«The Meditating Brain, a Challenge to Digital Revolution»

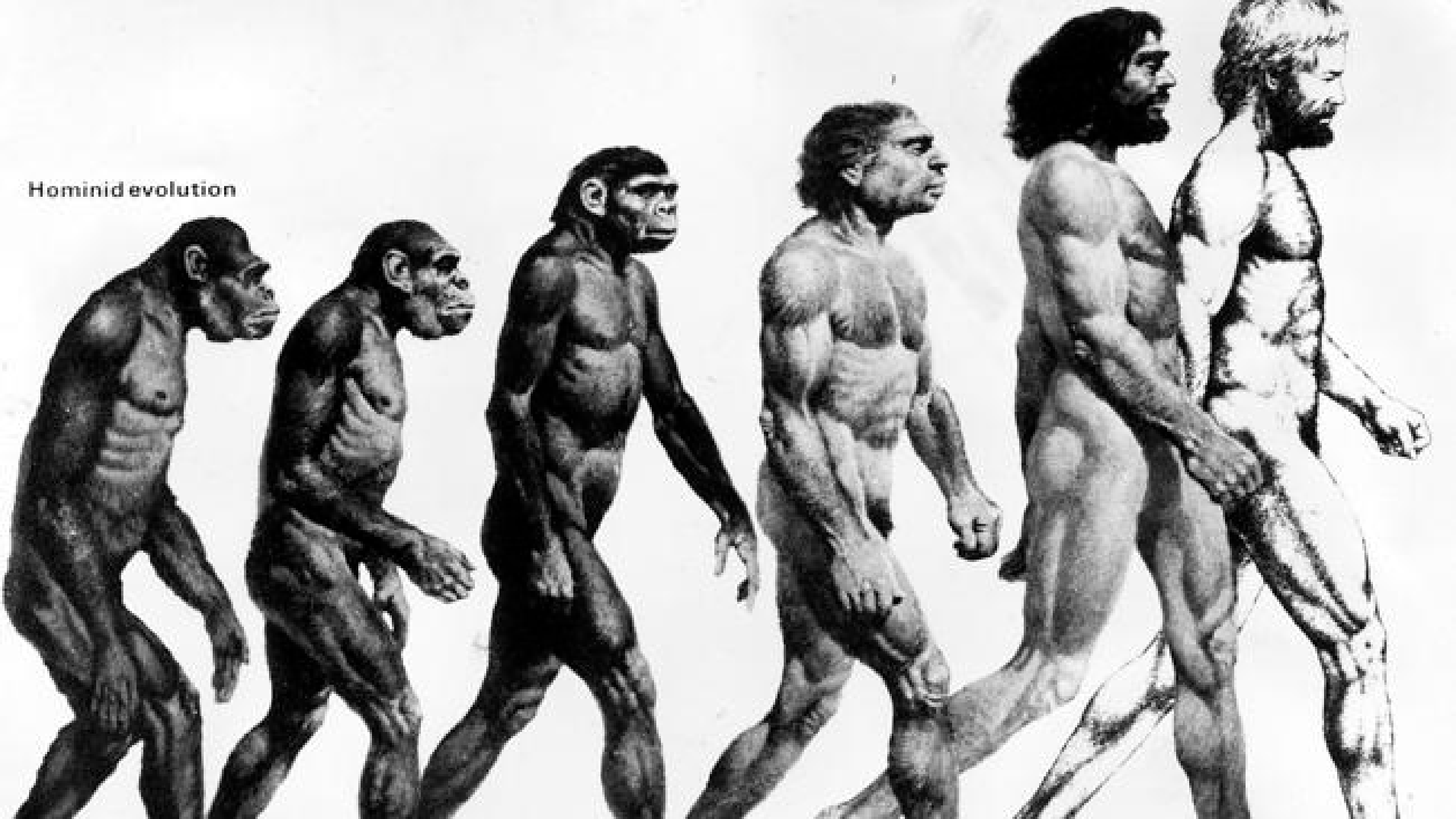
Epistemology

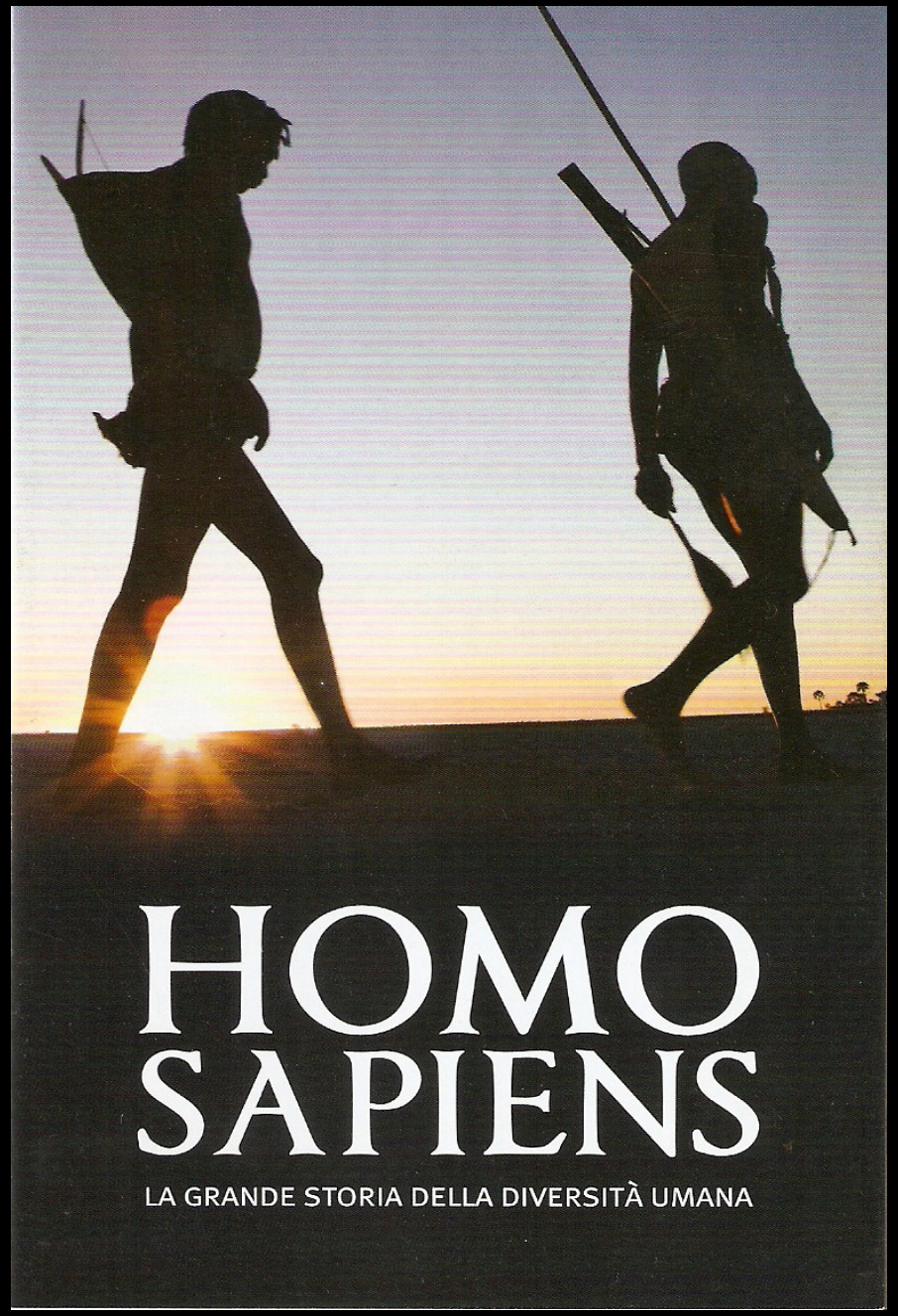
Neurosciences

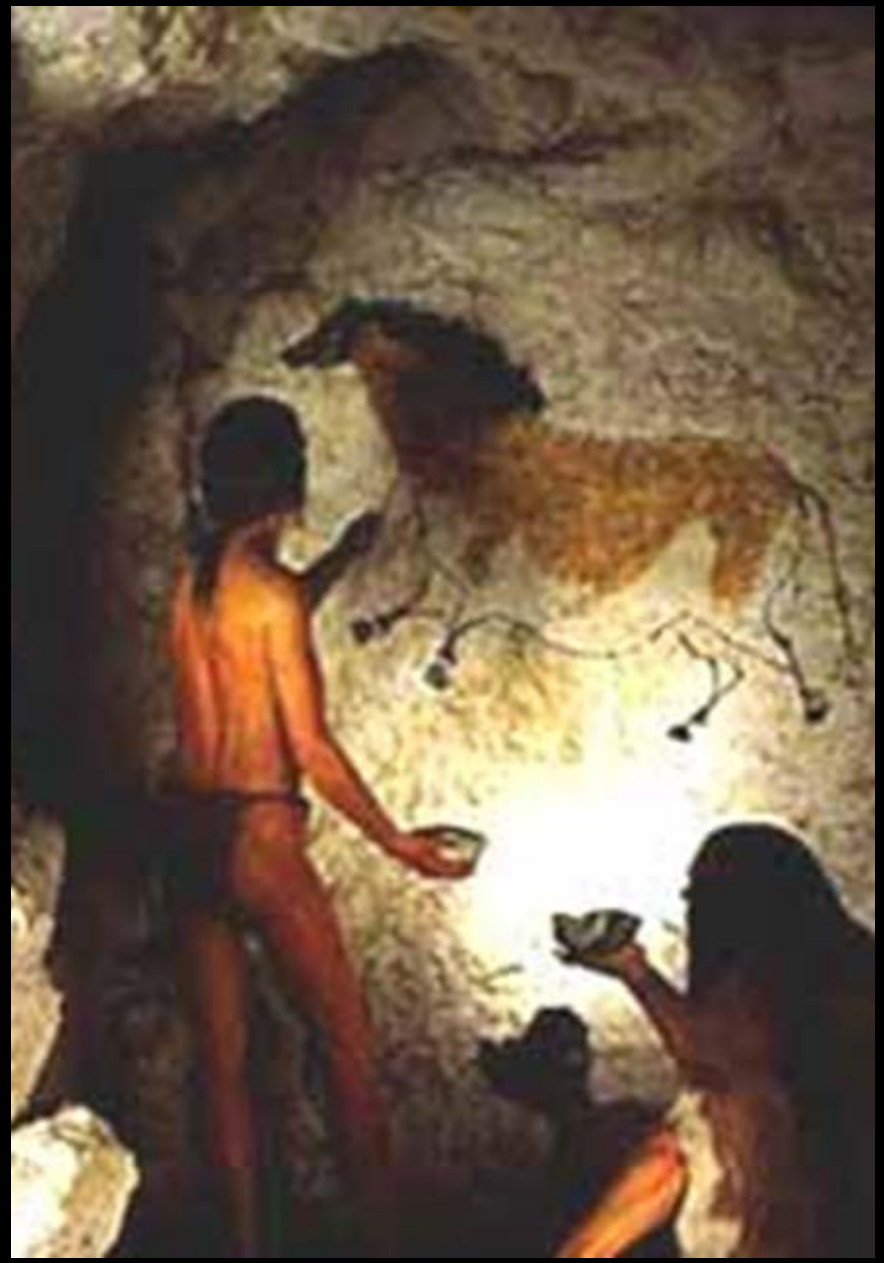
PNEI

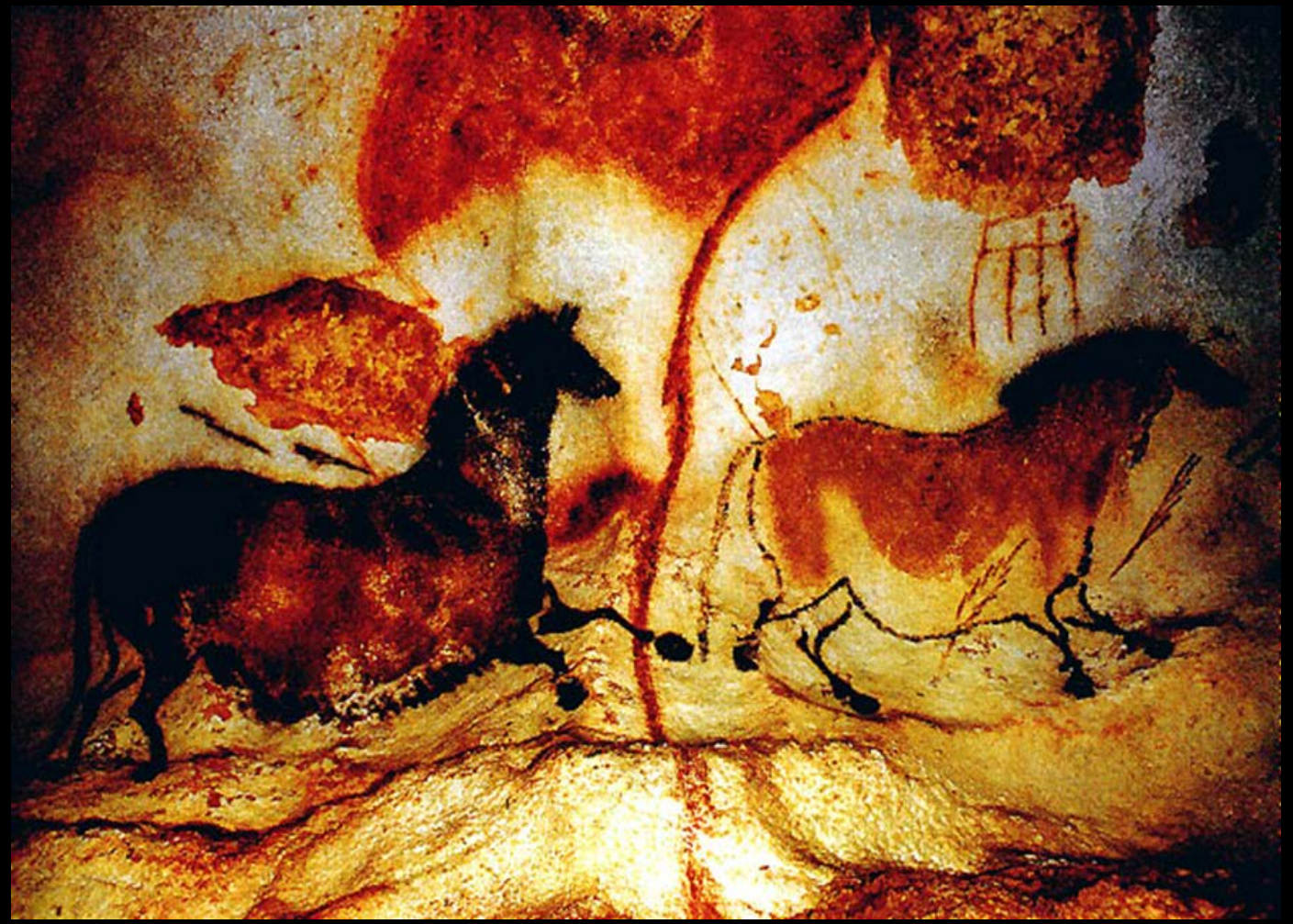
Self-observation

Hominid evolution




HOMO
SAPIENS
LA GRANDE STORIA DELLA DIVERSITÀ UMANA





Verbal Language

Fenicio Arcaico (senza vocali)	valore fonetico	lettera greca	greco classico	greco occident. (Beozia)	greco occid. (Calcide)	valore fonetico	etrusco arcaico	etrusco classico	etrusco marsiliana	valore fonetico	latino arcaico	latino classico
𐤀	ʾ	alpha	A a	𐌀 𐌀 𐌀	A	a	A	A	A	a	A	A
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𐤂	g	gamma	Γ g		〈C	g	〈C	ↄ [k]	3	ch (k)	ↄ [k,g]	C [k]
𐤃	d	delta	Δ d	𐌃 D	Δ D	d	D		D	d	D	D
𐤄	h	épsilon	E e	𐌄 E	𐌄 [	e	𐌄	𐌄	𐌄	e	𐌄	E
𐤅	w	digamma		𐌅 E	𐌅	v	𐌅		𐌅	f	𐌅	F [f]
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𐤋	l	lambda	Λ l	𐌋	L	l	L	L	L	l	L	L
𐤌	m	mu	M m	M M m	M	m	M	M	M	m	M	M
𐤍	n	nu	N n	N N	N	n	N	N	N	n	N	N
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𐤔	š	siqma	Σ s	𐌔 ϟ	ϟ ϟ	s	ϟ	ϟ ϟ	ϟ	s	ϟ	S
𐤕	t	tau	T t	T	T	t	T	ϟ [s]	T	t	T	T
		upsilon	Y u	⅄ ⅄	⅄	u	⅄	⅄ ⅄	⅄	u	⅄	V
		phi	Φ ph	+ ×	+	x	+	+	X	ks	X	X
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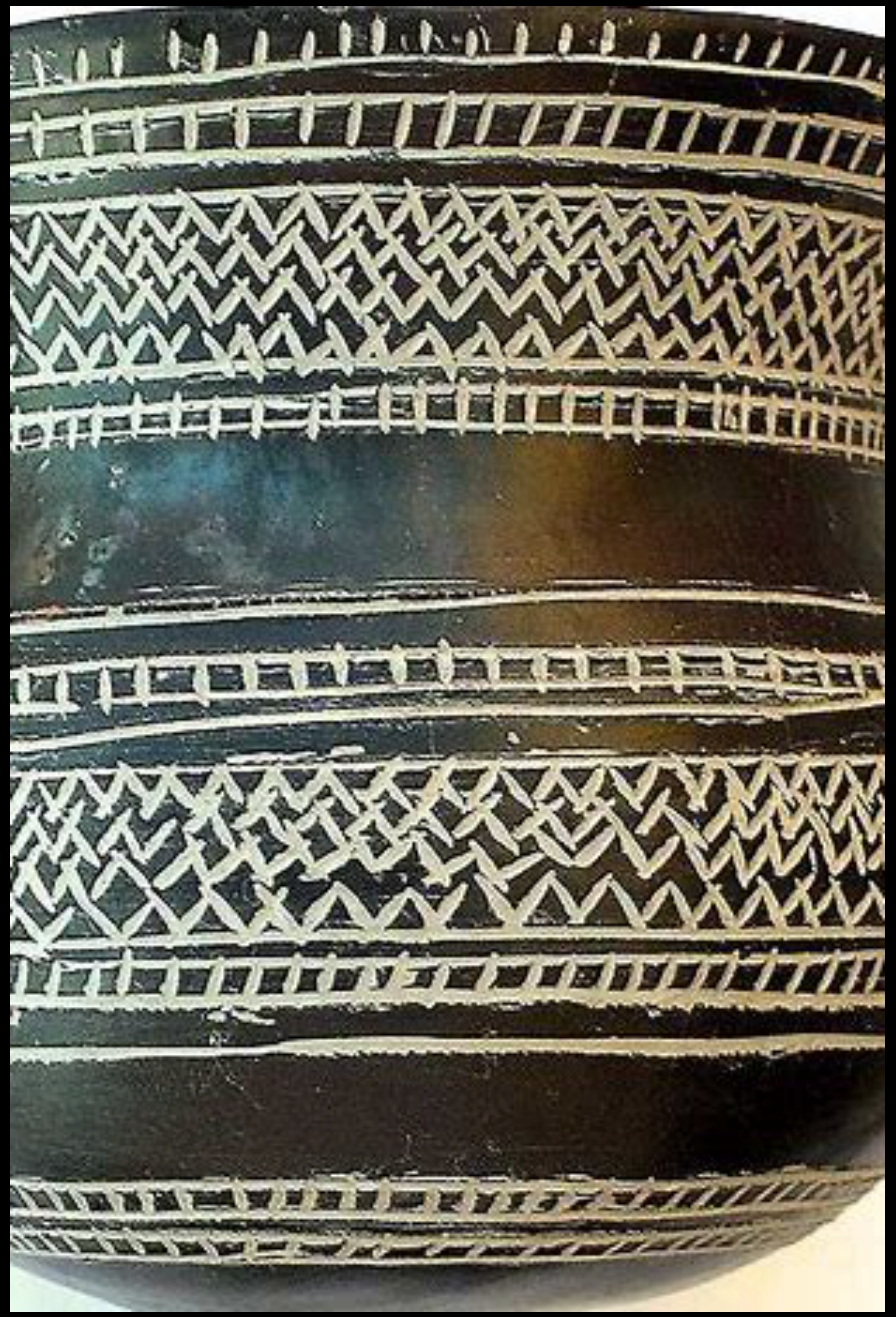
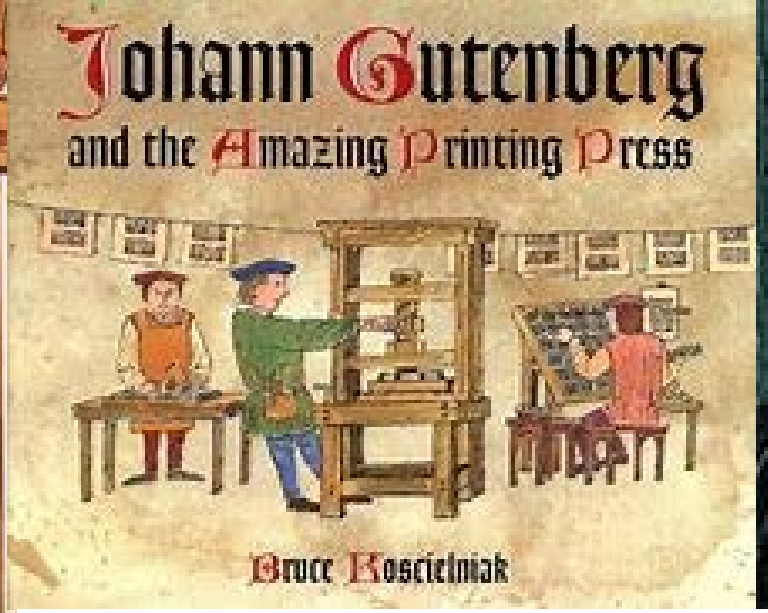
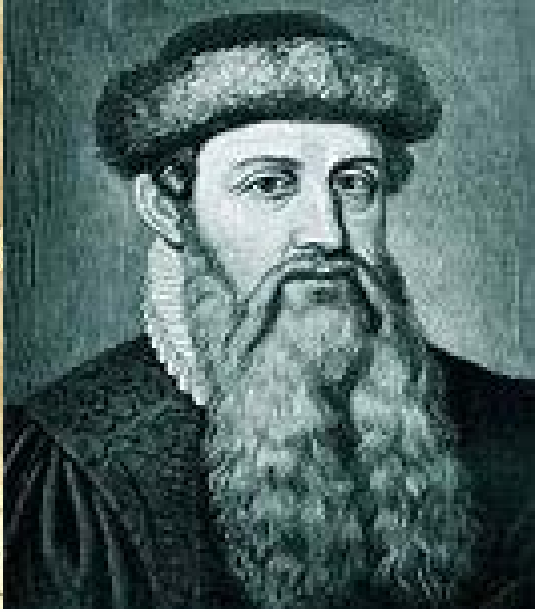


