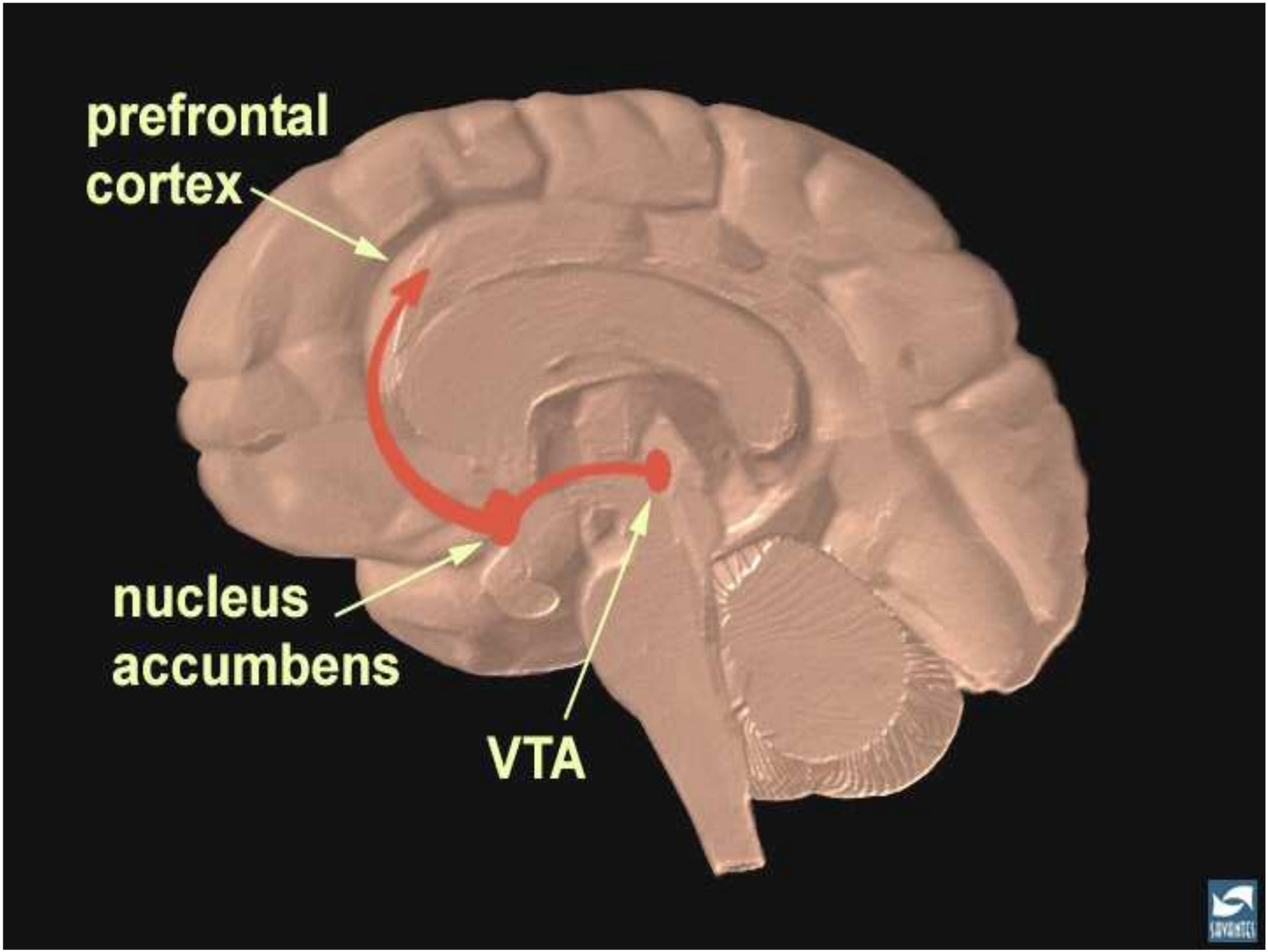
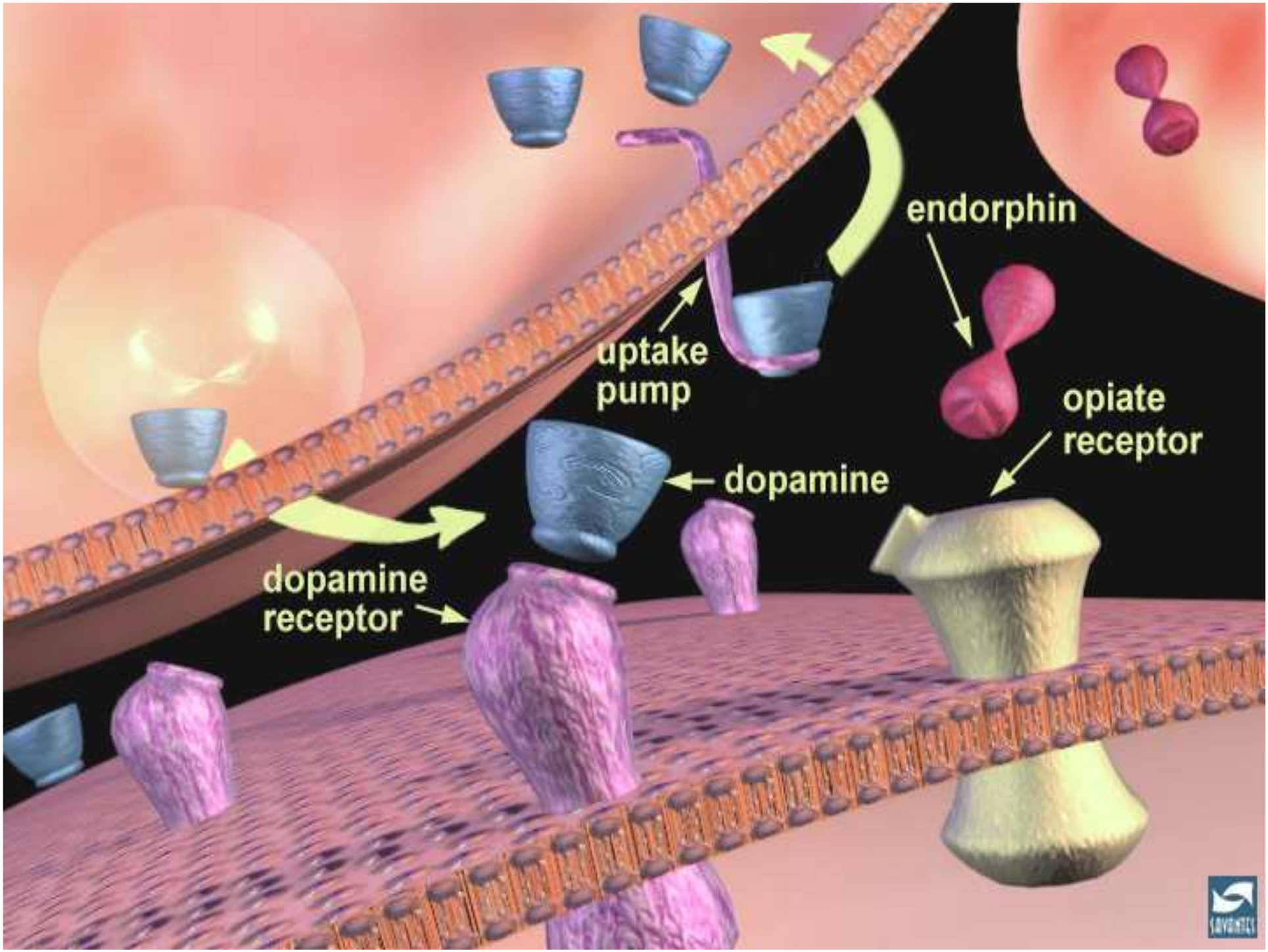
Addiction

A state in which an organism engages in a compulsive behavior

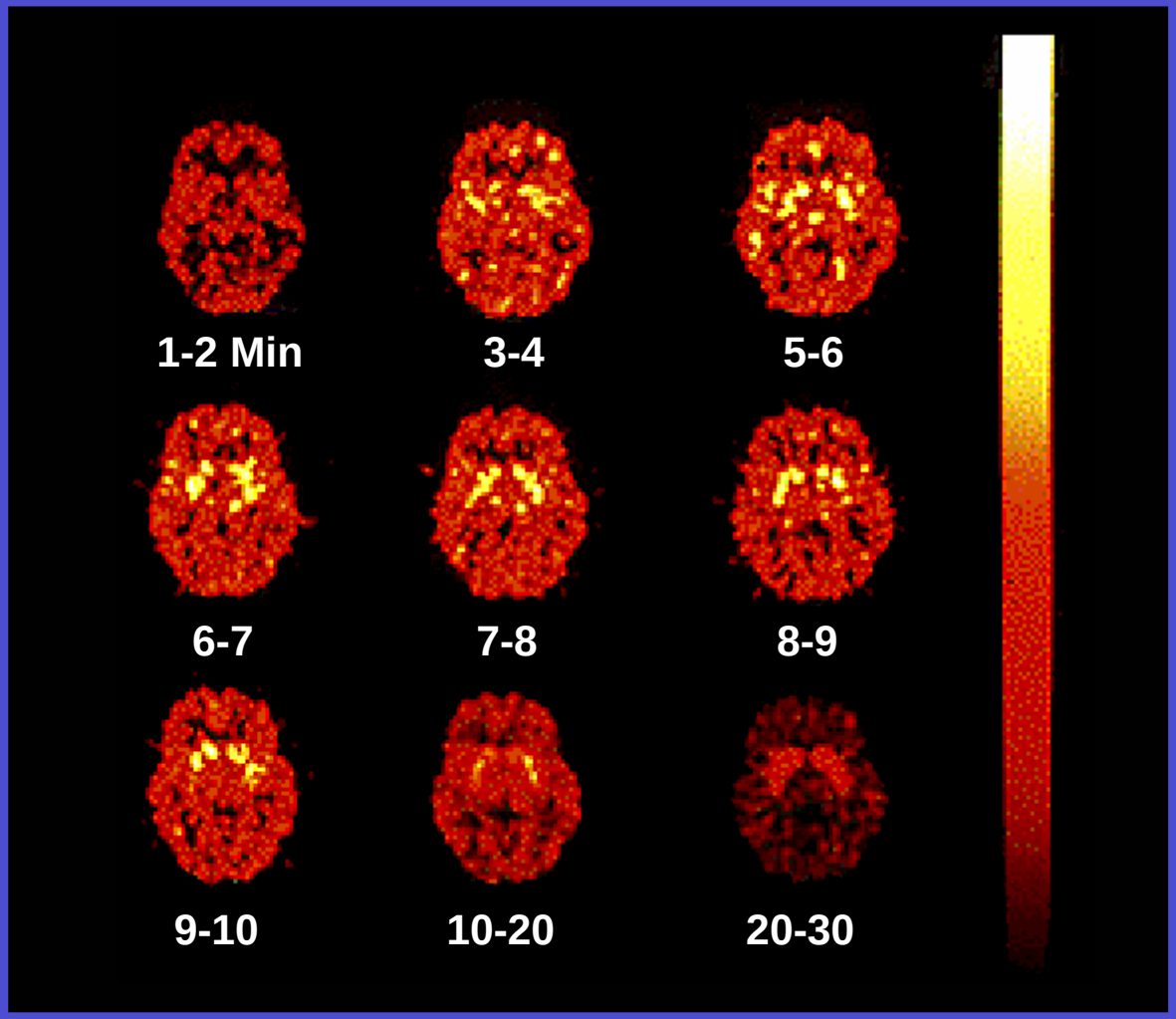
- behavior is reinforcing (rewarding or pleasurable)
- loss of control in limiting intake


prefrontal
cortex
nucleus
accumbens
VTA


endorphin
uptake
pump
opiate
receptor
dopamine
dopamine
receptor

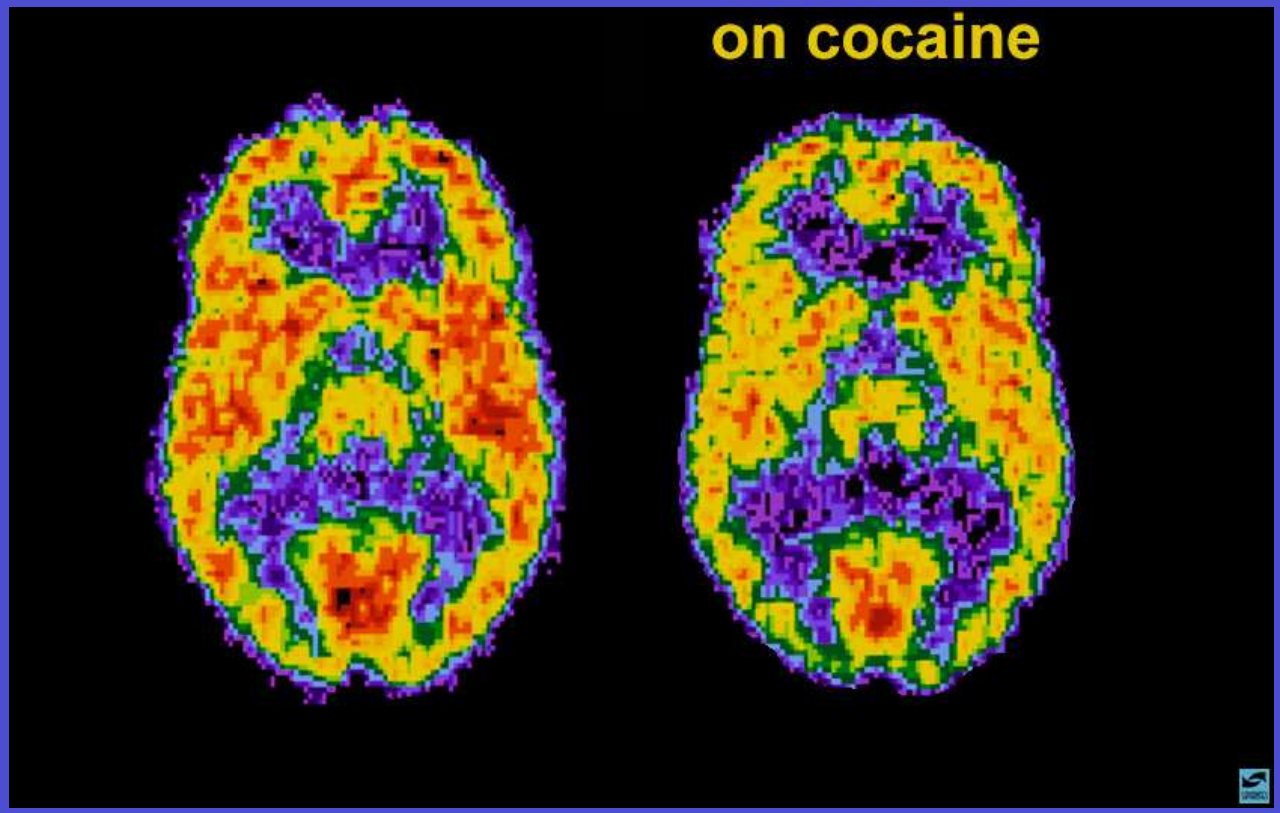
Positron Emission Tomography (PET)

