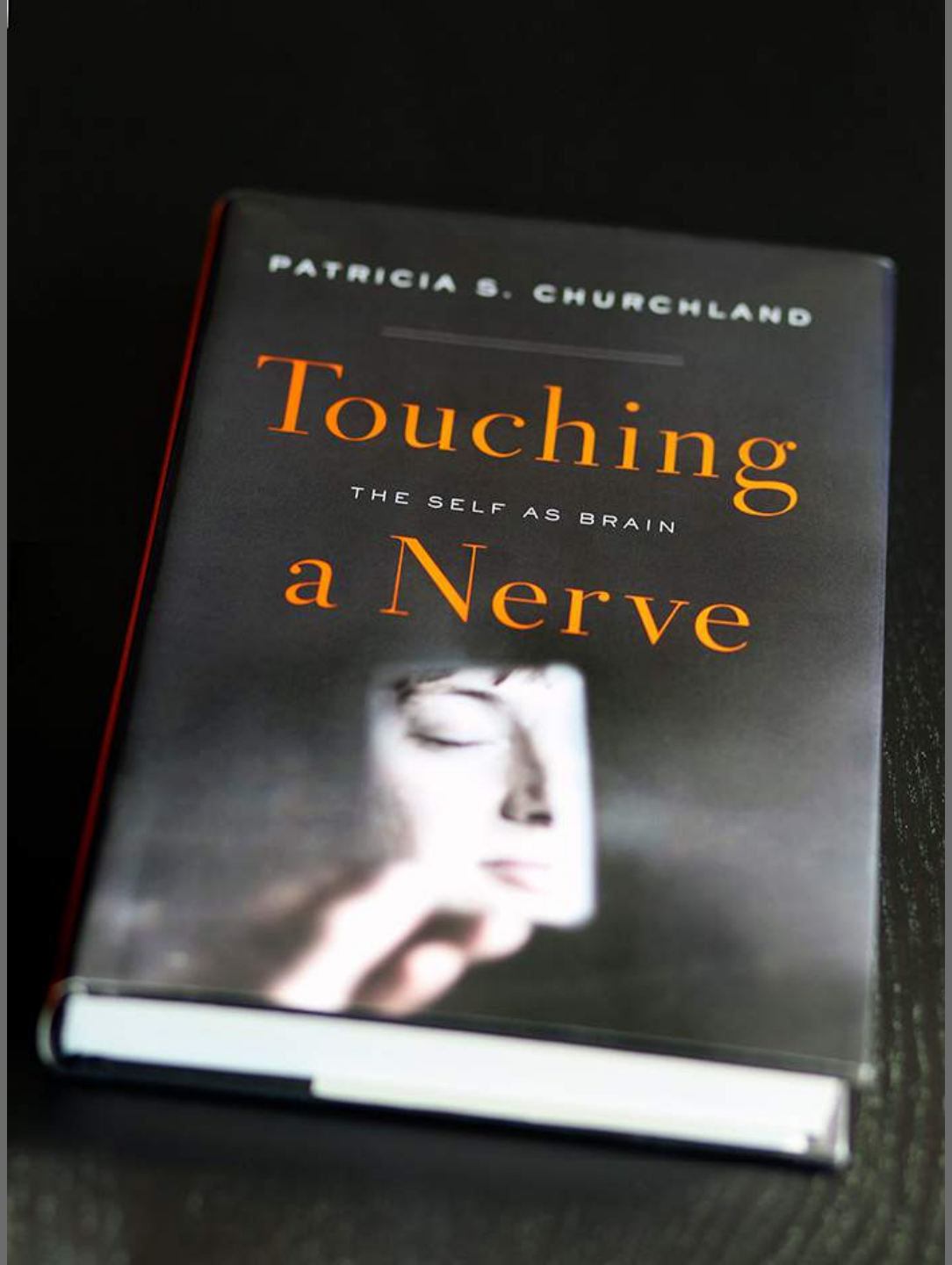

PATRICIA S. CHURCHLAND
Touching
THE SELF AS BRAIN
a Nerve

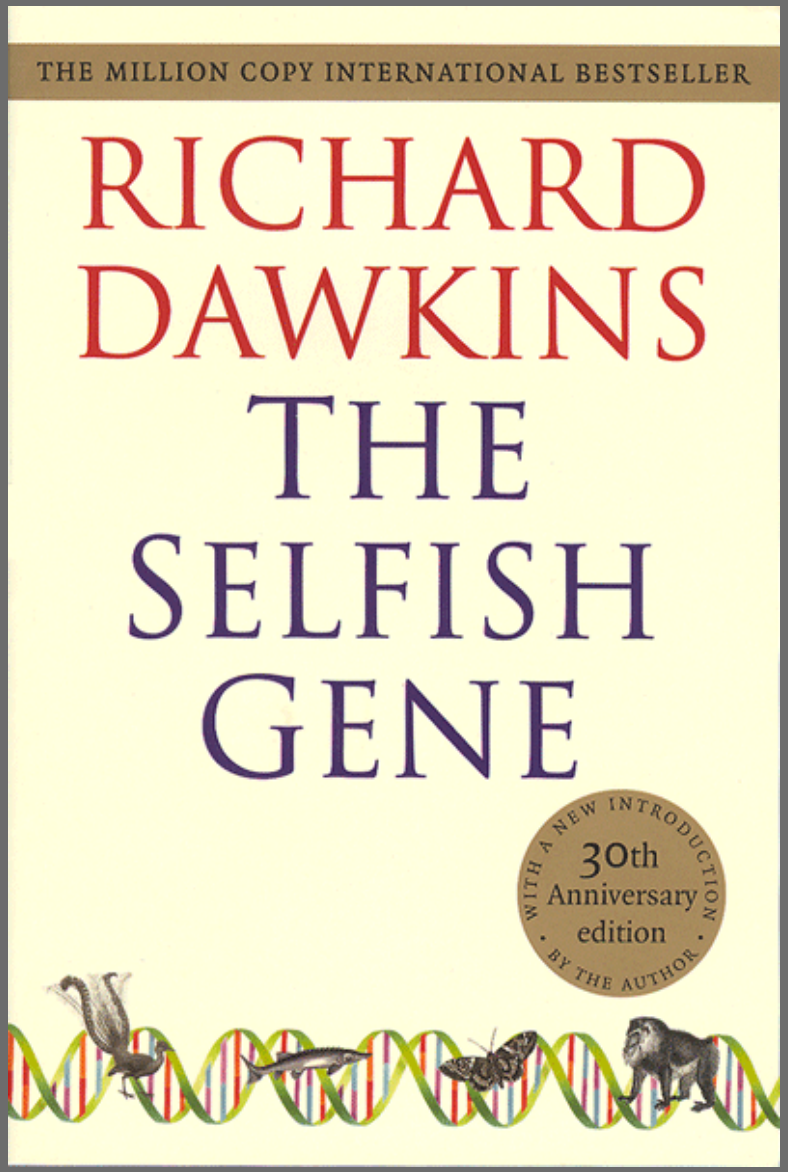
the evolution of human sociality is the fundamental condundrum of biology
EO Wilson 1975

MY QUESTION: WHERE DO MORAL VALUES COME FROM ?

DEEPEST LEVEL OF VALUE

emotional and motivation systems for survival & well-being

Life-value

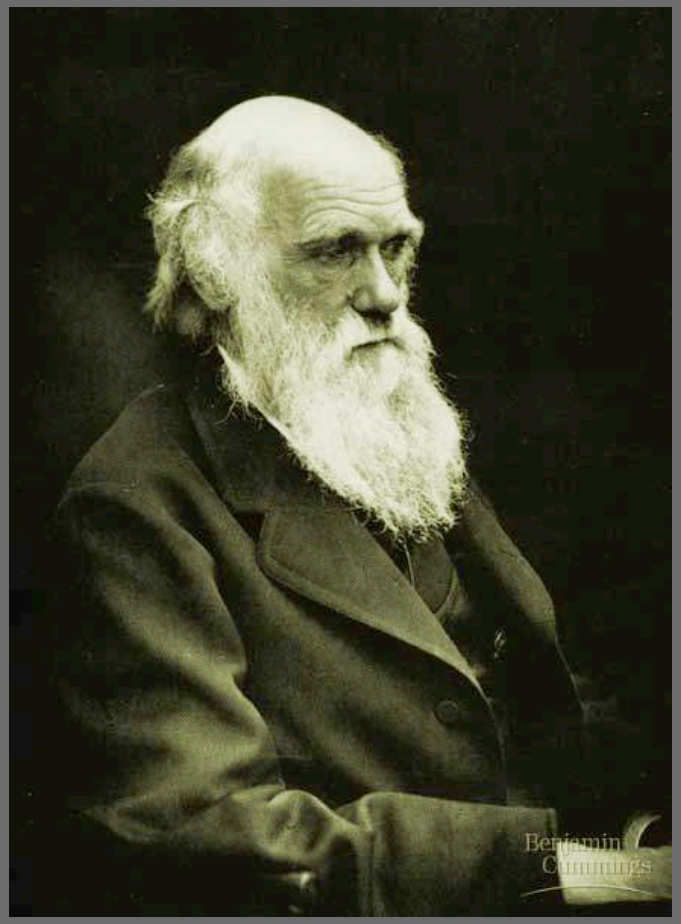


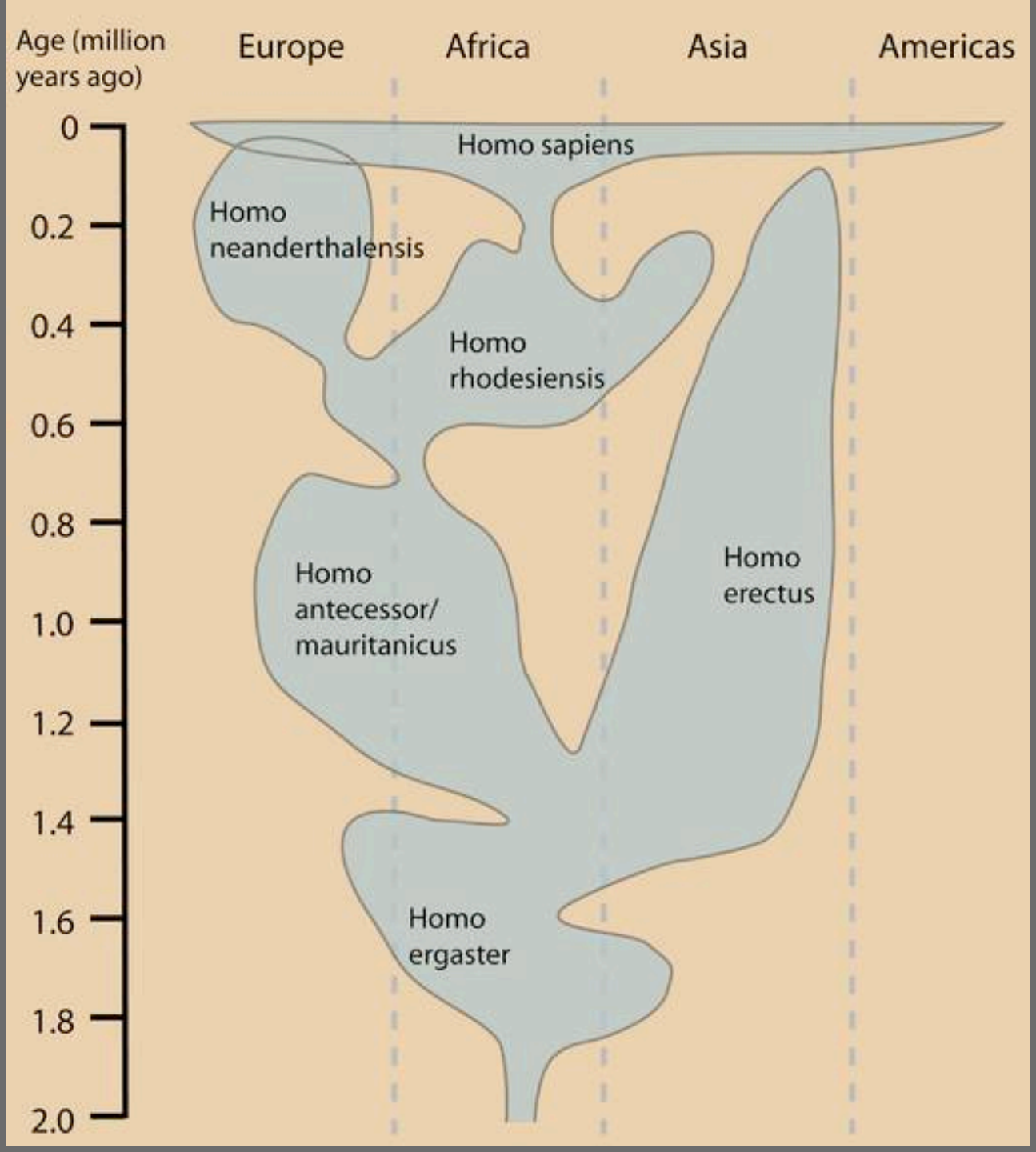
"Let us try to teach generosity and altruism, because we are born selfish."

Darwin: our moral sense or conscience

- social instincts
- habits & skills
- reason

Aristotle
David Hume
Adam Smith




Age (million years ago)
Europe
Africa
Asia
Americas
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Homo sapiens
Homo neanderthalensis
Homo rhodesiensis
Homo antecessor/ mauritanicus
Homo erectus
Homo ergaster

Agriculture – about 10,000 years ago

Robin Dunbar – brain size/friend size roughly 150 folks

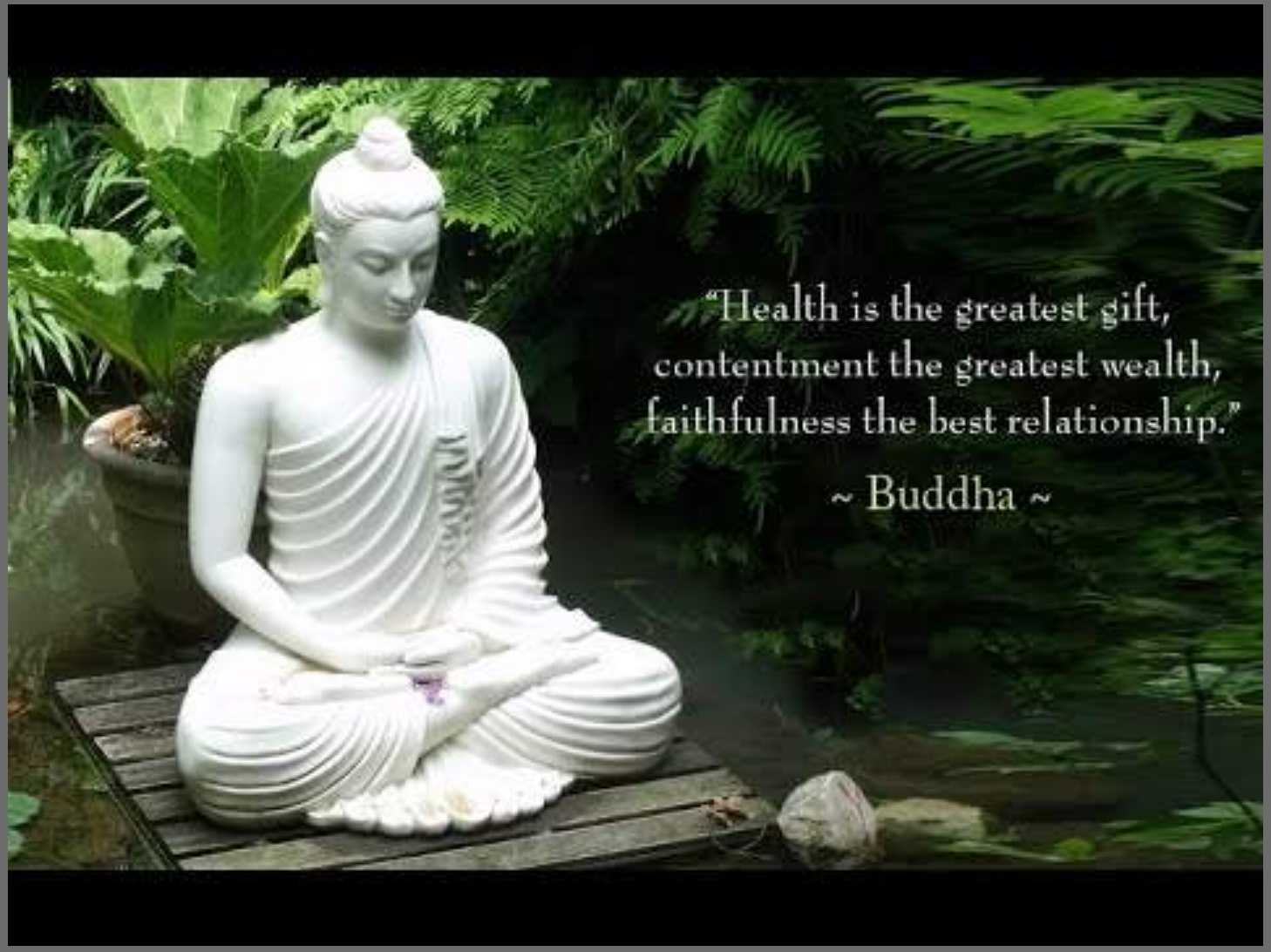

ADULT VIDEO
JESUS
IS WATCHING YOU
The Roman Catholic Churches of San Juan County
Carolyn Fox

Mencius

385-303BC

Confucius

551-479 BC


"Health is the greatest gift,
contentment the greatest wealth,
faithfulness the best relationship."
~ Buddha ~

CONCEPTS & CATEGORIES

Eleanor Rosch

1. have a radial structure

2.prototypes at center

3. have fuzzy boundaries


NewMexicoPhotos.com

Social categories are radial

PROTOTYPES & SIMILARITY

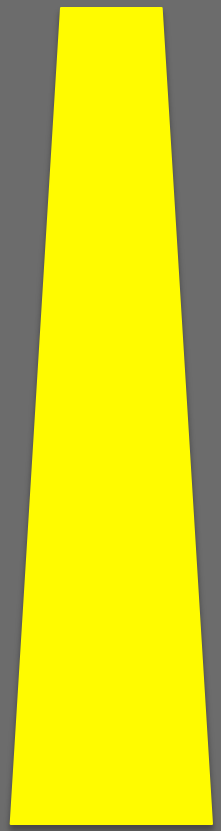
friend
honest
kind
brave
trustworthy

Moral Not moral

Two Traditions

Legal Model

Moses
Kant
Aquinas
Bentham
.....