Neolithic

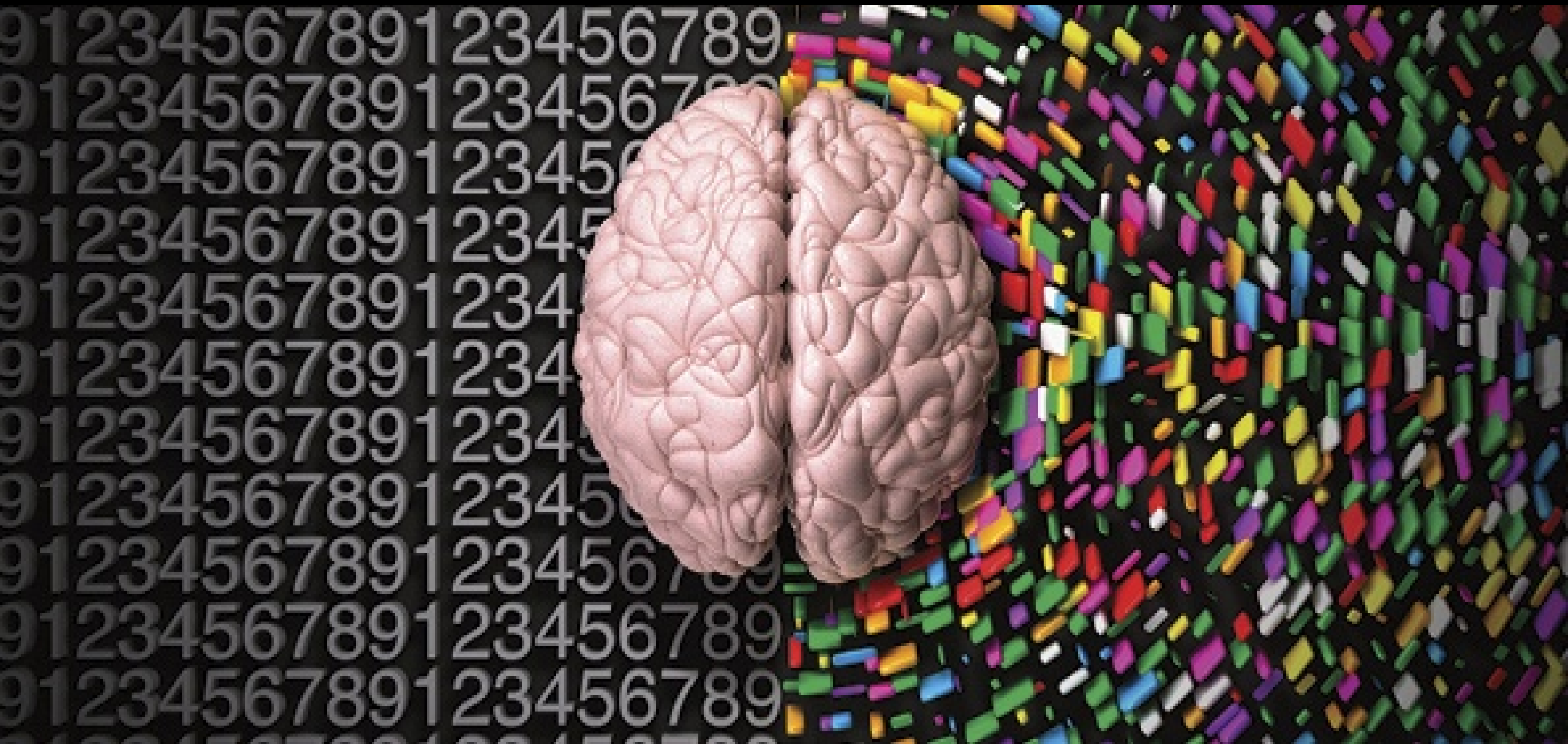

Johann Gutenberg
and the Amazing Printing Press
Bruce Koscielniak




This Gutenberg contraption is going to change everything.
You jest! People will never give up their illuminated manuscripts!
CARTOONSTOCK .com
Search ID: dchn129

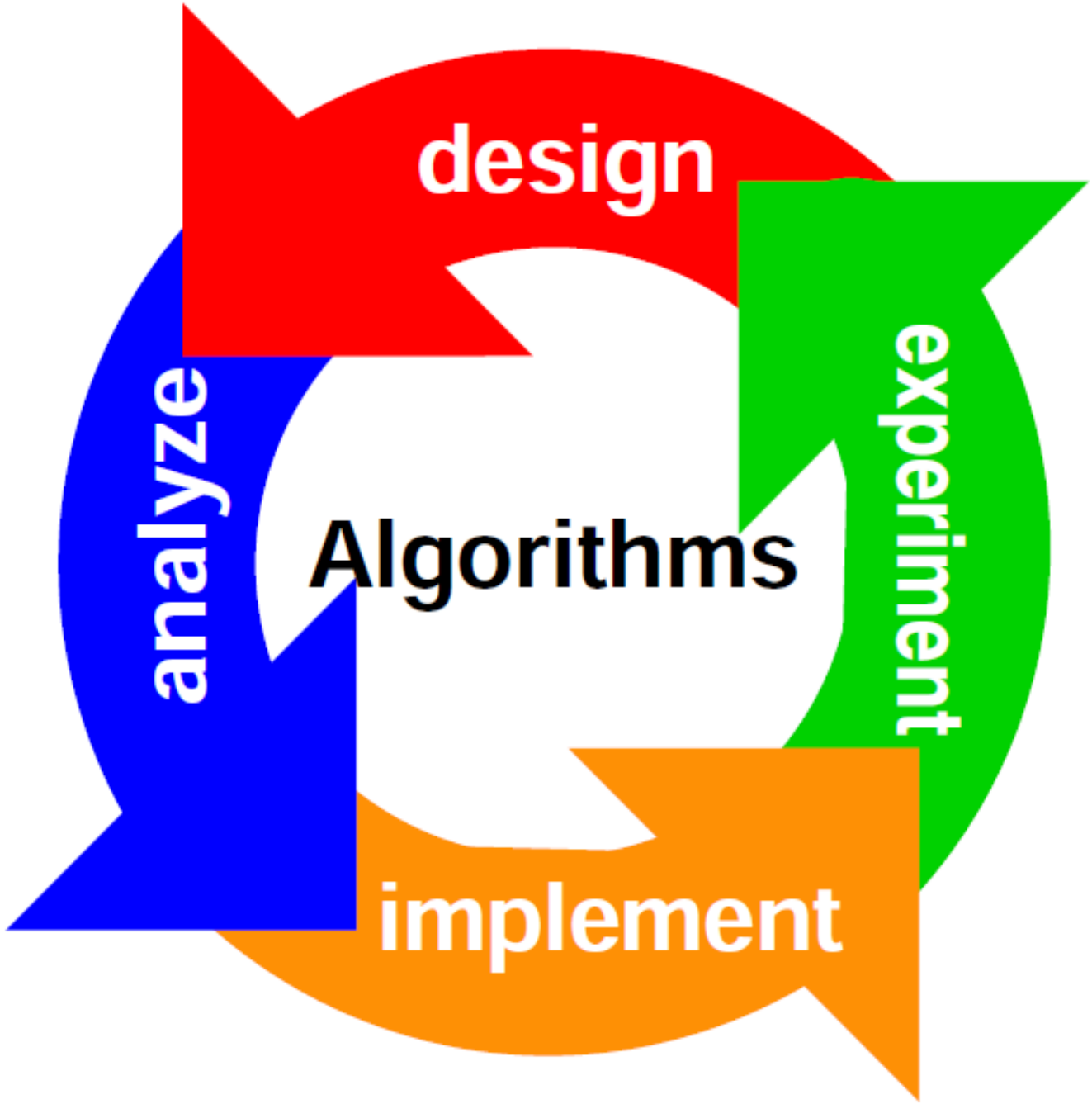

THE INDUSTRIAL REVOLUTION
1750-1840

Digital Revolution




Welcome to the
future


BIG
DATA


design
experiment
implement
analyze
Algorithms

Algorithm

An algorithm is a procedure or formula for solving a problem, based on conducting a sequence of specified actions

Digital Revolution

The Digital Revolution is the change from mechanical and analogue electronic technology to digital electronics

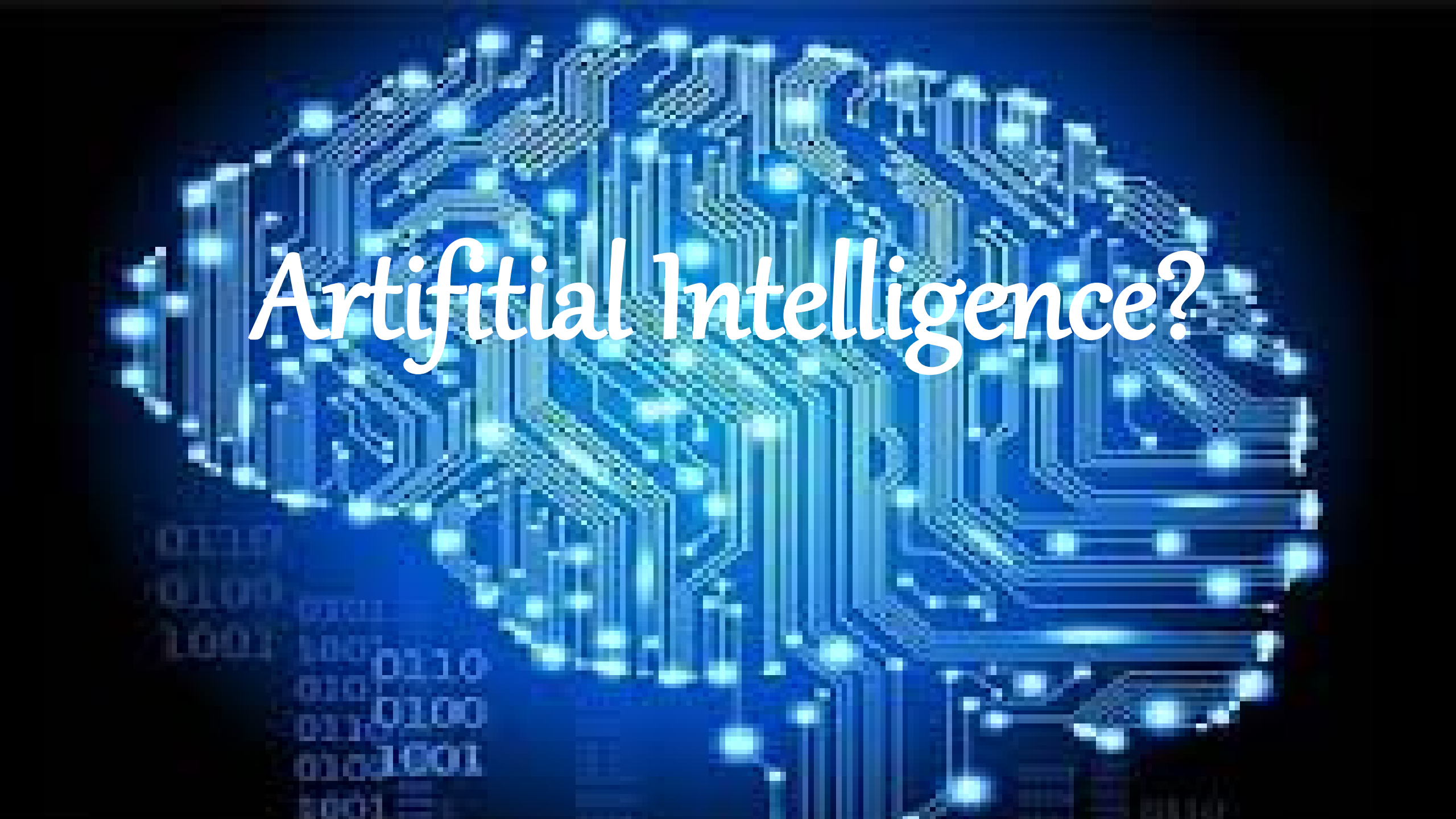
Digital Revolution

Central to this revolution is the mass production and widespread use of digital logic circuits, and its derived technologies, including the computer, digital cellular phone, and the Internet.

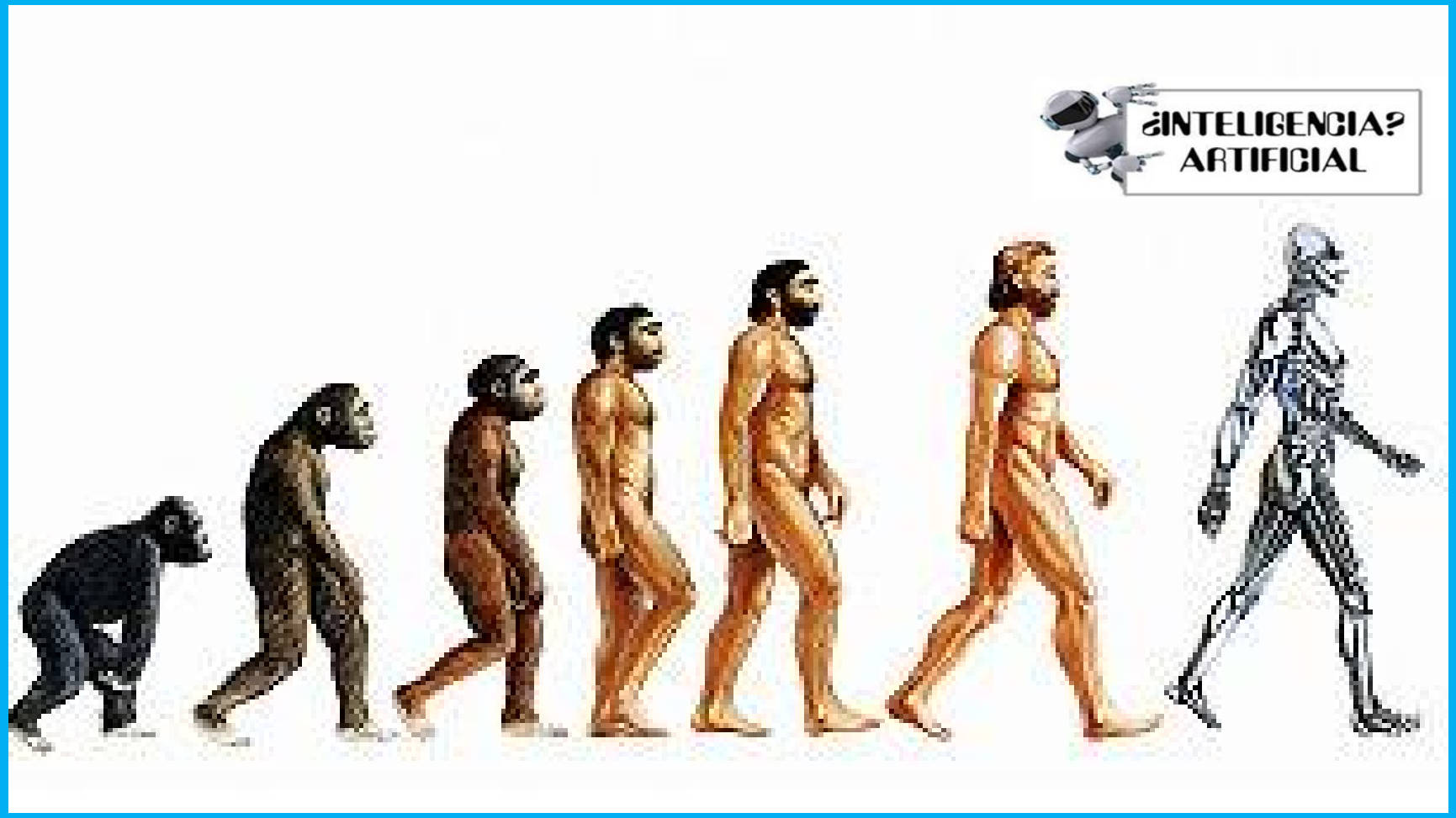

Insta
in


NanoRoboMed
• Nuclear Medicine • Nano Medicine • Nano Sciences
• Medical Robotics • Artificial Intelligence

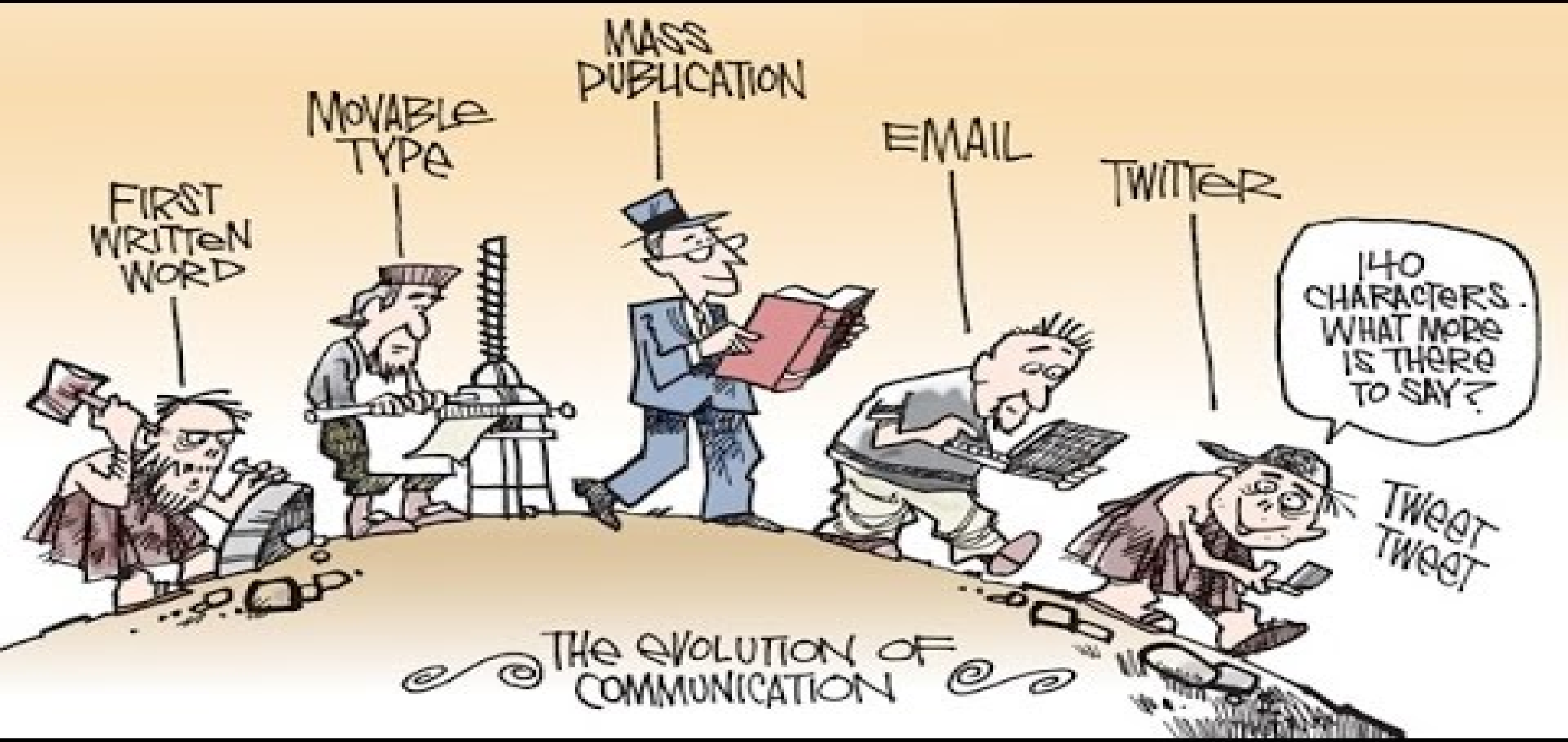

WittySparks.com
Look how the Digital Revolution is Changing our Cities


Artifitial Intelligence?

