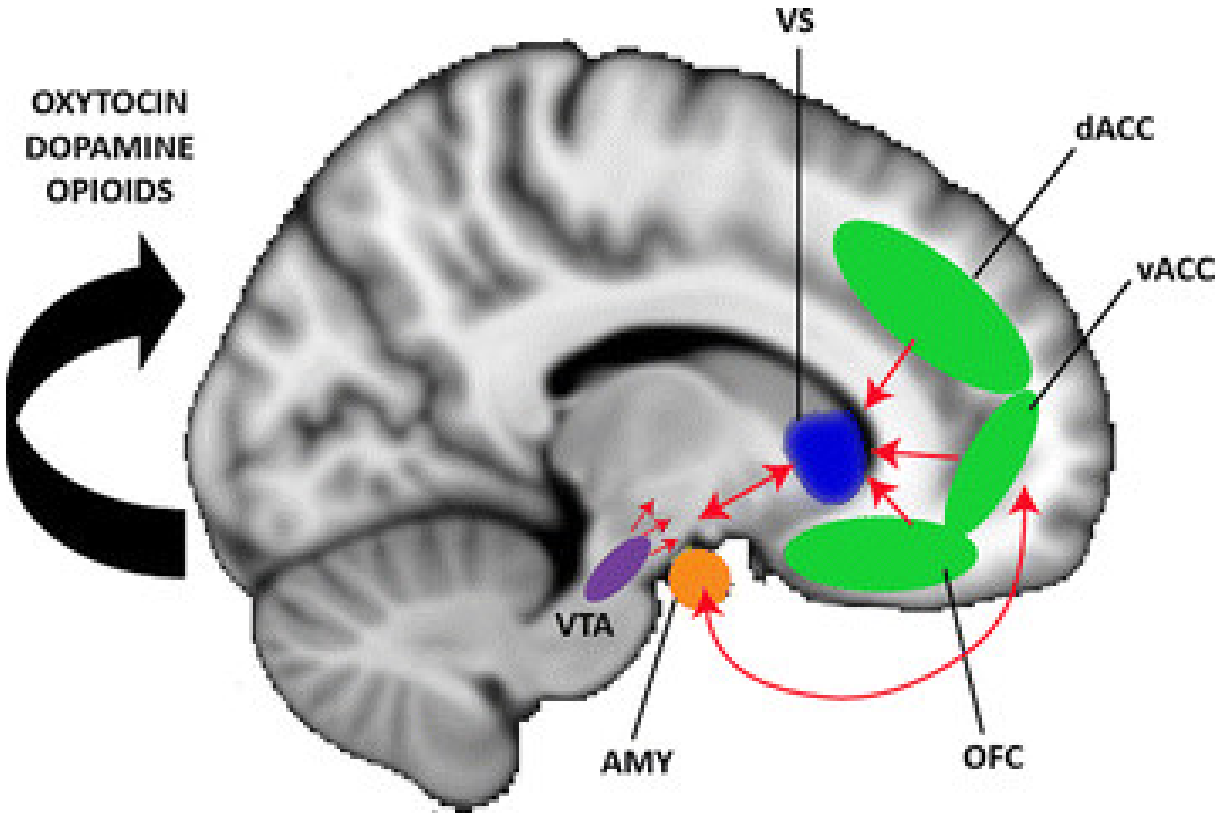


(Nestler and Carlezon 2006)

Nodes in the "reward" circuit

- Ventral tegmental area (VTA) in midbrain
- Nucleus accumbens (nAcc)
- Hypothalamus (Hyp)
- Amygdala (Amy)
- Hippocampus (HP)
- Dorsal Raphe Nucleus/Locus Coeruleus (DR/LC)
- Prefrontal cortex (PFC)