Skill Model

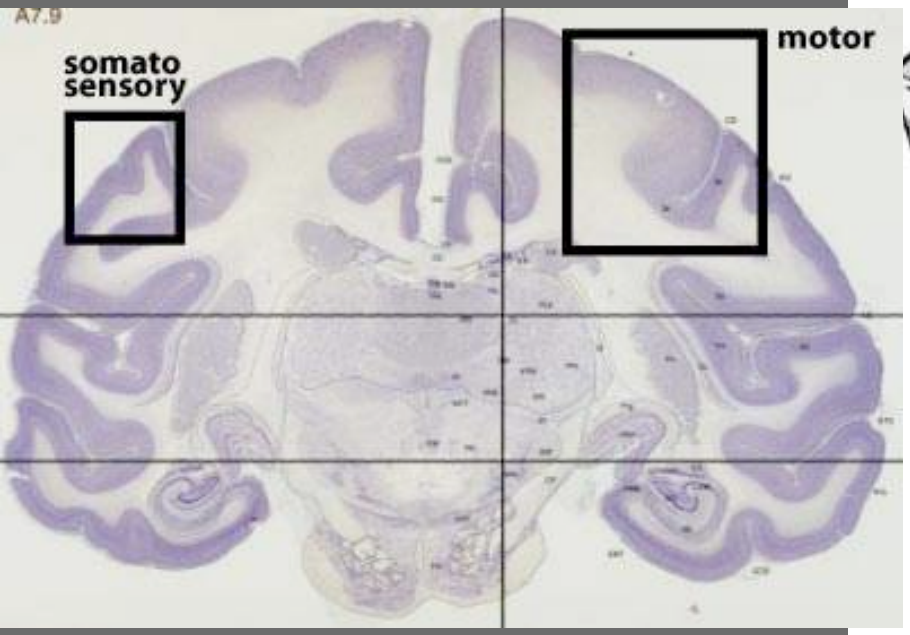
Aristotle
Confucius
Hume
Smith
Darwin
.....

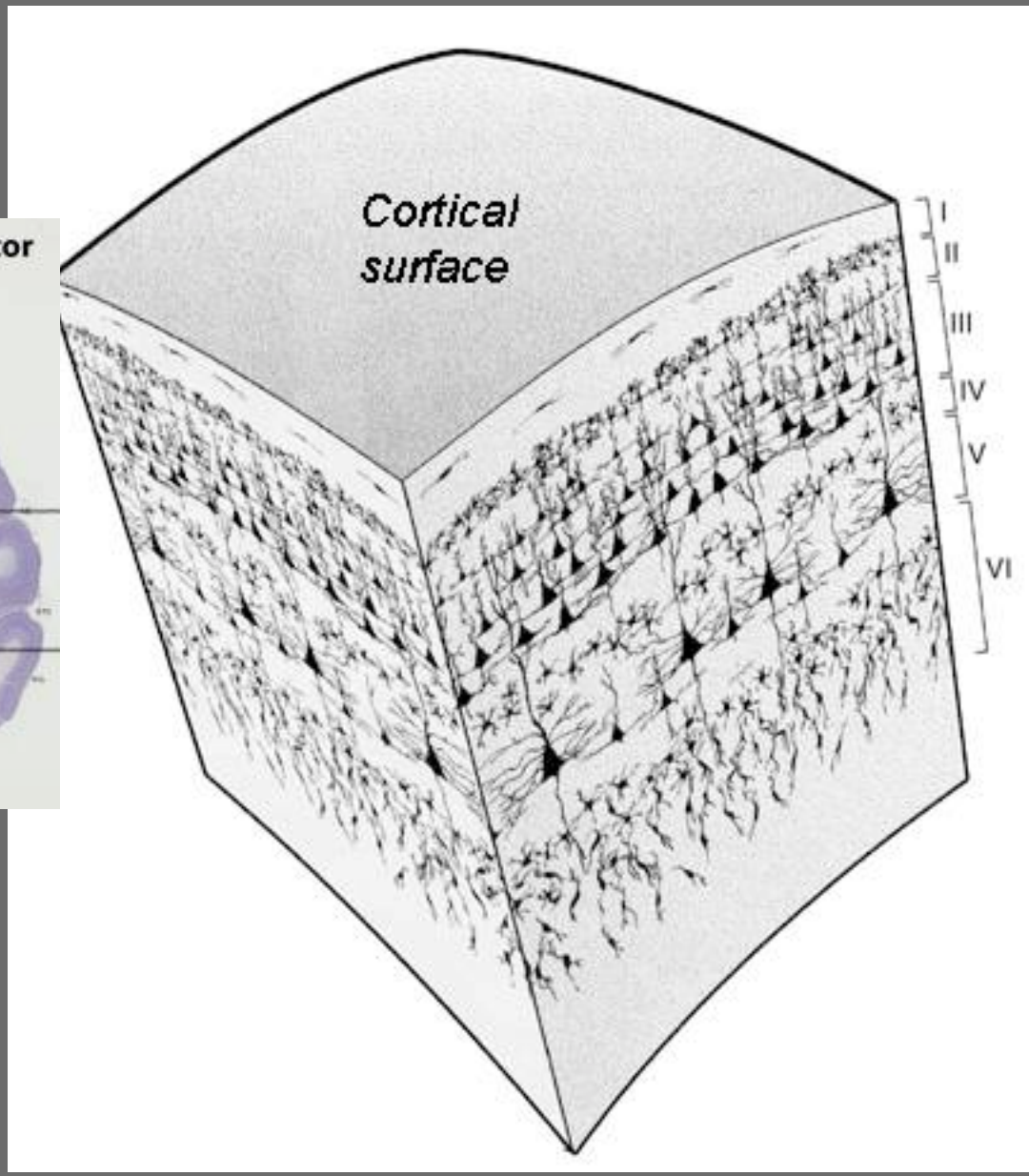
ethology

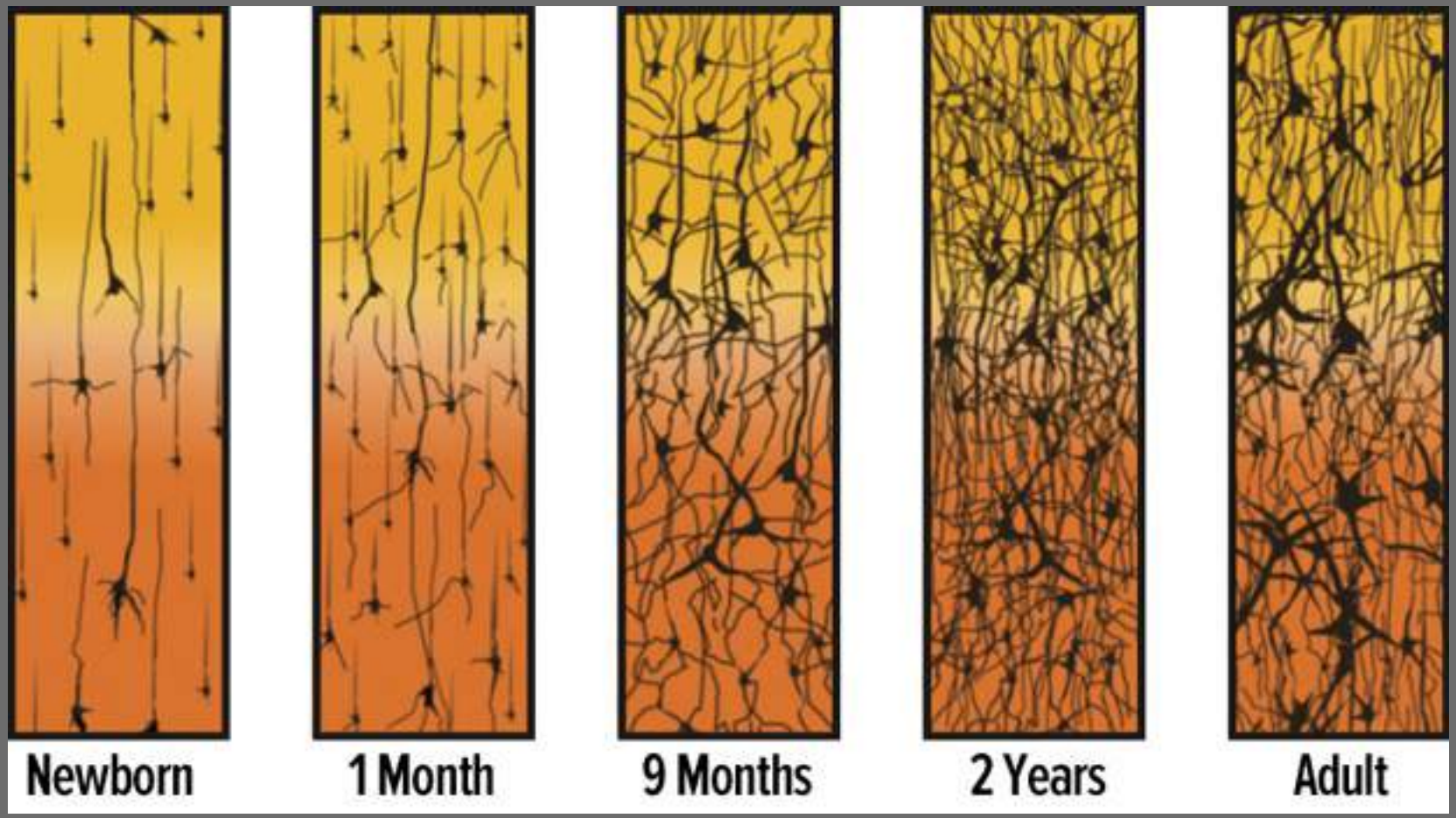
Consolation, reconciliation, prosocial choice, orphan adoption, empathy, punishment, fairness, self-control, cooperation, reasoning

Sociality likely evolved many times

Proto-mammals:
warm-blooded
SO: greater energy use


A7.9
somato
sensory
motor


Cortical
surface
I
II
III
IV
V
VI


Newborn
1 Month
9 Months
2 Years
Adult

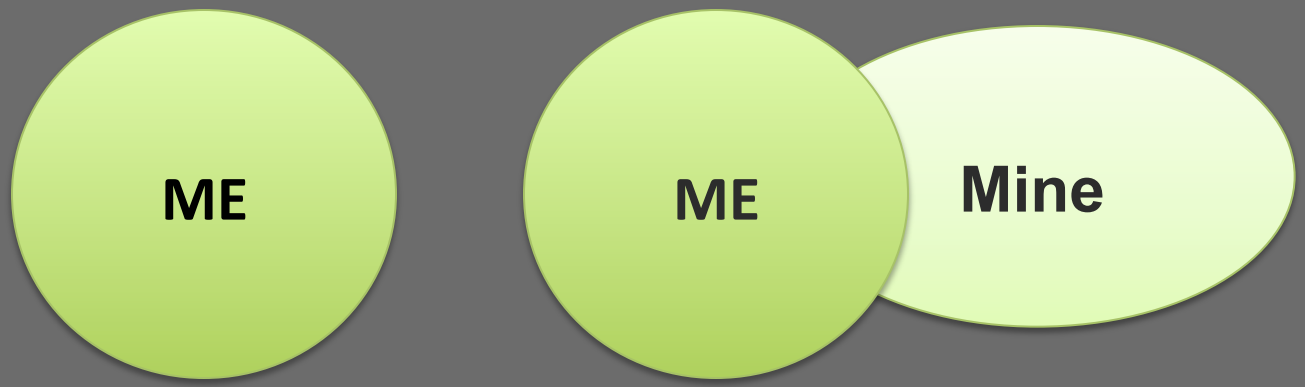
Evolution of homeotherms

Trade off:

Learning capacity ↑

Newborn Independence ↓

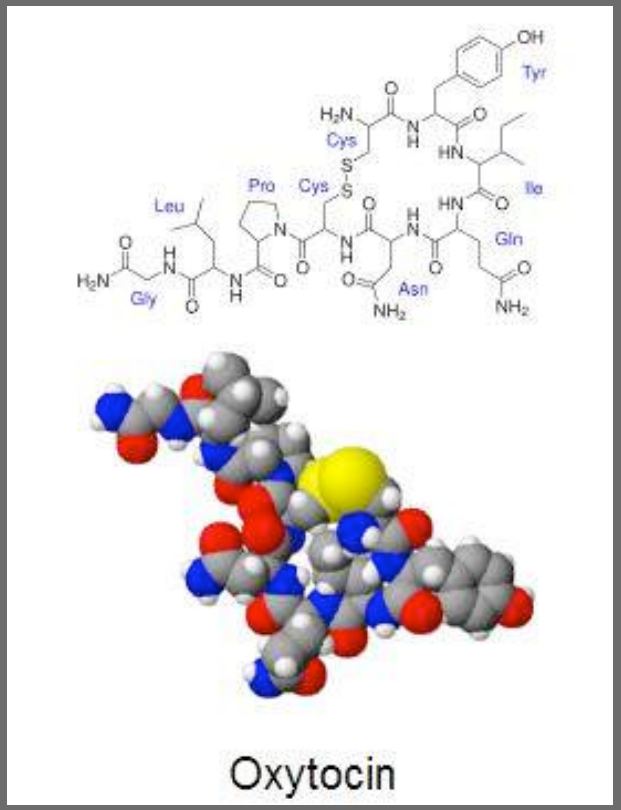
Mammals: expansion of domain where brain manages well-being



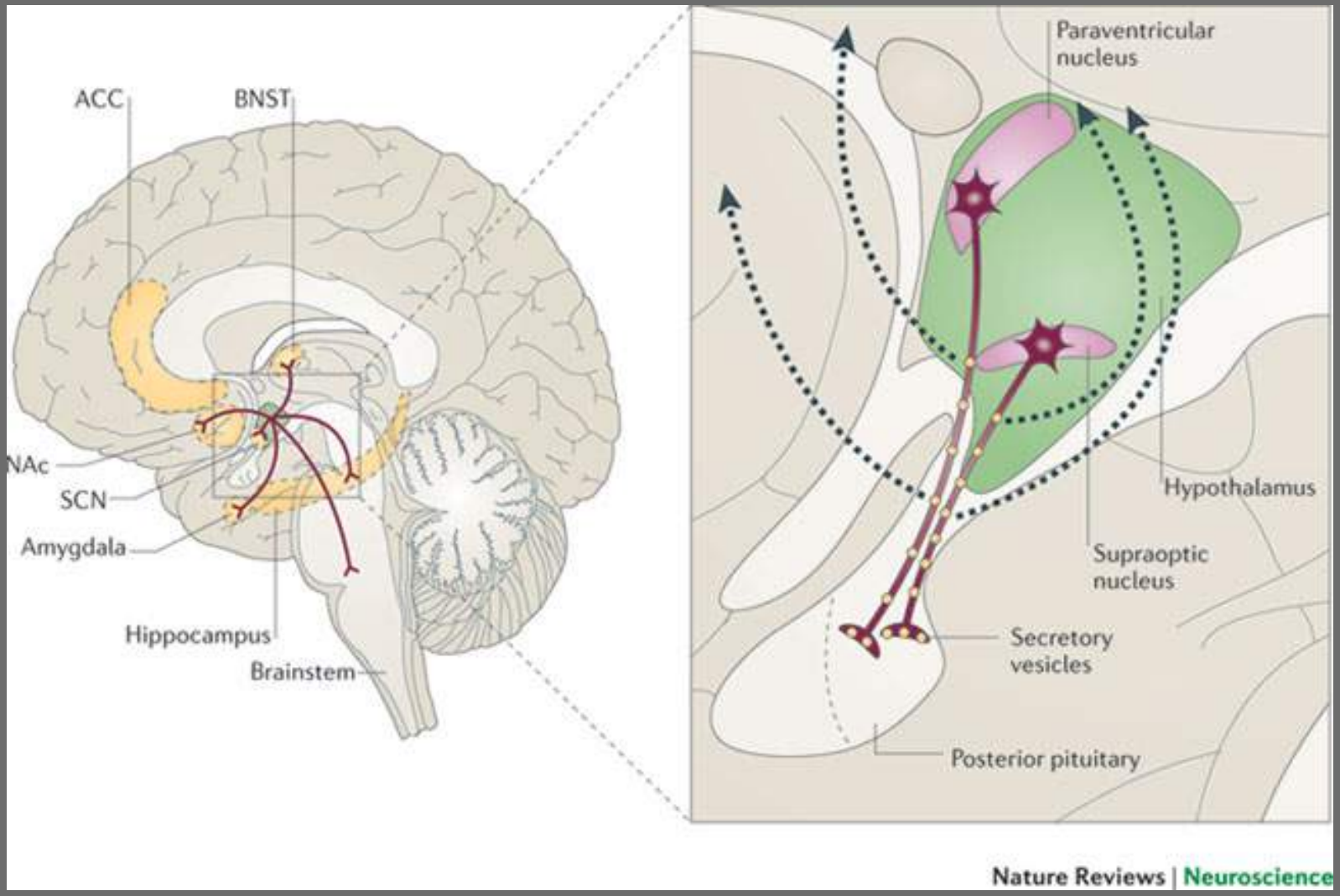
Paul MacLean, Barry Keverne, Jaak Panksepp