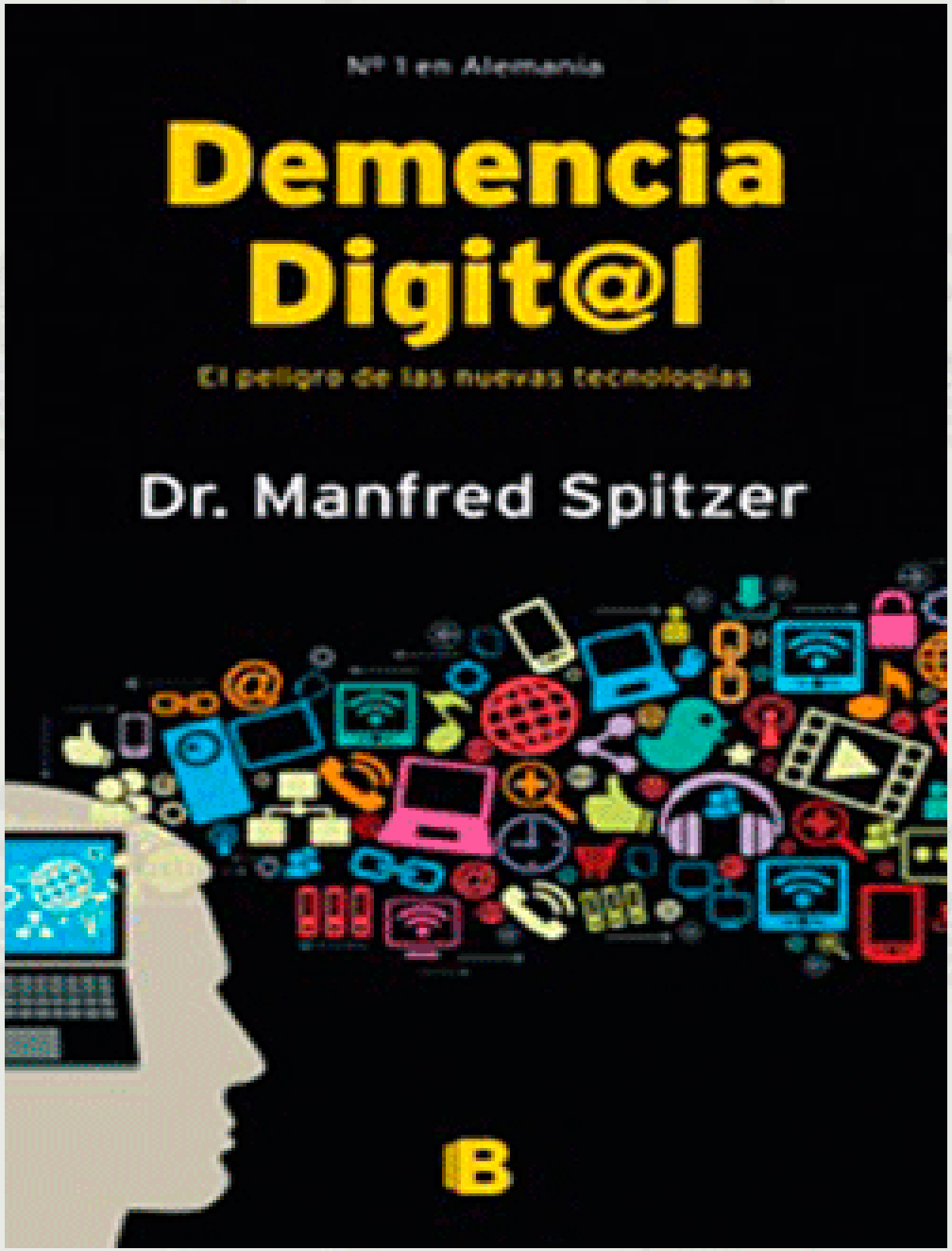
Homo digitalis?



The Digital Revolution is a Challenge for la Mankind


FIRST WRITTEN WORD
MOVABLE TYPE
MASS PUBLICATION
EMAIL
TWITTER
140 CHARACTERS. WHAT MORE IS THERE TO SAY?
TWEET TWEET
THE EVOLUTION OF COMMUNICATION

“Digital Dementia”


Nº 1 en Alemania
Demencia Digit@l
El peligro de las nuevas tecnologías
Dr. Manfred Spitzer
B

"Digital Dementia"

"Multitasking and clicking around are distracting, contribute to low attention and impair learning"

Dr. Manfred Spitzer (neuroscientist and psychiatrist)

Digital Dementia: What we and our children are doing to our minds

“The more you train kids with computer games, the more attention deficit you get”

“Games also can be addictive”

“Many children don’t memorize anything because they can Google it”

“The more time you spend with screen media … the less your social skills will be”

Digital Dementia

“The 2-year-old who can nimbly use an iPad or kill a gazillion monsters playing a video game isn’t necessarily a genius”

“That child could be ‘en route’ to trouble with memory and thinking” (a condition Spitzer and others call “digital dementia”)

Digital Revolution

“It makes sense at the extreme that it would affect memory”

“We do know it can affect sleep quality”

Dr. Stephen Pont, a pediatrician at Dell Children’s Medical Center


Here's your zombie apocalypse

The psychis of mankind is seriuosly sick

A growing number of adults, too, are susceptible to constant connection and overuse of technology which can lead to lateralization of brain function which means the brain suffers imbalance.

Damage to the right side of the brain is associated with deficits in ability to concentrate, short attention, memory span, and emotional disturbances, such as depression.

Digital Revolution

“Children should spend more time interacting with others and exercising, which boosts brain health”

“If a person is constantly letting a computer think for them or are spending hours surfing the Internet, then they are not using their brain and, hence, their neural pathways are not stimulated”. “We know very well that neurons that are not used are pruned away”

Dr. Bradley Berg, medical director of pediatrics at Scott & White Hospital-Round Rock

depositphotos
Image ID: 179452258
www.depositphotos.com

Dr. Santiago Ramón y Cajal
1852-1934

Dr. Santiago Ramón y Cajal
Nobel Price 1906

“Every man can, if so desires, become the sculptor of his own brain.”

Neuroplasticity

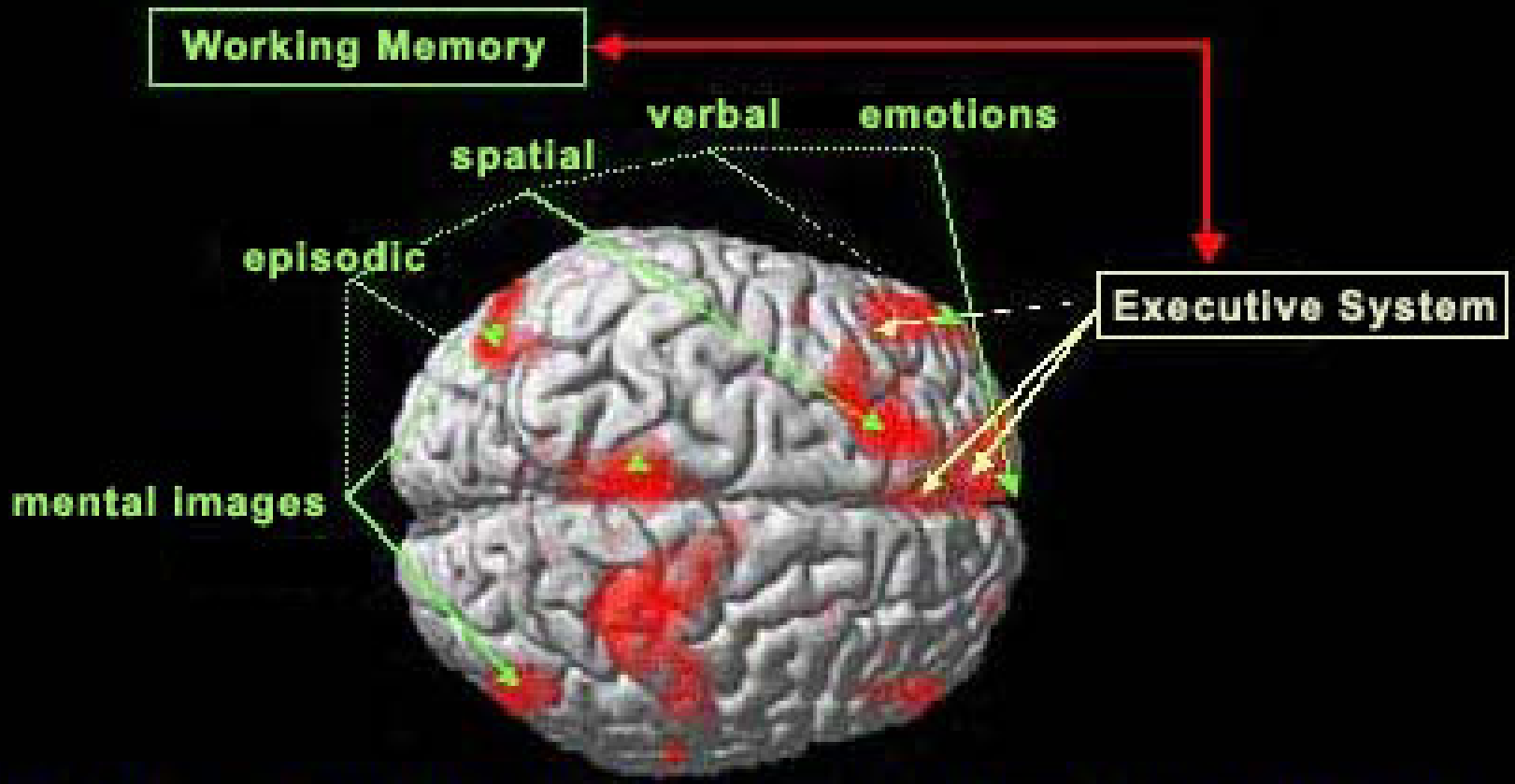
The possibility of reiventing our brain with our free will

Neuroplasticity

1. Stimulates neurogenesis
2. Increase or decrease the intensity of the synapses
3. Create new neural connections
4. Eliminate some synapses

Central Executive

A network reflecting the content and management of conscious thoughts

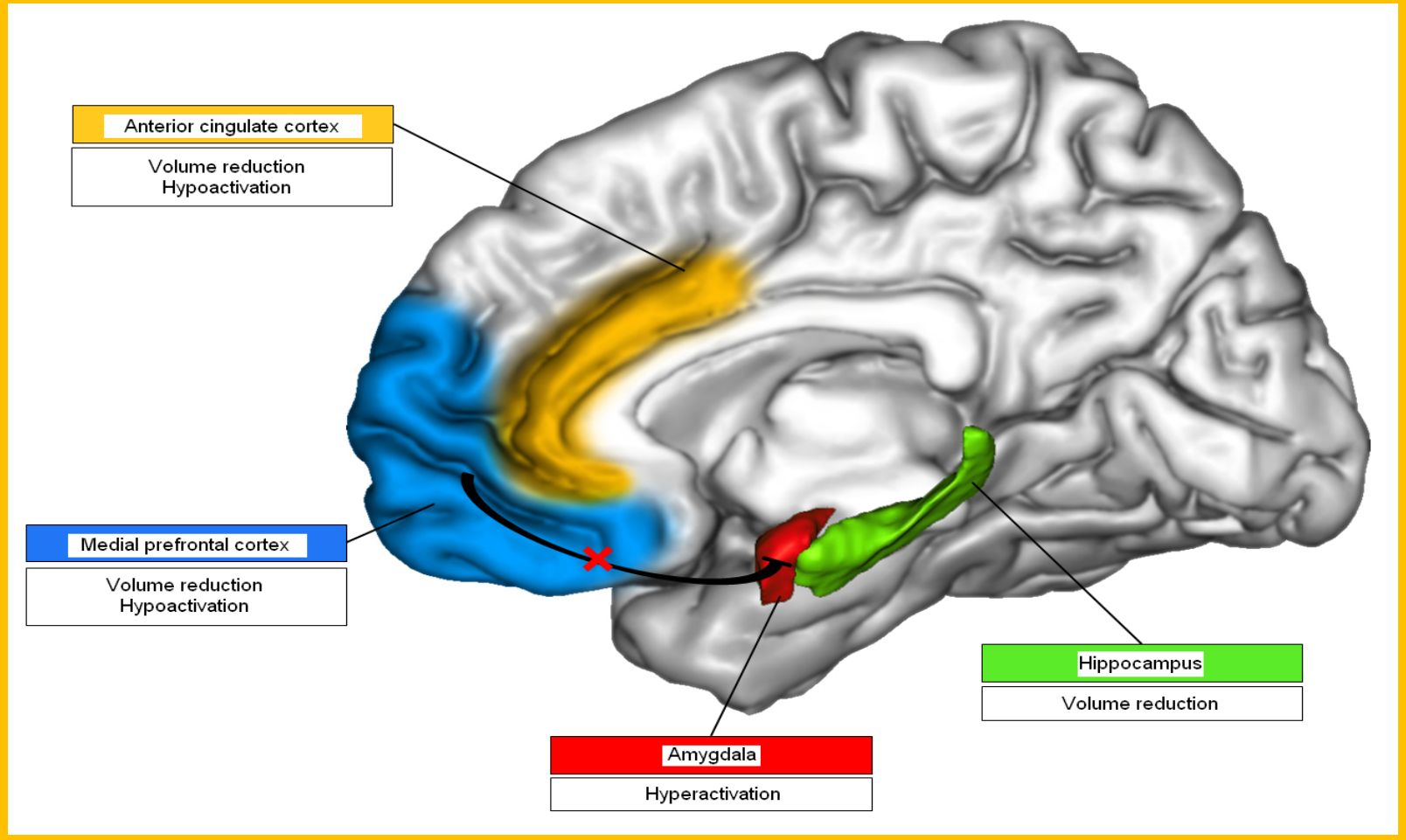


Working Memory: recalls and maintains thoughts in the form of images, episodes, language, emotions, etc.

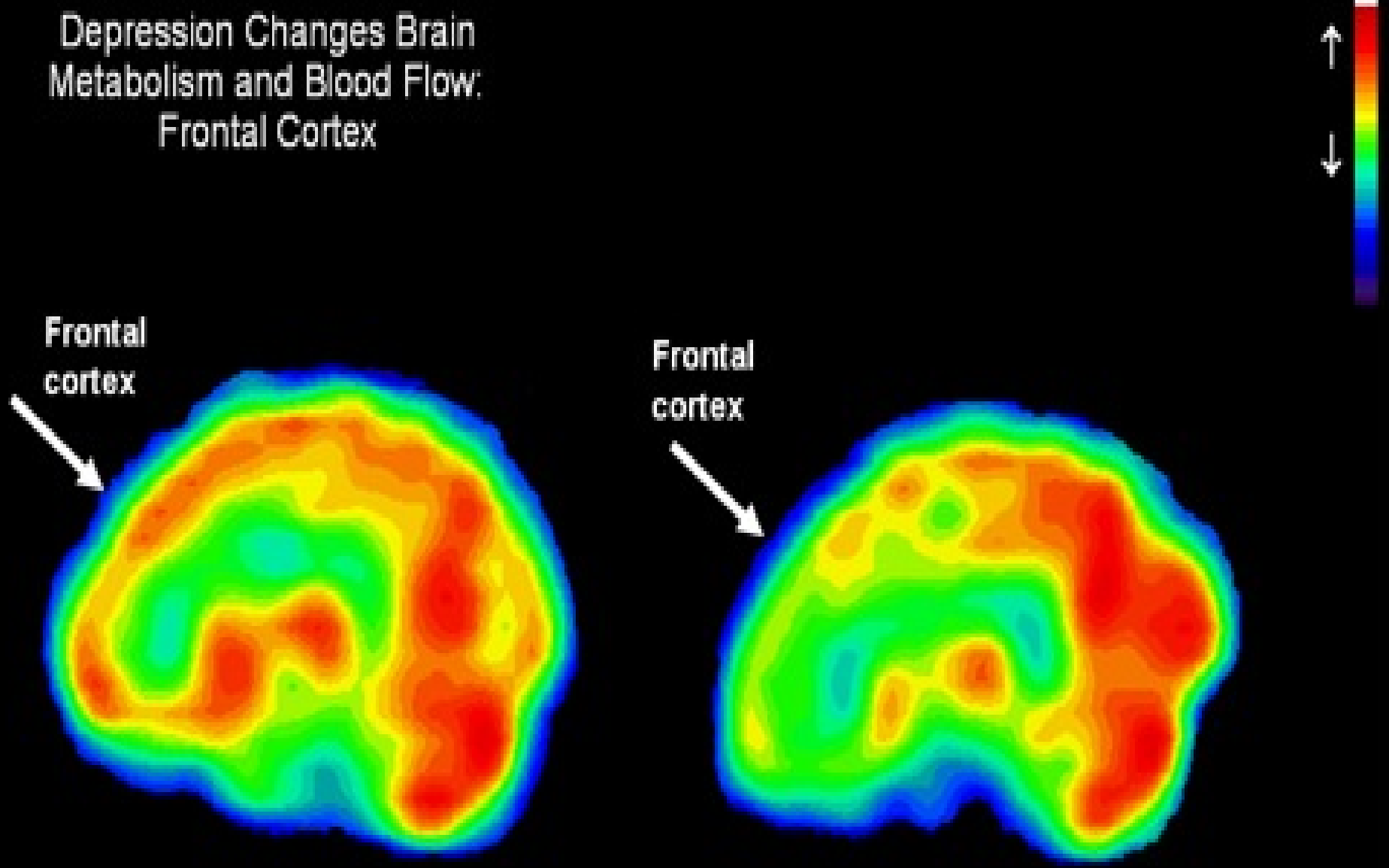
Executive System: manipulates contents of working memory; inhibits and selects thoughts, manages motivation, controls emotions

Mazoyer et al., Brain Res.Bull., 2001

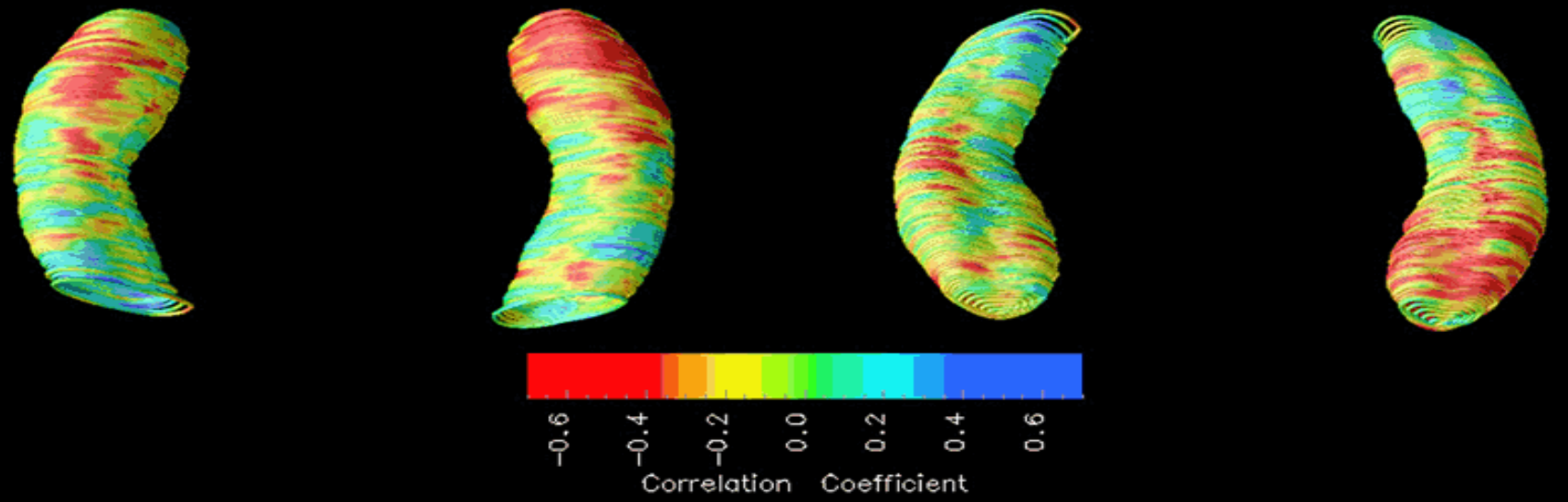
How Depression Affects Your Brain Structure

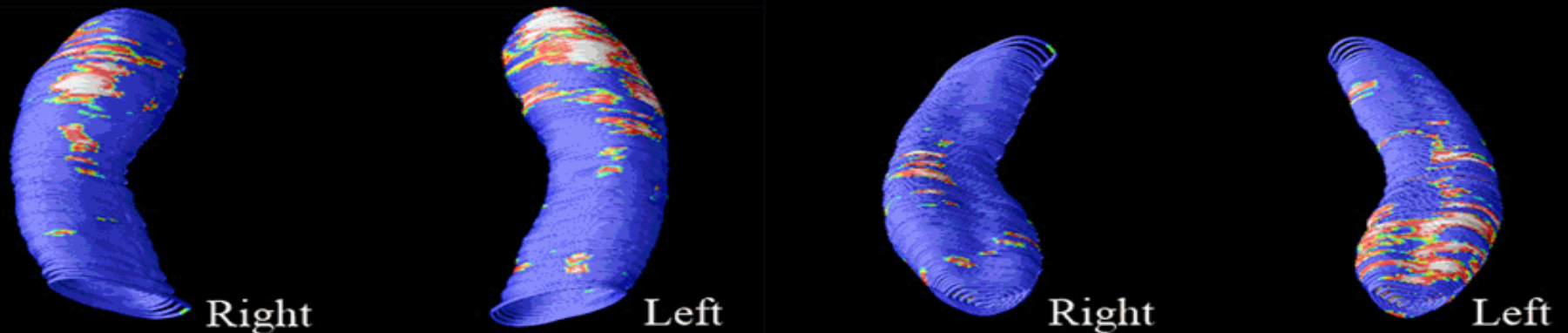

Anterior cingulate cortex
Volume reduction
Hypoactivation
Medial prefrontal cortex
Volume reduction
Hypoactivation
Hippocampus
Volume reduction
Amygdala
Hyperactivation