Nucleus accumbens and dorsal striatum

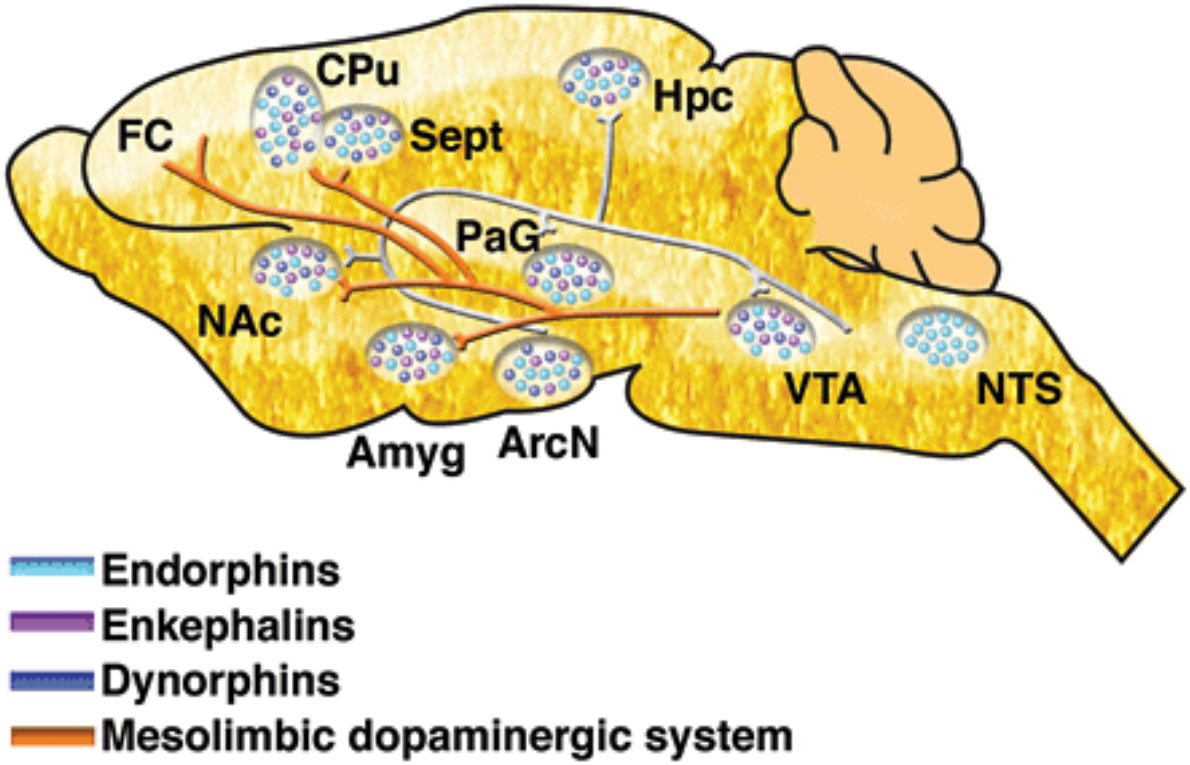


(Kohls et al. 2012)

Psychopharmacology of 'happiness'