All vertebrates have Oxytocin, vasopressin

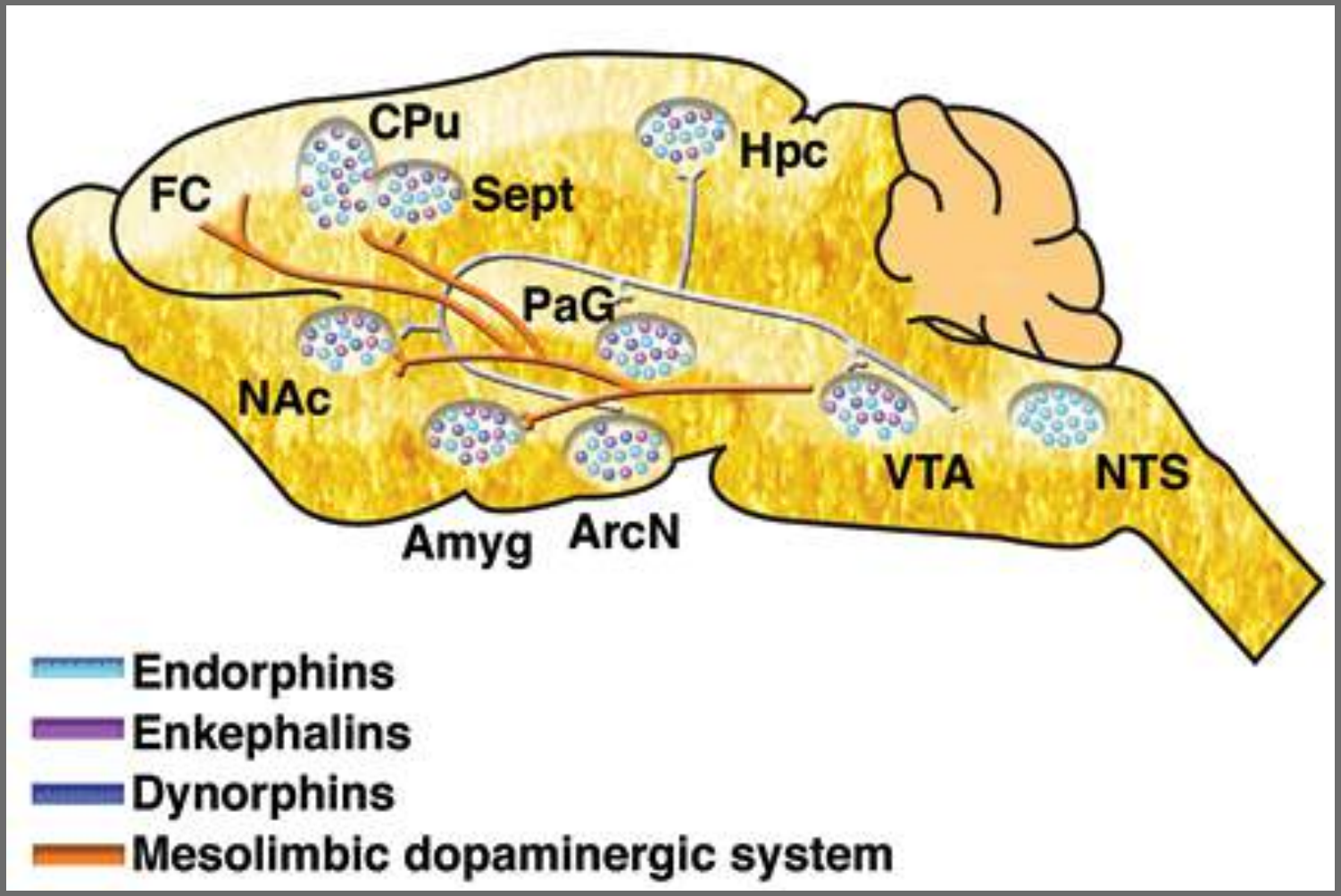
In mammals, put to New jobs



Oxytocin



Meyer-Lindenberg et al 2011



ALSO: endocannabinoids. Wei et al PNAS/15

The Skin as A Social Organ

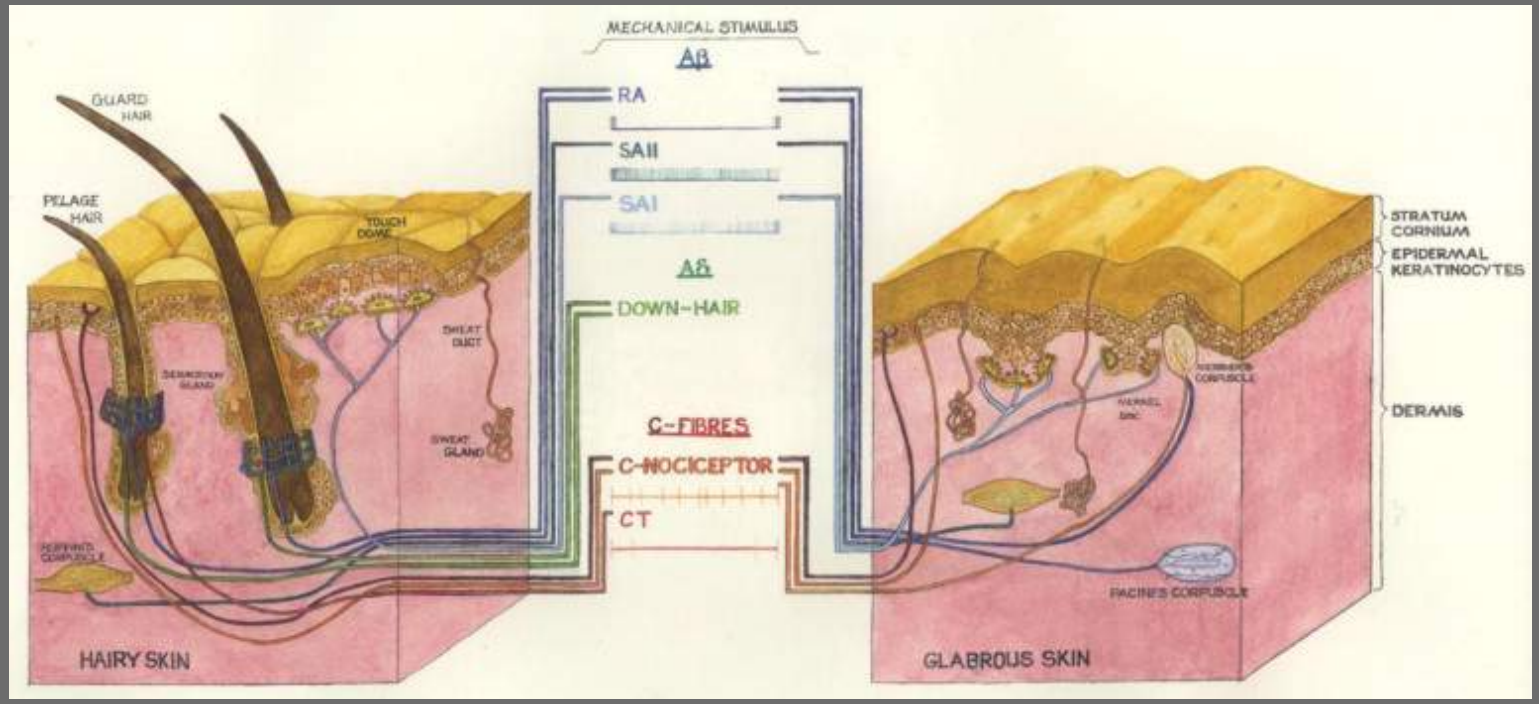


Figure 2. The Innervation of Hairy and Glabrous Skin Showing the Types of Nerve Fibers and ReceptorsThe discriminative aspects of touch are coded by LTMs present in both skin types, but the coding of affective touch (CT) is limited to hairy skin. Abbreviations...

Francis McGlone, Johan Wessberg, Håkan Olausson

Discriminative and Affective Touch: Sensing and Feeling

null, Volume 82, Issue 4, 2014, 737–755

their adequate stimulus is found at stroking velocities which correlate with subjective pleasantness ratings

Hypothesis

Mammalian & Avian Sociability:

- **Platform: *oxytocin & cannabinoids* +**

- **Norms emerge from problem-solving;**
- **learned by reward system**

HIGHLY SOCIAL MAMMALS:

ME

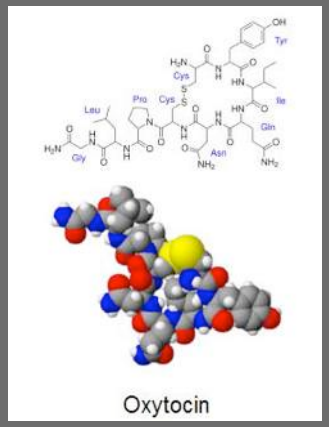
ME

kin

ME

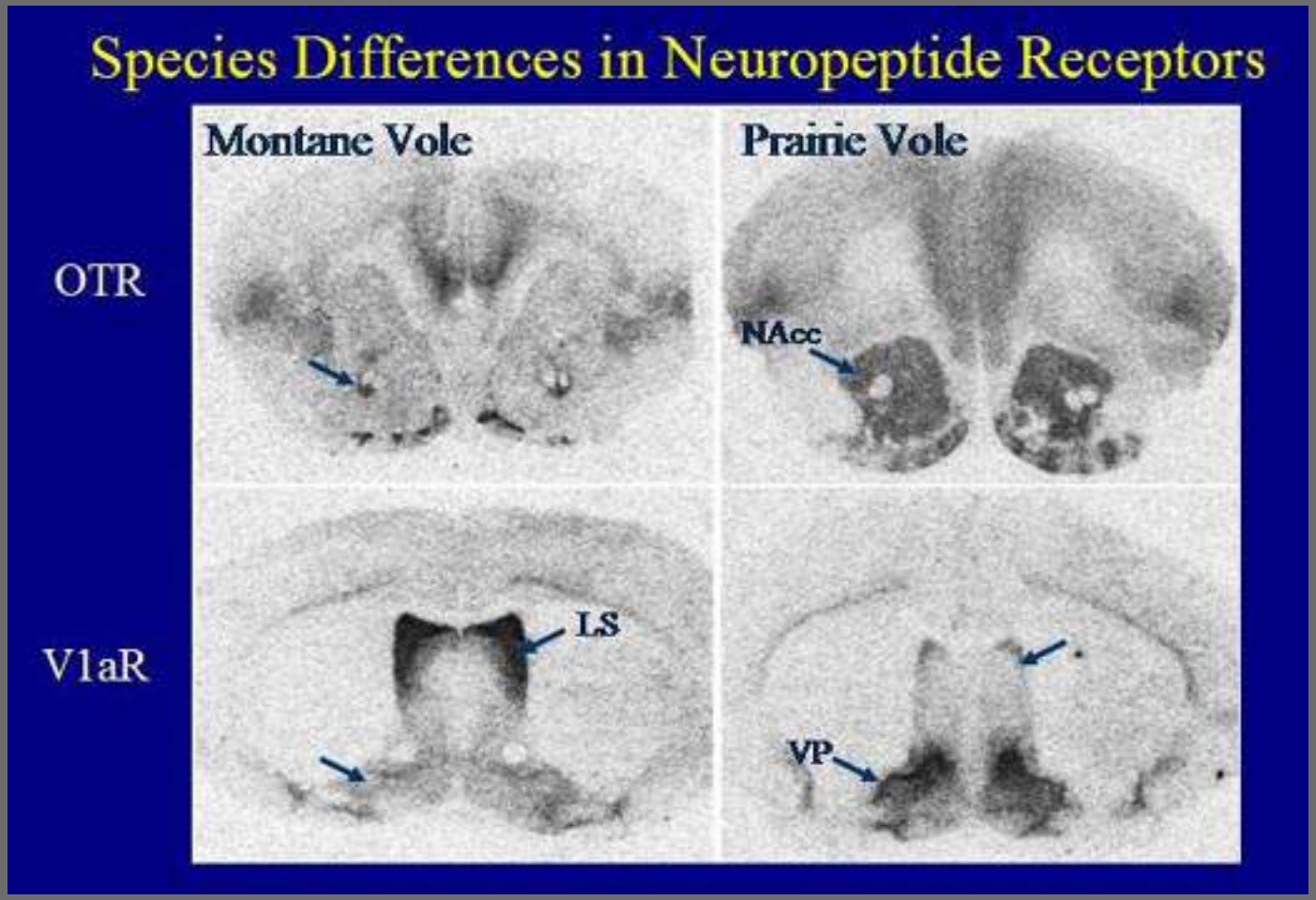
kin

kith



Prairie voles

OTR in nucleus accumbens linked to rewarding aspects of bonding.



Densities of **oxytocin** & **vasopressin receptors (Lim, Murphy & Young 2004)**

Anacker & Beery 2013

Meadow Voles

Food sharing  OXT levels

Wittig et al. Proc Biol. Sci 2014

Co-opts mechanisms to support mother-Infant bonding in lactation

If sociality is pleasurable, we may engage in many behaviors largely unrelated to passing on genes.