Brain on Cocaine

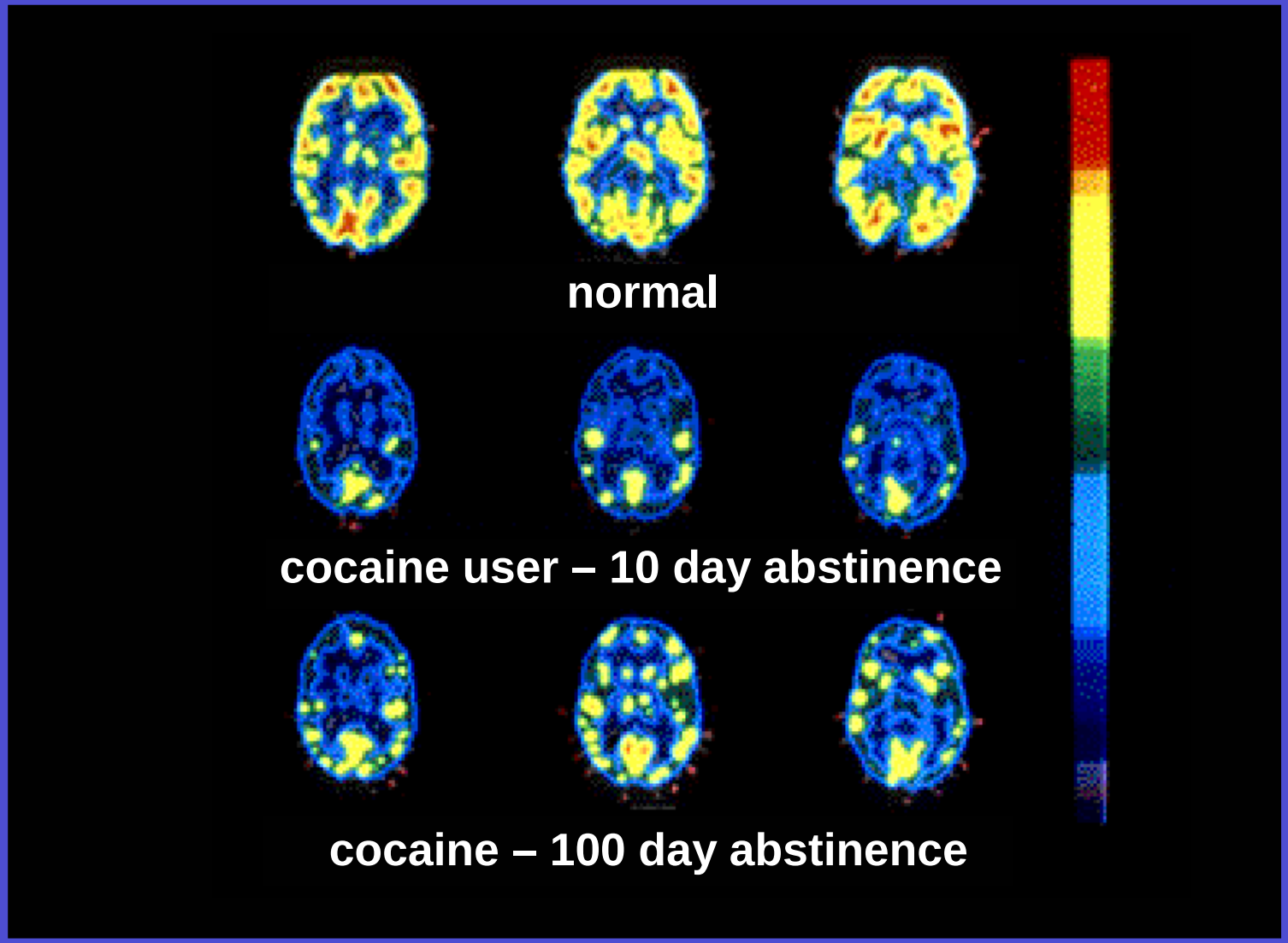


Glucose utilisation

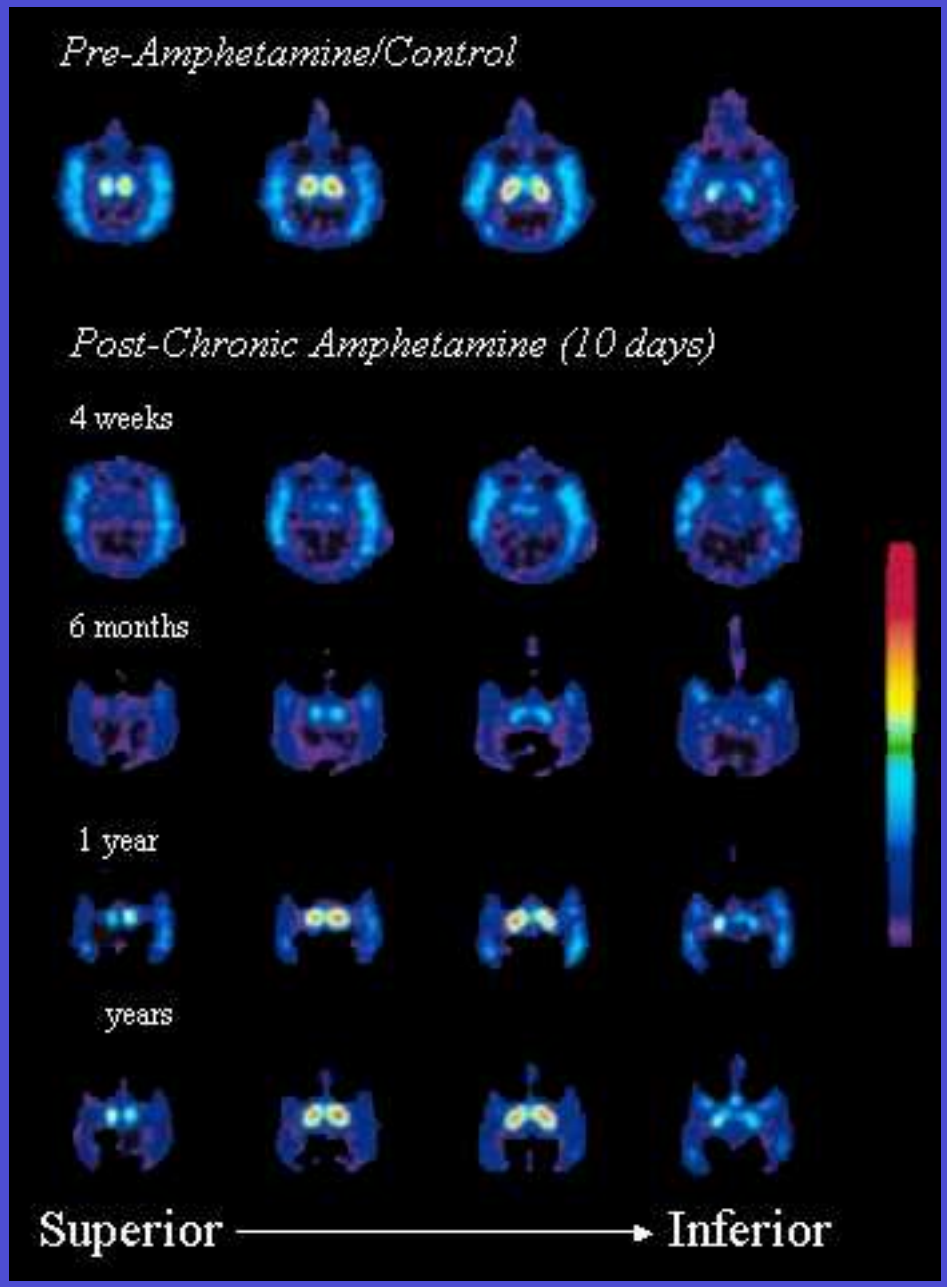
red: +++, yellow: ++, blue: +

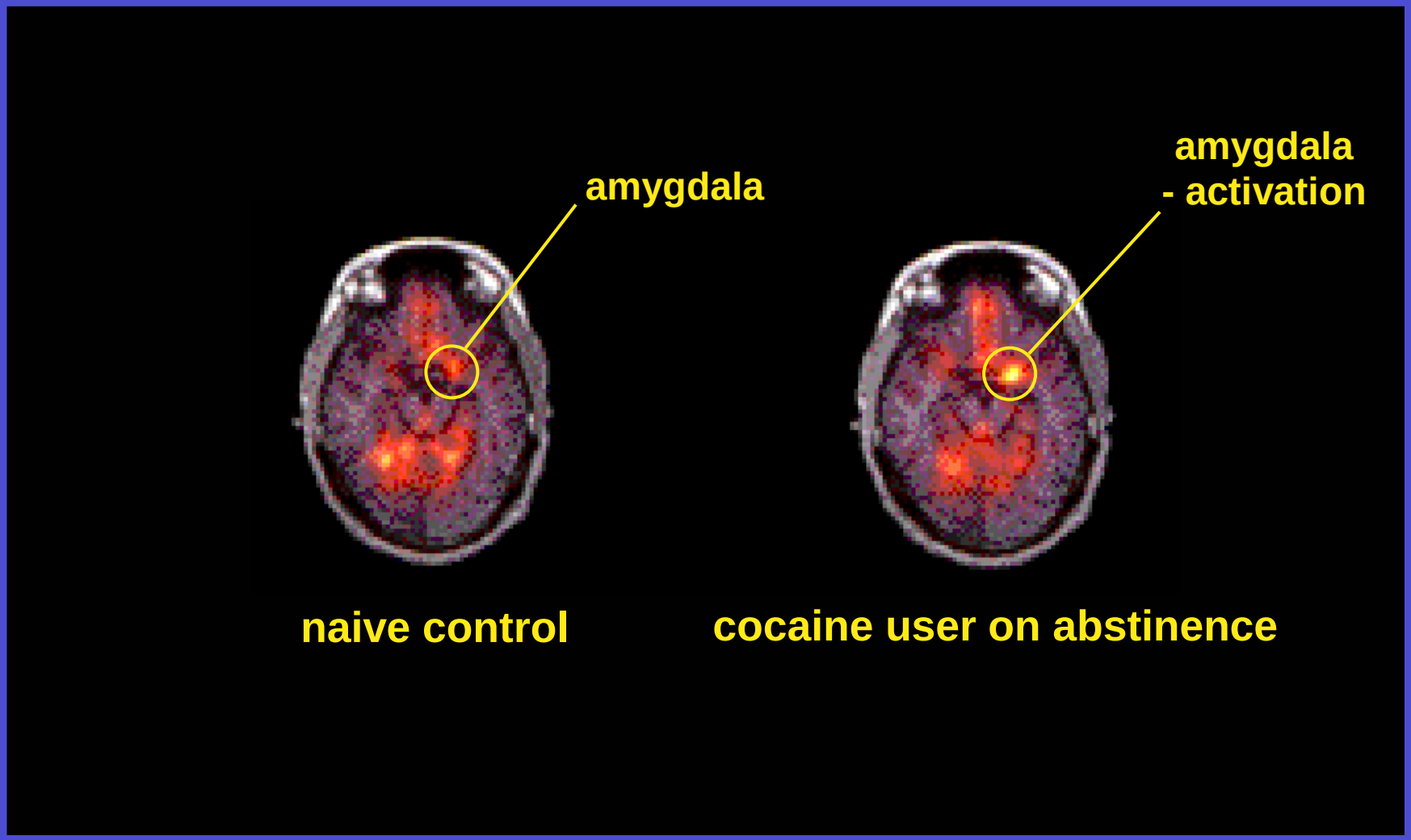


Changes of brain function activities - PET

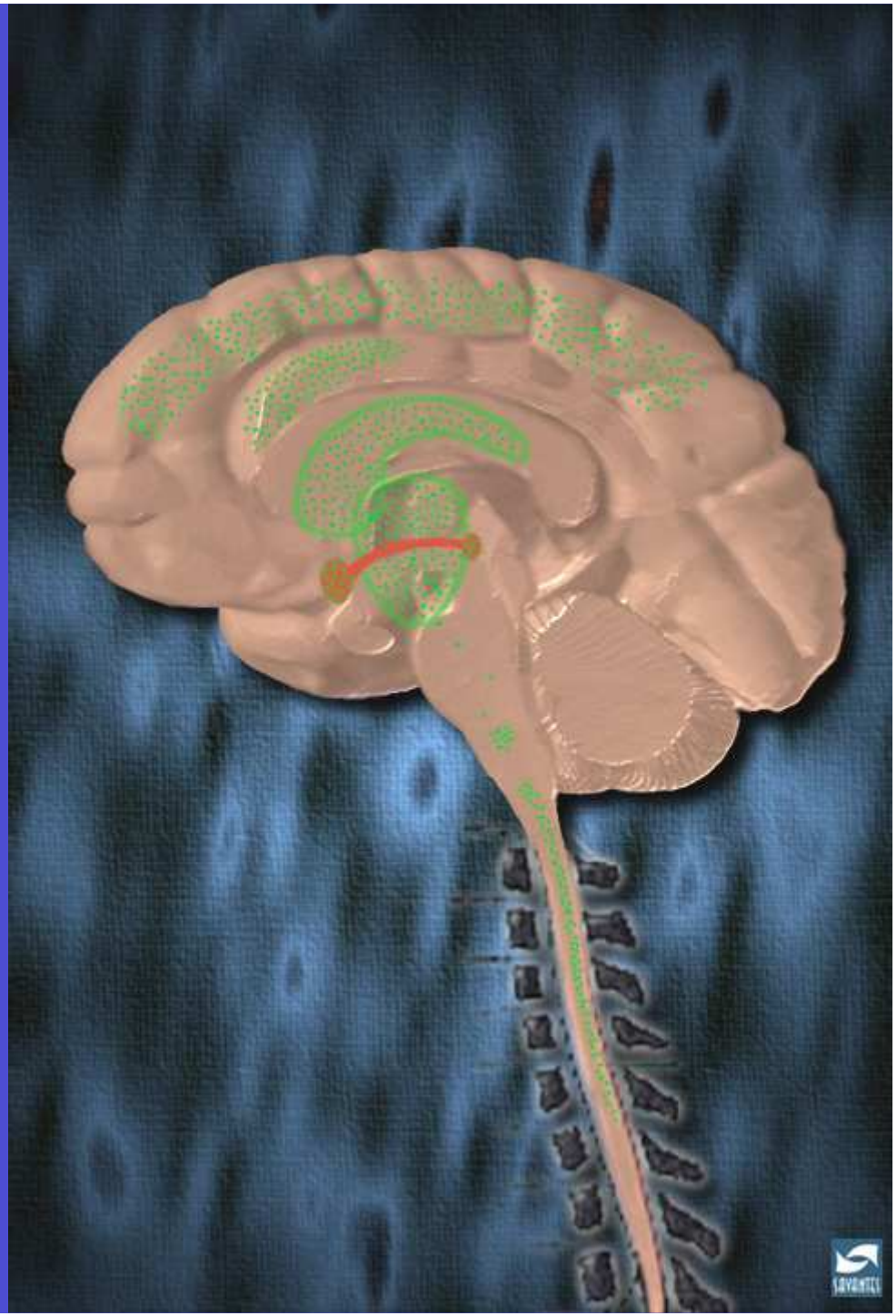


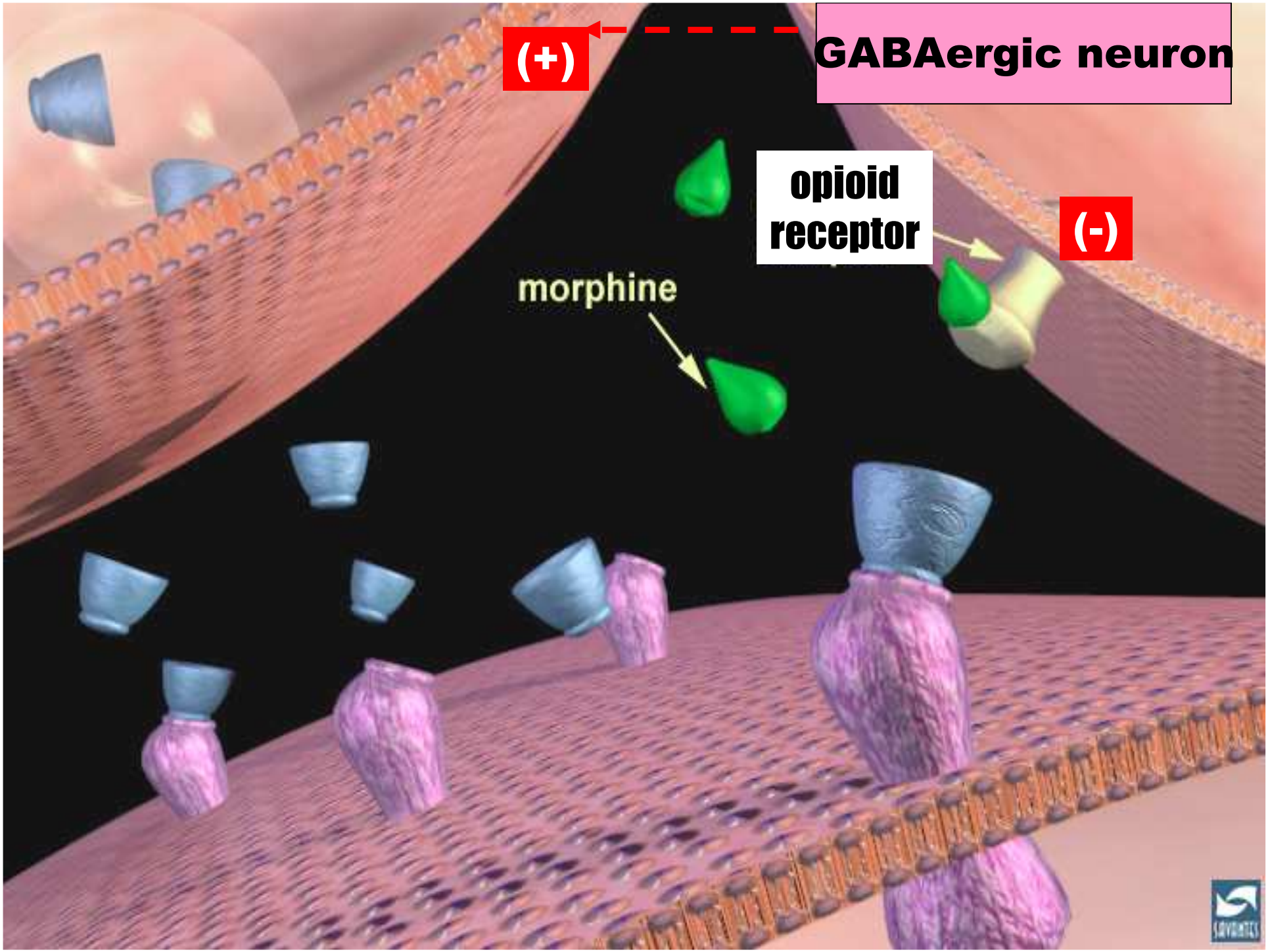