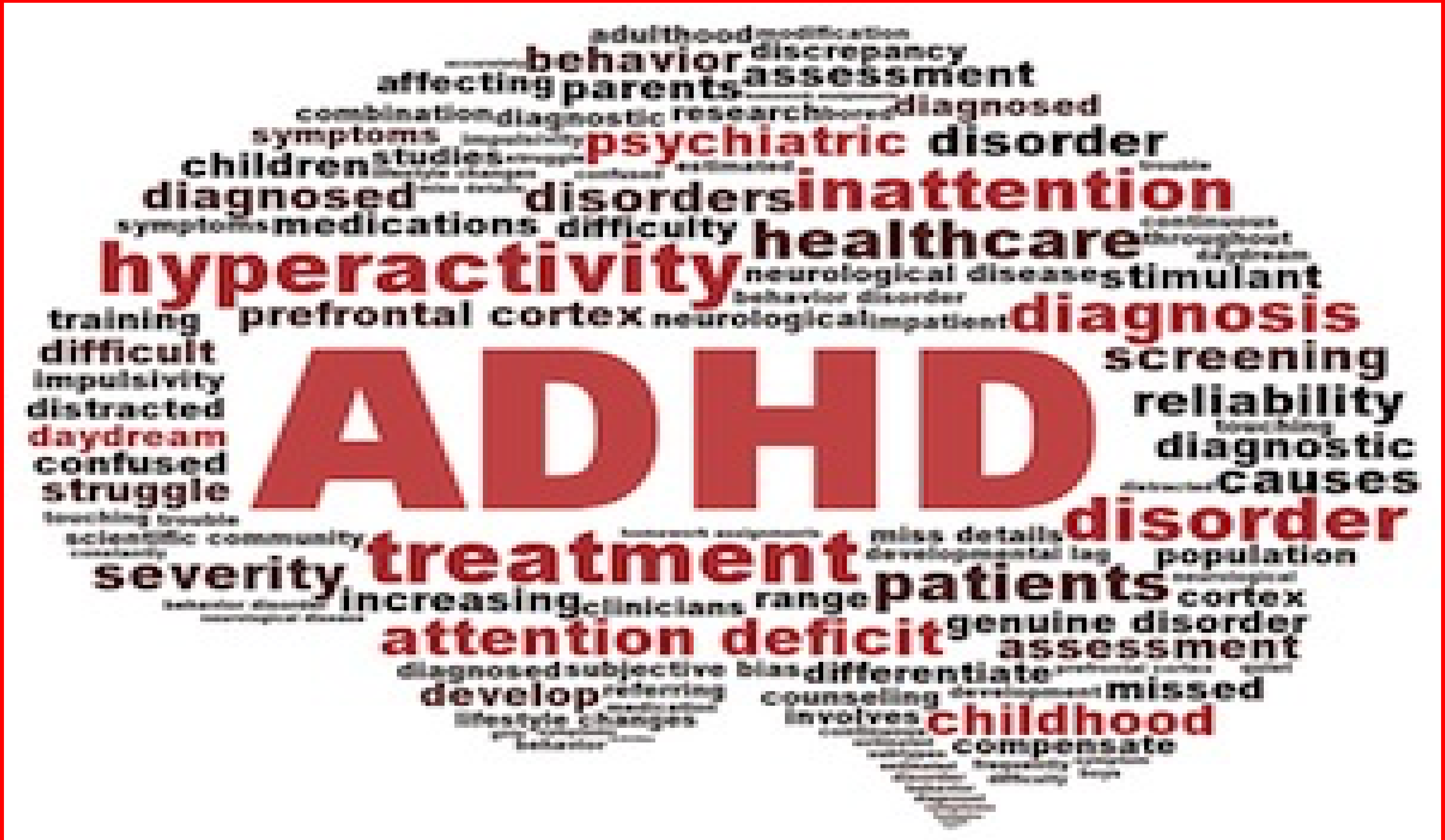
Depression Changes Brain Metabolism and Blood Flow: Frontal Cortex



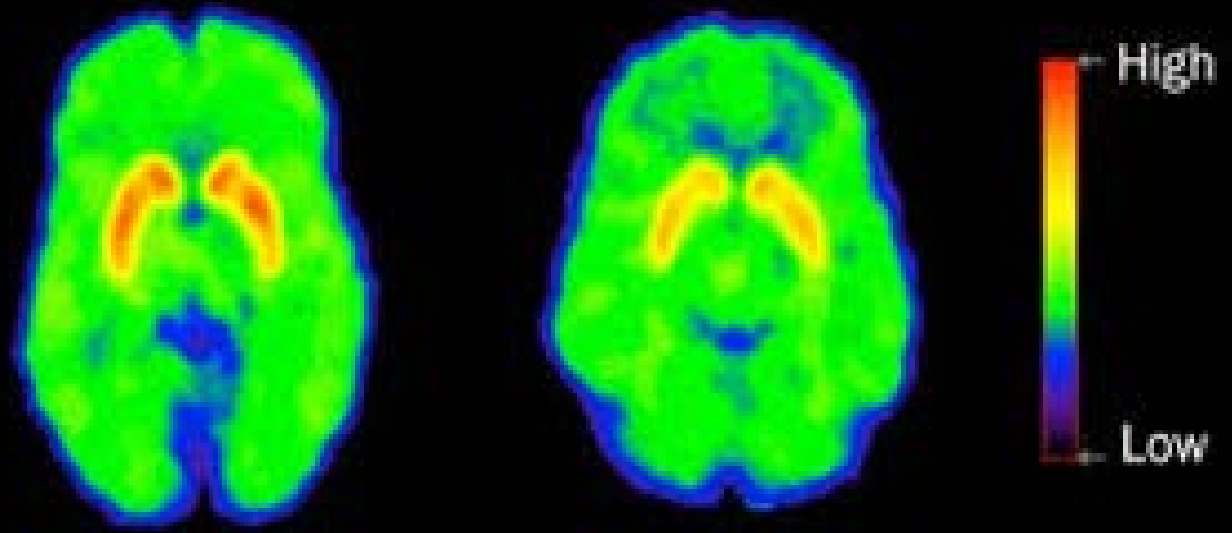
Correlation of Depression Severity with Hippocampal Atrophy






ADHD
hyperactivity
inattention
psychiatric
disorder
healthcare
diagnosis
treatment
disorder
attention deficit
patients
childhood
adulthood
behavior
discrepancy
assessment
affecting
parents
combination
diagnostic
research
diagnosed
symptoms
children
studies
diagnosed
disorders
symptoms
medications
difficulty
neurological disease
stimulant
behavior disorder
training
prefrontal cortex
neurological
impatient
difficult
impulsivity
distracted
daydream
confused
struggle
screening
reliability
diagnostic
causes
scientific community
severity
increasing
clinicians
range
miss details
developmental lag
population
cortex
genuine disorder
assessment
diagnosed
subjective
bias
differentiate
develop
referring
counseling
missed
lifestyle changes
involves
compensate

Do children diagnosed as ADHD really have different brains?



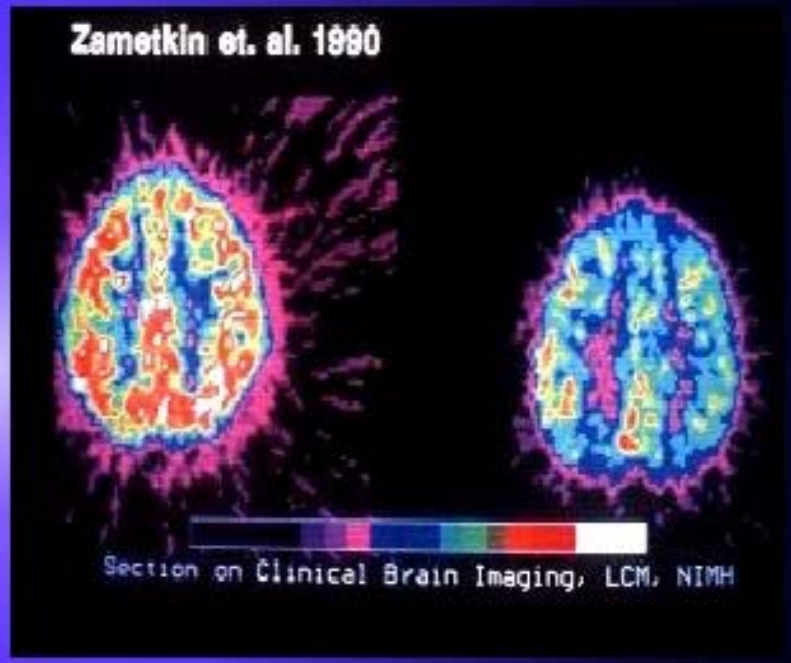
Control Subject

ADHD Subject

Neuro-imaging or neuro-imagining?

ADHD and the Brain

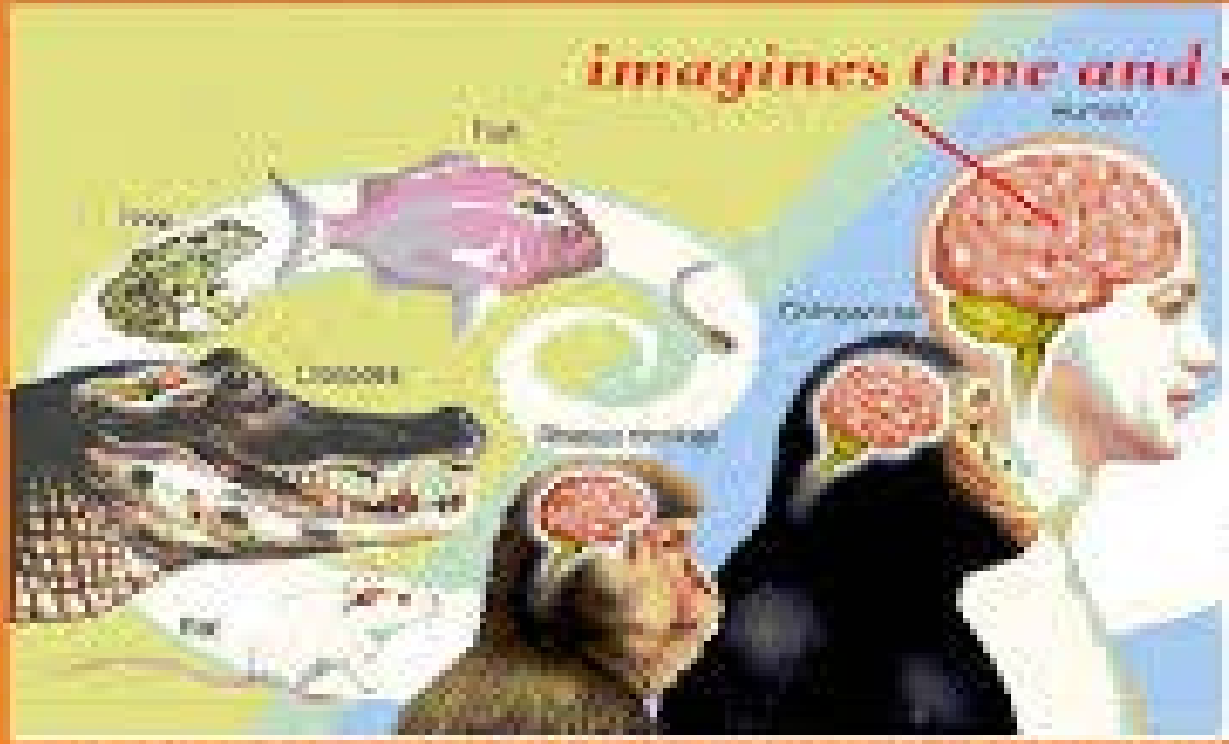
- Diminished arousal of some regions of the nervous system
- Decreased blood flow to prefrontal cortex and pathways connecting to limbic system (caudate nucleus and striatum)
- PET scan shows decreased glucose metabolism throughout brain

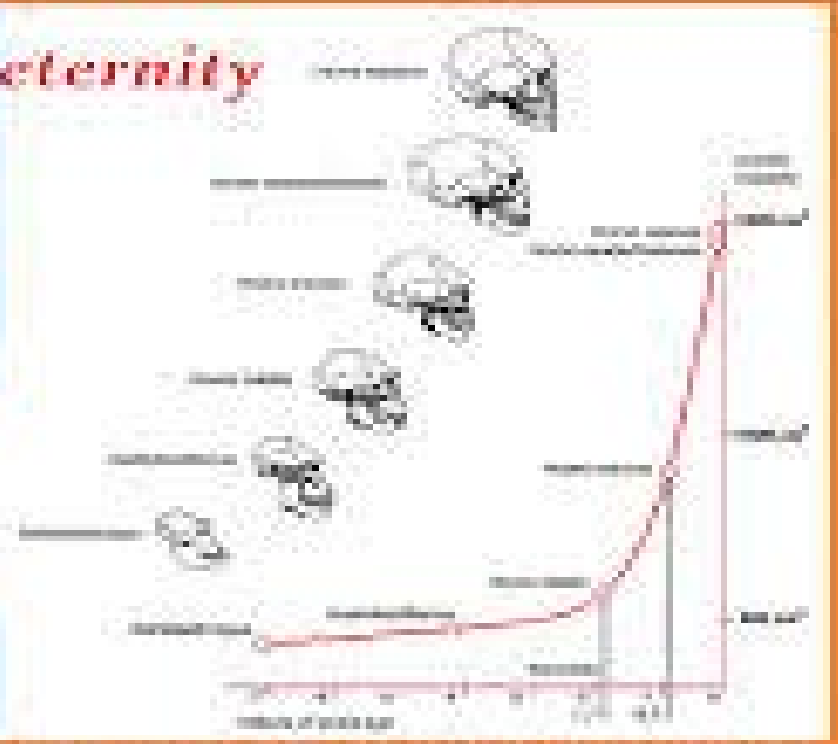


Comparison of normal brain (left) and brain of ADHD patient.

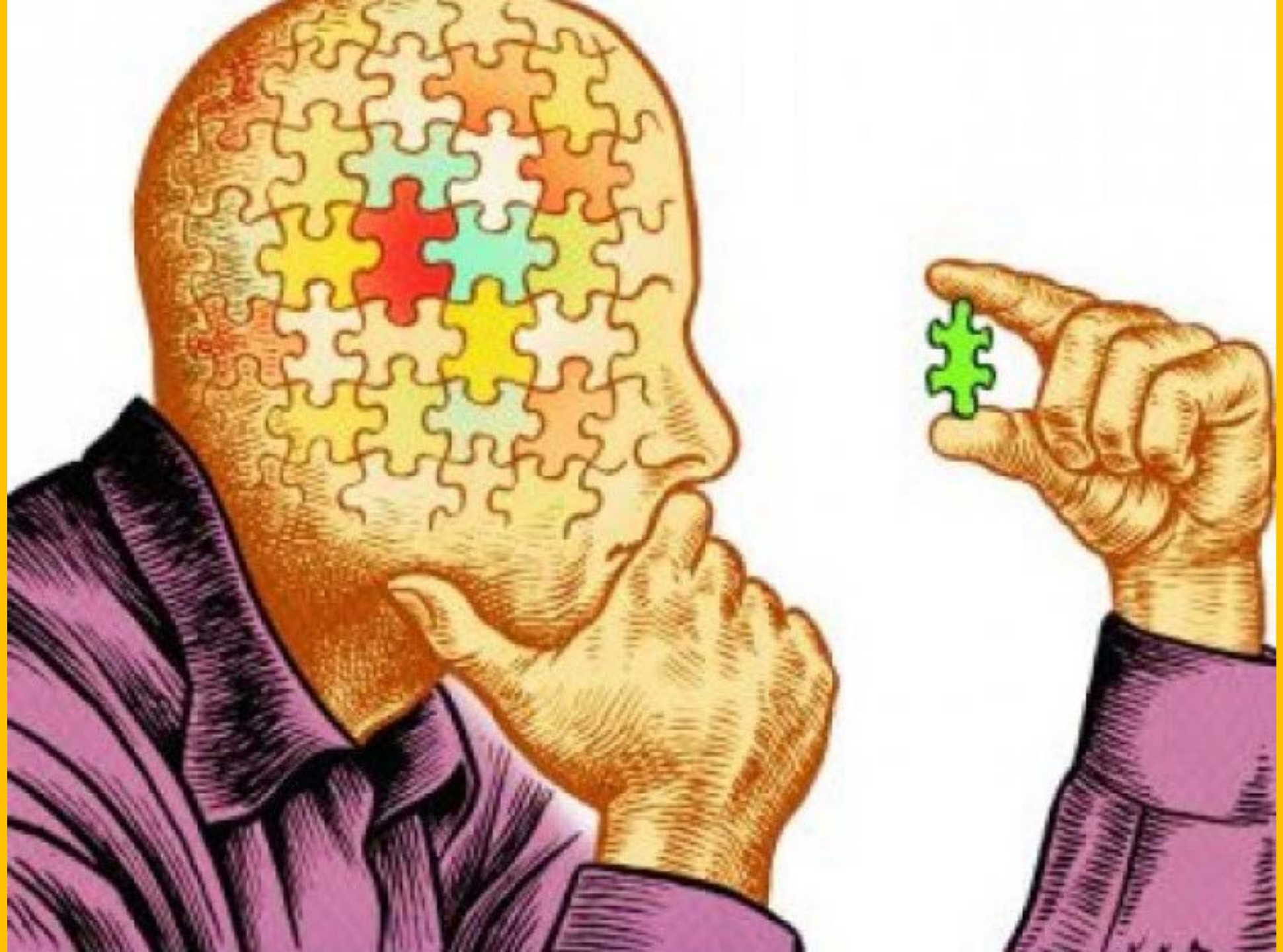
Verbal Language

AS BRAIN PROCESSING INCREASED THE BIPEDAL HOMINIDS





GAINED SELF AWARENESS AND INVENTED ABSTRACT IDEAS



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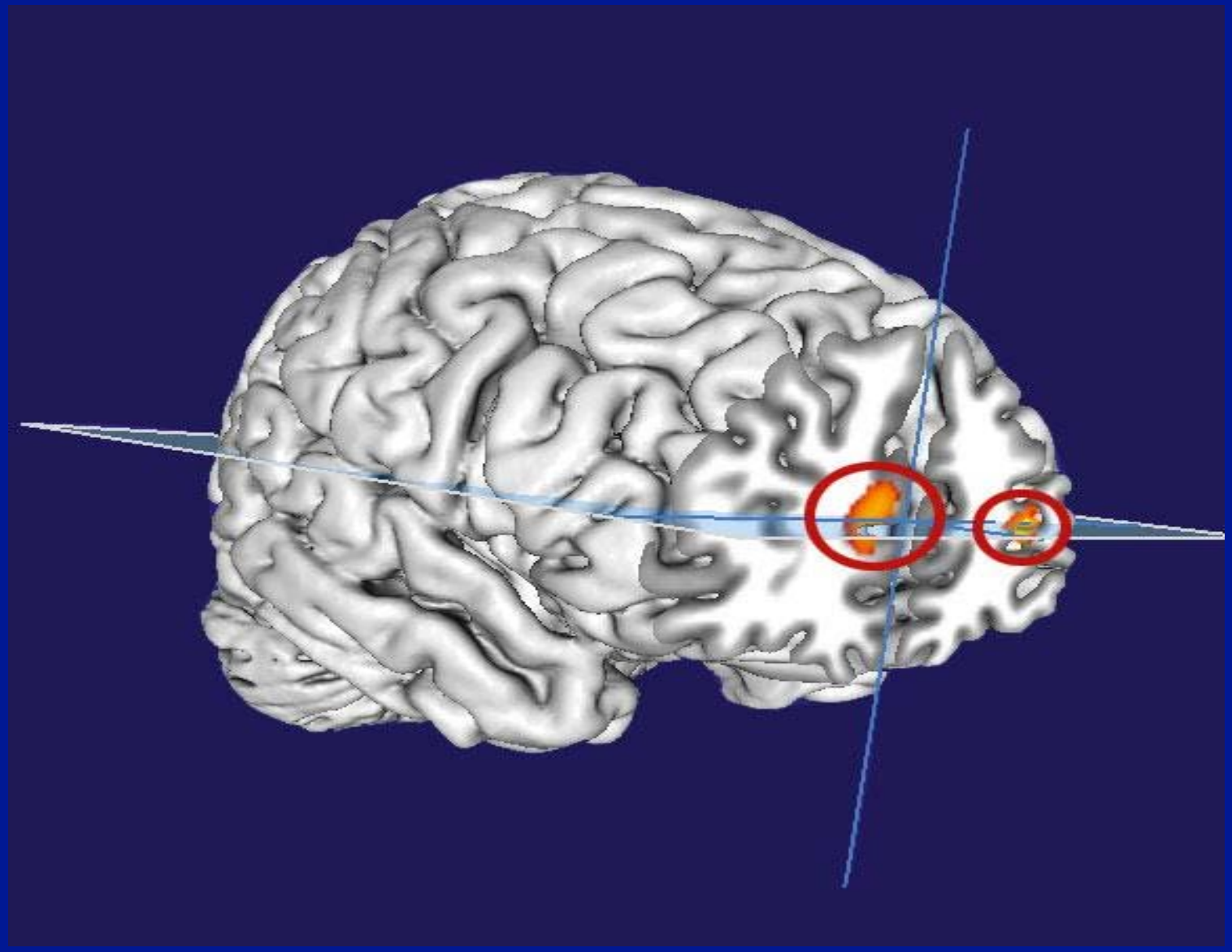
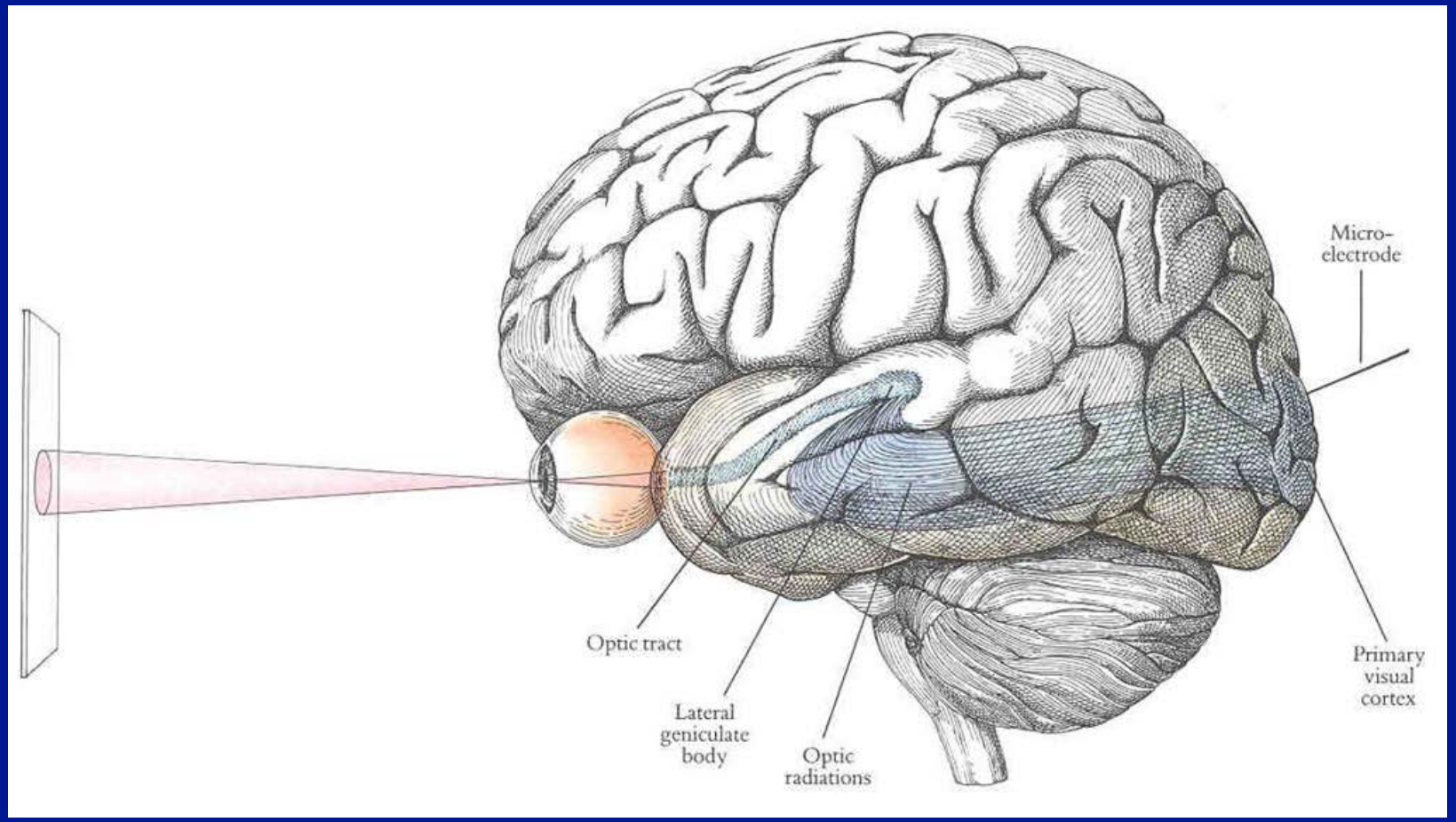
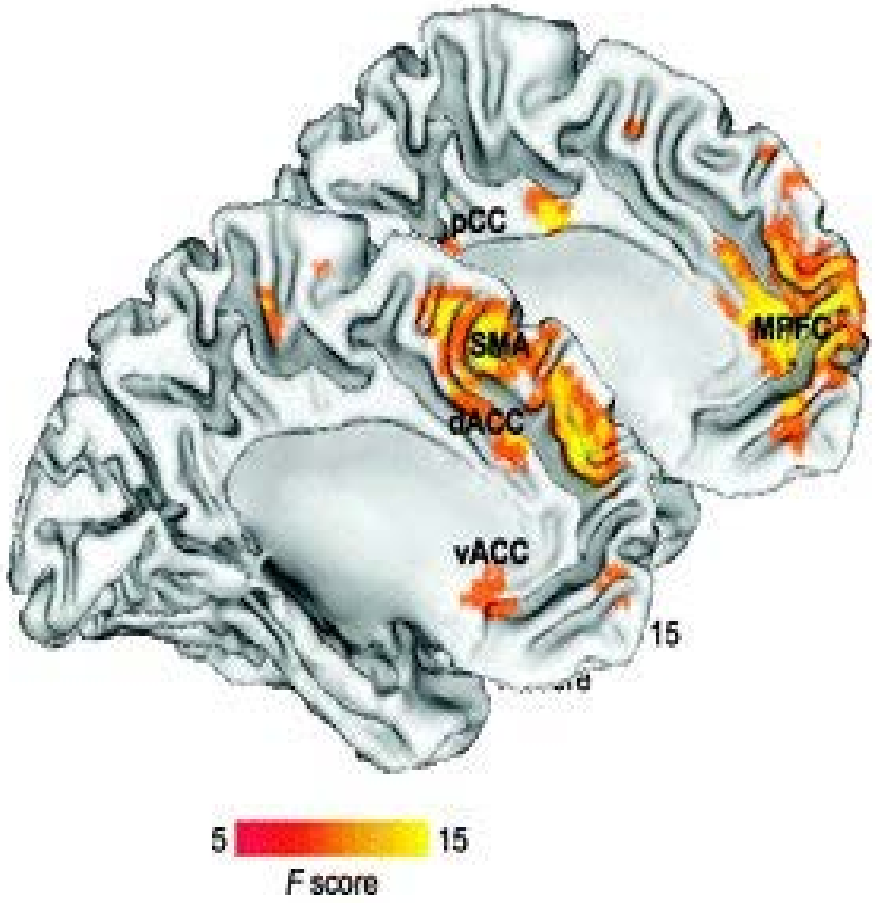
Metacognition