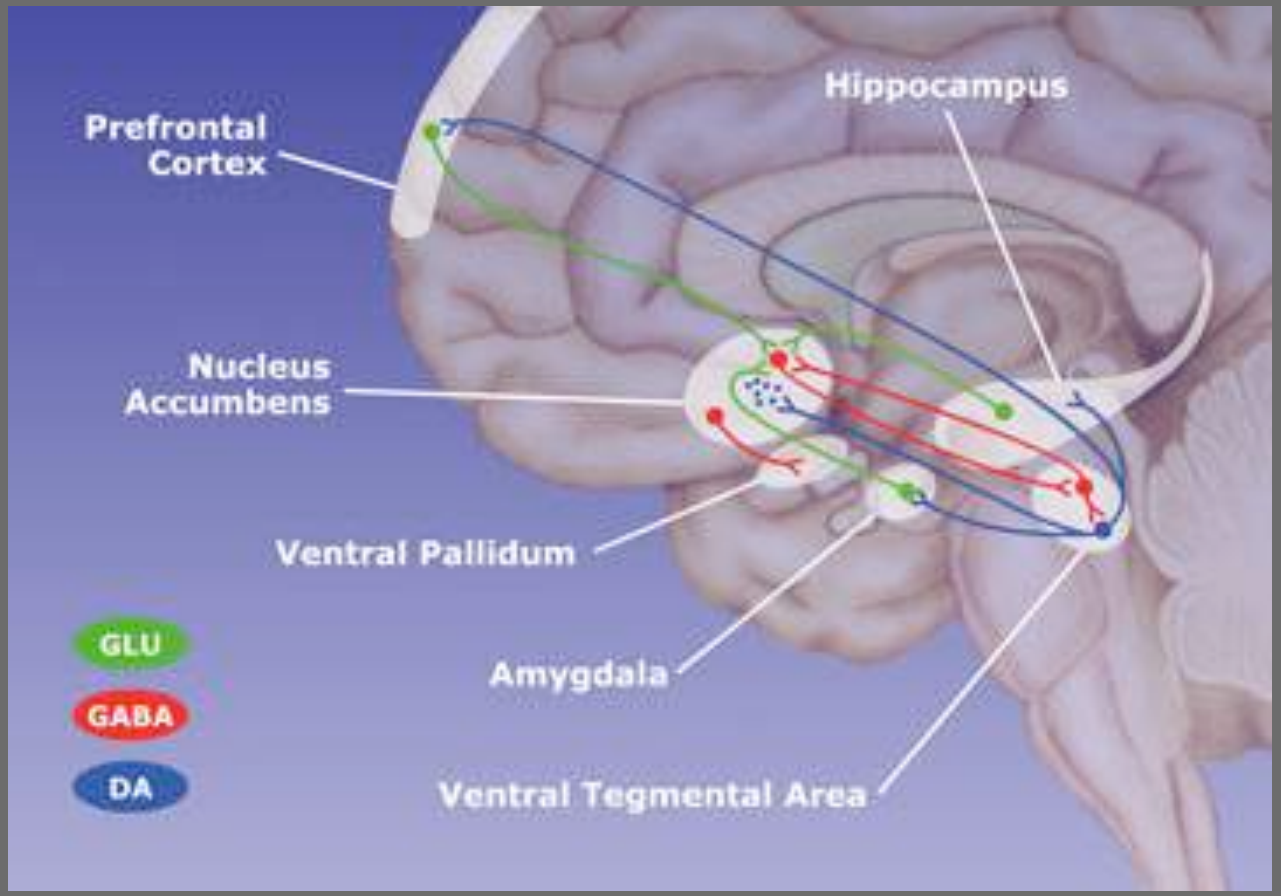
Tanya Brandt

Within group competition

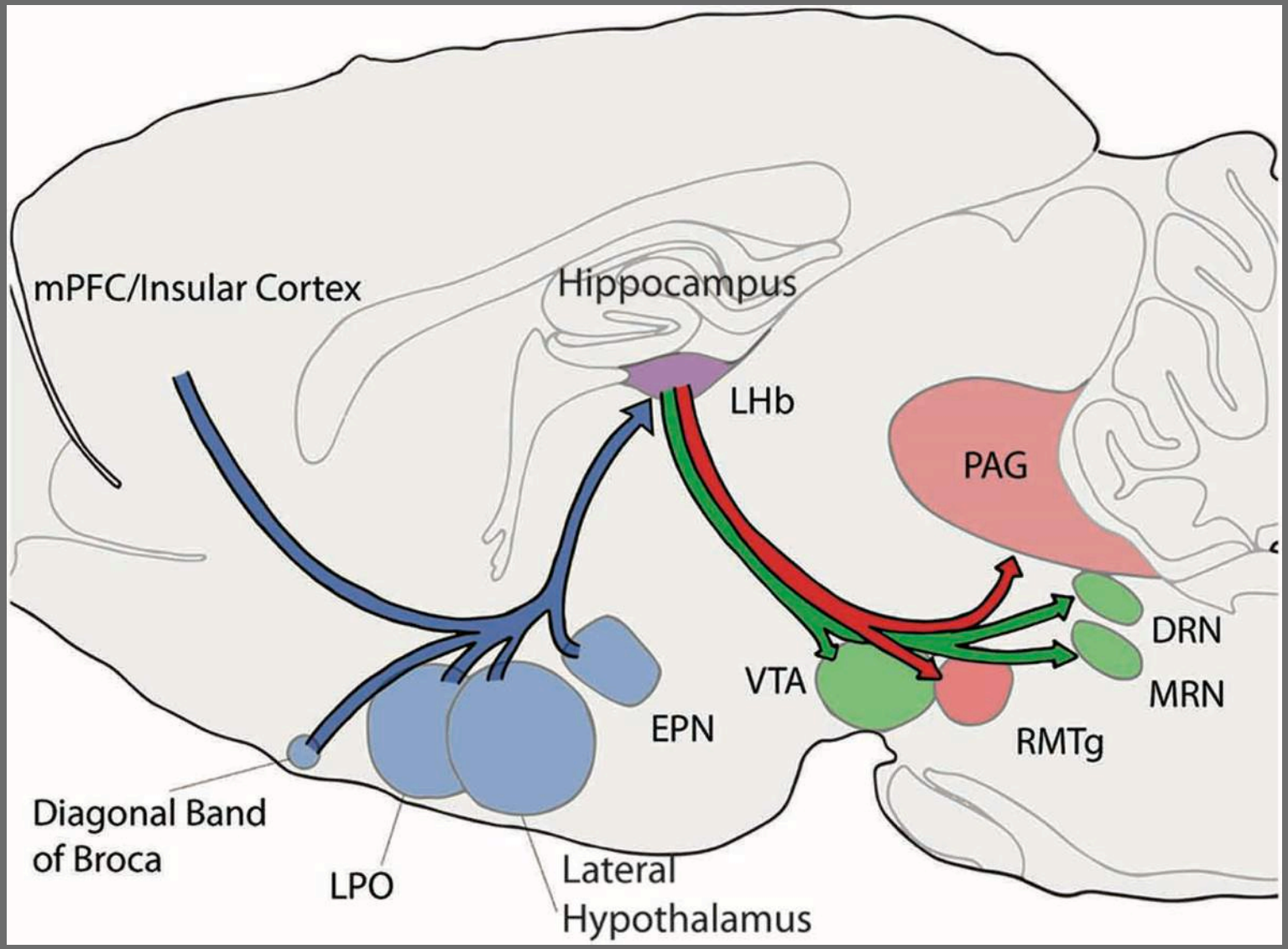
Evolution sets the brain's basic style of pain & pleasure

Experience shapes
into specific habits & preferences
using the *reward system*

NORMS & VALUES


Prefrontal Cortex
Hippocampus
Nucleus Accumbens
Ventral Pallidum
Amygdala
Ventral Tegmental Area
GLU
GABA
DA

Frank Meye et al 2013 Fonrtiers in Hum Neuro.



Cortex: signature brain structure of mammals

Allows for social problem solving
Allows for learning of social practices

Gives flexibility to social behavior

If animals like to be together, trusting each other, cooperation can emerge.

Orangutan & Dog

Paul MacLean

New with mammals:

- nursing & parental care**
- playful behavior
- separation vocalisation**
- mate attachment**

“.. The history of the evolution of mammals is the history of the development of a family way of life….”

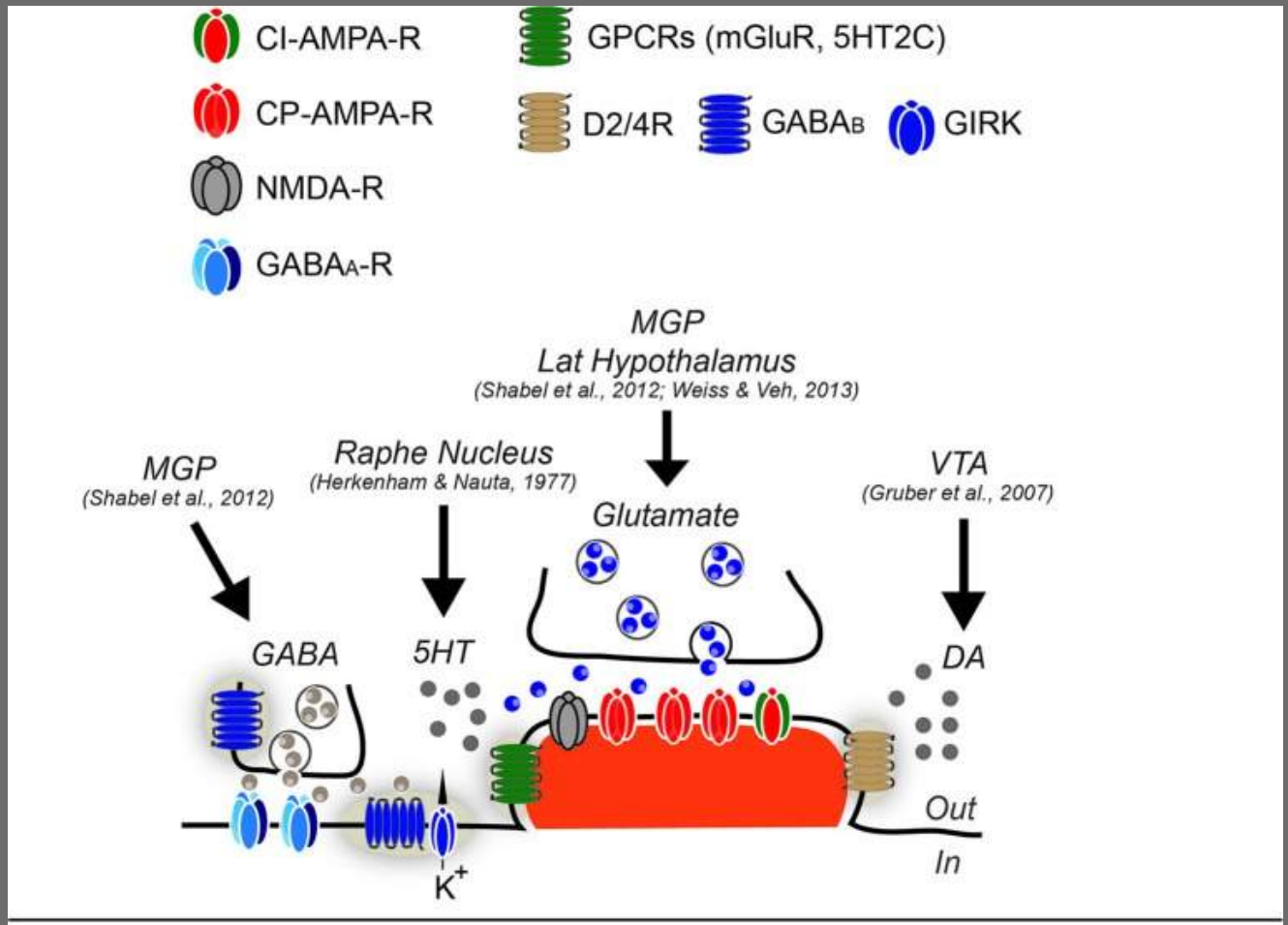
Morality is not a ‘module’

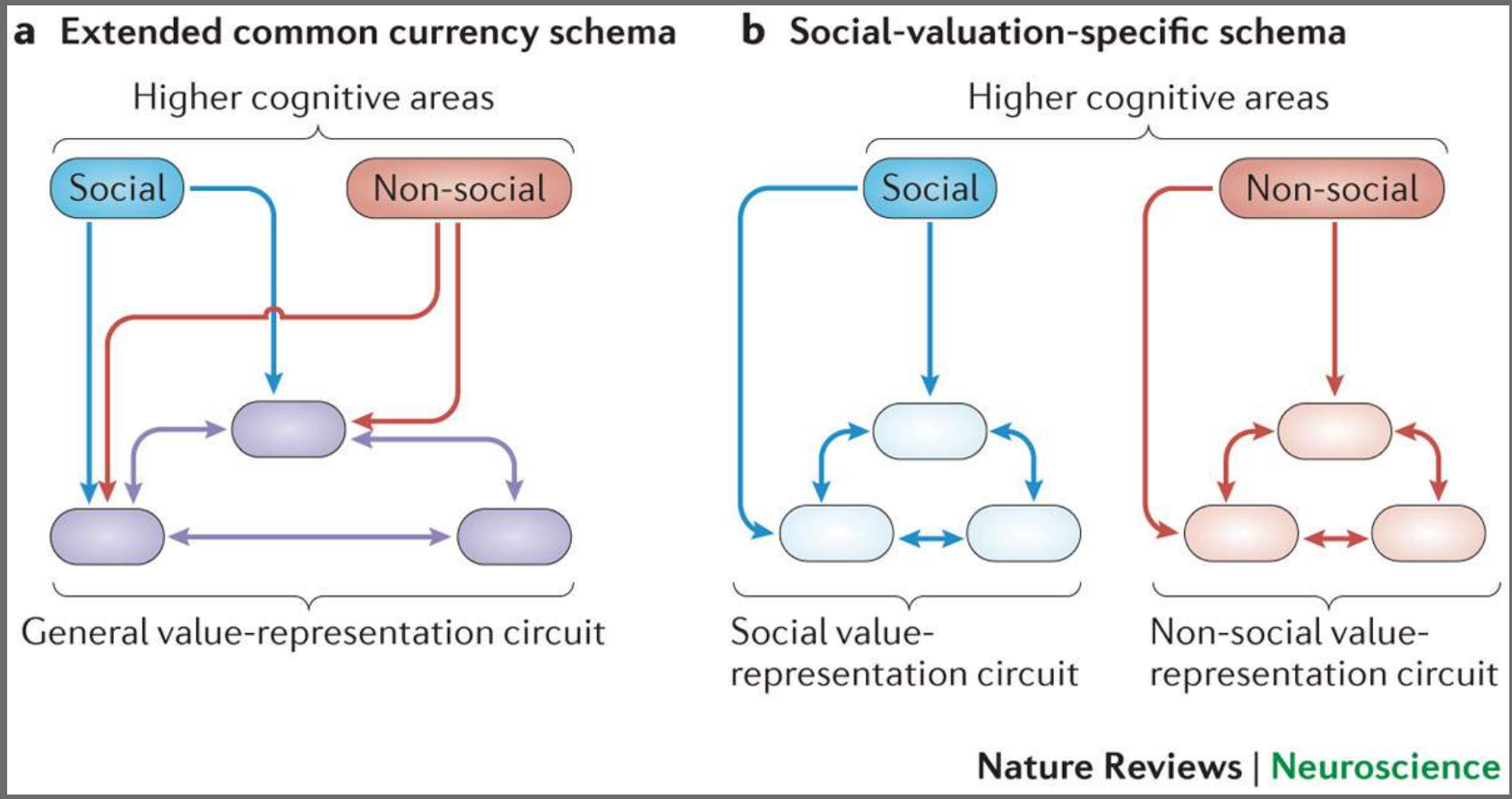
Cognition is not a module

Moral judgment not neatly separable from emotions, reasoning, motives, habits, styles, stress, energy levels, temperament, moods, age, risk-aversion……

Cotton-top tamarin monkeys

Frank Meye et al 2013 Fonrtiers in Hum Neuro.





Ruff & Fehr 2014

Humans create long-lasting niche changes that alter selective pressures

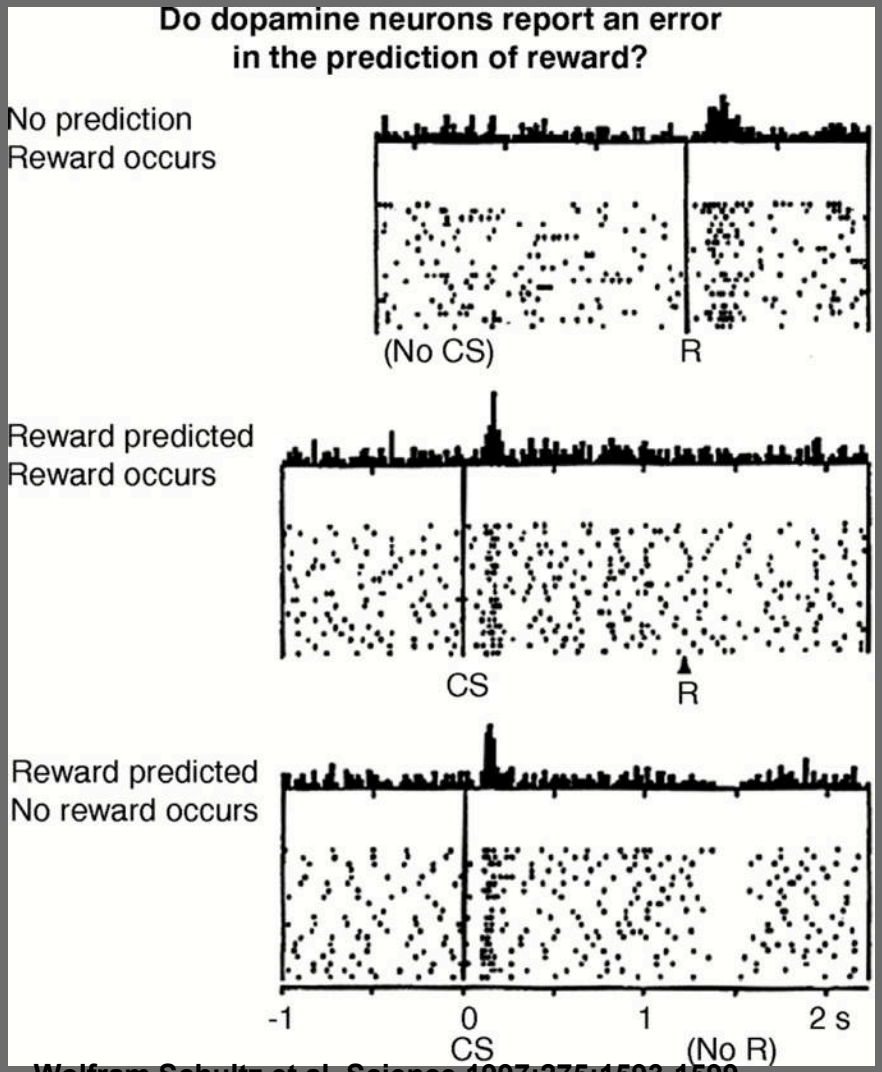
Clever solutions to problems, learned & modified by offspring

Norms in boatmaking

Fig. 1. Changes in dopamine neurons' output code for an error in the prediction of appetitive events.