Drugs Have Long-term Consequences

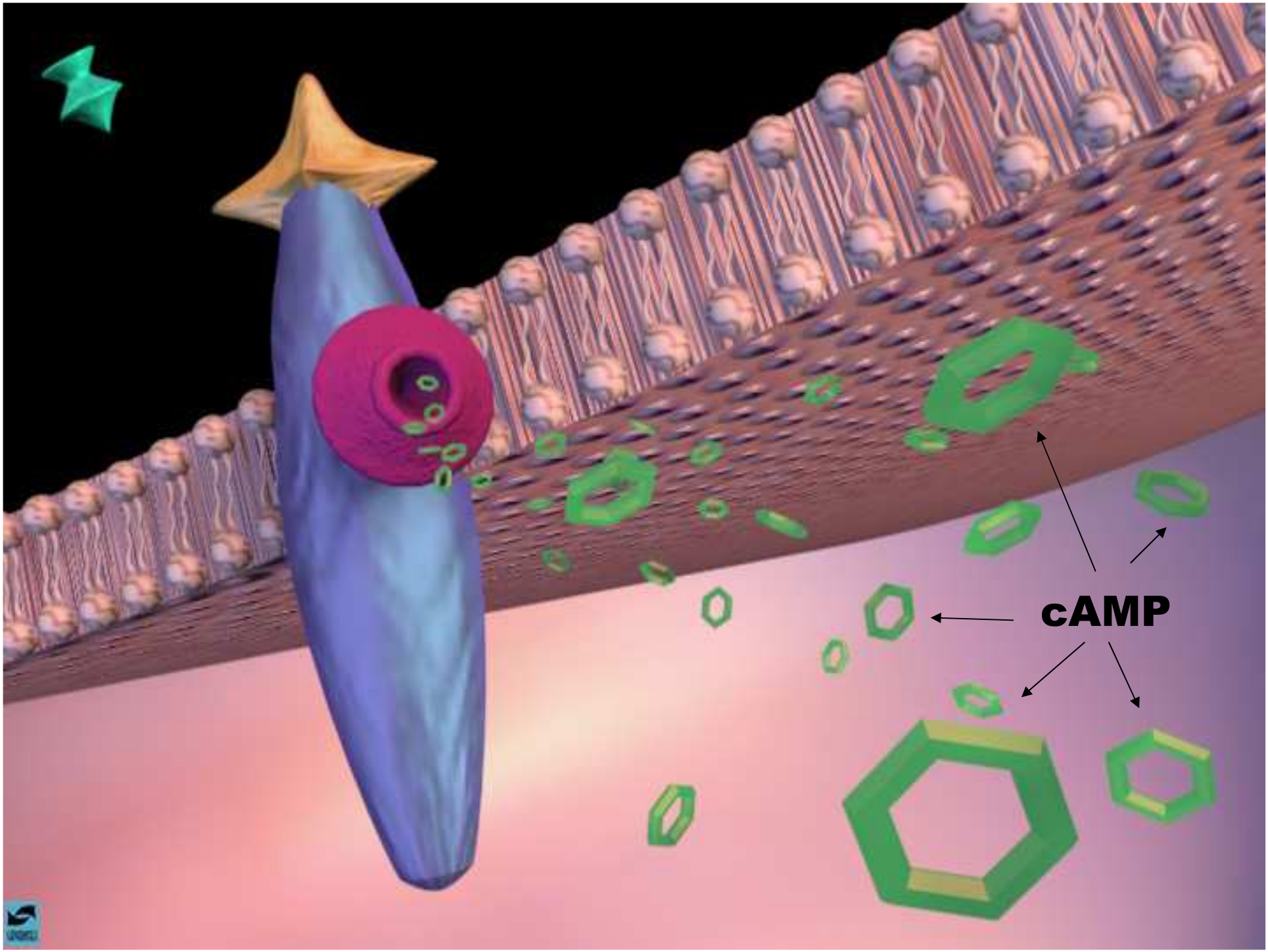


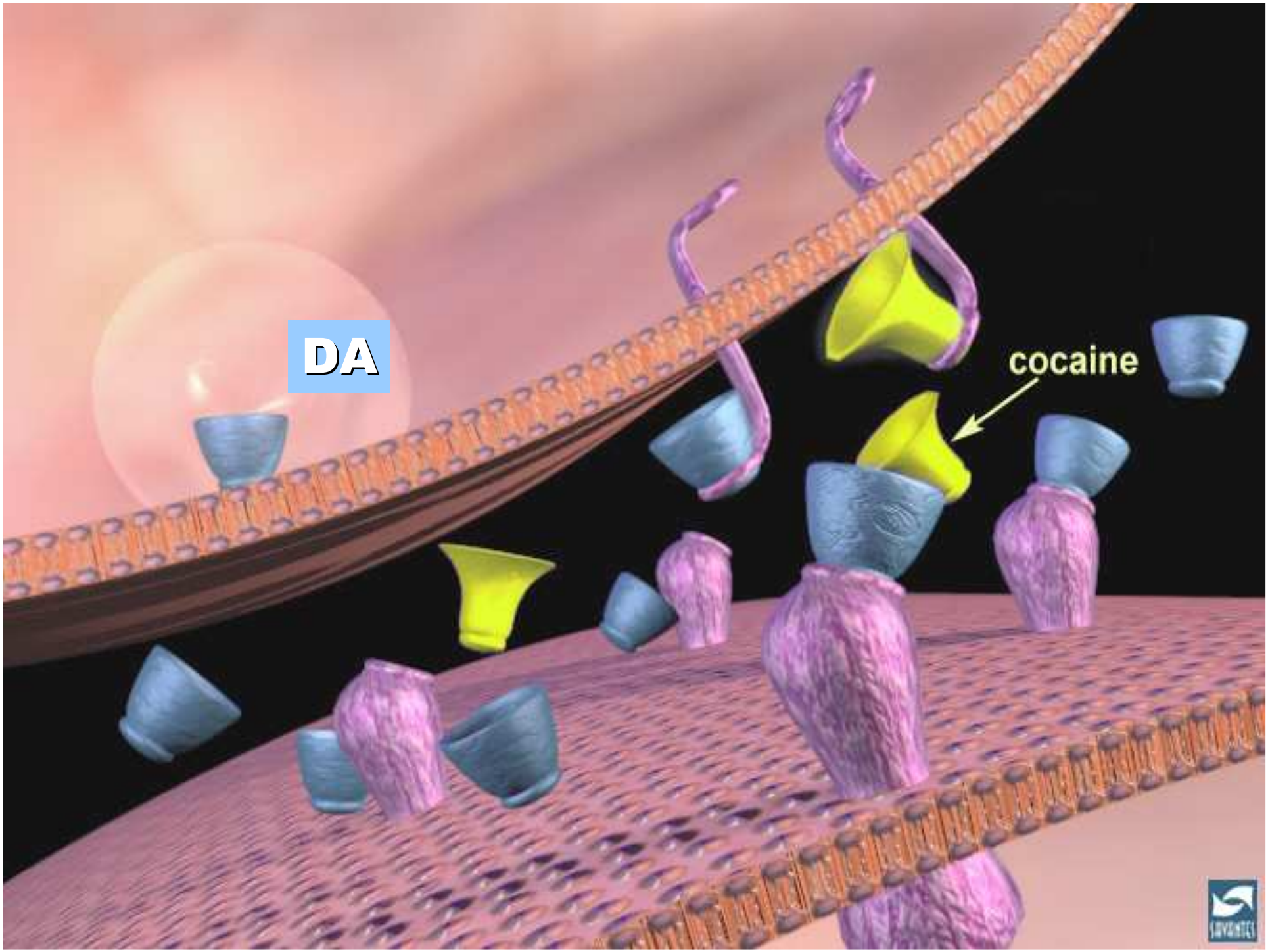

amygdala
amygdala
- activation
naive control
cocaine user on abstinence

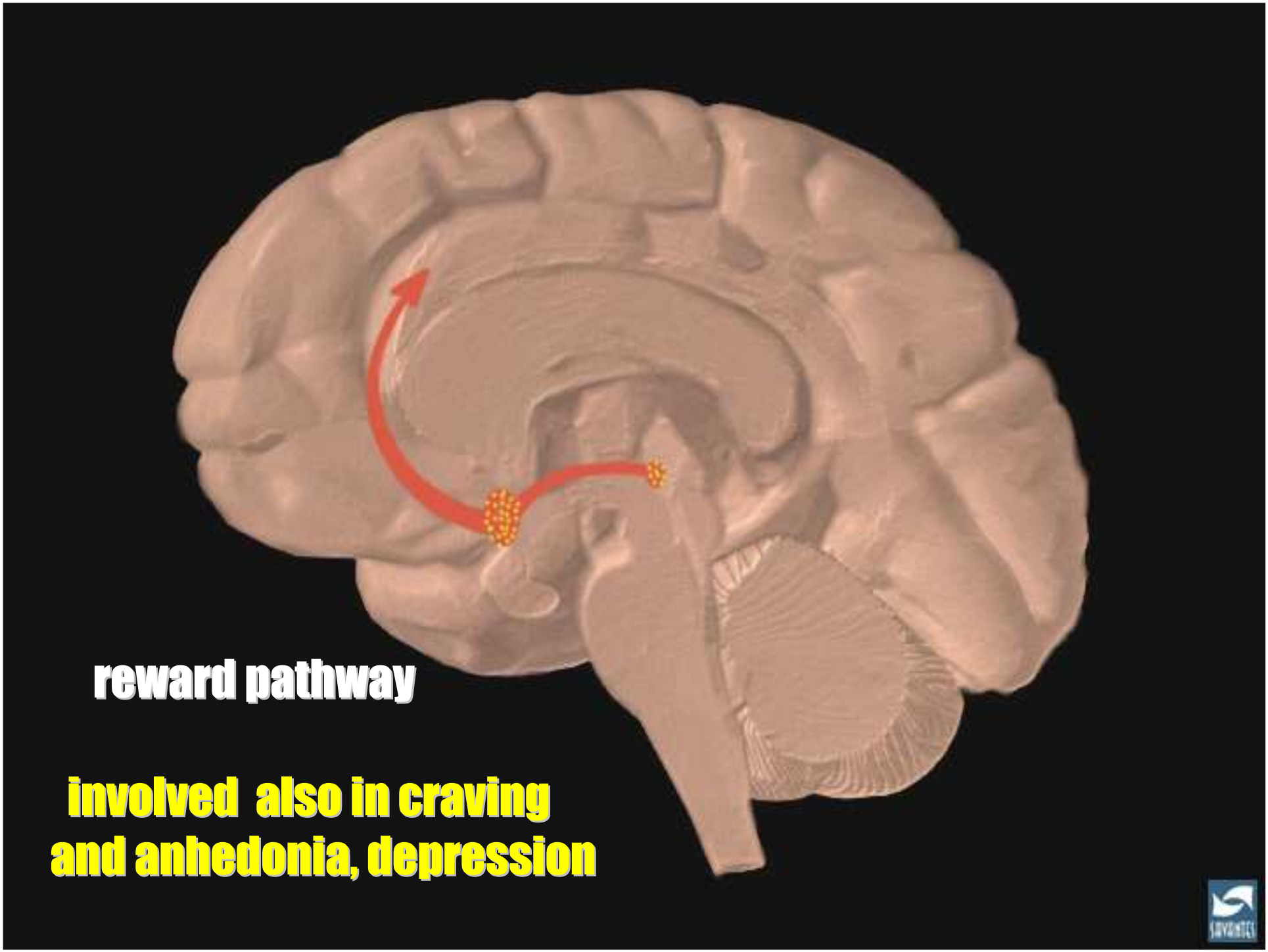
Opioid binding in the brain

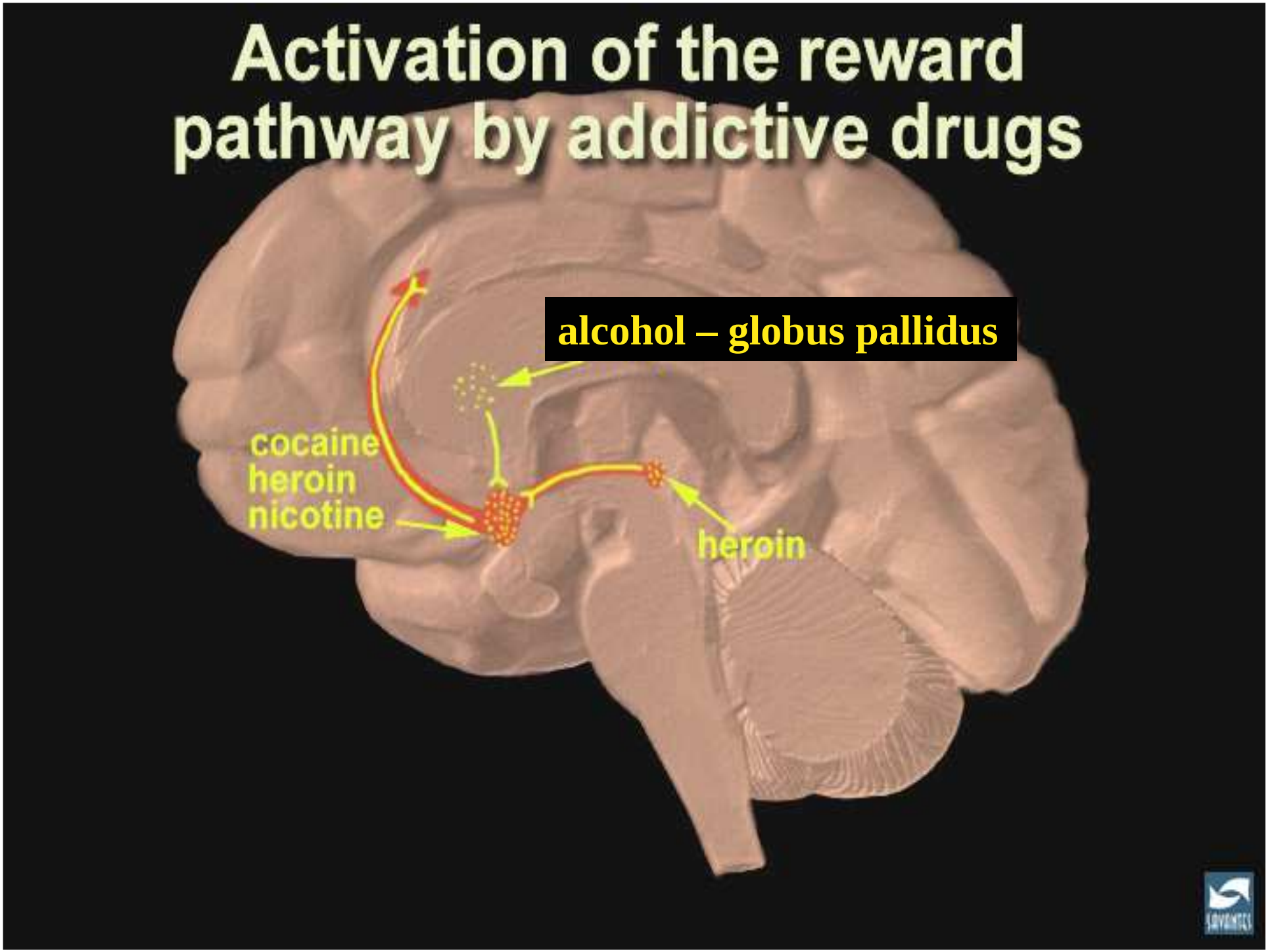