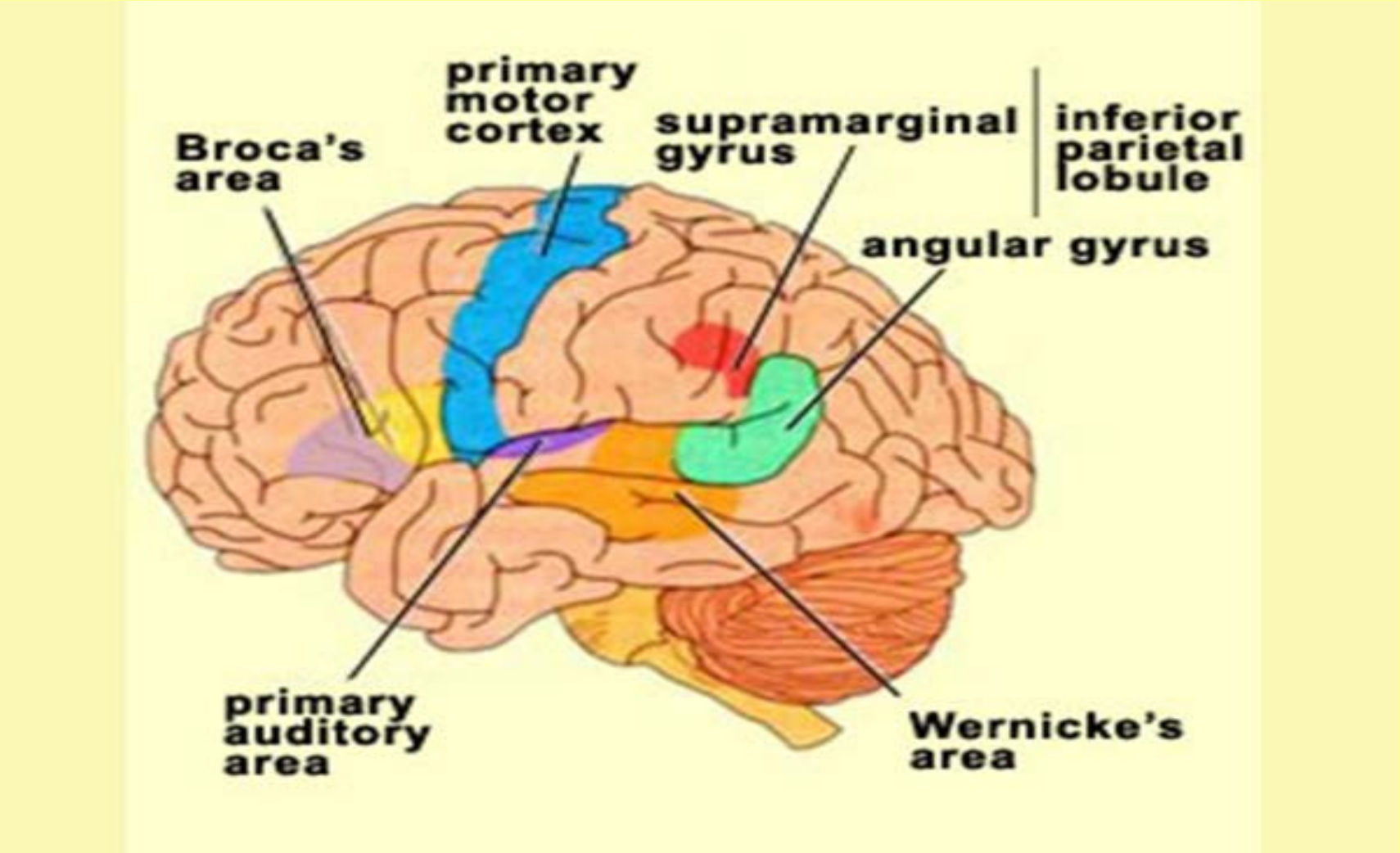

Micro-
electrode
Optic tract
Lateral
geniculate
body
Optic
radiations
Primary
visual
cortex

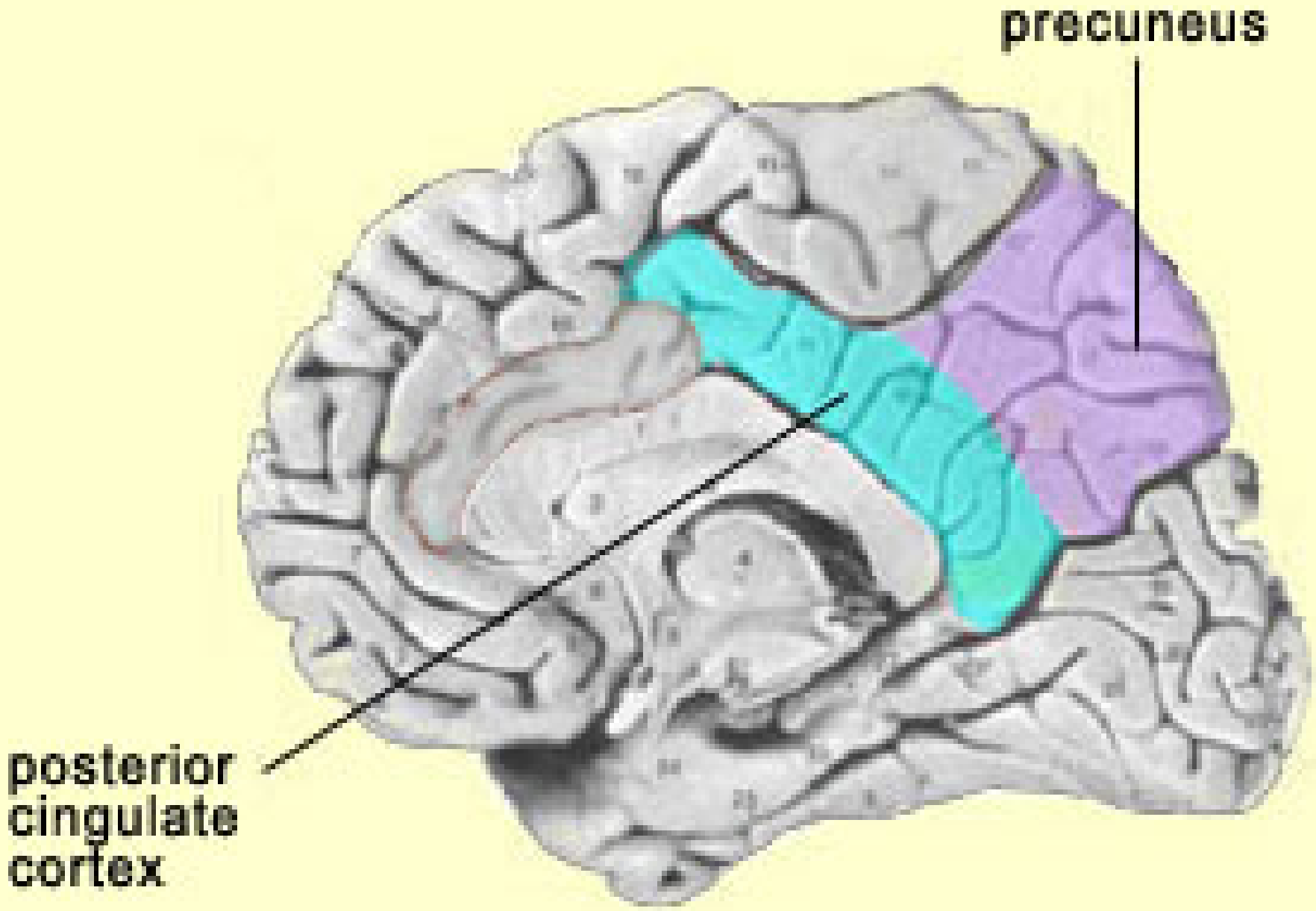
Language and self-awareness

by Alain Morin



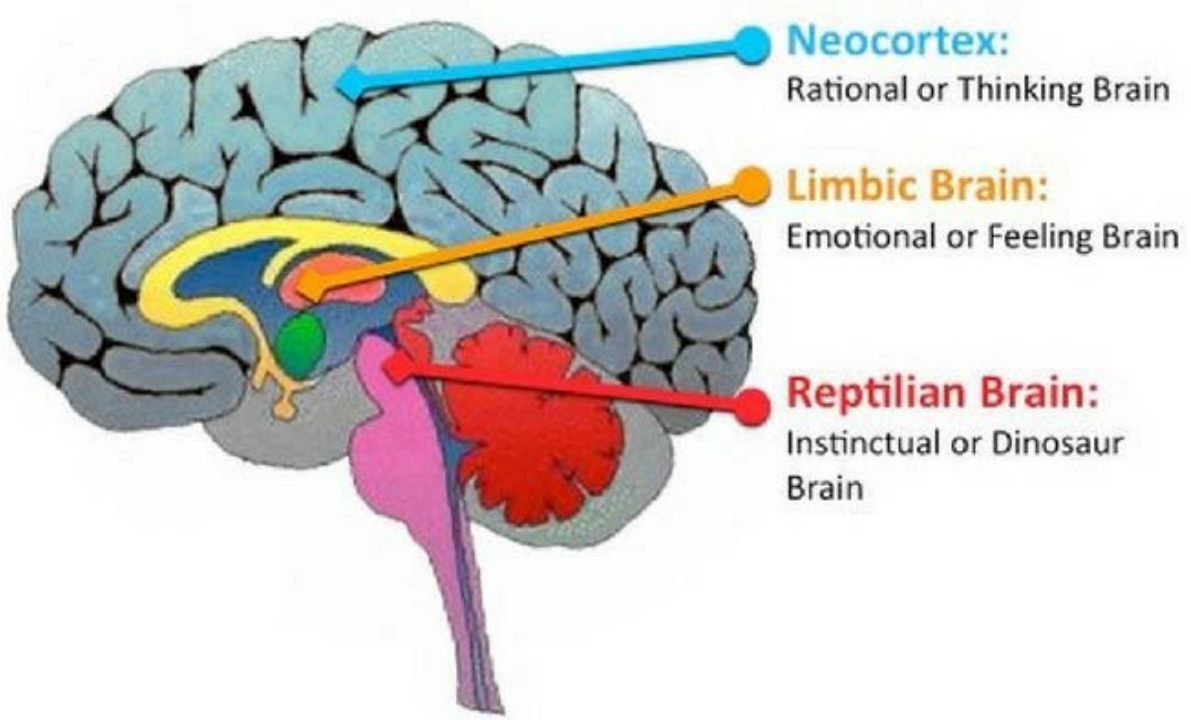
Phonological Loop



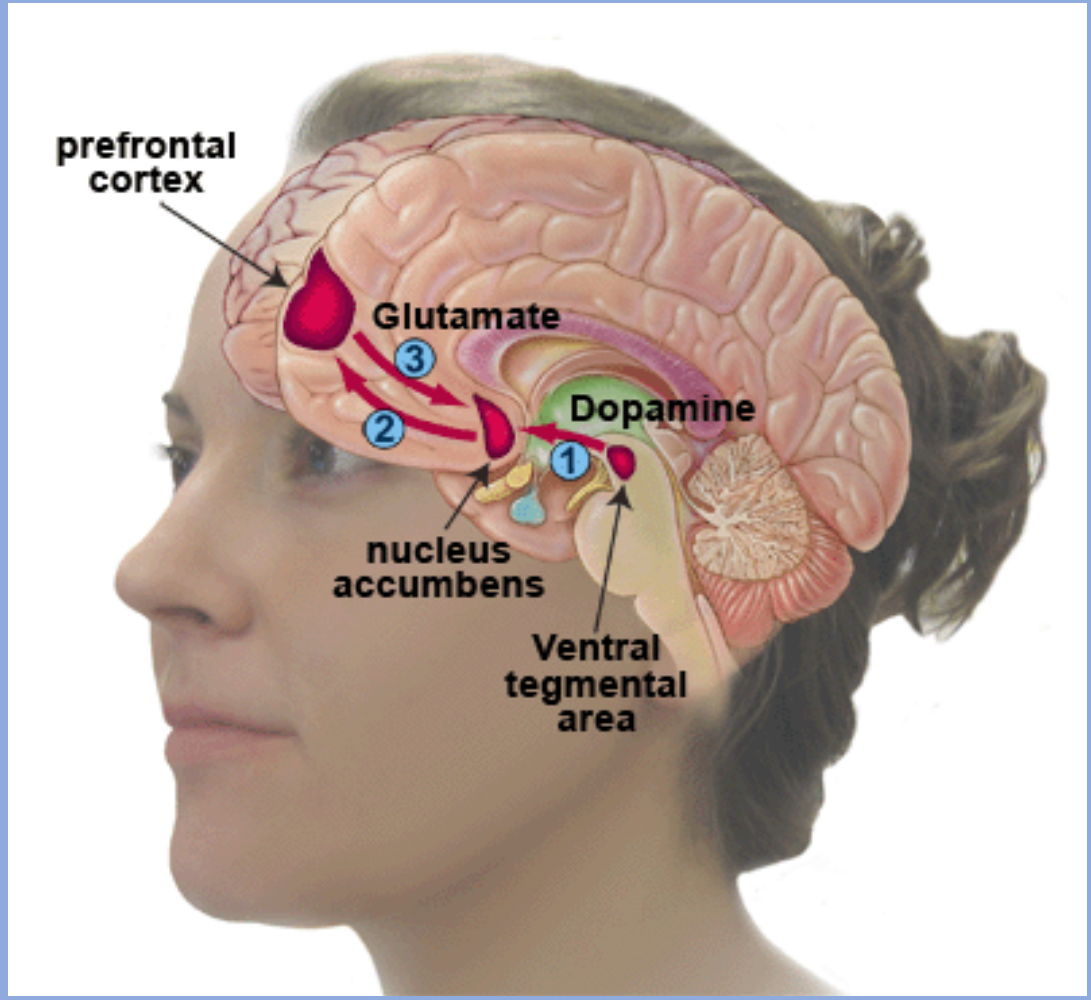

precuneus
posterior
cingulate
cortex

Your Actions Are Not Your Own

Your Three Brains

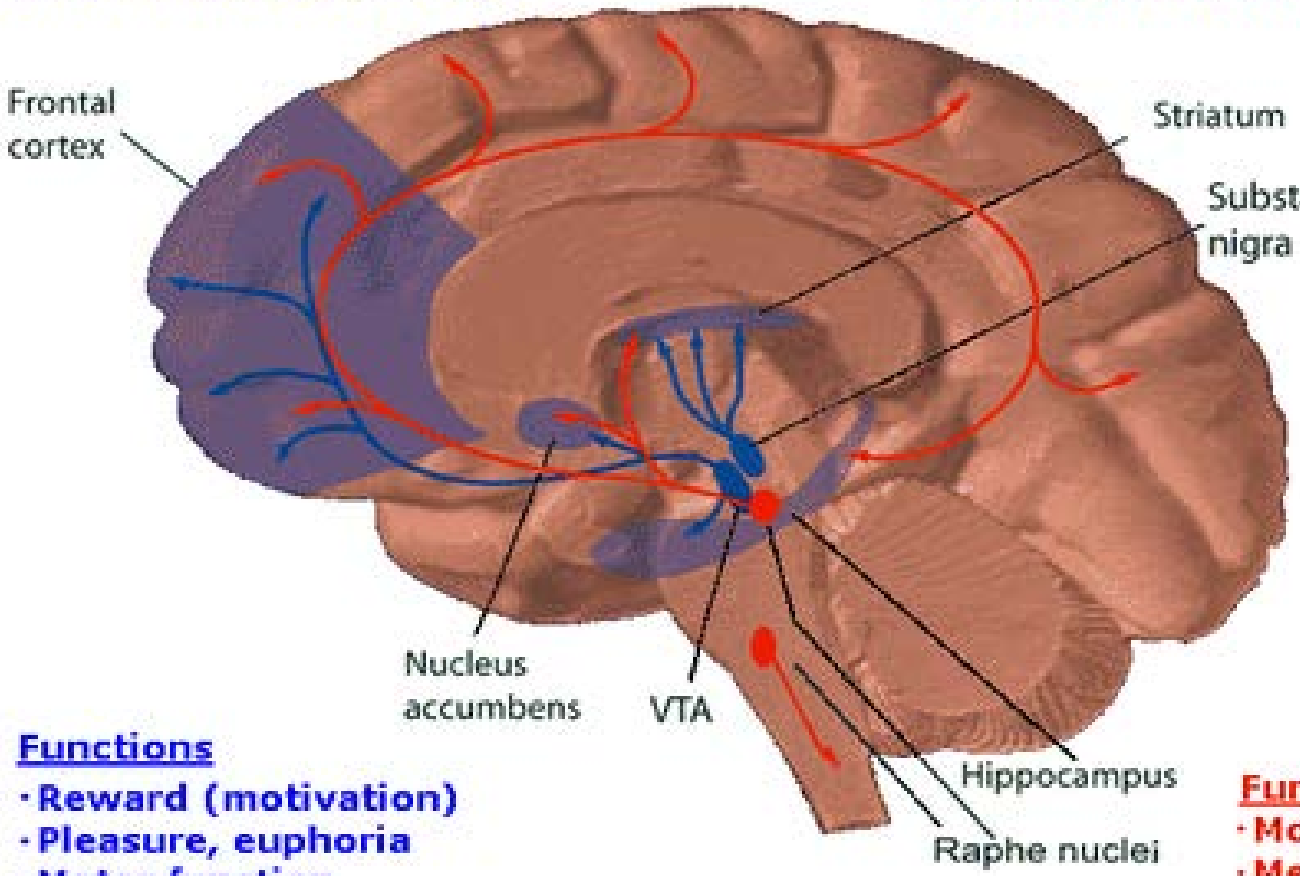


Dopamin Reward



Dopamine Pathways

Serotonin Pathways



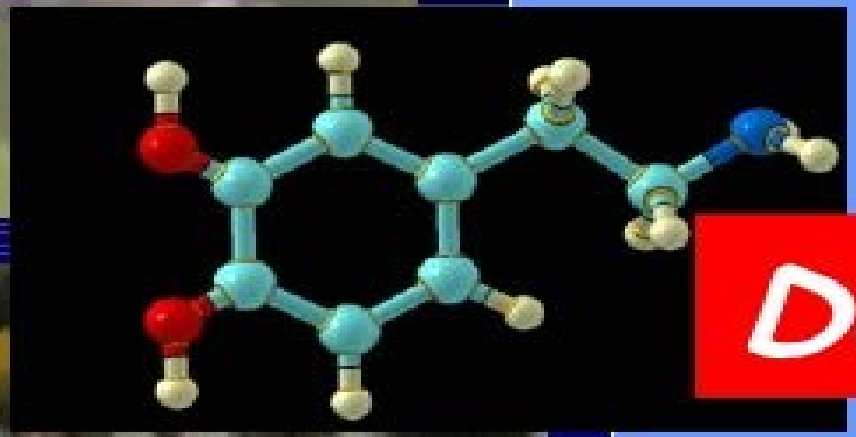
Functions

- Reward (motivation)
- Pleasure, euphoria
- Motor function (fine tuning)
- Compulsion
- Perseveration