VTA

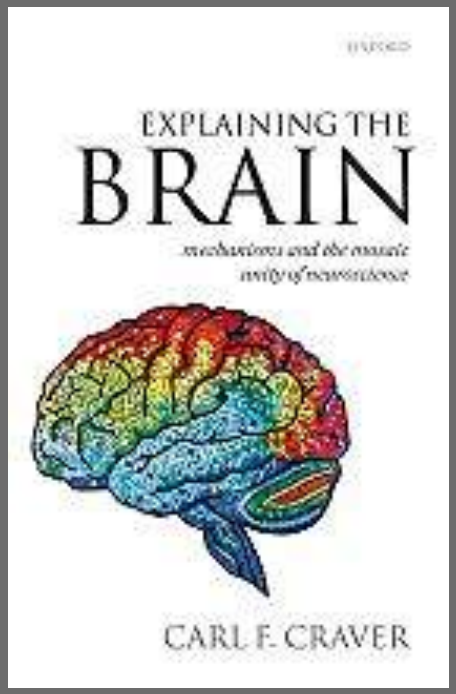
Wolfram Schultz
1997



Wolfram Schultz et al. Science 1997;275:1593-1599

Carl Craver

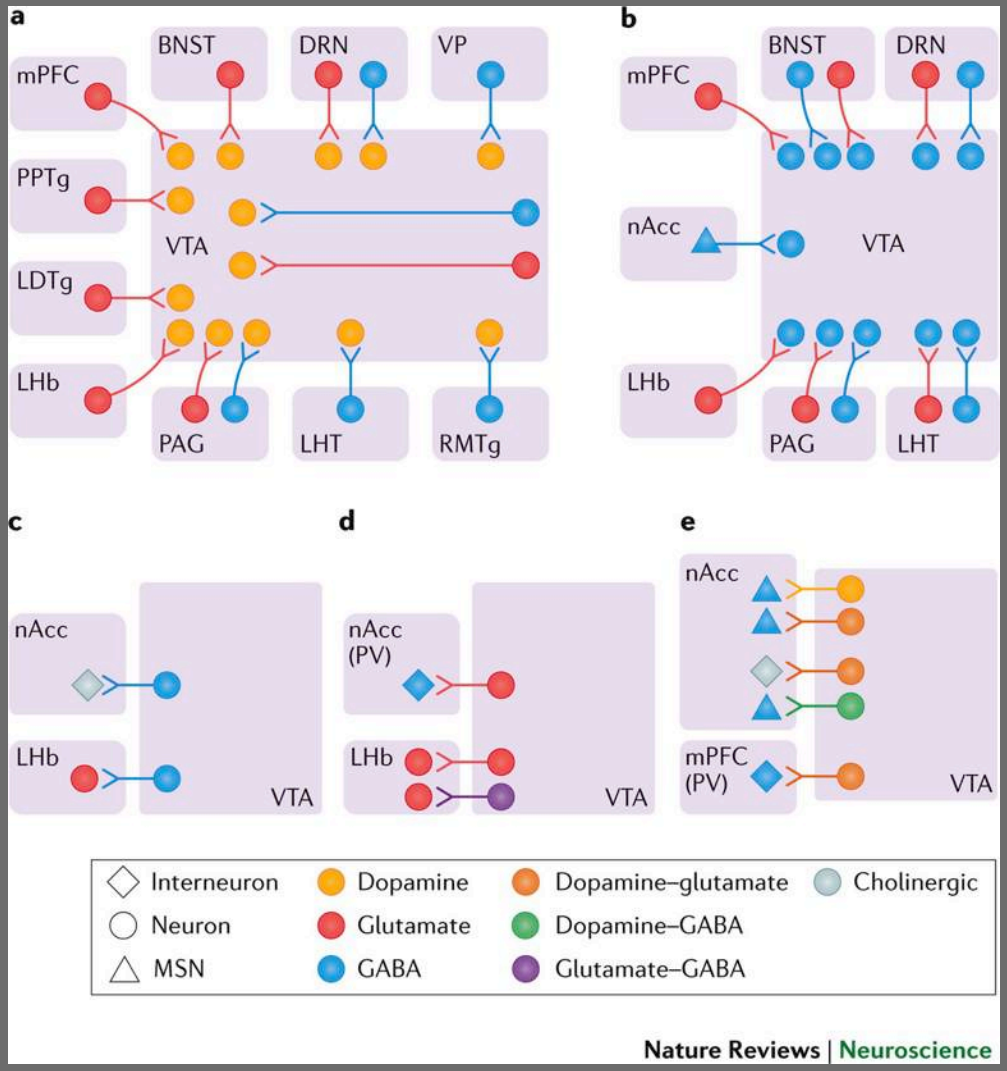
To explain is to show how it is situated in the causal structure of the world

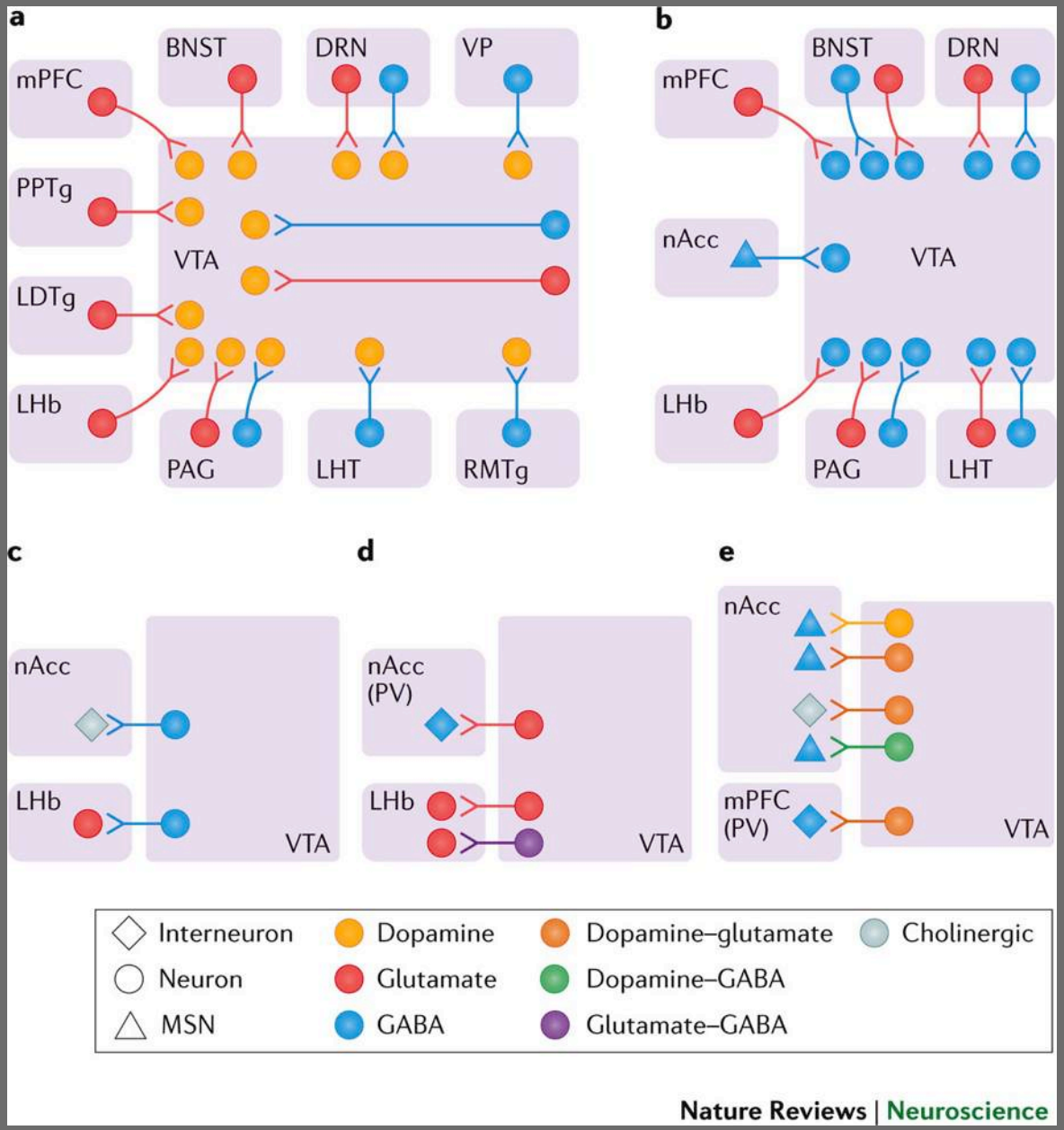


Neuro&
Bio Rev
2013

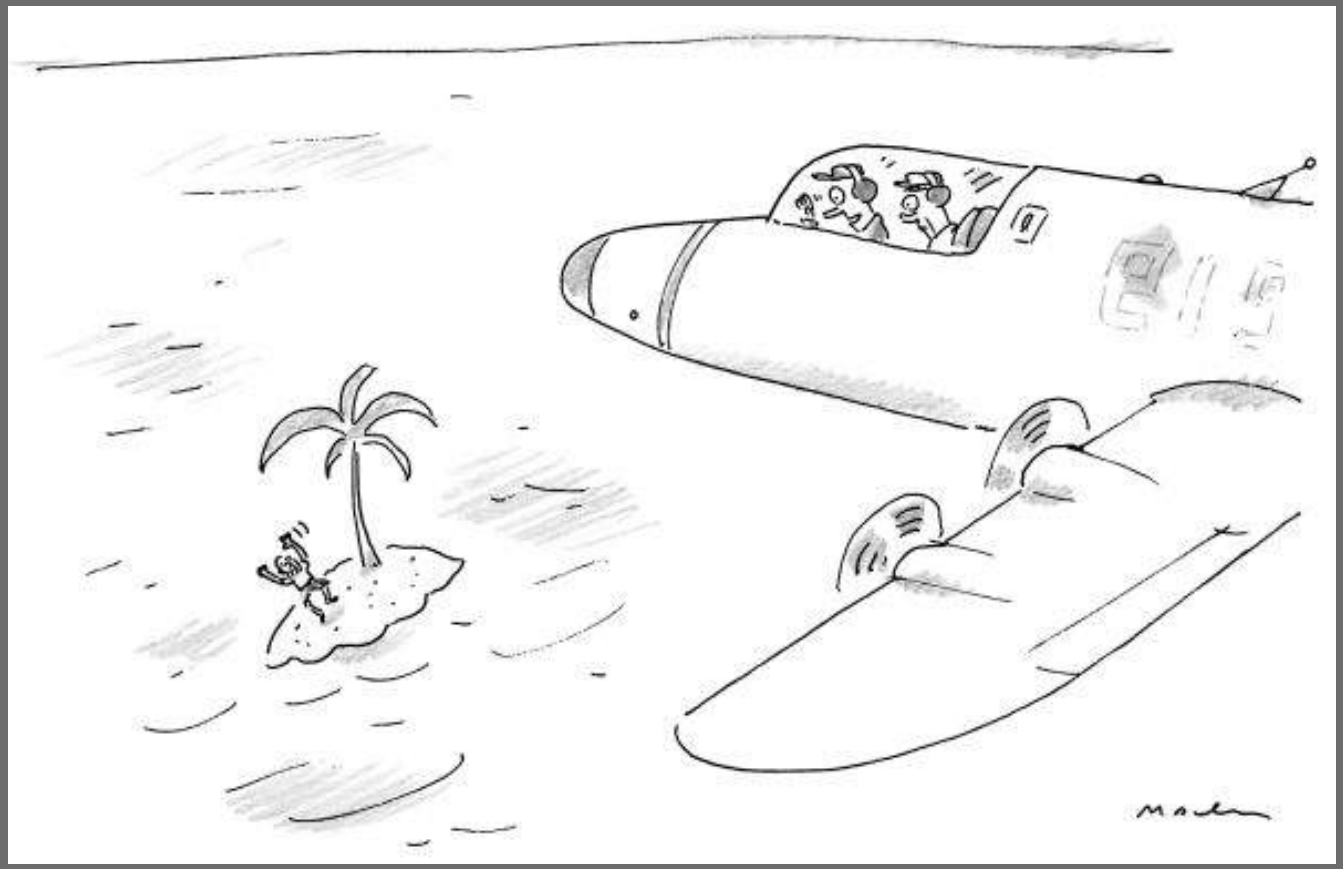
Problems with measuring peripheral oxytocin: Can the data on oxytocin and human behavior be trusted?

Michael E. McCullough,
Patricia Smith Churchland,
Armando J. Mendez,*


a
BNST
DRN
VP
mPFC
PPTg
VTA
LDTg
LHb
PAG
LHT
RMTg
b
BNST
DRN
mPFC
nAcc
VTA
LHb
PAG
LHT
c
nAcc
LHb
VTA
d
nAcc
(PV)
LHb
VTA
e
nAcc
mPFC
(PV)
VTA
Interneuron
Neuron
MSN
Dopamine
Glutamate
GABA
Dopamine–glutamate
Dopamine–GABA
Glutamate–GABA
Cholinergic
Nature Reviews | Neuroscience



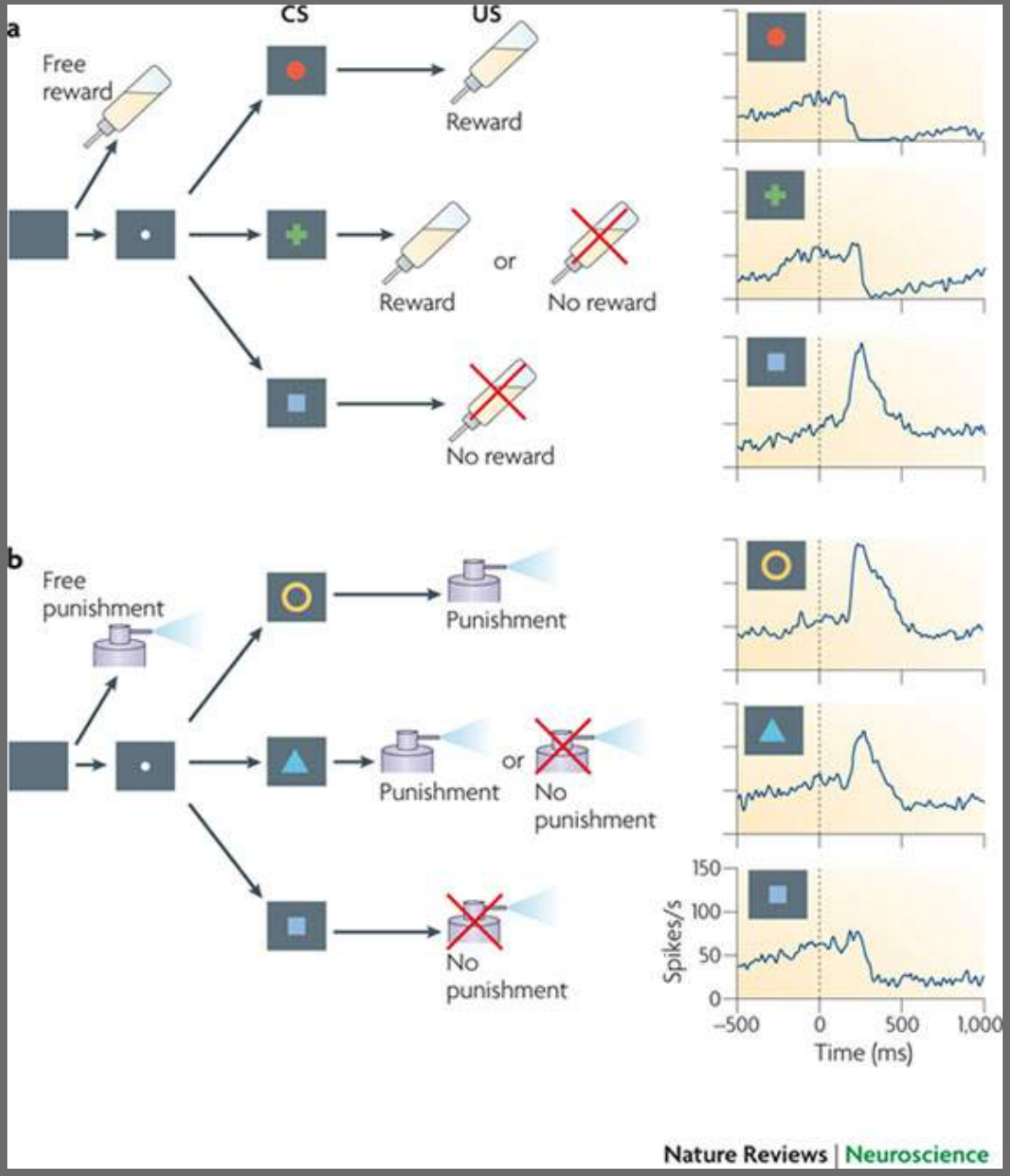
Morales & Margolis NRN 2017

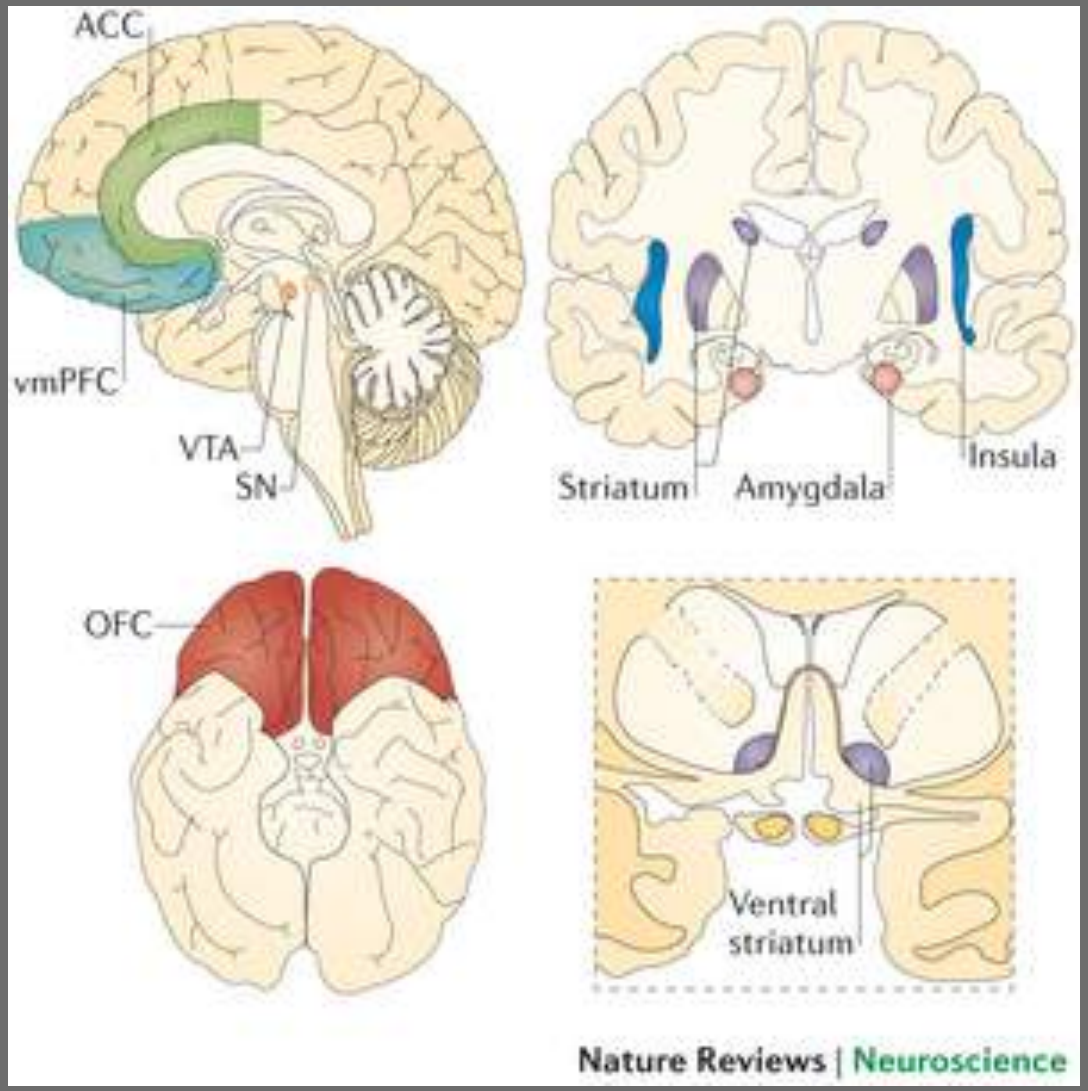


He always gives me such a nice wave!