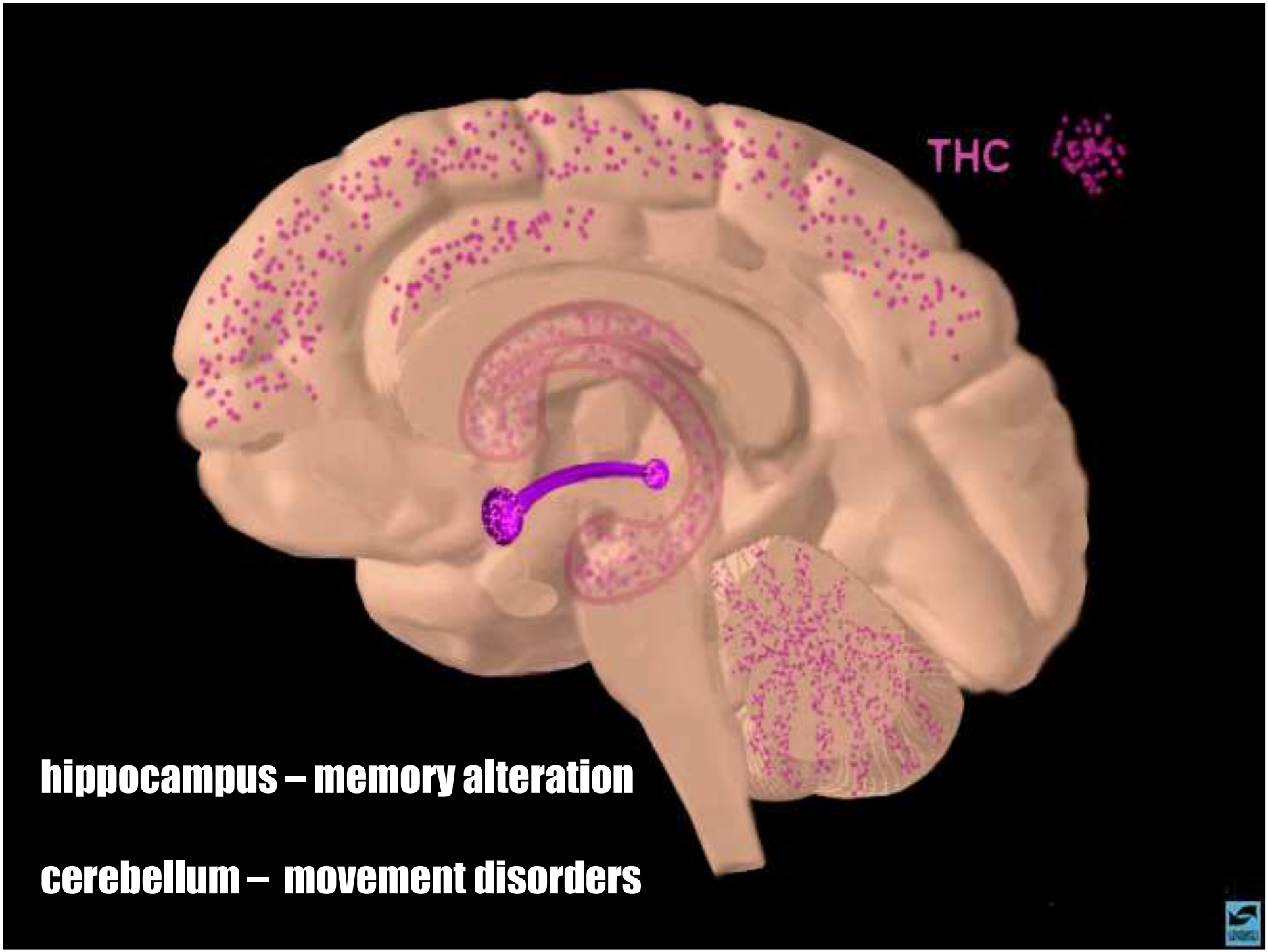

(+)
GABAergic neuron
opioid receptor
(-)
morphine

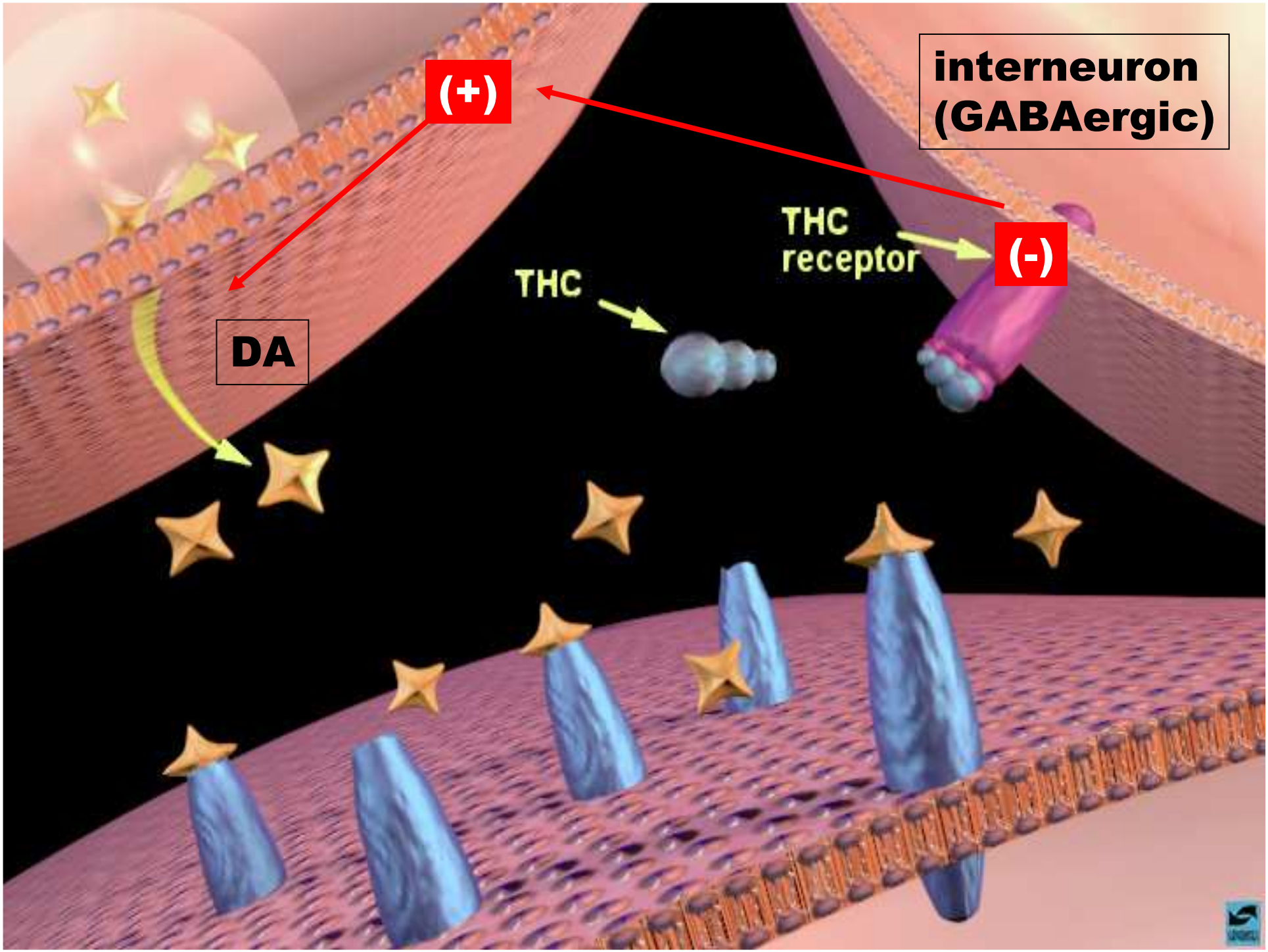

cAMP


DA
cocaine


reward pathway
involved also in craving
and anhedonia, depression


Activation of the reward pathway by addictive drugs
alcohol – globus pallidus