Functions

- Mood
- Memory processing
- Sleep
- Cognition

movimiento

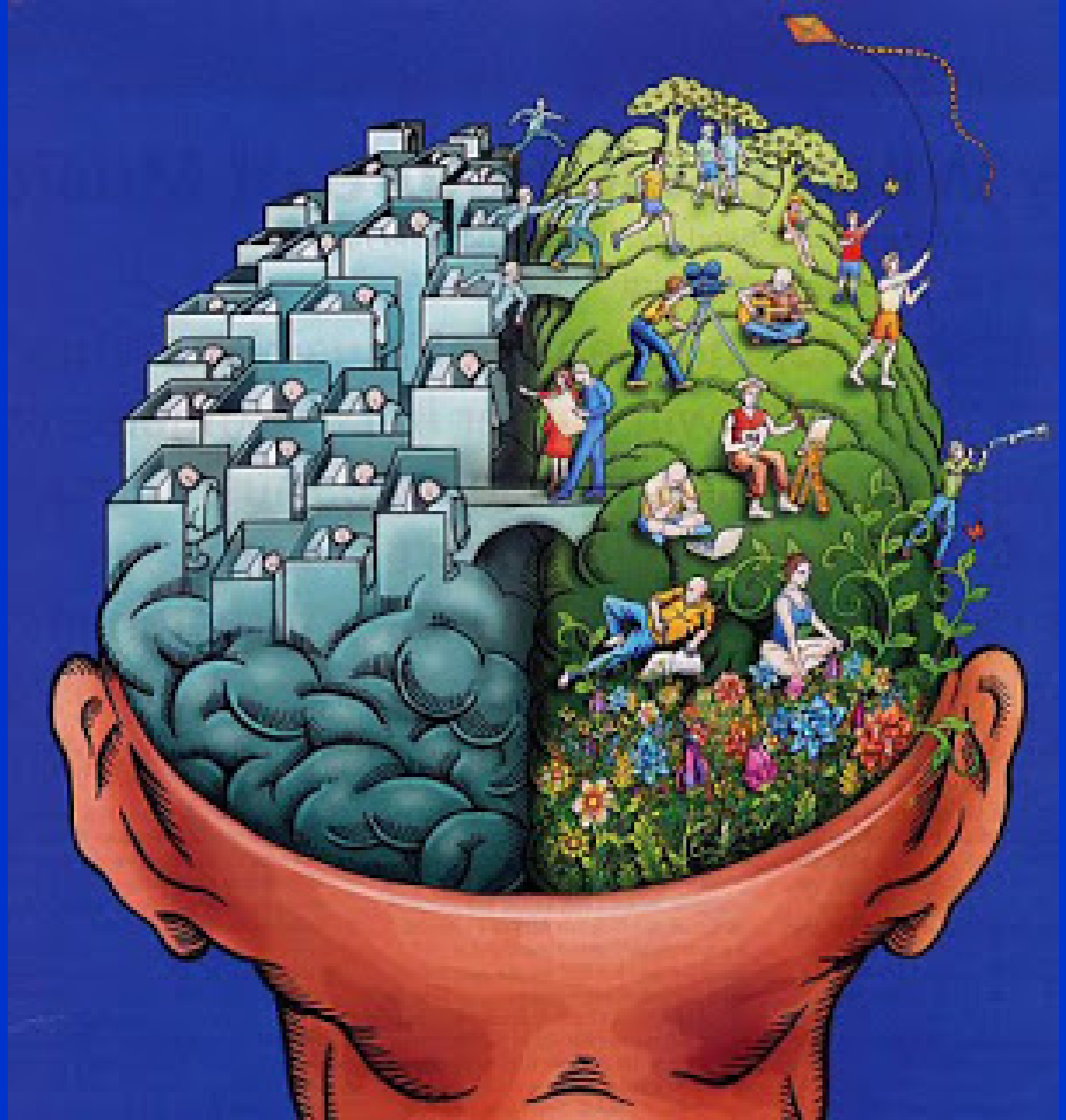


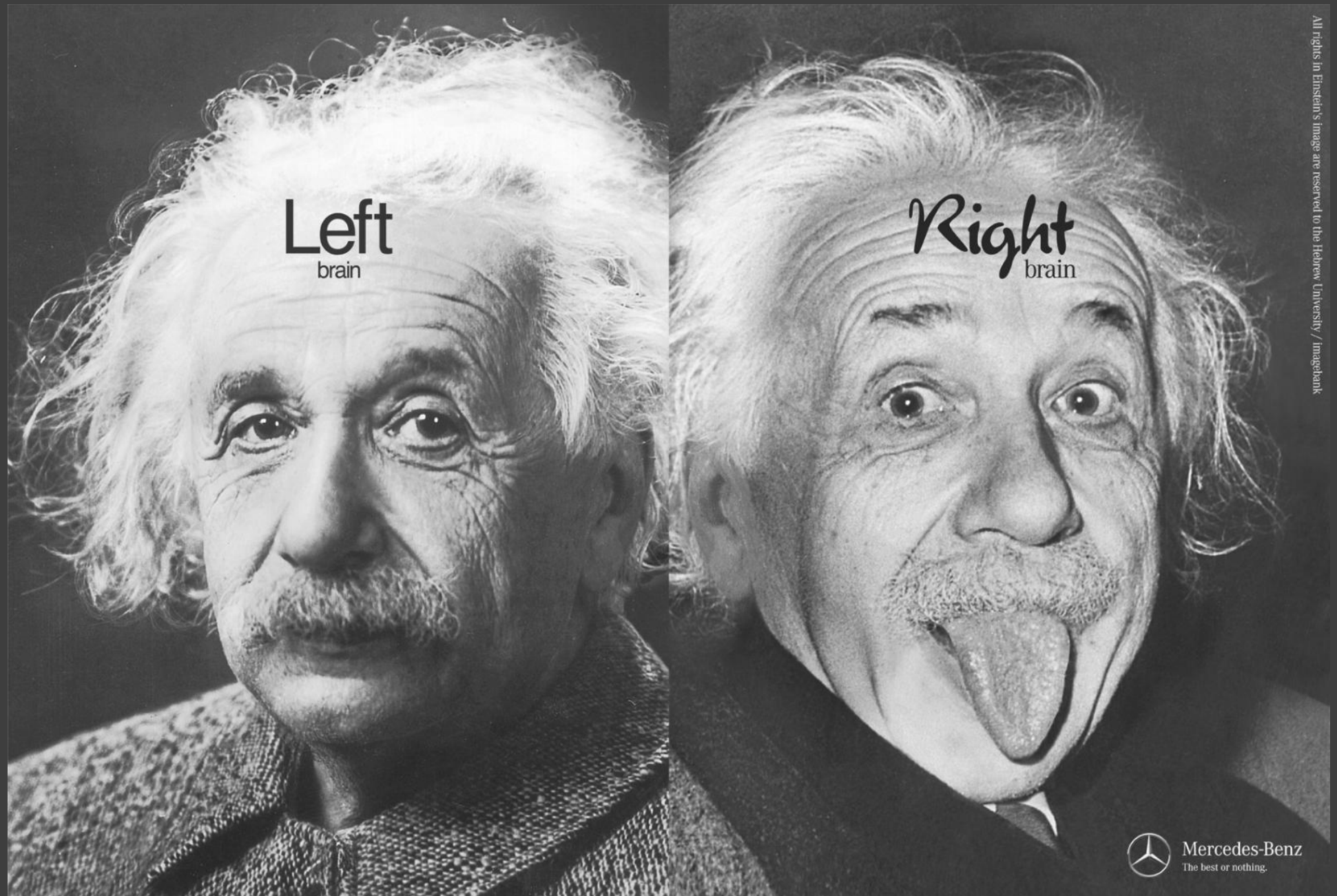
motivación

Dopamina

adicción

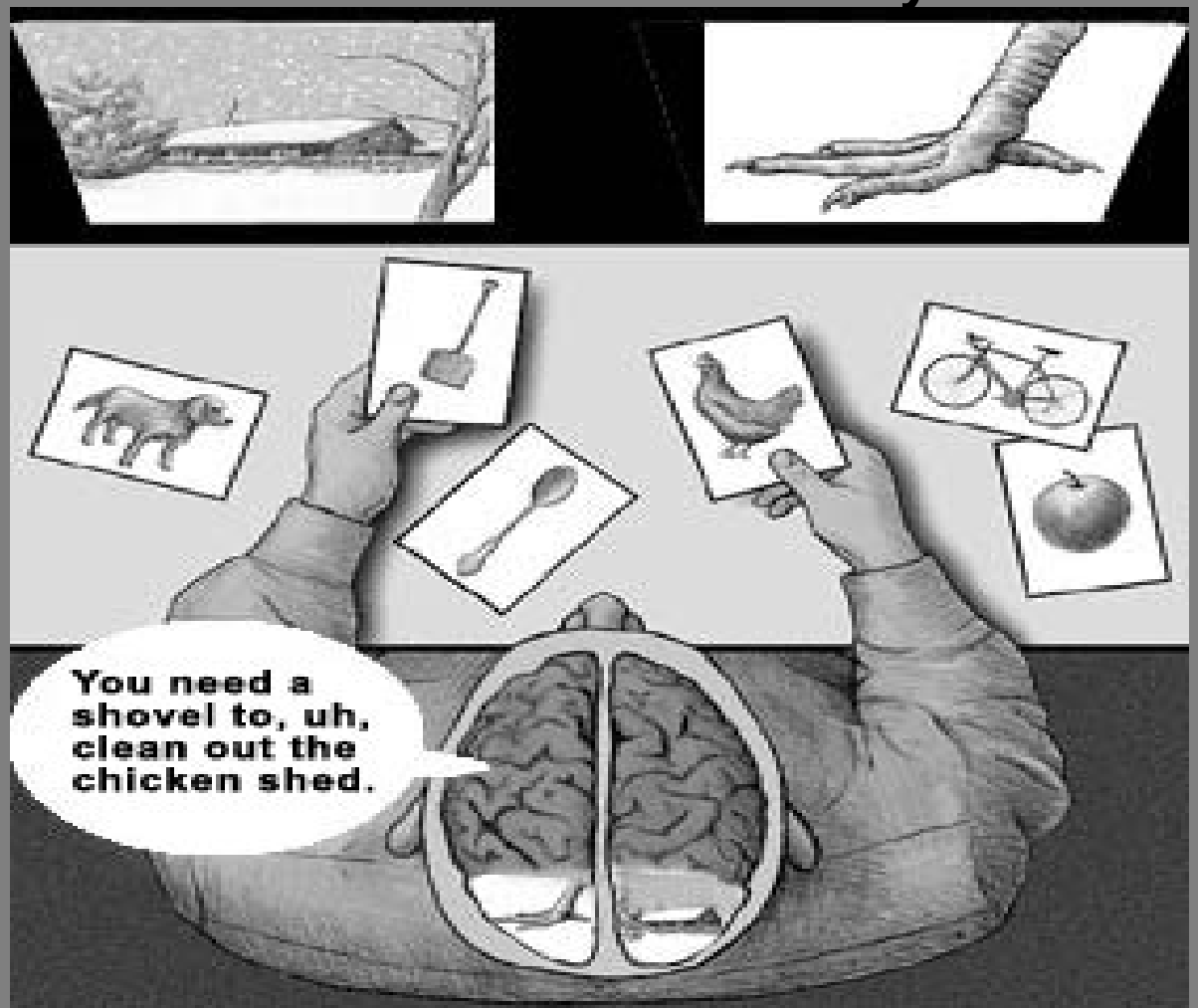
Recompensa y bienestar




Left
brain
Right
brain
All rights in Einstein's image are reserved to the Hebrew University / imagebank
Mercedes-Benz
The best or nothing.

What a patient with a split brain answers when asked to explain why his left hand chose the picture of the shovel.

Illustration: Joan M.K. Tycko

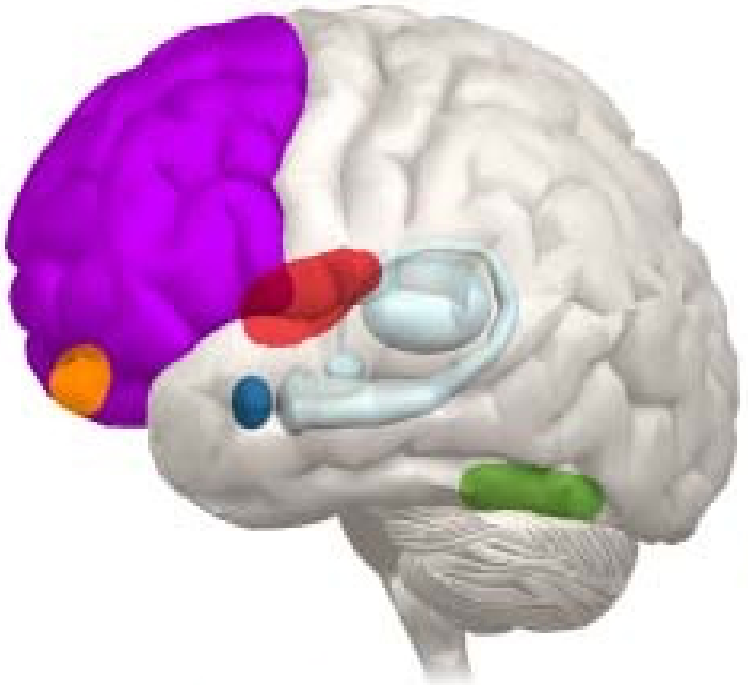


Movies on the brain

©NewScientist

Scanning the brains of people as they watch a film may allow movie-makers to gauge the viewers' innate reaction to the footage

Frontal cortex
ATTENTION
Enables a viewer to understand consequences of actions



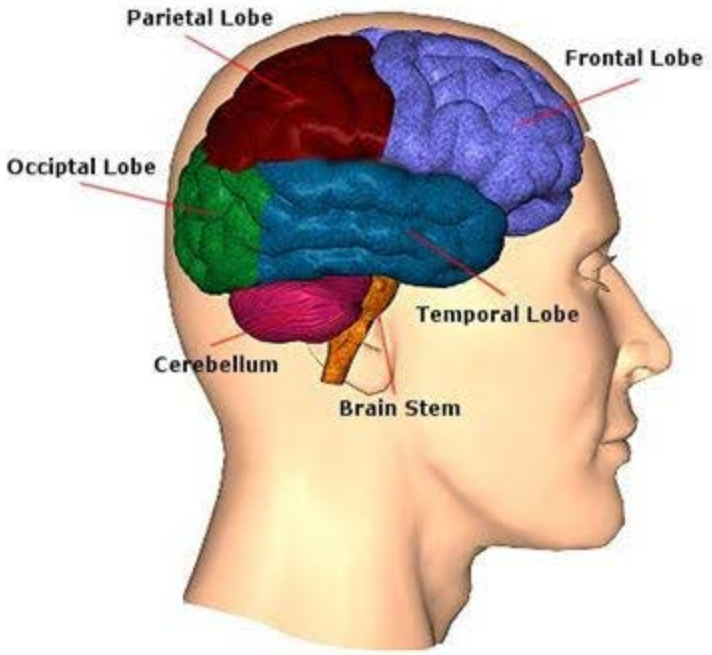
Insula
EMOTION
Involved in empathy and compassionate responses

Ventromedial prefrontal cortex
SELF-AWARENESS
Activity here likely means the film is "speaking" to the viewer

Amygdala
EMOTION AND MEMORY
Particularly active while experiencing threat or fear

Fusiform gyri
FACIAL RECOGNITION
Have a role in understanding facial expressions

The Frontal Lobes



"Thinking" Brain

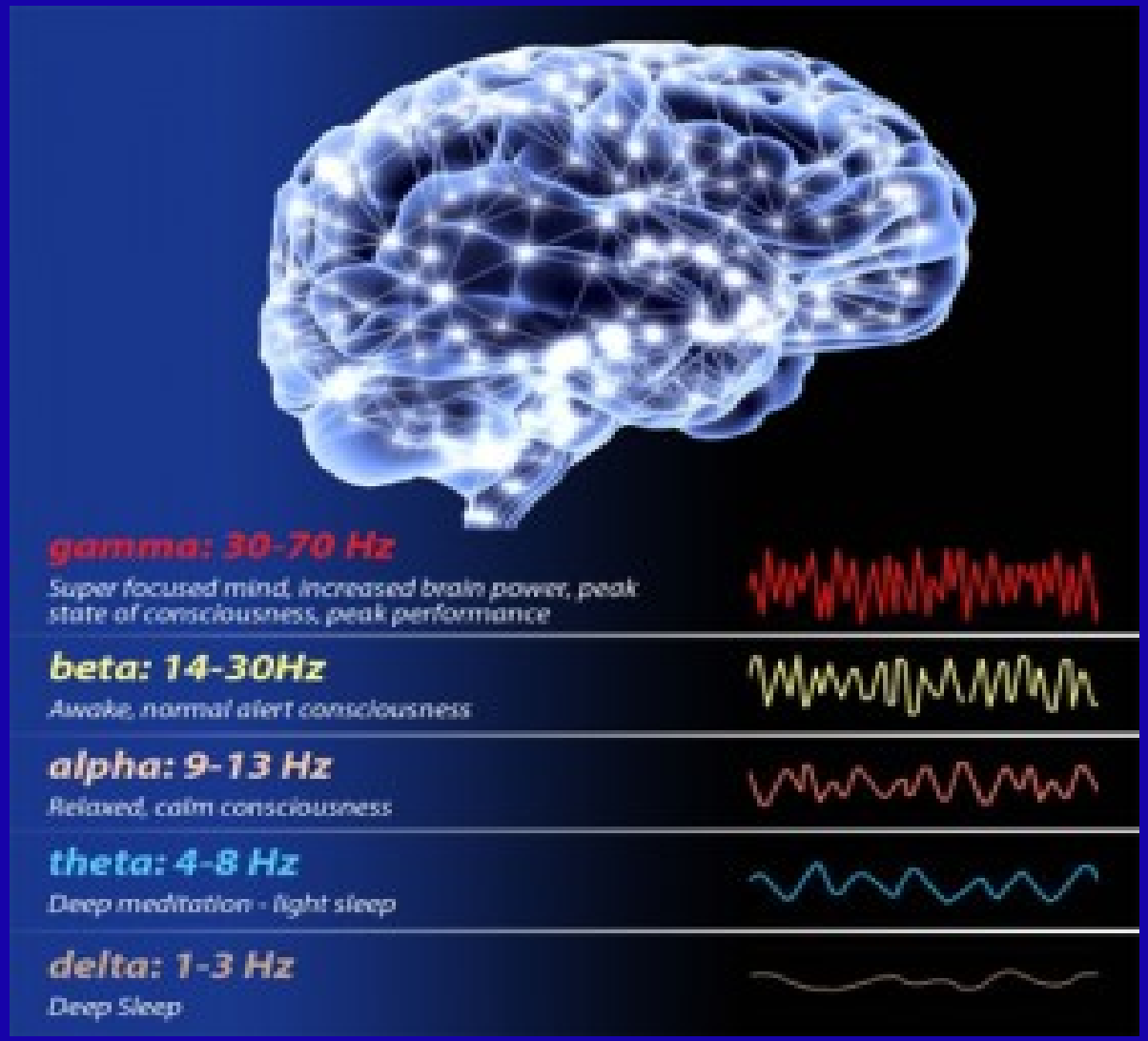
- Governing emotions
- Judgment
- Planning
- Organization
- Problem Solving
- Impulse Inhibition
- Abstraction
- Analysis/synthesis
- Self-awareness*
- Self-concept*
- Identity
- Spirituality


WHO SAYS MEDITATION IS A SPIRITUAL ACTIVITY?
Meditation, Stage 1 Separation of the spirit-body, for independent existence

To be aware of the breath

To be aware to the movement of life

Meditation & EEG



EEG in Meditating State

1. Increased alpha rhythm
2. Plotting is slower overall
3. Alpha wave amplitude increases
4. More coherence
5. Displacement of the electrical activity from left to right hemisphere with increasing synchronization
6. Increasing Alpha wave coherence

With progression of meditation

The Alpha rhythm becomes Theta in some areas of the neocortex

Delta Rhythm in Occipital Lobe

Concomitant with this EEG pattern: arousal of deep joy, perfect orientation and lucidity