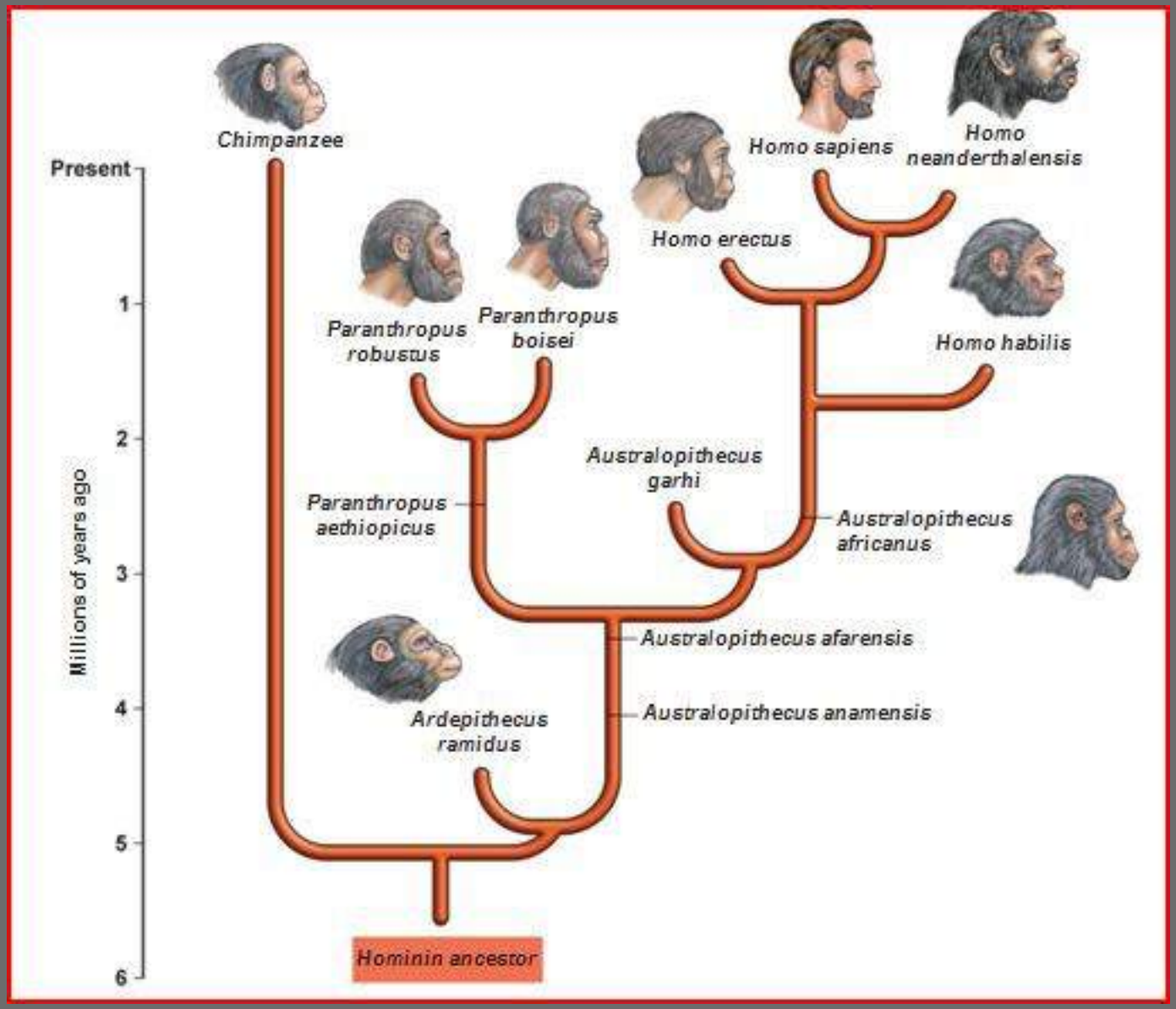
Complex because

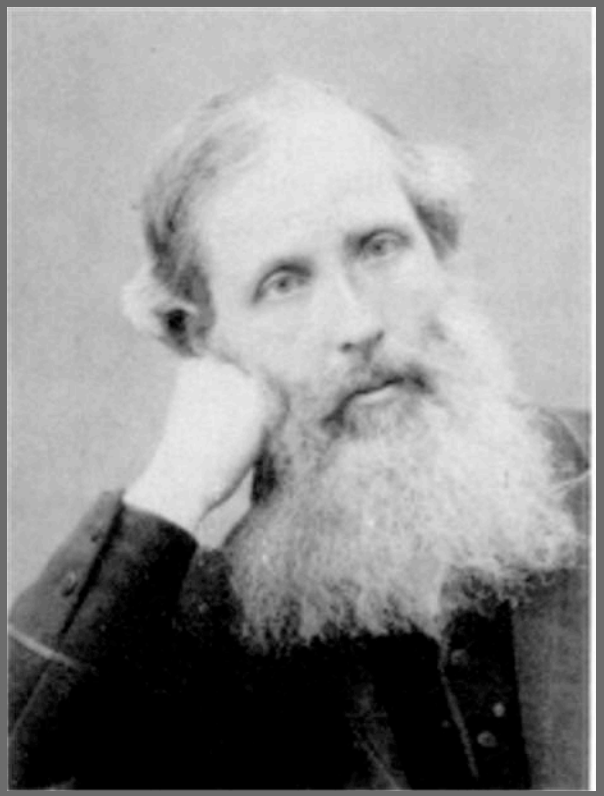
- Norms conflict with preferences
- Norms conflict with norms
- Norms vary across individuals
- Norms vary within an individual
- Relevant memories


a
CS
US
Free reward
Reward
Reward
or
No reward
No reward
b
Free punishment
Punishment
Punishment
or
No punishment
No punishment
Spikes/s
150
100
50
0
−500
0
500
1,000
Time (ms)
Nature Reviews | Neuroscience



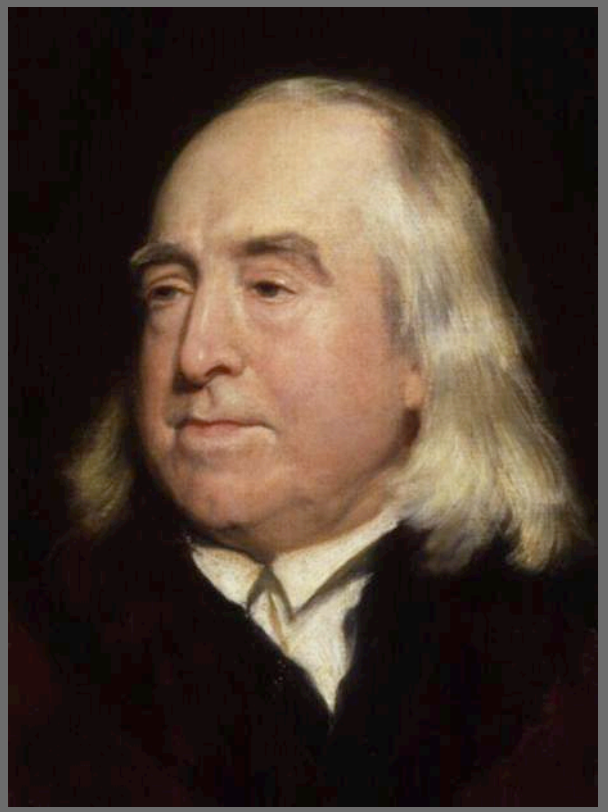
Ruff & Fehr 2014


Present
1
2
3
4
5
6
Millions of years ago
Chimpanzee
Homo sapiens
Homo neanderthalensis
Homo erectus
Paranthropus robustus
Paranthropus boisei
Homo habilis
Australopithecus garhi
Paranthropus aethiopicus
Australopithecus africanus
Australopithecus afarensis
Ardepithecus ramidus
Australopithecus anamensis
Hominin ancestor