cocaine
heroin
nicotine
heroin


THC
hippocampus – memory alteration
cerebellum – movement disorders


(+)
interneuron
(GABAergic)
THC
receptor
(-)
THC
DA

Defining Ecstasy

A derivative of amphetamine

MDMA, XTC, E, essence, Adam

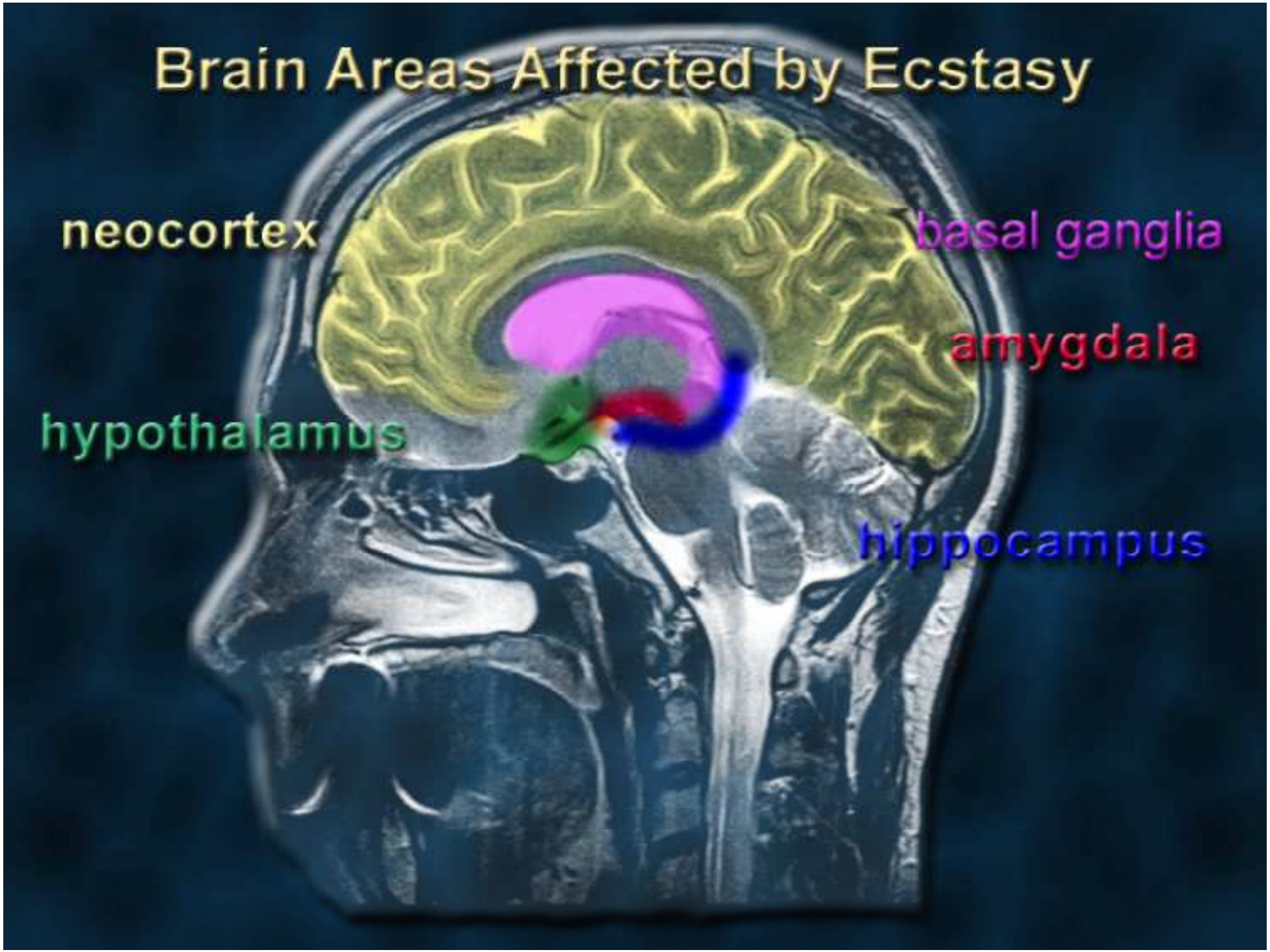
Ecstasy effects in the brain:

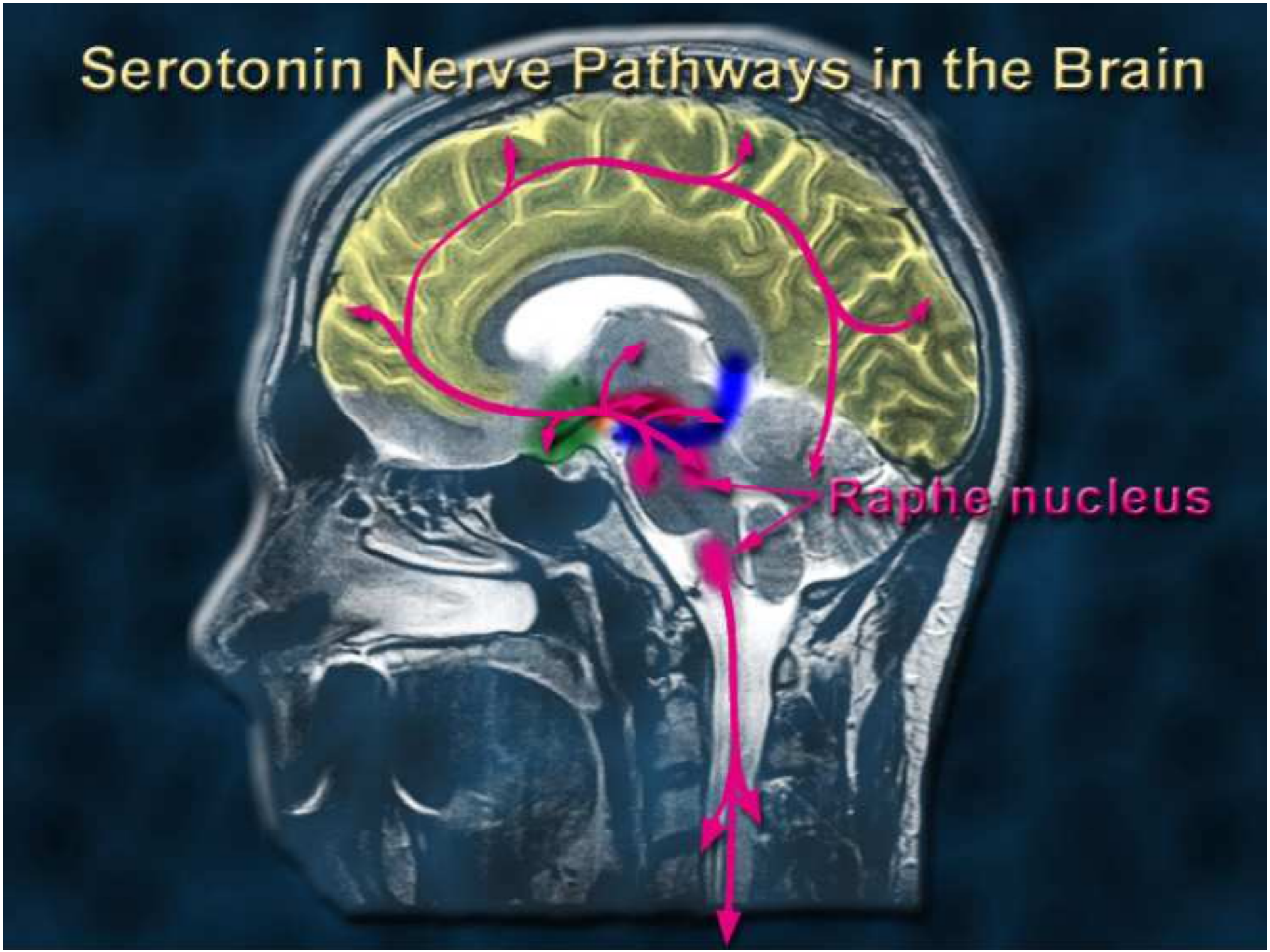
- **short-term**

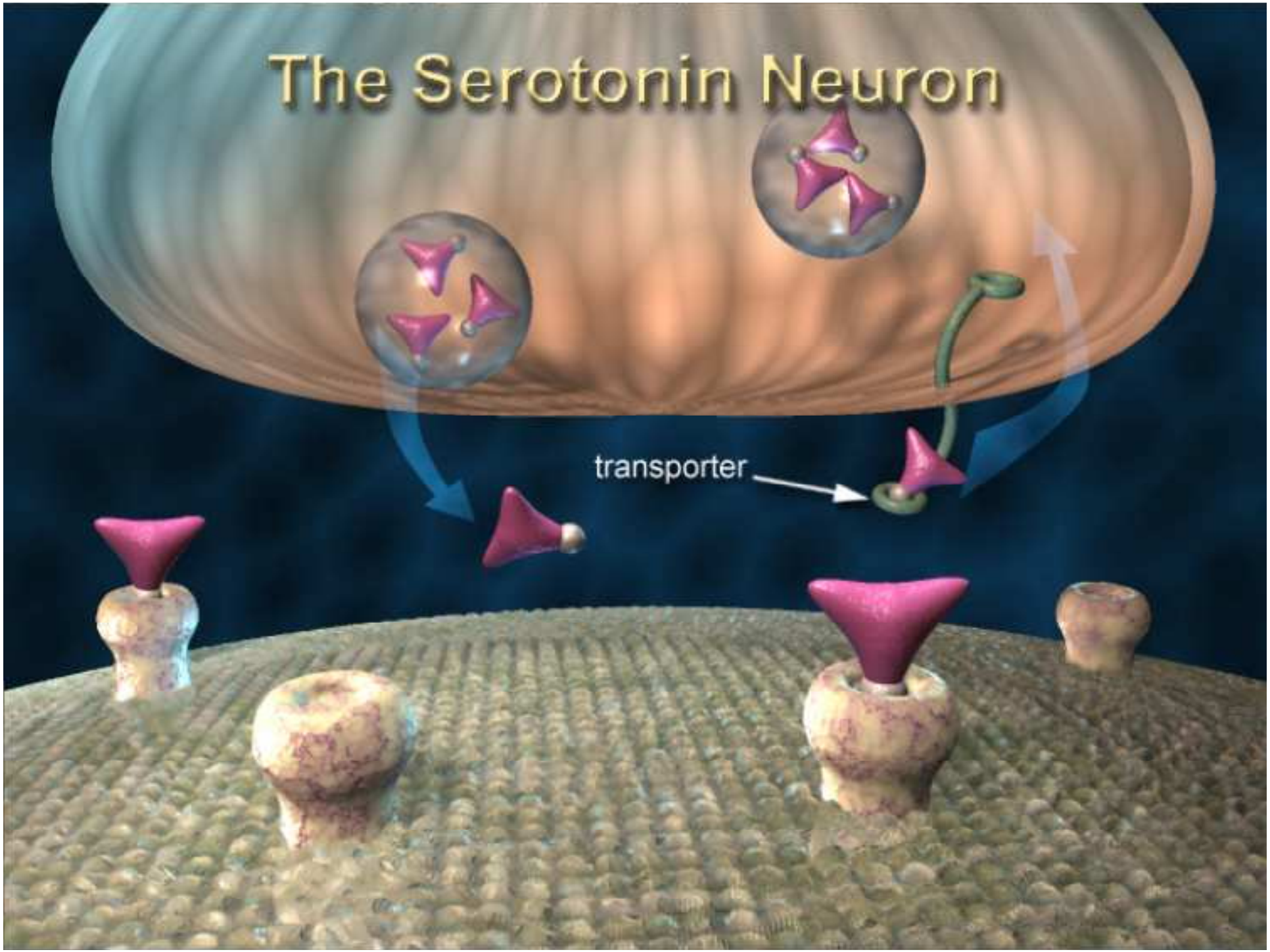
changes in brain biochemistry, behaviour

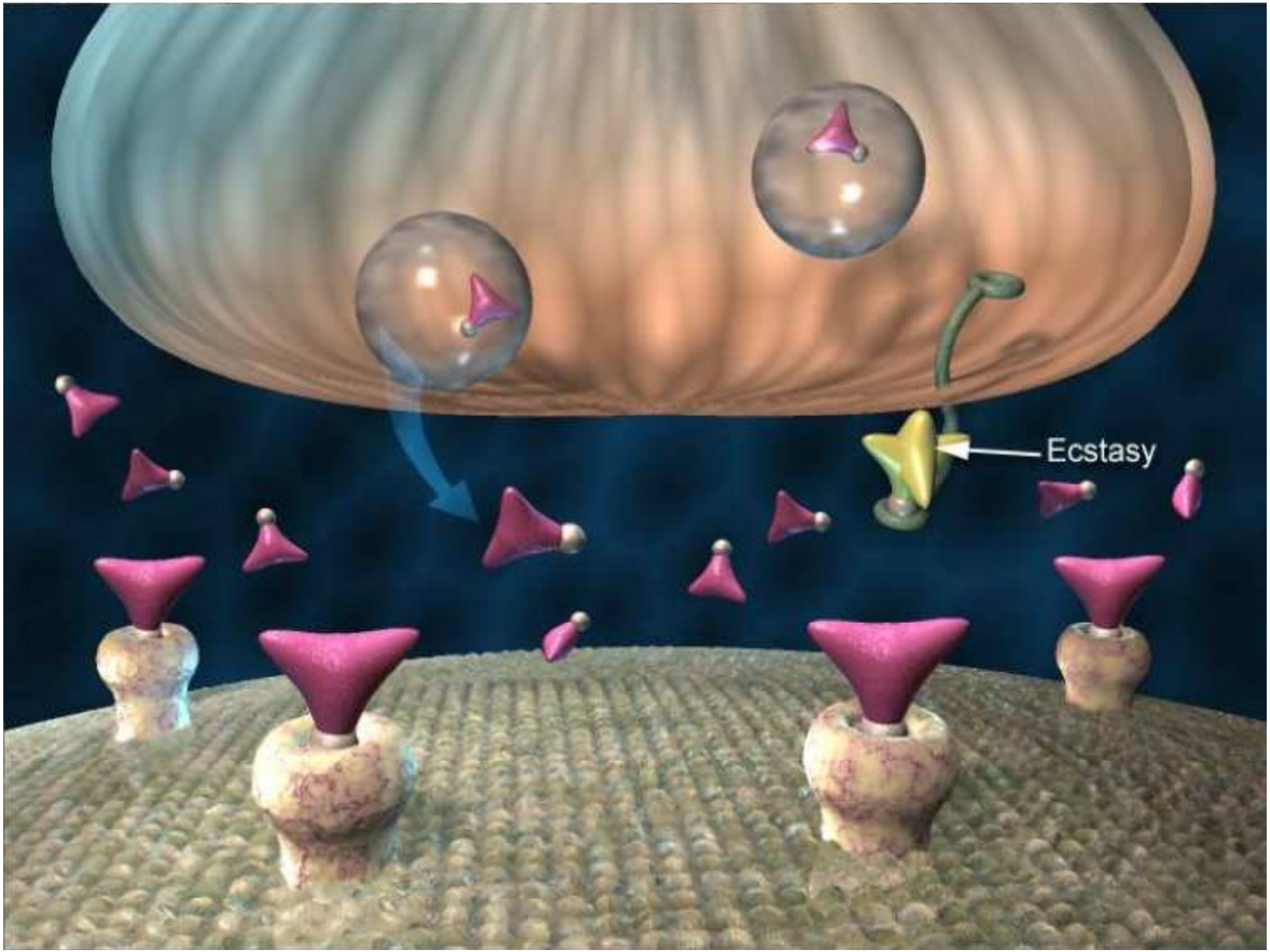
- **long-term**

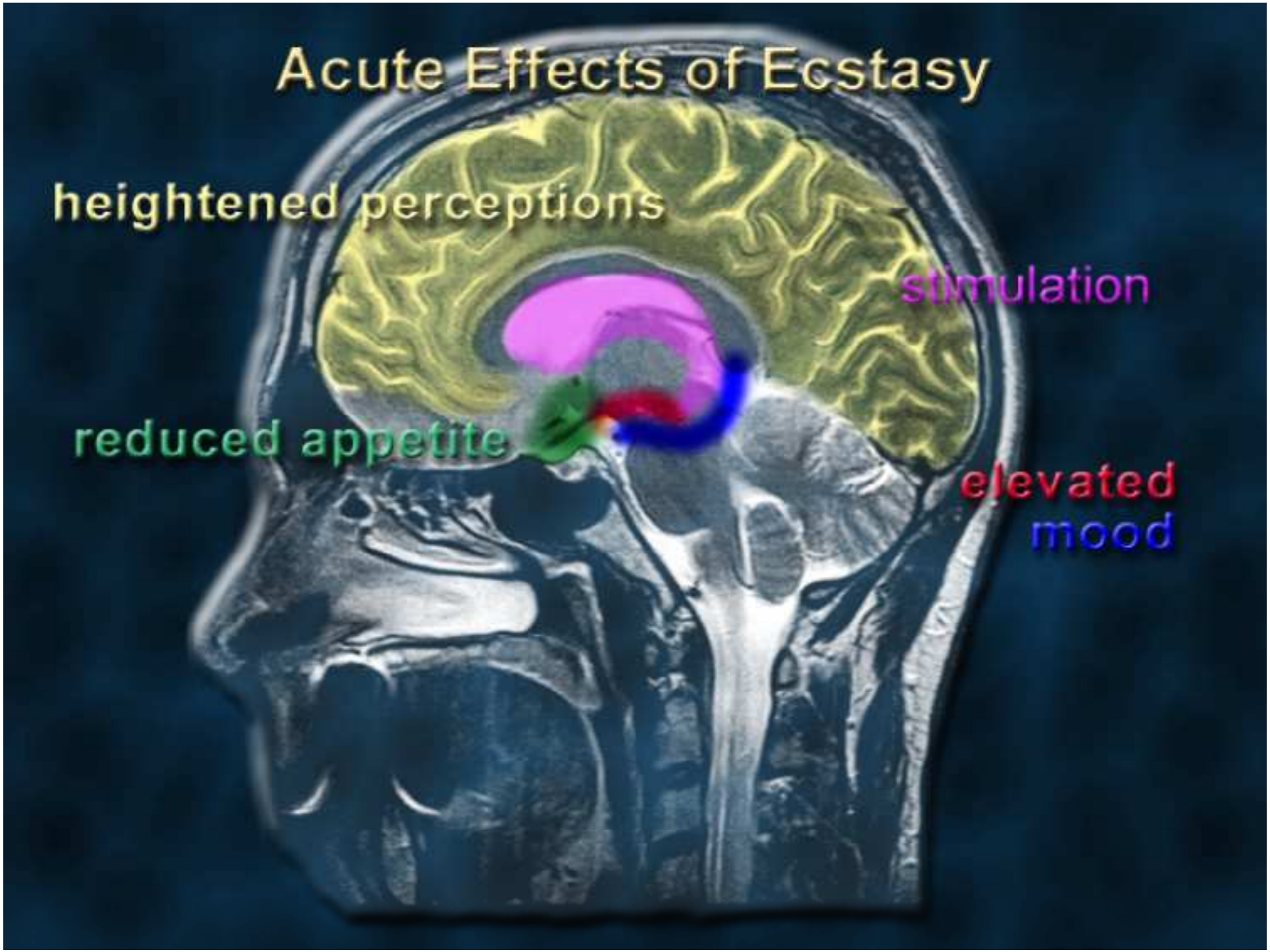
changes in brain structures, behaviour

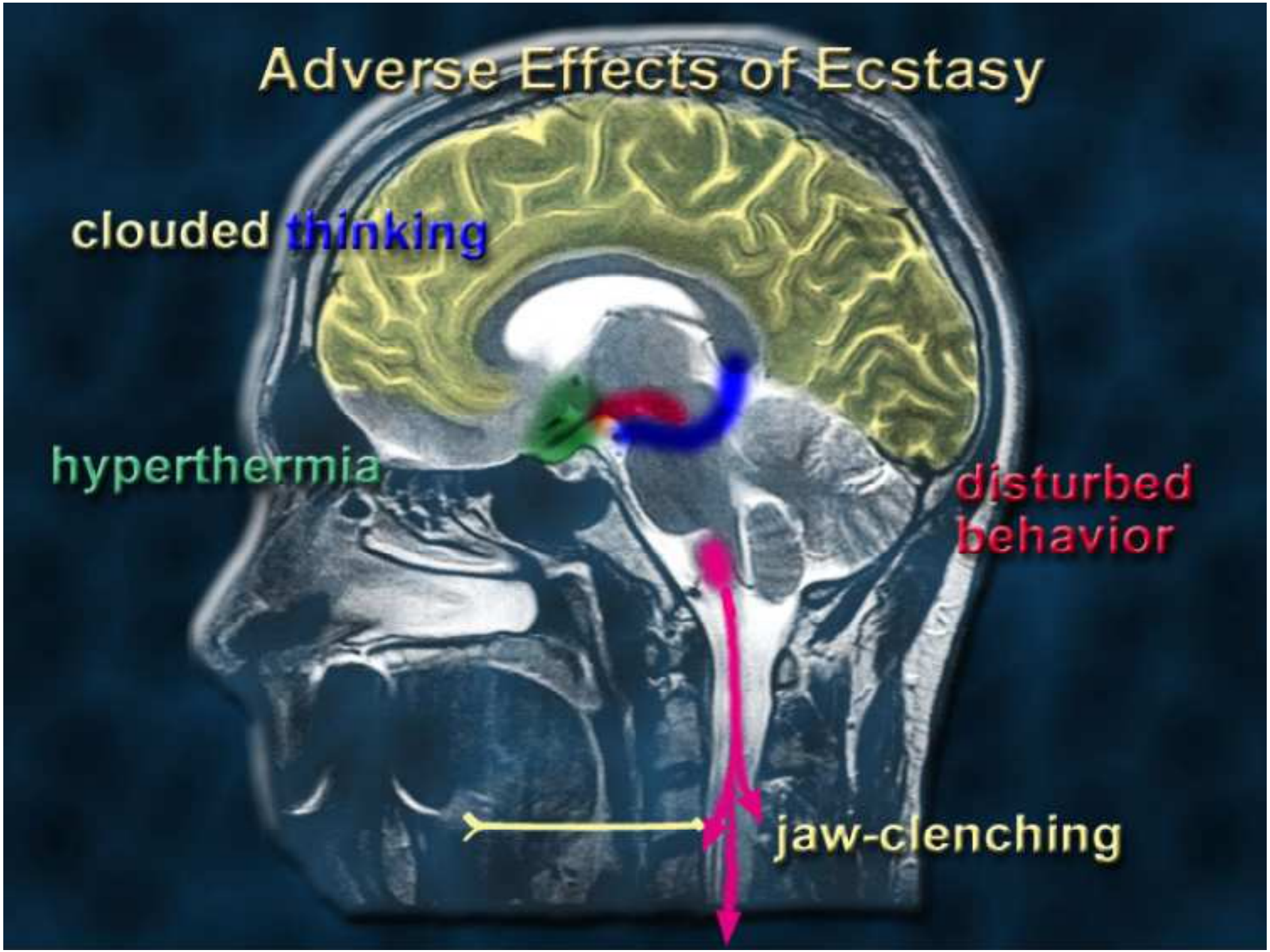

Brain Areas Affected by Ecstasy
neocortex
basal ganglia
amygdala
hypothalamus
hippocampus