MEDITATION

1. Sensed Presence

2. Improved psychological skills during meditation

3. Activation of the ‘Inner Observer’

MEDITATION

1. Increased surveillance
2. Deep physiological relaxation
3. Decreased cardiac work
4. Increased cerebral flow and EEG synchrony
5. Decreased basal metabolism and muscle breakdown
6. Increased Grey Matter & Altruism

Biological Effects of Meditation

1. Predominantly parasympathetic system
2. Decreased heart rate
3. Decreased blood pressure
4. Decreased blood lactic acid
5. Decreased electrical resistance of the skin

Neuroimaging Studies

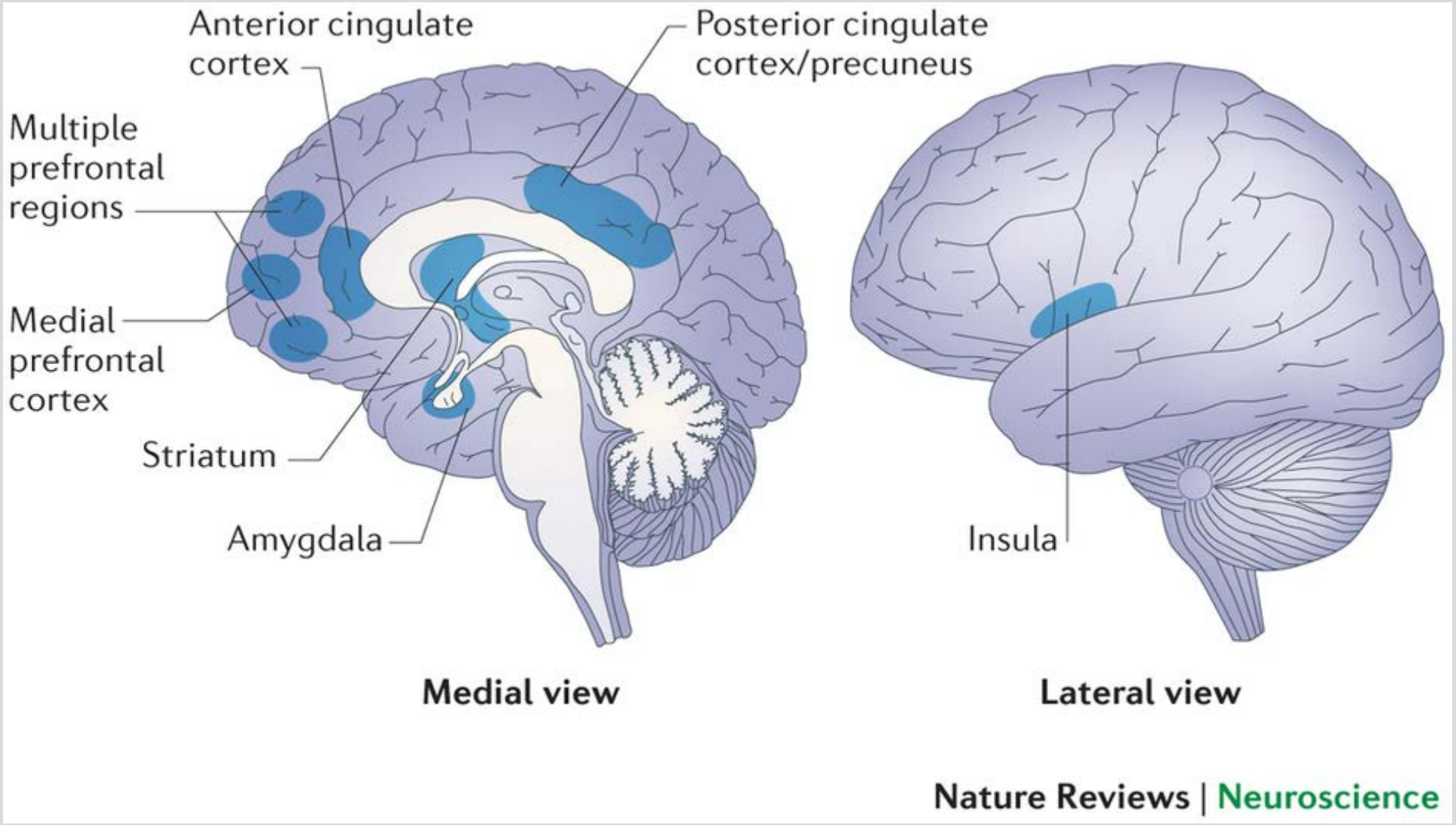
PET Positron Emission Tomography
fMRI functional Magnetic Resonance Imaging

Areas active during meditation:

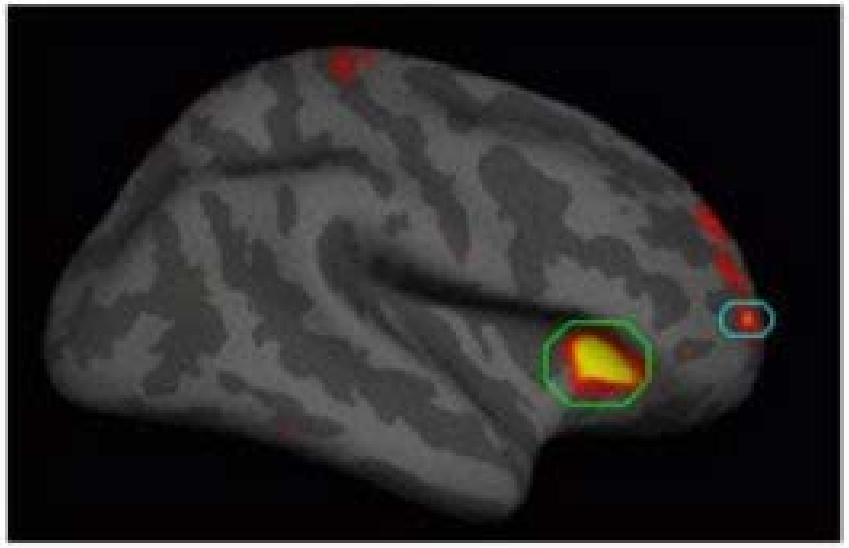
1. In the fronto-parietal lobes
2. Striatum
3. In the anterior cingulate cortex of the right hemisphere
4. In the dorsolateral cortex
6. Insula

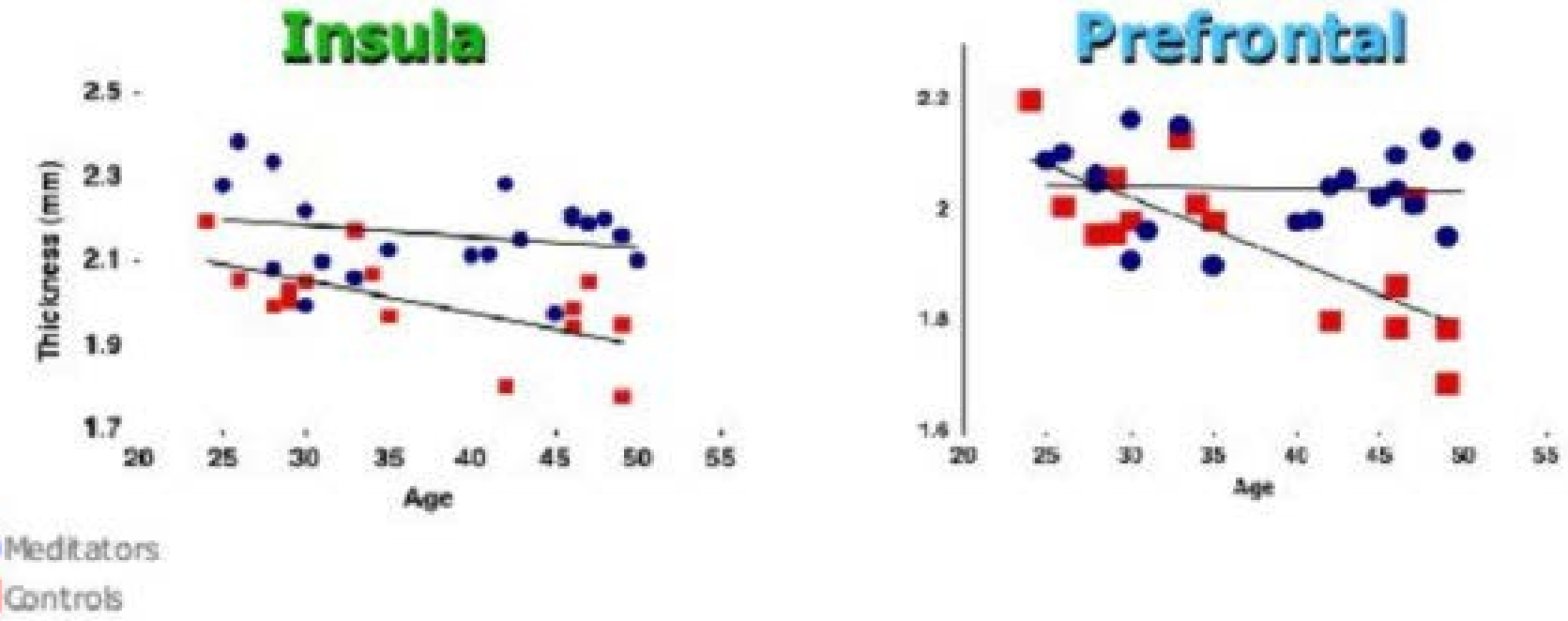
RIGHT HEMISPHERE

1. SILENT
2. PEACEFUL
3. CONNECTED WITH IMMENSITY
4. POWERFUL
5. CREATIVE


Anterior cingulate cortex
Posterior cingulate cortex/precuneus
Multiple prefrontal regions
Medial prefrontal cortex
Striatum
Amygdala
Insula
Medial view
Lateral view
Nature Reviews | Neuroscience

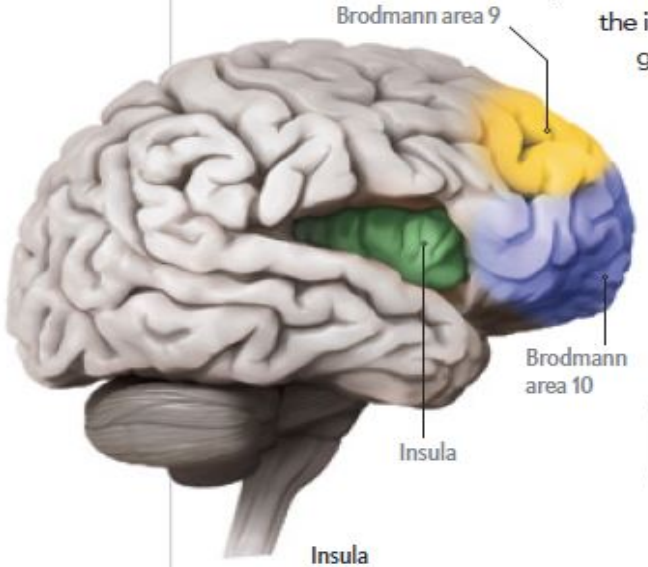
Cortical areas thicker in meditators

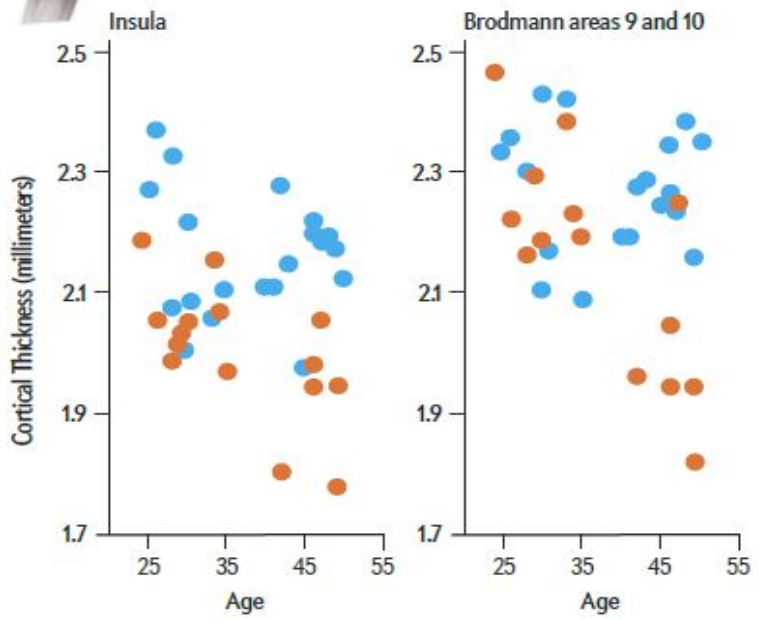


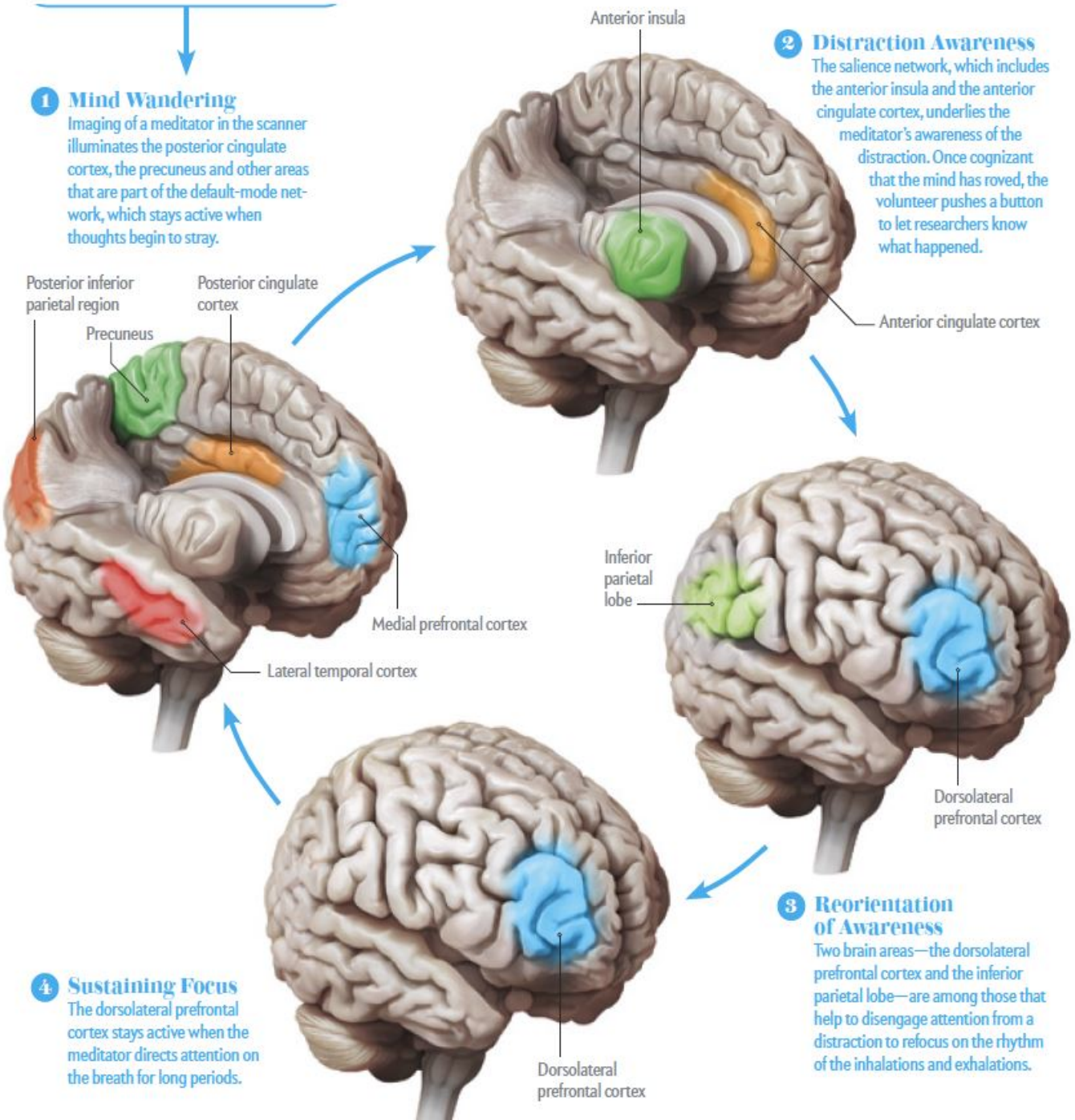


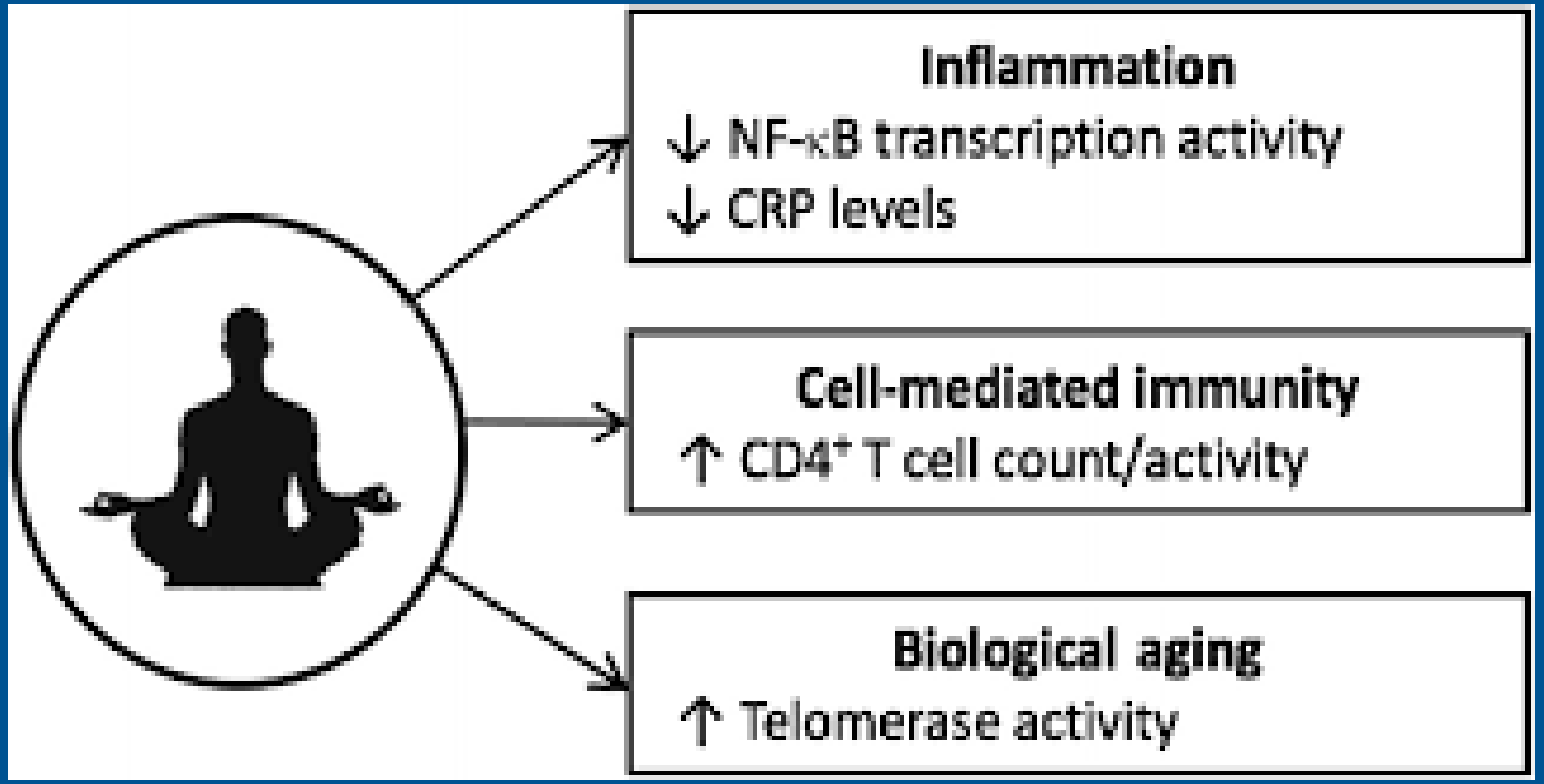
Grow More Brain

Researchers from several universities explored whether meditation might bring about structural changes in brain tissue. Using magnetic resonance imaging, they found that 20 experienced practitioners of one type of Buddhist meditation had a greater volume of brain tissue in the prefrontal cortex (Brodmann areas 9 and 10) and the insula than a control group did (*graphs*). These regions play a role in processing attention, sensory information and internal bodily sensations. Future long-term studies will be needed to confirm this finding.