Henry Sidgwick

1838-1900



Jeremy Bentham

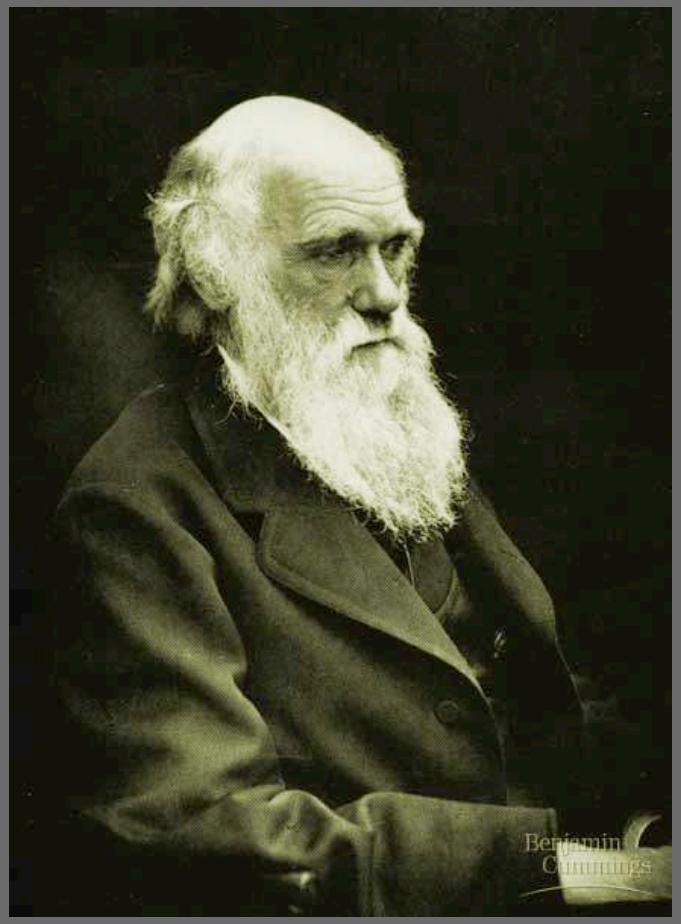
1748-1832

Maximize aggregate utility

Darwin: our moral sense or conscience

- social instincts
- habits & skills
- reason

Aristotle
David Hume
Adam Smith



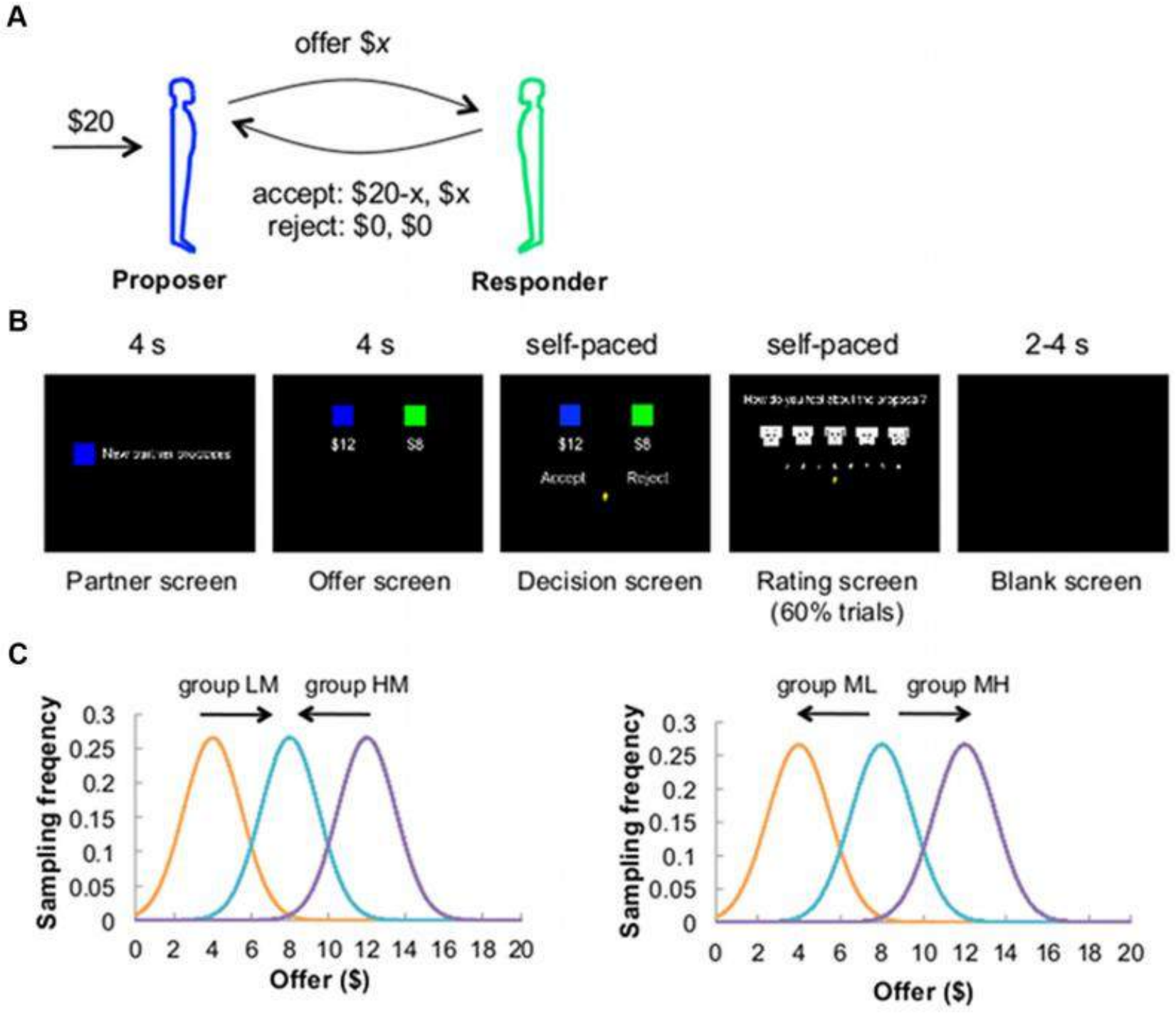
Immanuel Kant

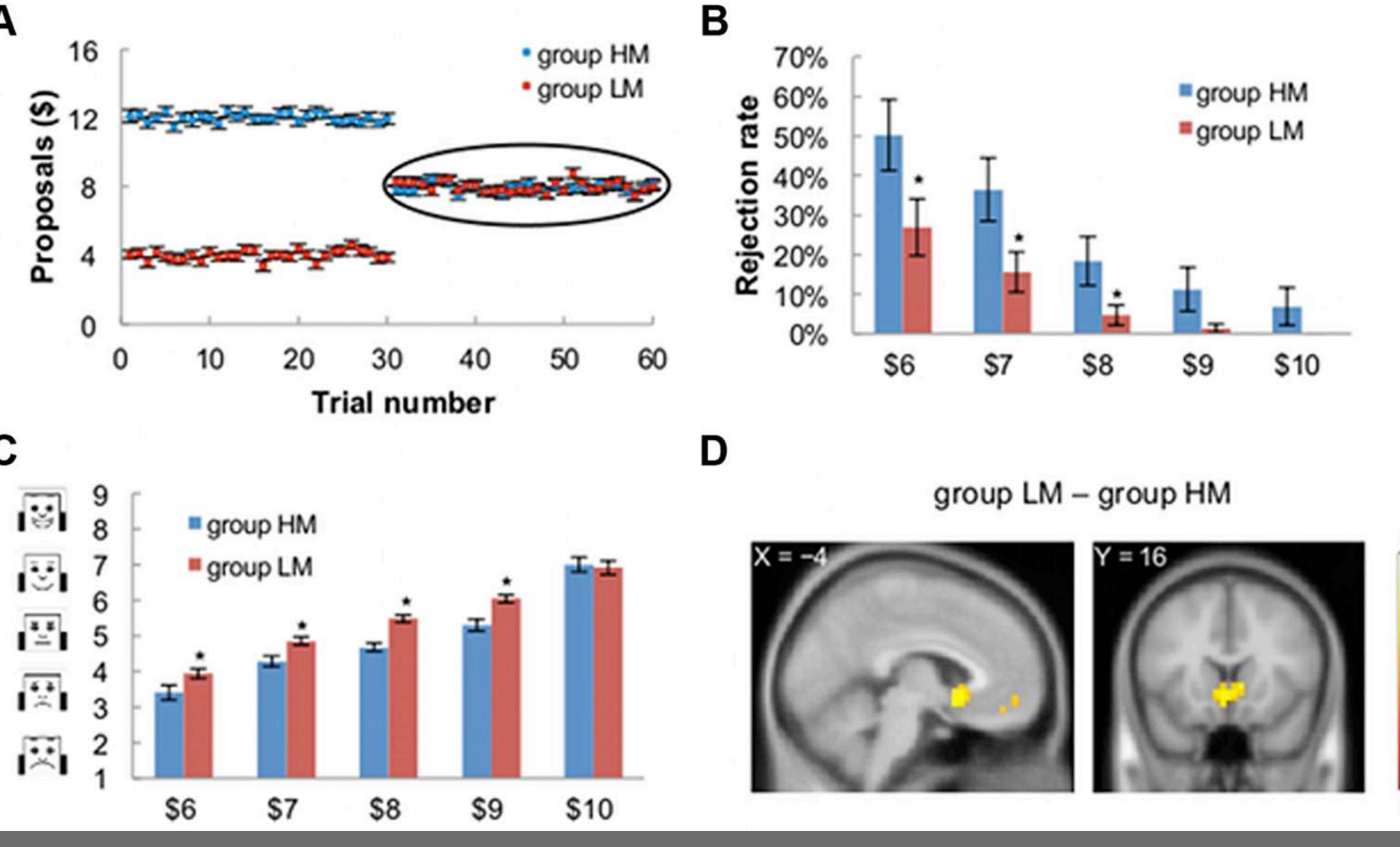
1724-1804

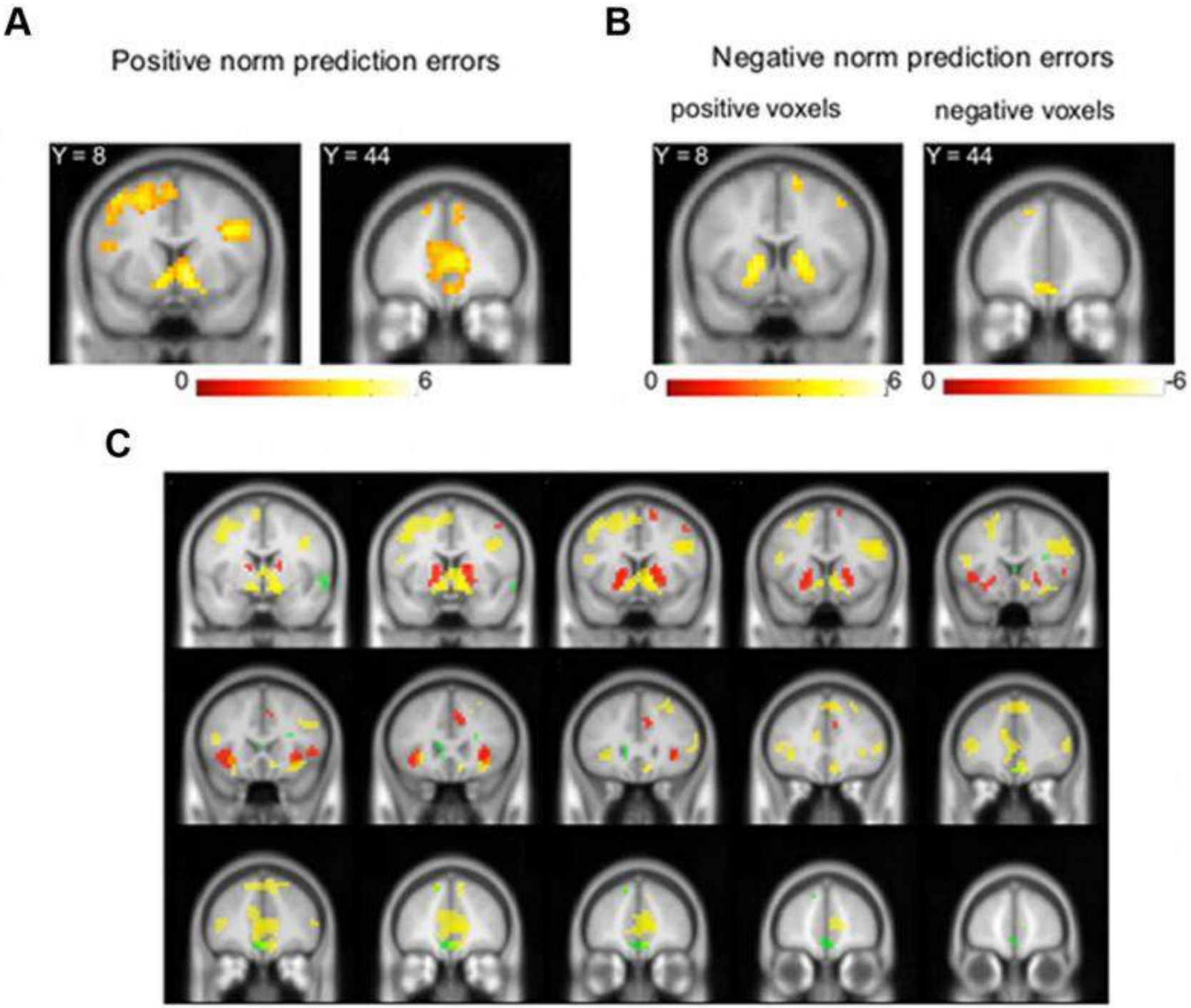
Foundational Rule/Test

is the proposal
rationally
universalizable ??

Requires a radically Free will


A
offer $x
$20
accept: $20-x, $x
reject: $0, $0
Proposer
Responder
B
4 s
4 s
self-paced
self-paced
2-4 s
$12
$8
Accept
Reject
Partner screen
Offer screen
Decision screen
Rating screen
(60% trials)
Blank screen
C
group LM
group HM
Sampling freqency
0.3
0.25
0.2
0.15
0.1
0.05
0
0 2 4 6 8 10 12 14 16 18 20
Offer ($)
group ML
group MH
Sampling freqency
0.3
0.25
0.2
0.15
0.1
0.05
0
0 2 4 6 8 10 12 14 16 18 20
Offer ($)


A
group HM
group LM
Proposals ($)
Trial number
B
group HM
group LM
Rejection rate
$6
$7
$8
$9
$10
C
group HM
group LM
D
group LM – group HM
X = −4
Y = 16

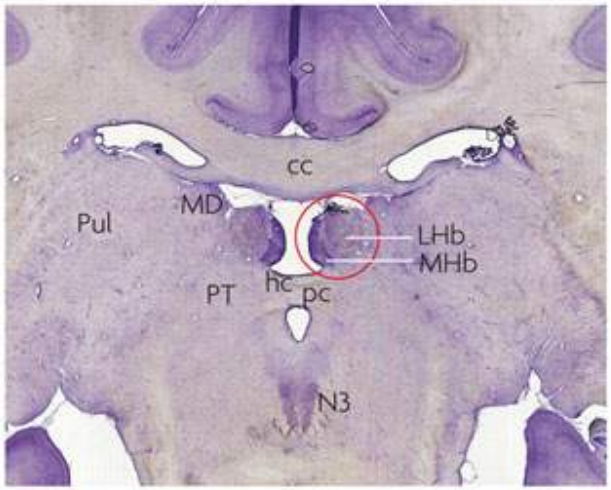

A
Positive norm prediction errors
Y = 8
Y = 44
0
6
B
Negative norm prediction errors
positive voxels
negative voxels
Y = 8
Y = 44
0
6
0
-6
C

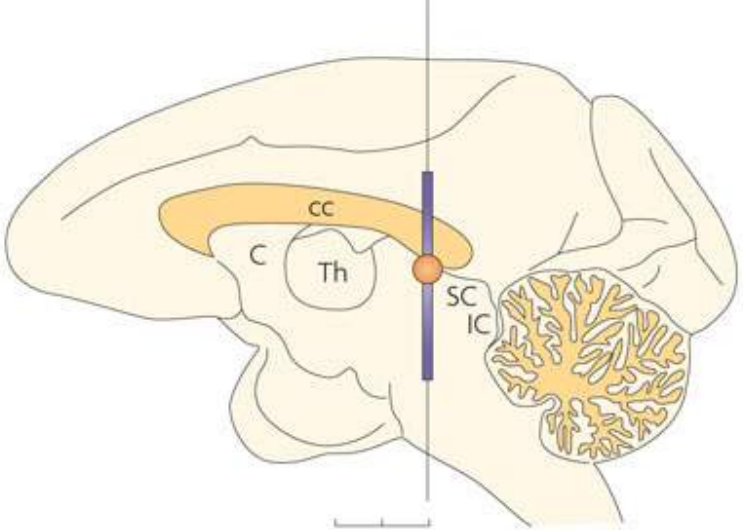
The Impact of Social Neuroscience on Moral Philosophy

Patricia Churchland
Philosophy

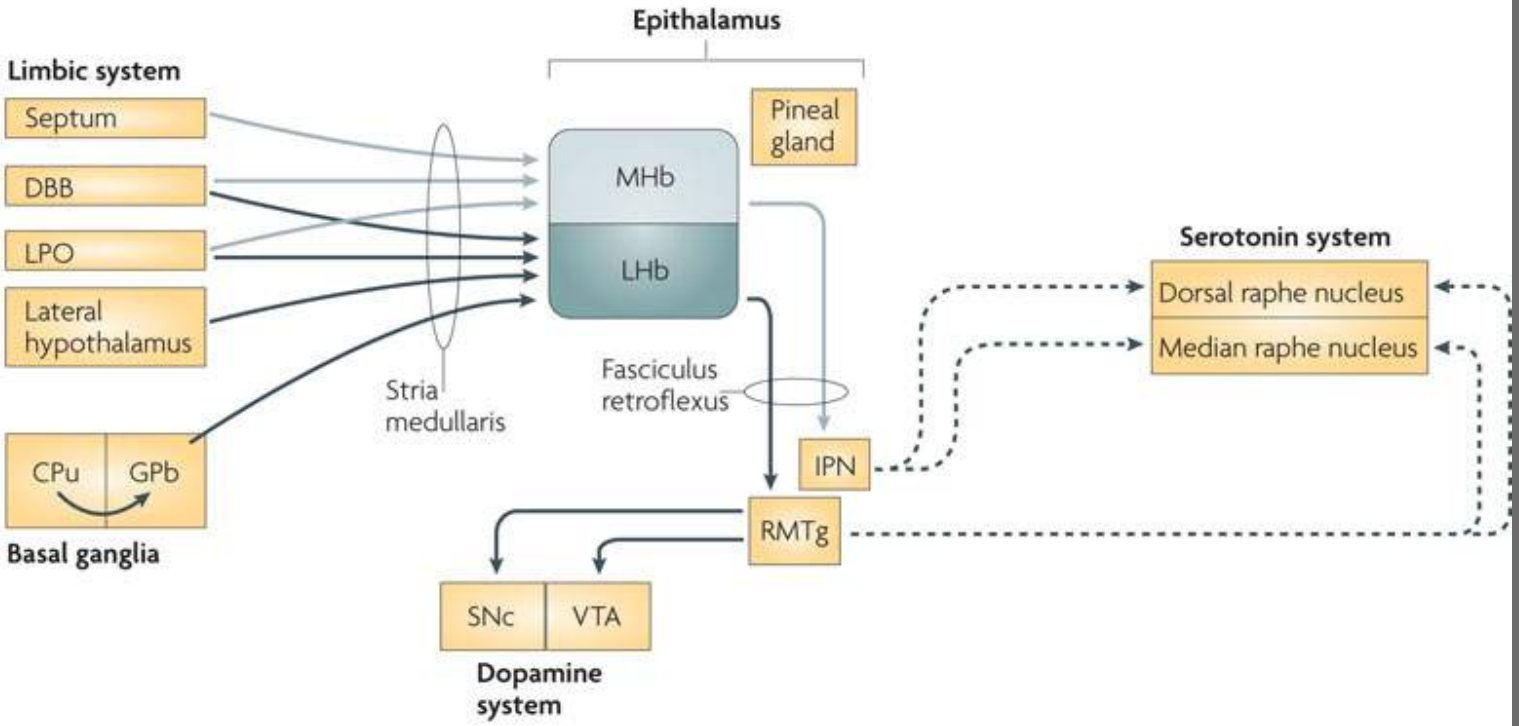
UC San Diego &
Salk Institute

a


cc
MD
Pul
LHb
MHb
PT
hc
pc
N3


cc
C
Th
SC
IC

b


Epithalamus
Limbic system
Septum
DBB
LPO
Lateral hypothalamus
Pineal gland
MHb
LHb
Serotonin system
Dorsal raphe nucleus
Median raphe nucleus
Stria medullaris
Fasciculus retroflexus
IPN
CPu
GPb
Basal ganglia
RMTg
SNc
VTA
Dopamine system

Nonhuman Social Behavior

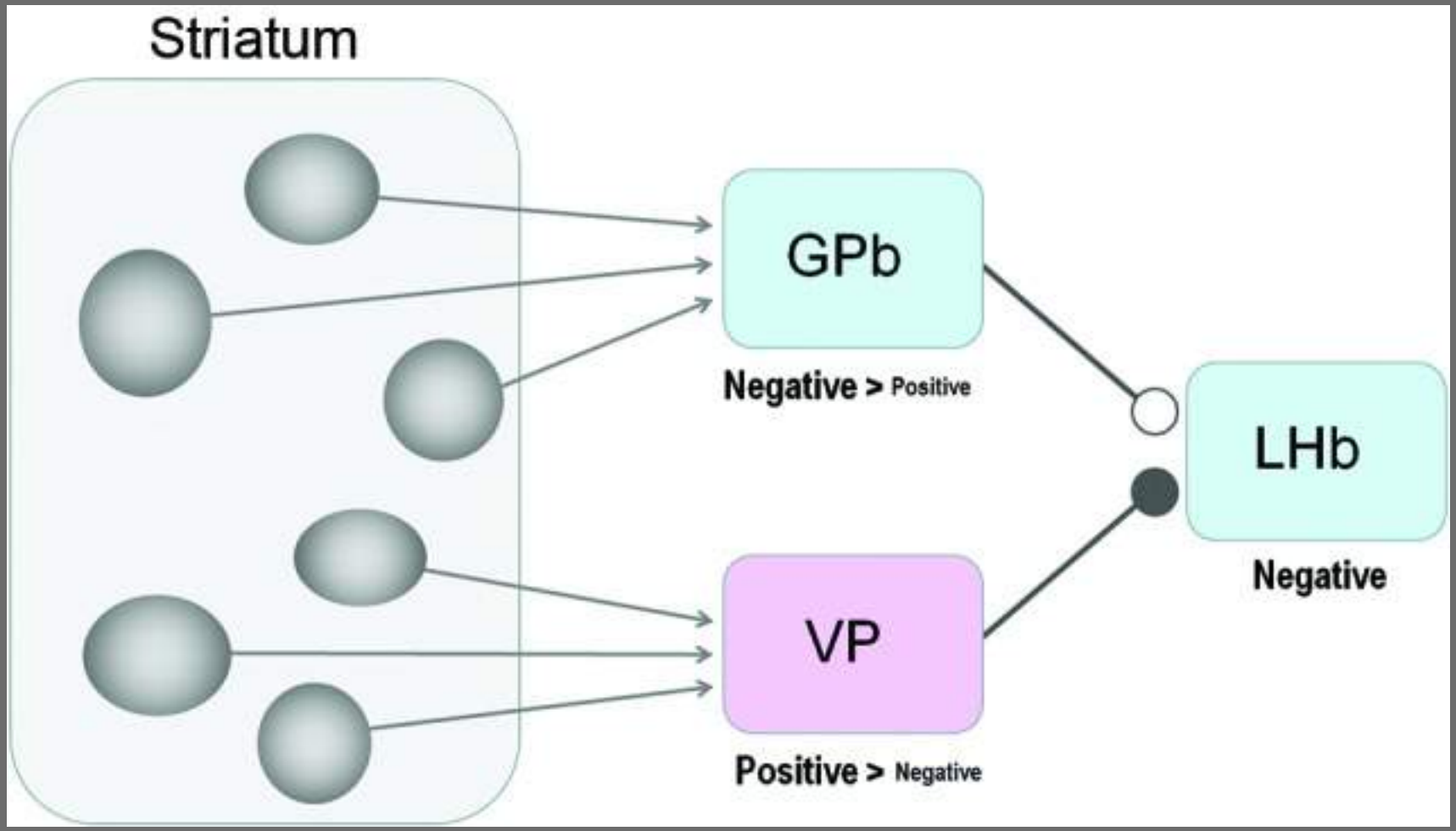
Neuroendocrinology & Sociality

Basal Ganglia: Skills & Habits

Genetics & Brain Evolution

Hippocampus & offline prediction*

neuroendocrinology



S. Hong and O. Hikosaka 2013 Frontiers in Hum. Neuro.

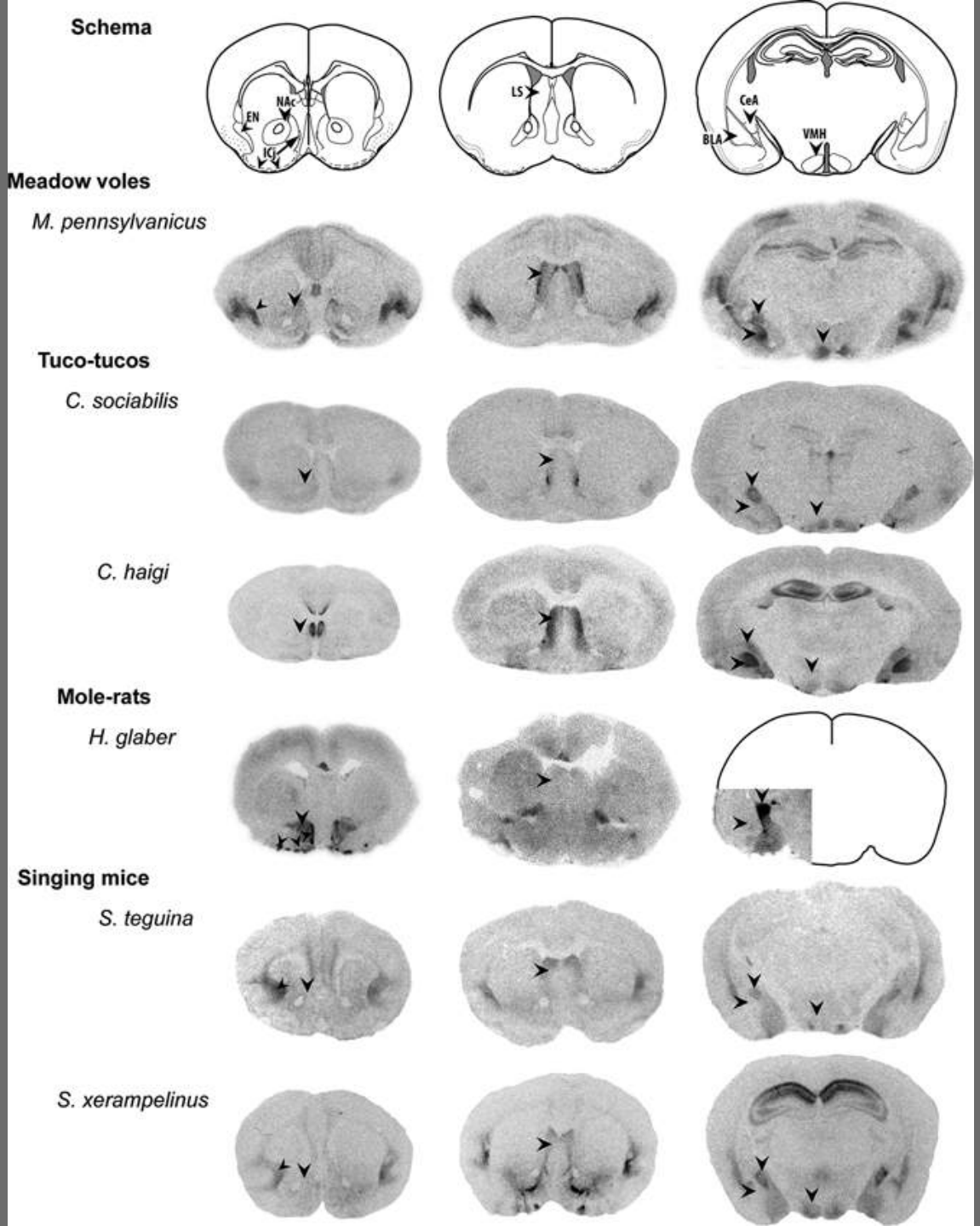
Nonhuman Social Behavior

Neuroendocrinology & Sociality

Basal Ganglia: Skills & Habits

Genetics & Brain Evolution

Hippocampus & offline prediction*


Schema
NAc
EN
ICj
LS
CeA
BLA
VMH
Meadow voles
M. pennsylvanicus
Tuco-tucos
C. sociabilis
C. haigi
Mole-rats
H. glaber
Singing mice
S. teguina
S. xerampelinus

What can science teach us about Morality?