- Dopamine
- Opioids
- Cannabinoids
- Serotonin, Norepinephrine
- ACh

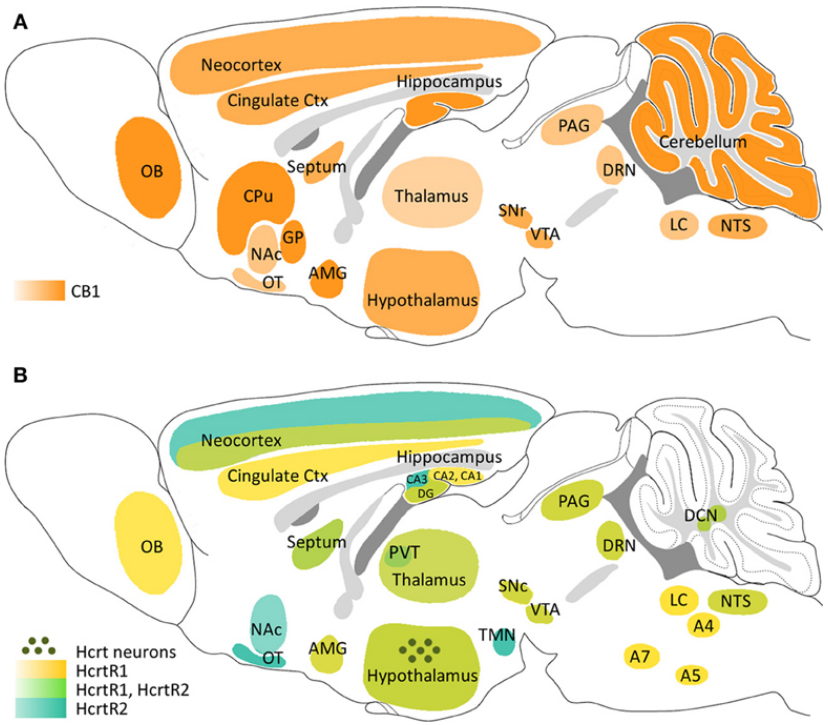
Endogenous morphine-like NTs (endorphins) from hyp, NST



(Clapp, Bhave, and Hoffman, n.d.)

Endogenous cannabinoid system

- Cannabinoids, psychoactive compounds found in cannibis
- Cannabinoid CB1 receptors in CNS; CB2 in body, immune system

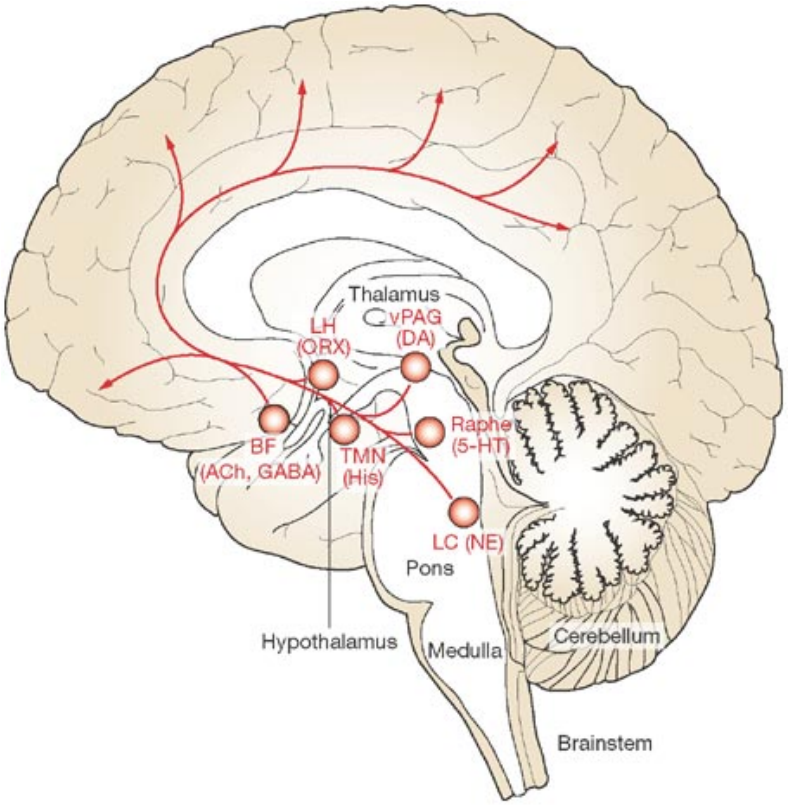


(Flores, Maldonado, and Berrendero 2013)

Brain contains its own systems for binding drugs associated with 'pleasure'

- Endogenous opioids (endorphins)
- Endogenous cannabinoids

ACh projections in the CNS



(Cock, Vidailhet, and Arnulf 2008)

Generalizations about happiness/pleasure

- Types of pleasure activate overlapping areas
- Pleasure/happiness engage a network of brain areas
- Pleasure/happiness signaling involves multiple neuromodulators, but DA especially important
- “Reward” pathways activated by many different inputs.

Next time

- Fear
- Stress

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