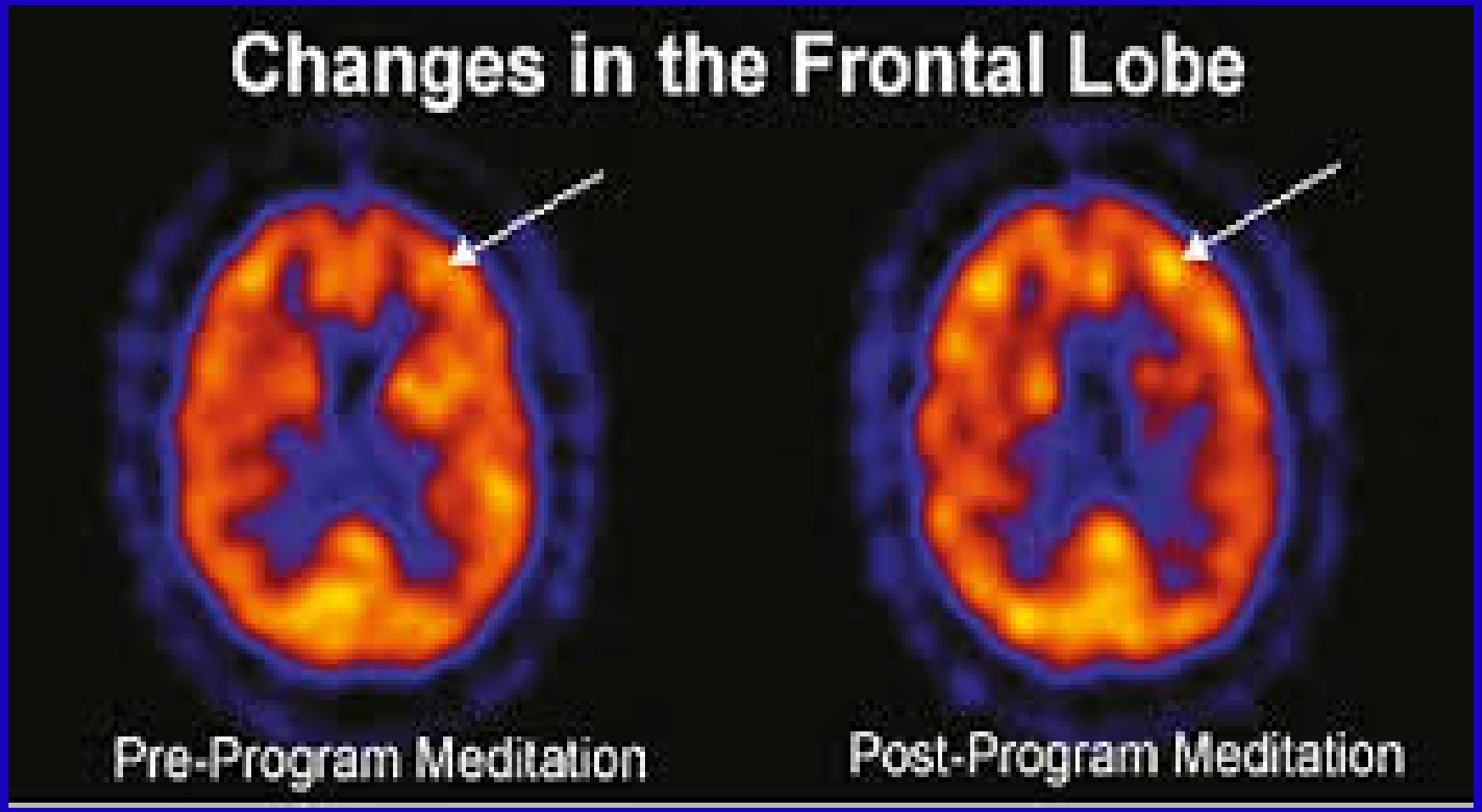





1 Mind Wandering
Imaging of a meditator in the scanner illuminates the posterior cingulate cortex, the precuneus and other areas that are part of the default-mode network, which stays active when thoughts begin to stray.
Posterior inferior parietal region
Posterior cingulate cortex
Precuneus
Medial prefrontal cortex
Lateral temporal cortex
2 Distraction Awareness
The salience network, which includes the anterior insula and the anterior cingulate cortex, underlies the meditator's awareness of the distraction. Once cognizant that the mind has roved, the volunteer pushes a button to let researchers know what happened.
Anterior insula
Anterior cingulate cortex
Inferior parietal lobe
Dorsolateral prefrontal cortex
3 Reorientation of Awareness
Two brain areas—the dorsolateral prefrontal cortex and the inferior parietal lobe—are among those that help to disengage attention from a distraction to refocus on the rhythm of the inhalations and exhalations.
Dorsolateral prefrontal cortex
4 Sustaining Focus
The dorsolateral prefrontal cortex stays active when the meditator directs attention on the breath for long periods.

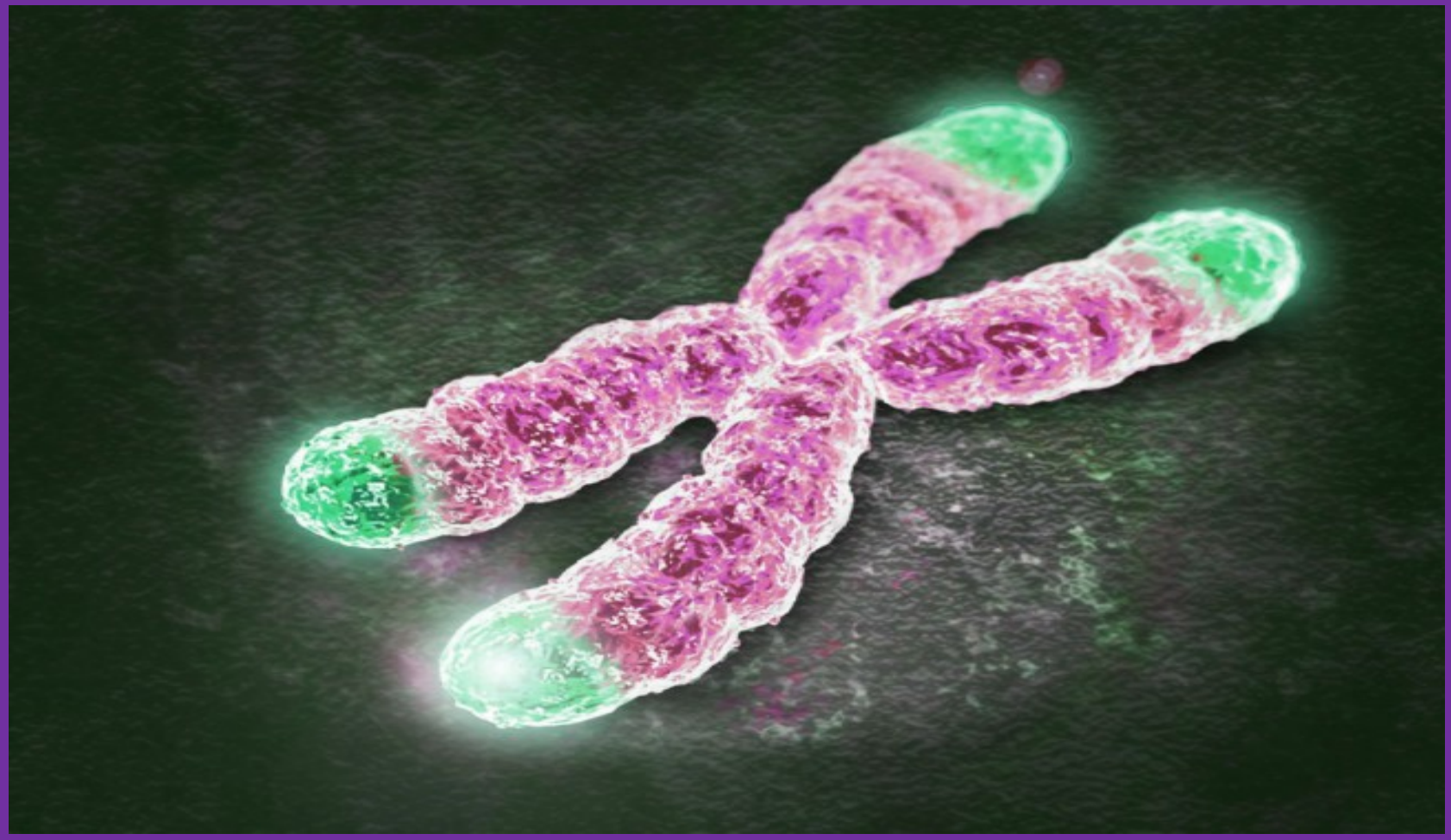

Inflammation
↓ NF-κB transcription activity
↓ CRP levels
Cell-mediated immunity
↑ CD4+ T cell count/activity
Biological aging
↑ Telomerase activity

Meditation & Neuroplasticity

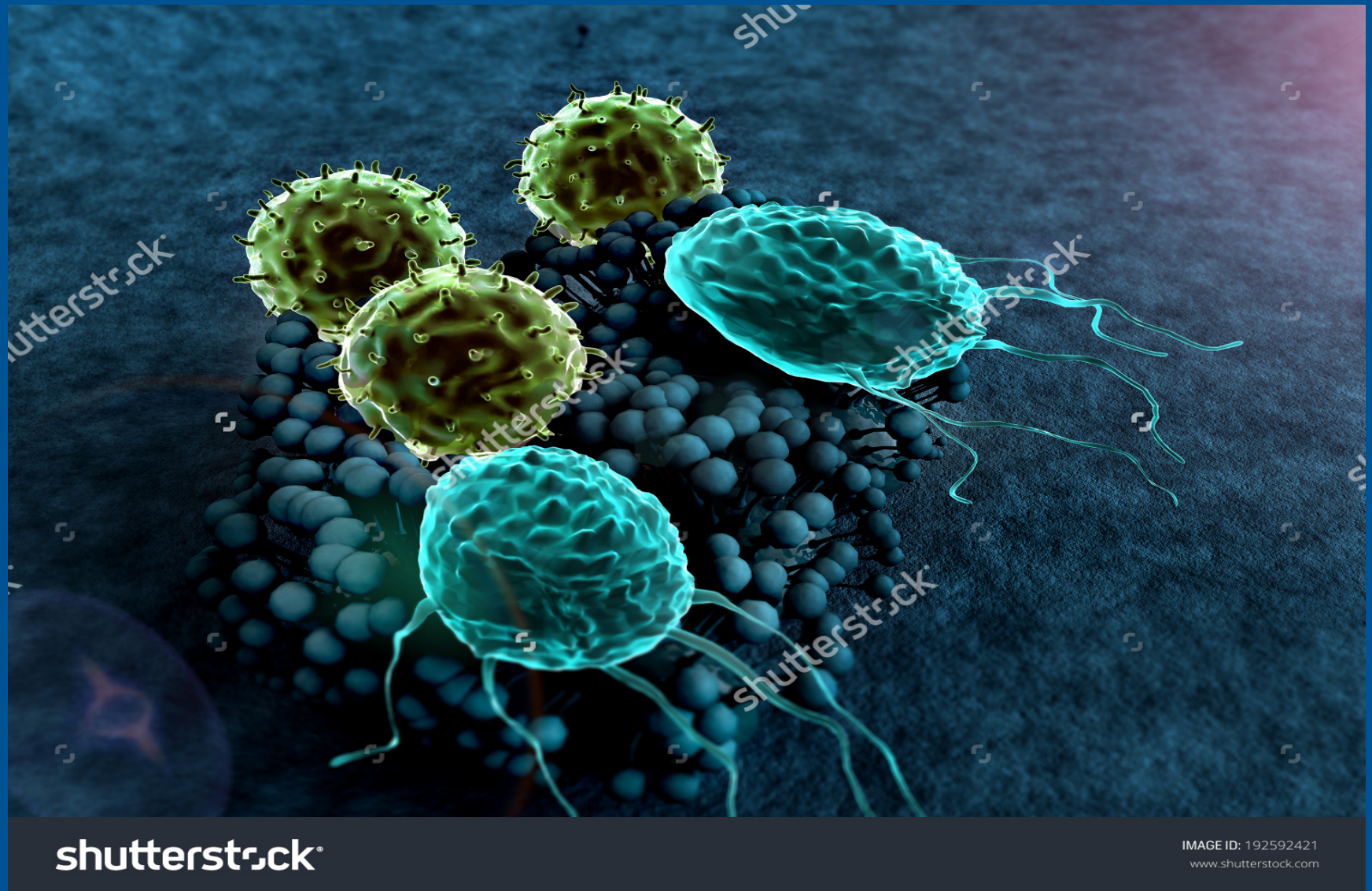


Meditation & Telomerase Activity

Meditation and Telomere Length

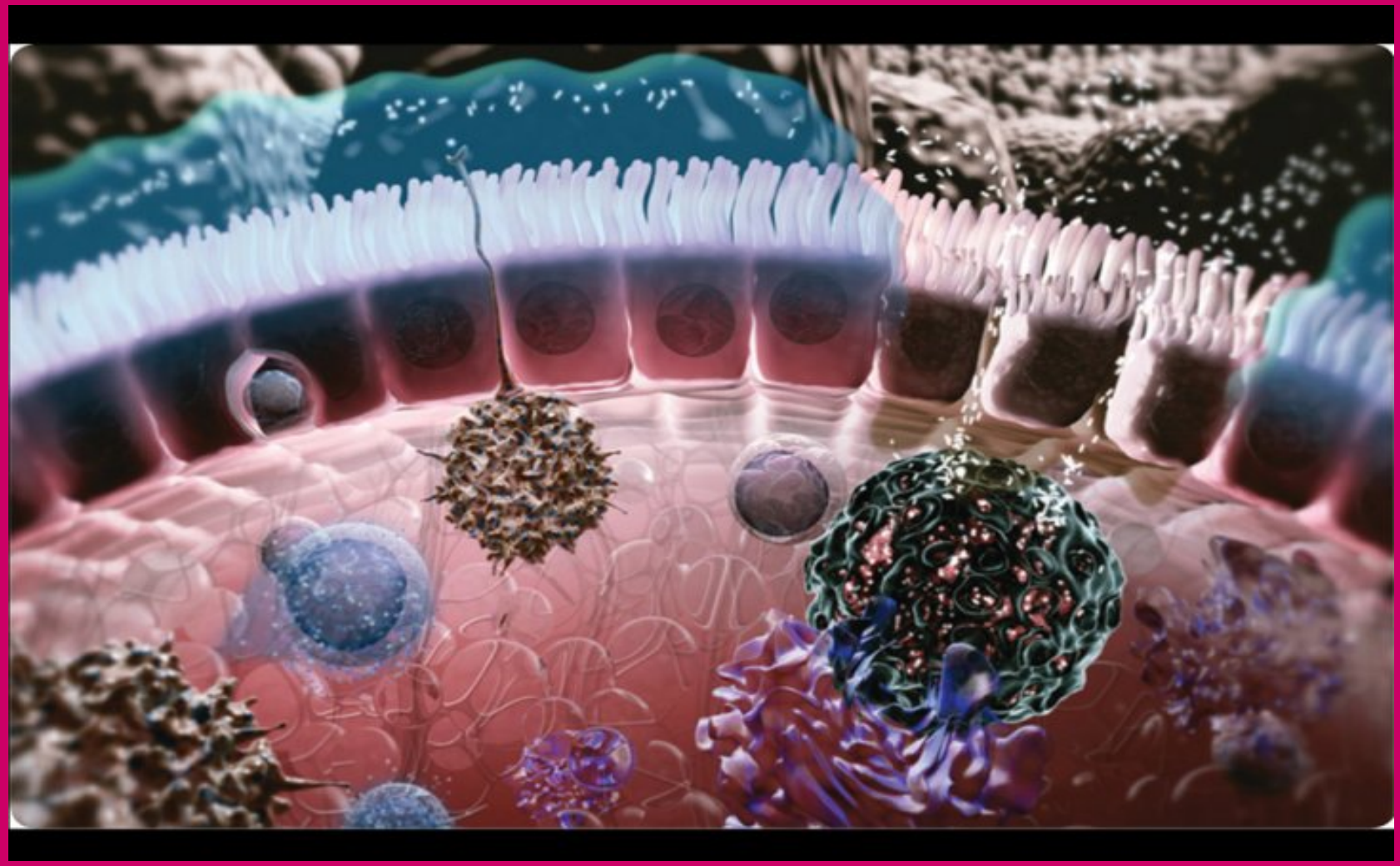


Meditation & Immune System



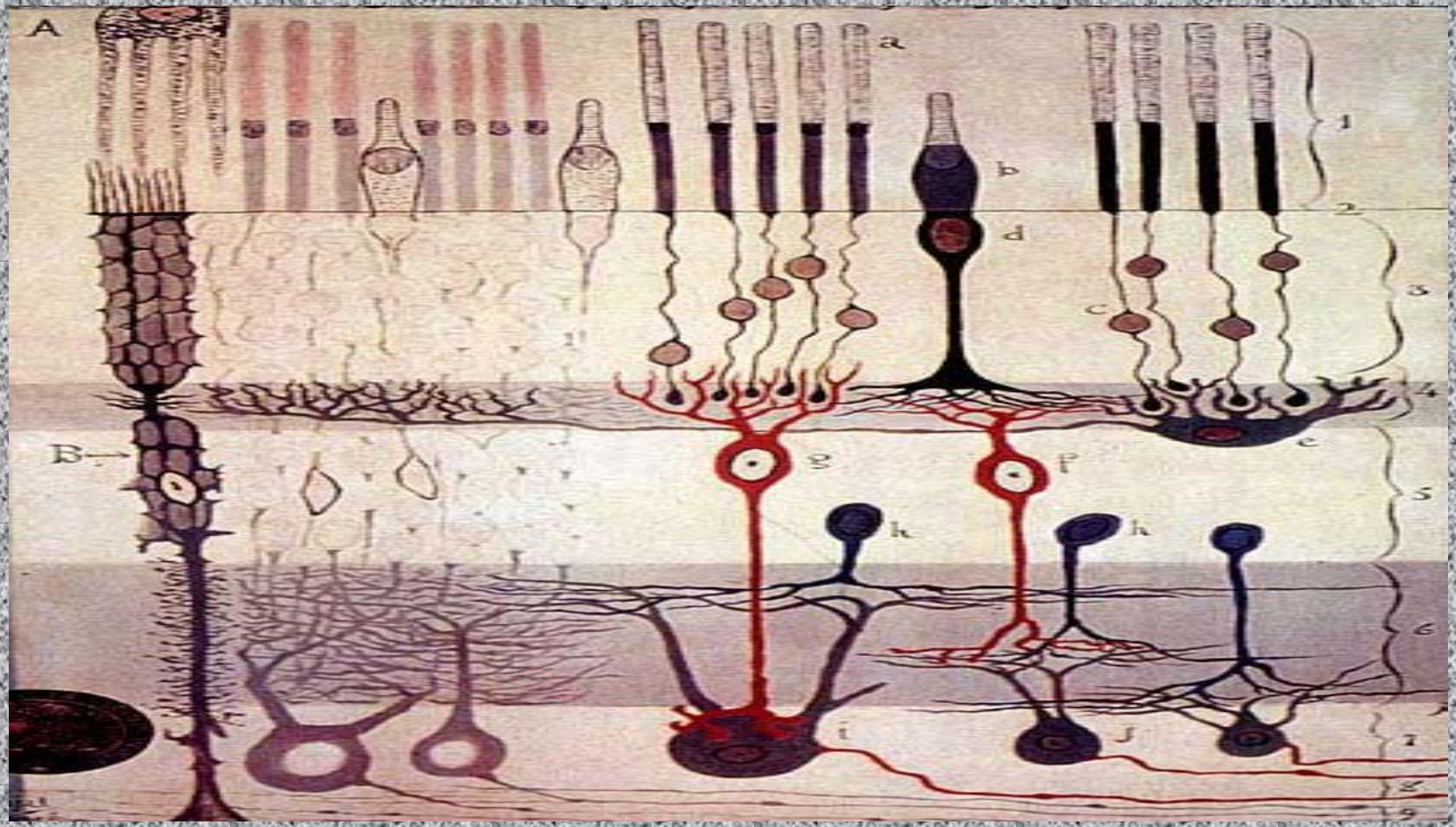
Meditation & Visualization

Meditation & Inflammatory Process



Creative Visualization

Thought modifies Biology



Hans Seyle

“ The physiological effects of meditation on metabolism, respiration, the electrical resistence of the skin, ECG, lactic acid levels in blood and the cardiovascular system are exactly opposite to those identified by the scientific investigation how caracteristic of the stress response”

MEDITATION

- From a reductionist point of view meditation is a neurological process.
- The brain presents a particular pattern of behaviour.
- This patter is exclusive of the meditation state.

Areas Active during Meditation PET (Positron Emission Tomography)

Measurement vascular flow increases:

- In the fronto-parietal lobes
- In the occipital region (Rhytm Delta)
- In the pars caudalis of the anterior cingulate sulcus of the right hemisphere
- In the insula

The Hypothalamic Pituitary Adrenal Axis

- The endocrine system is modified during meditation
- Effects on the neuroendocrine axis
- DHEA
- Melatonine
- Overall slowing of metabolism with decreased cholesterol y triglyceride
- Reduced glycolytic degradation
- Reduced level of cortisol

HOW THE BRAIN PROCESS THE INFORMATION

Neocortex activating process:

The brain create his reality in a dynamic and shifting process. This reality is conditioned by:

- **the flow of thougths**
- **interest**
- **memory**
- **attention**
- **anatomical and functional integrity of the brain**

Awareness
"It's a Process, not a Thing"

- Both hemispheres create different realities.
- The conscious state is dynamic.
- It is process that makes conscious the information bits of neurons
- It depends on the level of neuronal activation
- Different conscious states

Attention is a Process

1. Reticular Activating System
2. Neurotransmitters:
   Acetilcoline
   Norepinefrine
   Dopamine,
   Serotonine
   Adrenalin
3. Arousal System

Neocortex Activating Process

The brain create his reality in a dynamic and shifting process

The different areas of the brain must to be activated to make conscient the bits of information

The activation depends of the level of the attention

Homo sapiens

- Apear since 160.000 years ago
- From about 35.000 years ago Homo sapiens are leaving cultural testimonies
- The most significant is:
  the Verbal Language
- Over the millennia the size of our left hemisphere grew.

Noise vs. Silence

- The phonological loop needed more memory to properly process all the information.
- However, the right hemisphere phylogenetically was before more developed than the left.

Our Realty

- Over the millennia we have been enhancing the activity of the left hemisphere, especially the areas of Phonological Loop
- This made the fact that processes our conscious state is a fragmented reality

The Self

- **The left hemisphere is the self identification, self-consciousness.**
- **The self is separated from the rest of the cognitions and consequently the endless conflicts and wars caused by ideologies.**

Durig Meditation the Brain is:

- Timeless
- Silient
- Pacefully
- Connected with the Immensity
- Powerfull
- Creative

Inner Observer

Scientific research must present compelling arguments for a new education that considers all human aspects

The rigth hemisphere, the seat of the inner observer is only the eternal present and process a not separeted reality confirm with modern technologies during meditation

Sensed Presence

- During meditation improved psychological skills
- Increased observer presence

During Awareness

- The empathic brain establishes their relationships based on emotions and feelings
- It is the brain that was muted by the arrogance of knowledge
- The paradox is that it has the ability to be active while accessing programs of the left

It happened 2,500 years ago

They once asked Buddha: -what do you won with meditation?

Buddha replied: -Nothing...!
But let me tell you what I lost: Anger, anxiety, depression, insecurity, fear of old age, disease and death

Thank you very much !

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