Many sciences contribute:

- genetics & evolutionary biology
- experimental psychology
- ethology
- anthropology
- neuroscience*
- neuroendocrinology*

Social Problem Solving

Practical problems, constrained by features of body and brain.

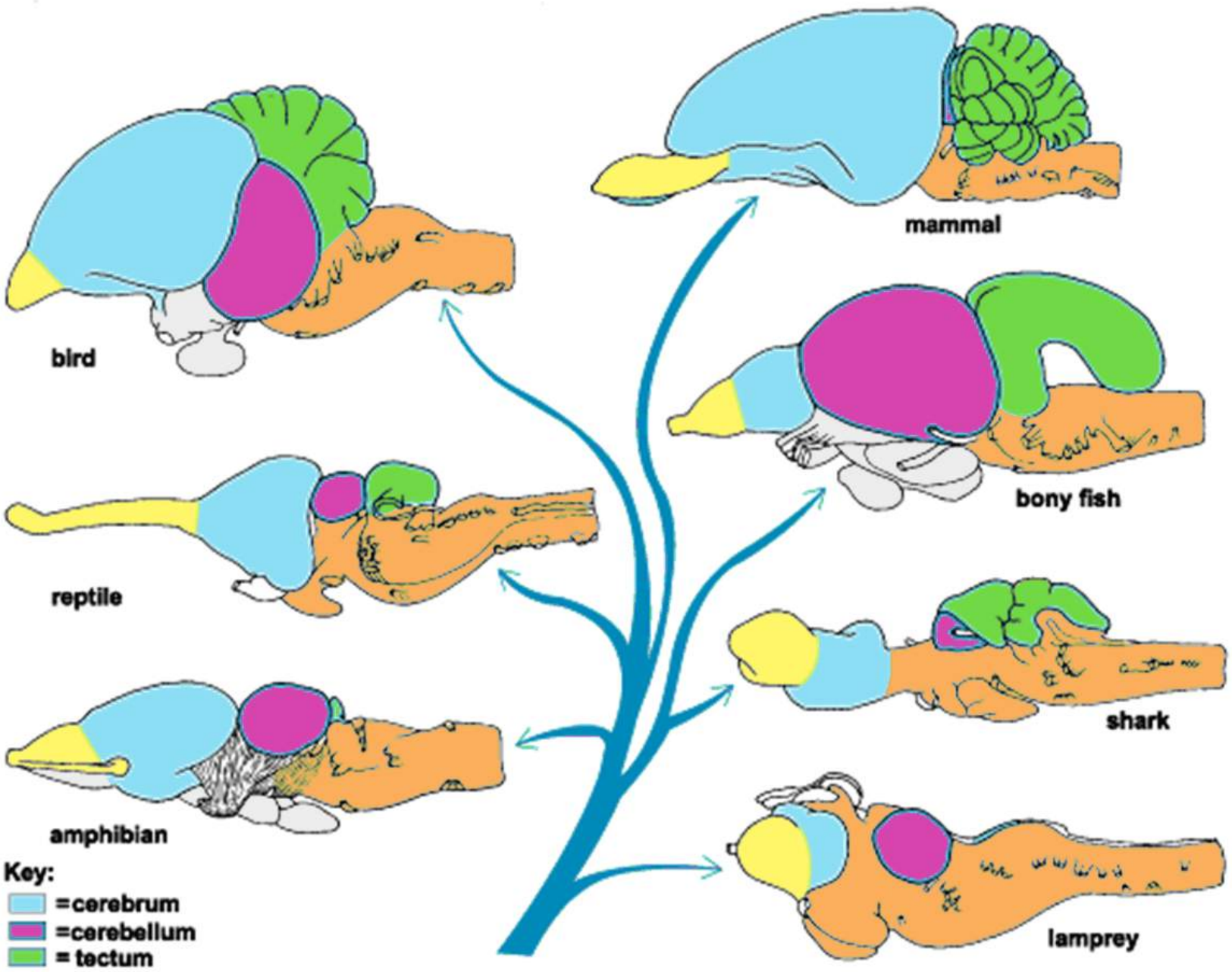
Separation, lack of cuddling alter adult behavior – maybe alters gene expression which changes stress responses

Szyf & Meaney

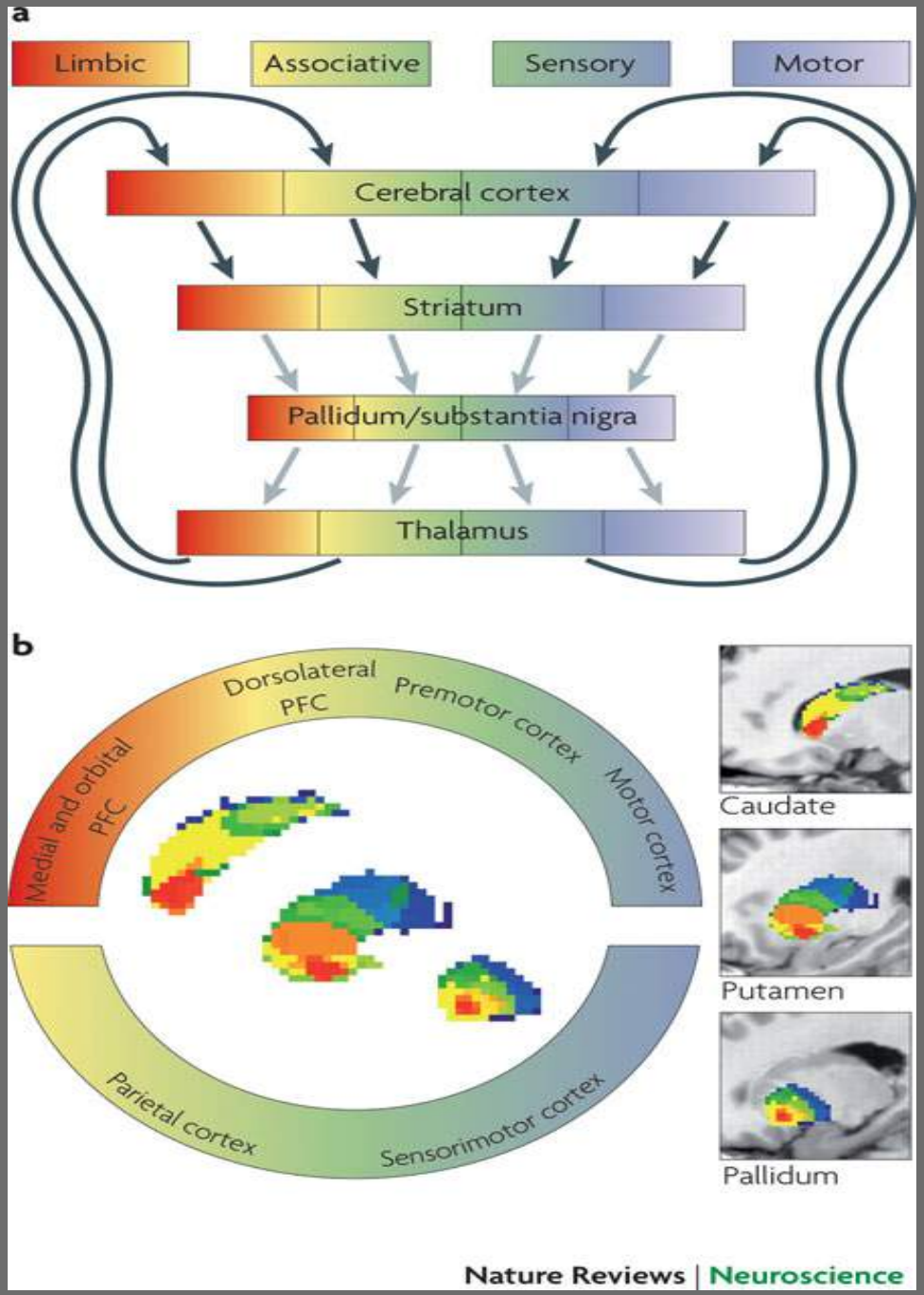
Moral Norms & Values

Not supernatural
Not esoteric or Platonic
Not unconditional
Ancient evolutionary roots

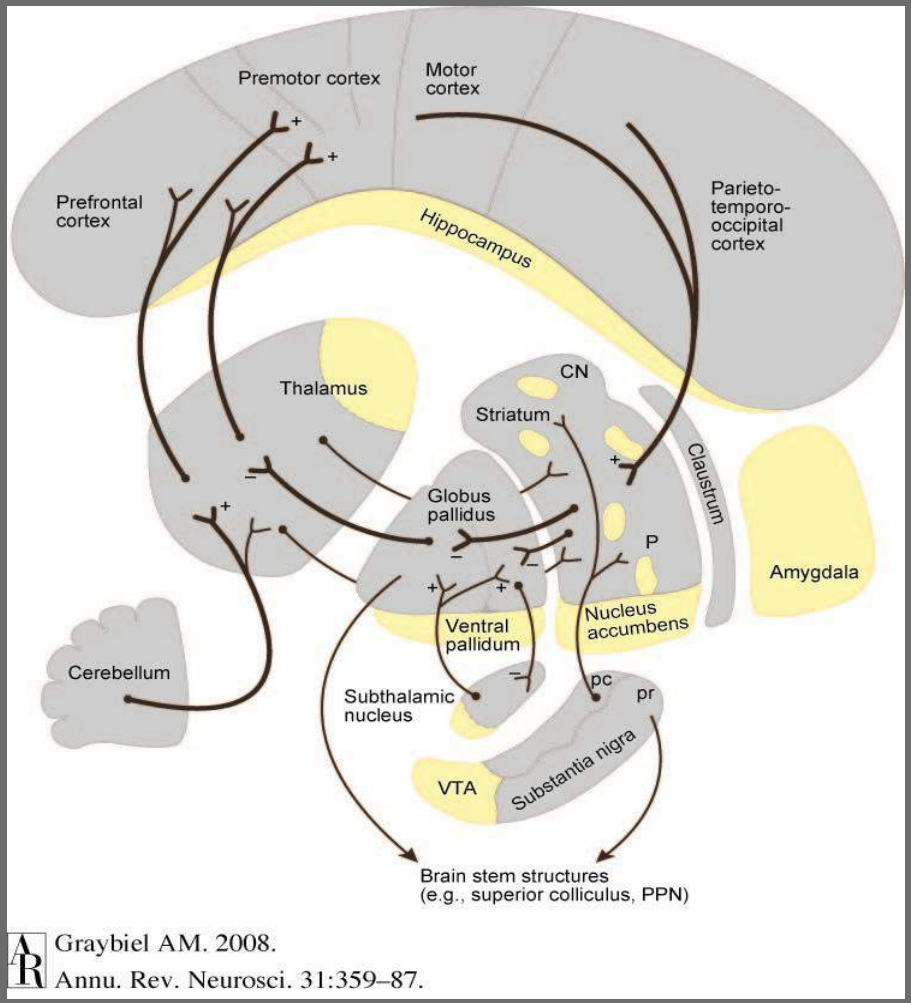

KEEP
CALM
AND
RELEASE
ENDORPHINS


mammal
bird
bony fish
reptile
shark
amphibian
lamprey
Key:
=cerebrum
=cerebellum
= tectum

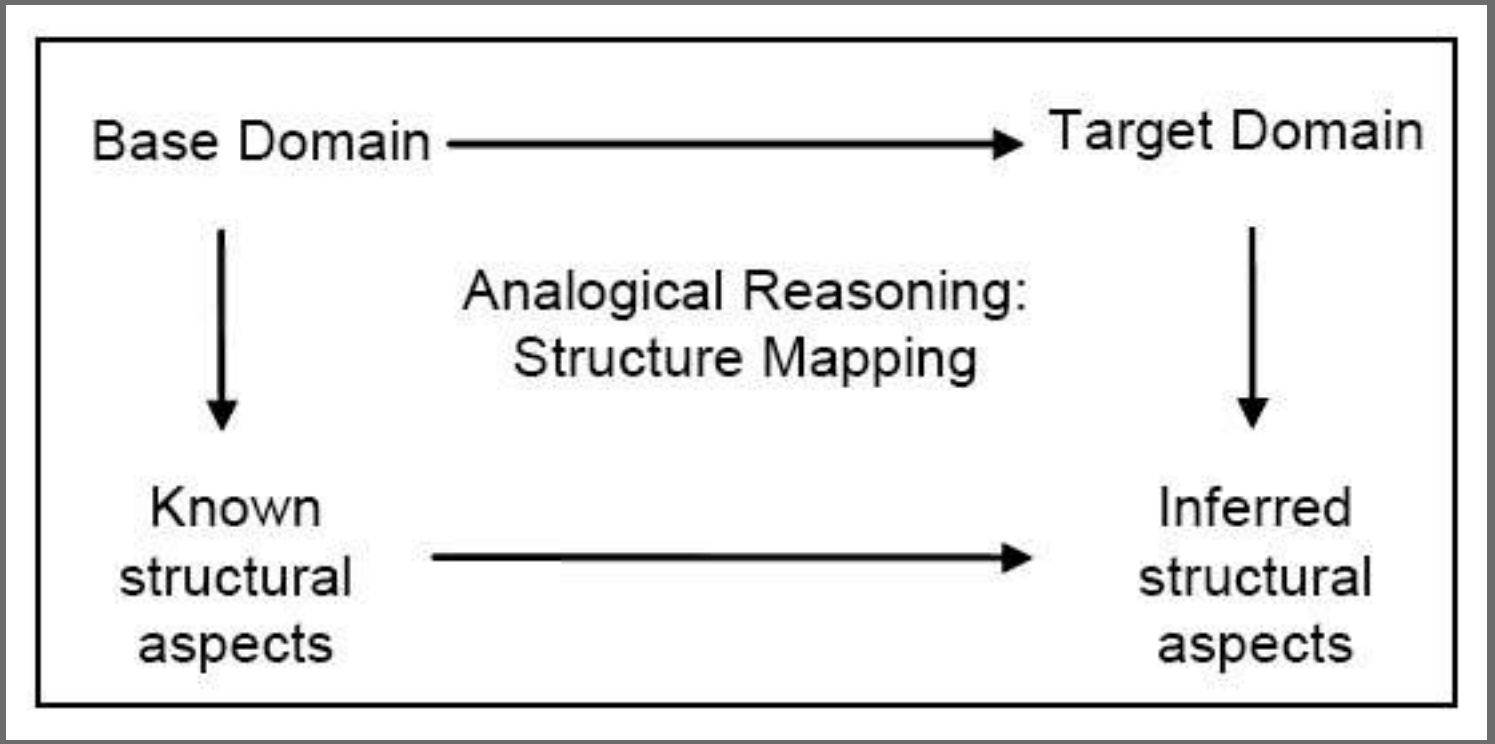
Redgrave et al Nature Neuro 2010



basal ganglia, thalamus, cortex, hippocampus



Graybiel AM. 2008.
Annu. Rev. Neurosci. 31:359–87.


Base Domain
Target Domain
Analogical Reasoning:
Structure Mapping
Known
structural
aspects
Inferred
structural
aspects