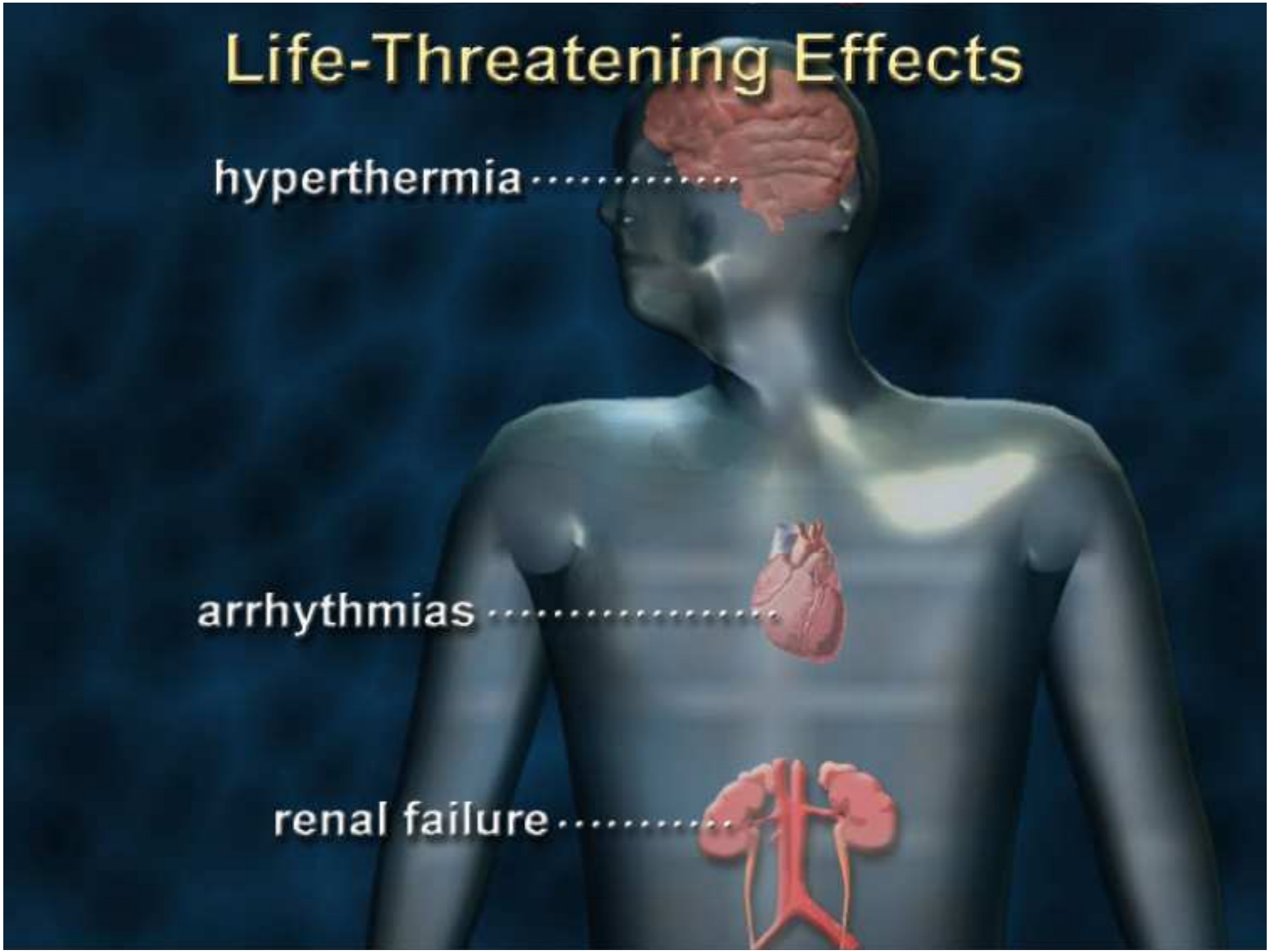

Serotonin Nerve Pathways in the Brain
Raphe nucleus


The Serotonin Neuron
transporter

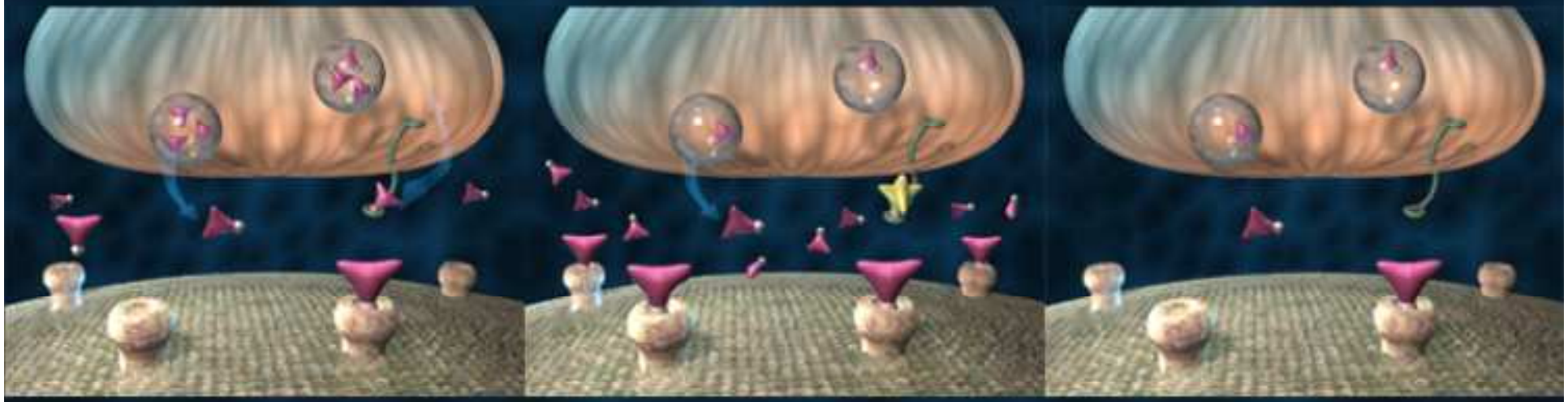

Ecstasy


Acute Effects of Ecstasy
heightened perceptions
stimulation
reduced appetite
elevated
mood


Adverse Effects of Ecstasy
clouded thinking
hyperthermia
disturbed behavior
jaw-clenching


Life-Threatening Effects
hyperthermia
arrhythmias
renal failure

Short Term Effects after Ecstasy is Gone



Normal

During Ecstasy
elevated mood

After Ecstasy
depression-like
feelings, irritablilty

Long Term Effects of Ecstasy: Neurotoxic?

Brain chemistry changes

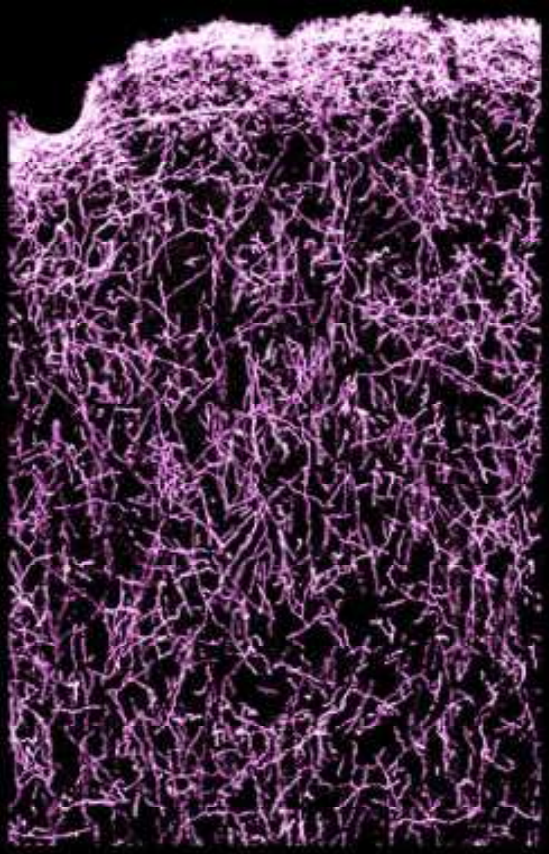
- serotonin reduced
- serotonin metabolites reduced

Brain structure changes

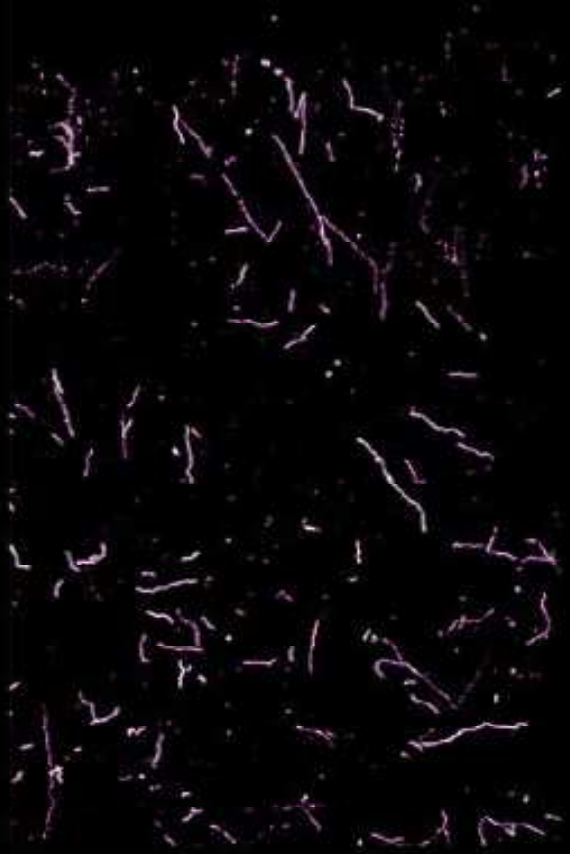
- serotonin transporters reduced
- serotonin terminals degenerate

Serotonin Present in Cerebral Cortex Neurons

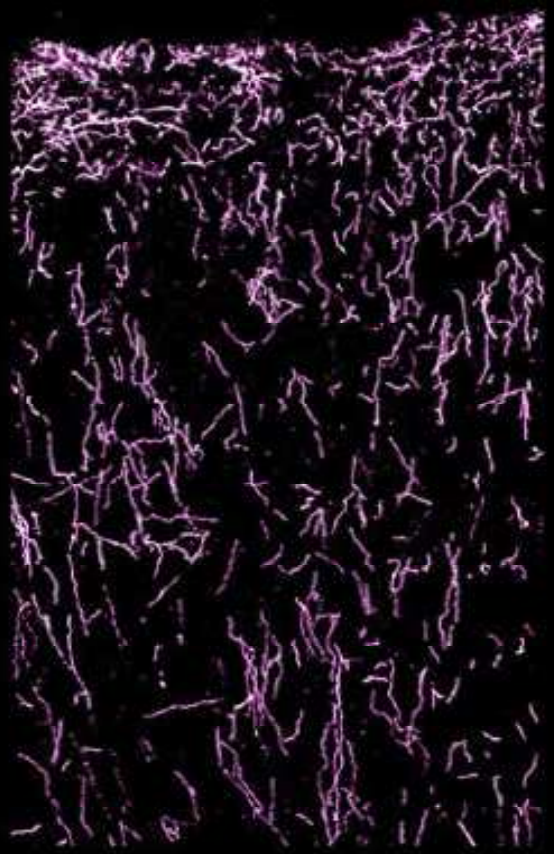
Normal



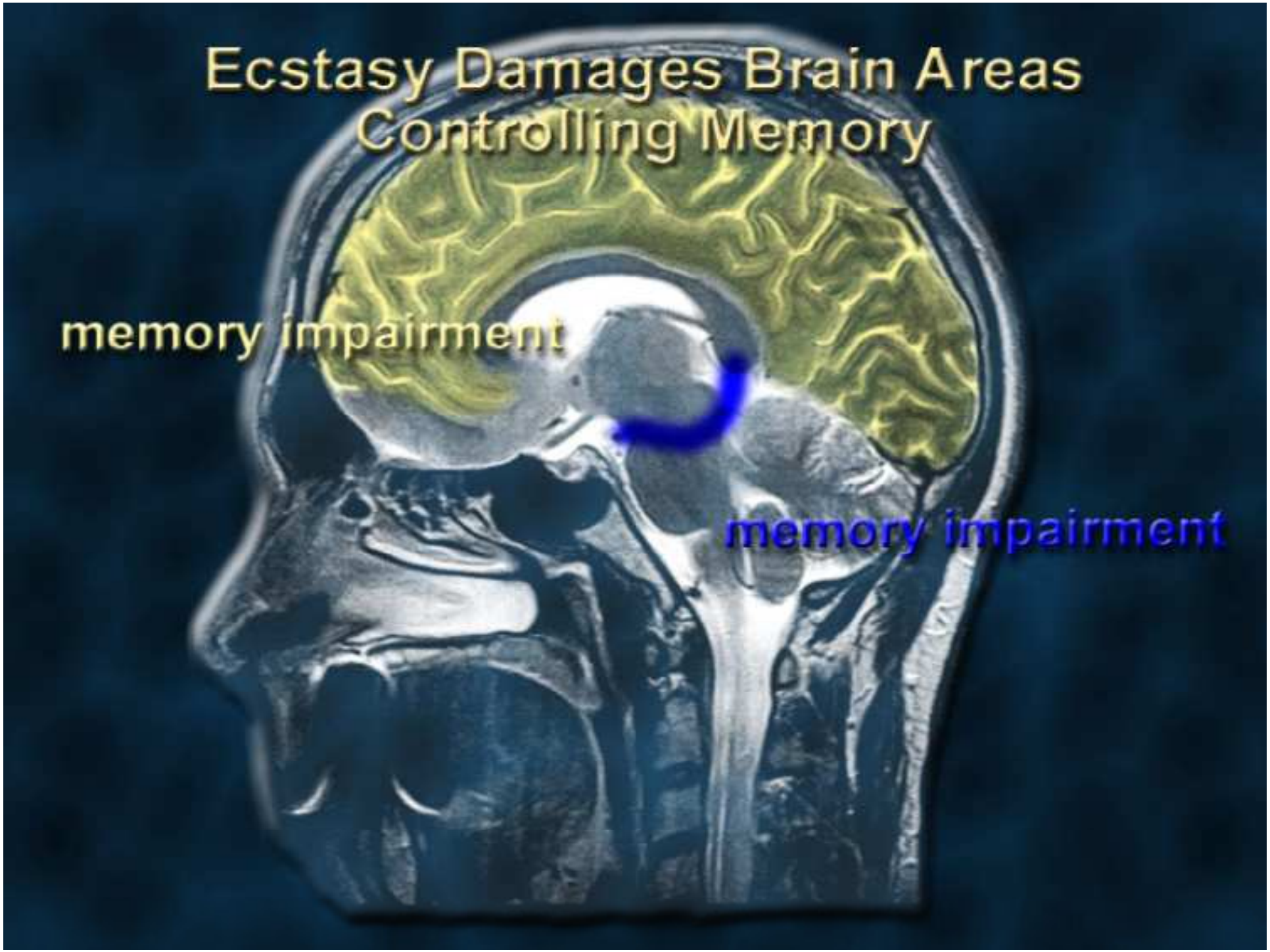
2 weeks after Ecstasy



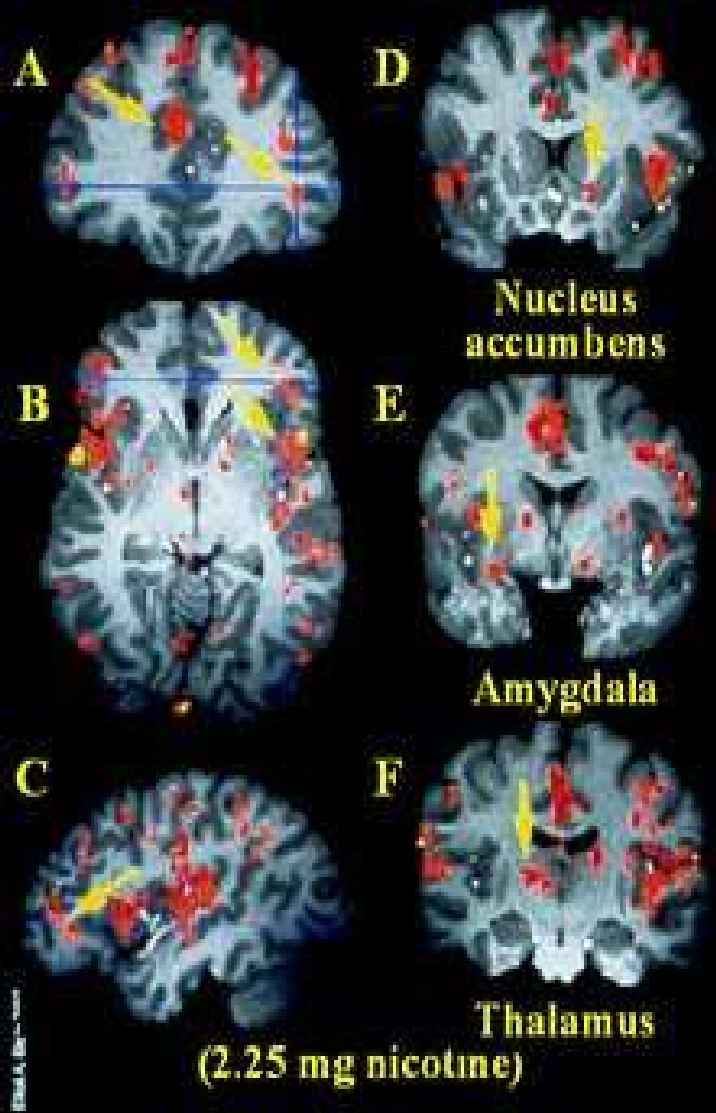
7 years after Ecstasy




Ecstasy Causes Degeneration of
Serotonin Nerve Terminals

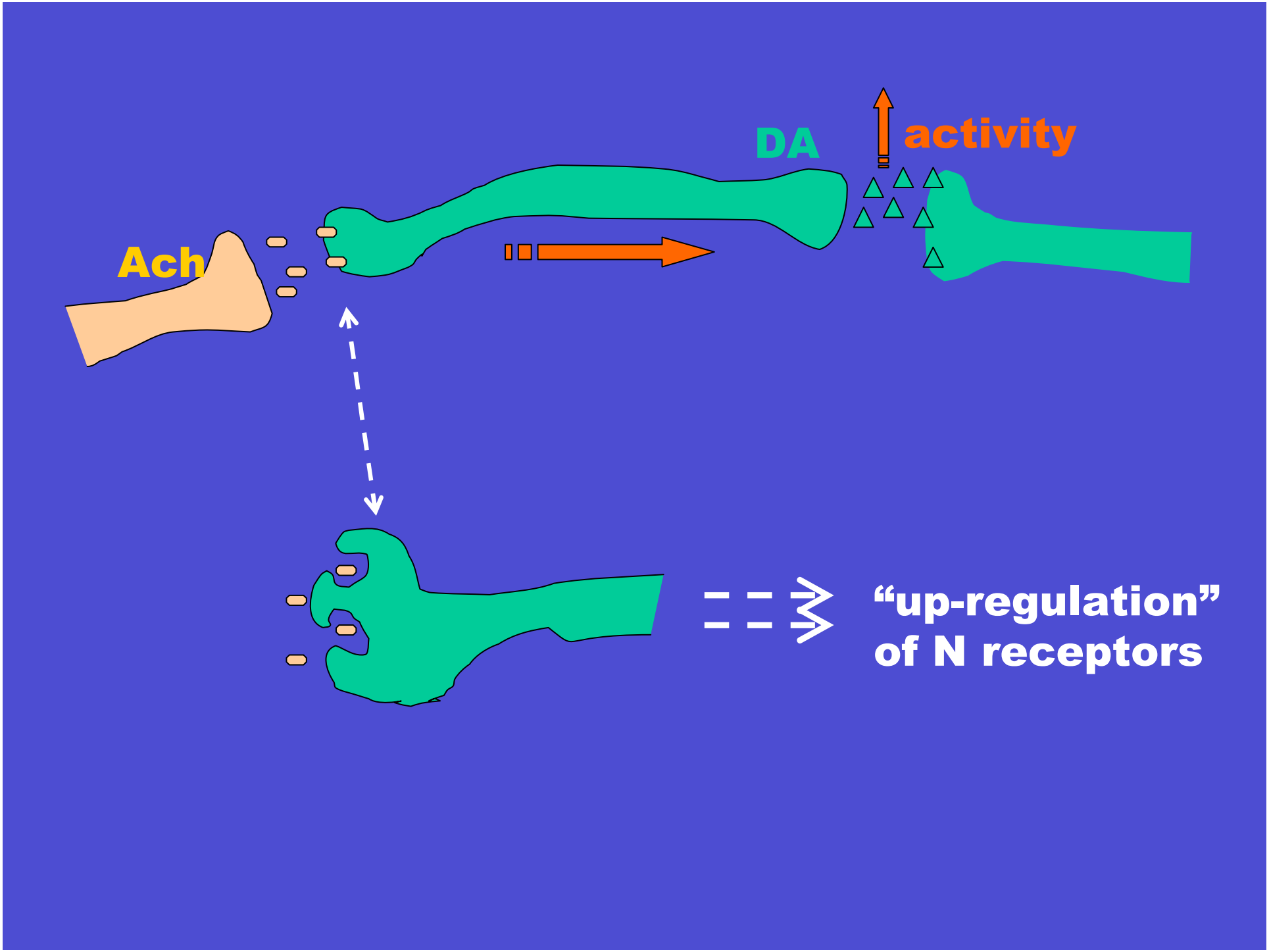

Ecstasy Damages Brain Areas
Controlling Memory
memory impairment
memory impairment

Nicotine-Induced Limbic Cortical Activation in the Human Brain

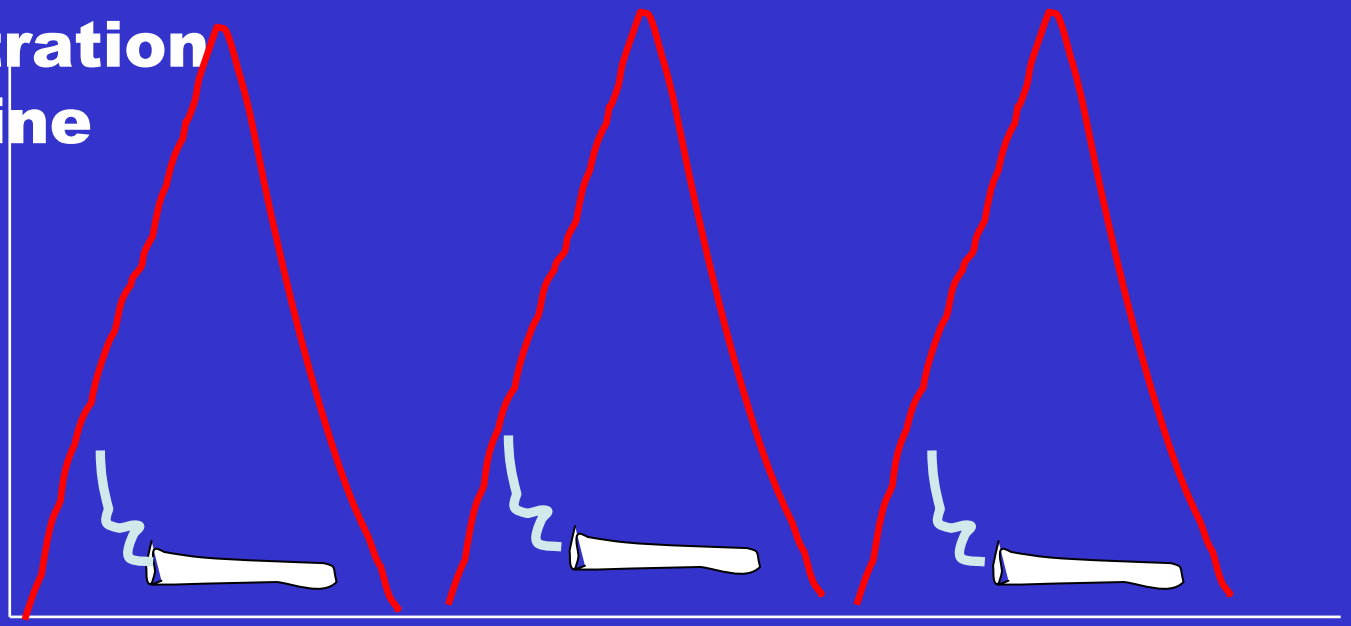


Source: Stein, E.A., et al. American Journal of Psychiatry, 155(8), August 1998.


RECEPTORS
N rec.

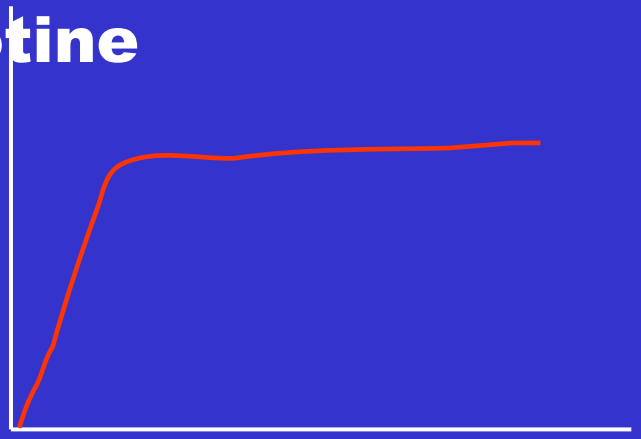

DA
activity
Ach
"up-regulation"
of N receptors

concentration
of nicotine



FOR WEANING

concentration
of nicotine



↑ DAergic activity

bupropion

= inhibition of
DA, NA reuptake