

Music, Brains, Drugs & The Beatles



David Hattner, Portland Youth Philharmonic

Bill Griesar, PSU/OHSU/Northwest Noggin

Aaron Eisen, OHSU/PSU/NW Noggin

Jeff Leake, PSU/NW Noggin

Charles Burchfield, Autumnal Fantasy

Northwest Noggin

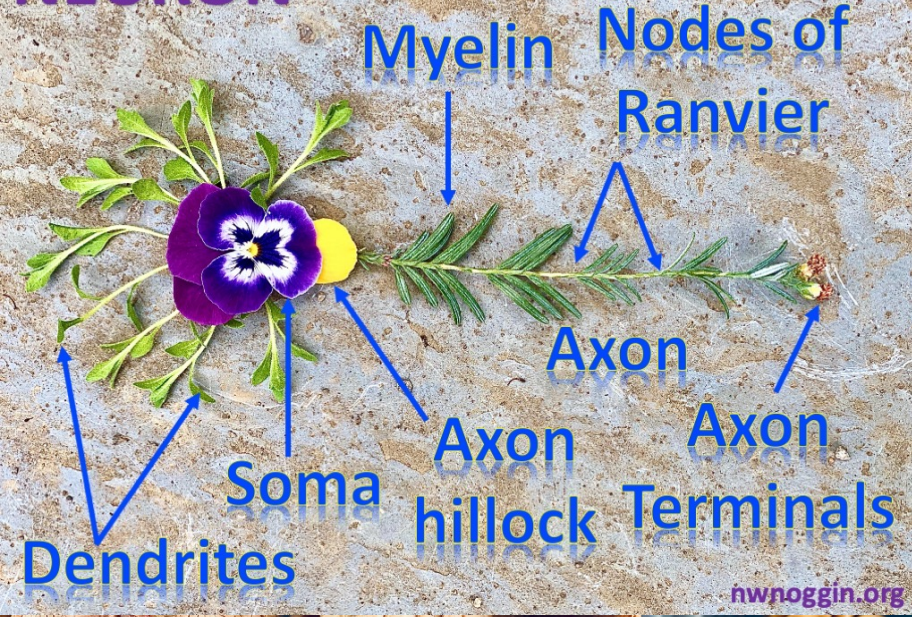
Community outreach 🎨🧠🤝
Interdisciplinary neuroscience
We've met 55,000+ people 🧑🏫
ALL VOLUNTEER ❤️
10 years! 🕶️

nwnoggin.org

Art & Brains!



NEURON



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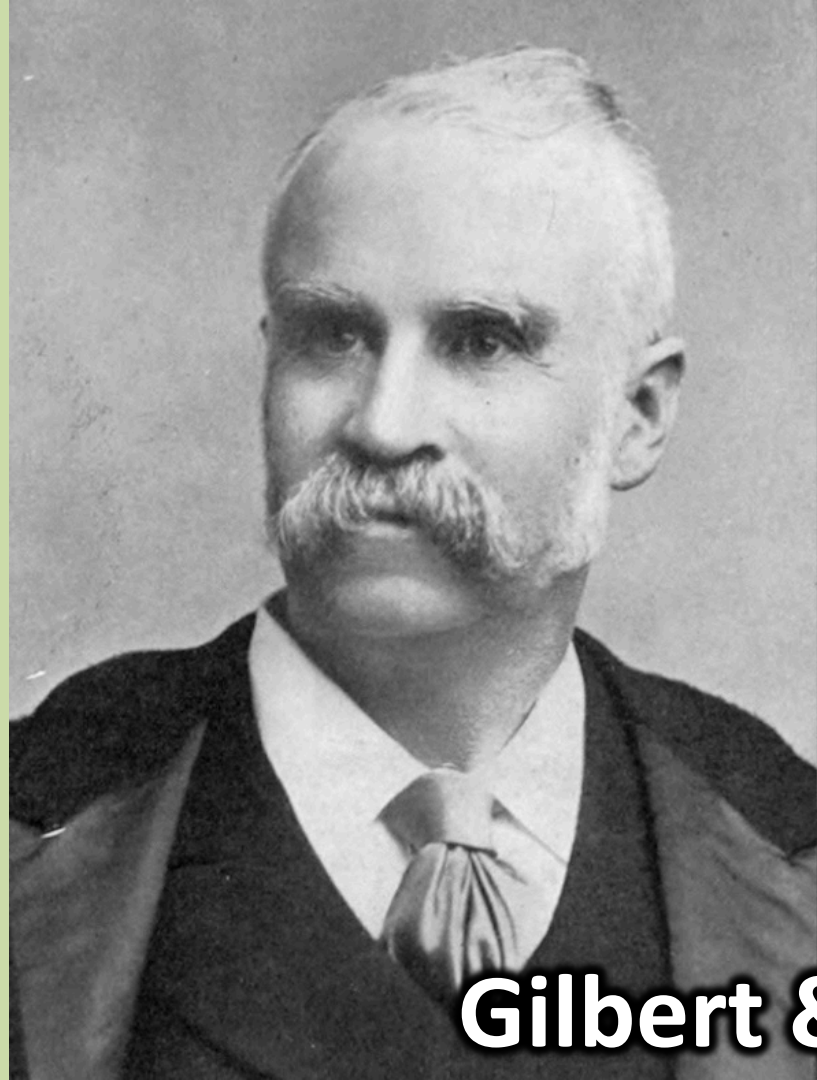




Sleep
Anxiety
Depression
ADHD
Autism
Development
Perception
Drugs
Memory
Language
Racial Bias

...

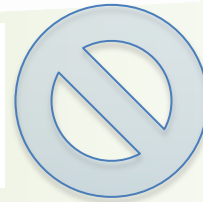
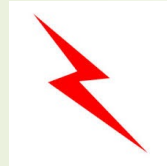
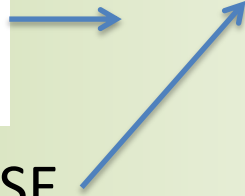
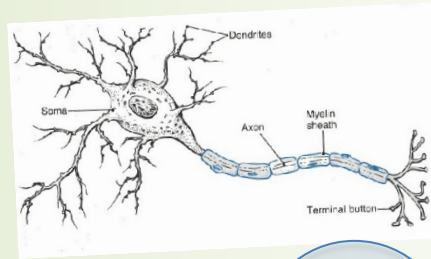
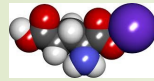
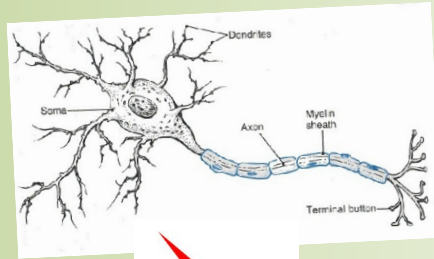
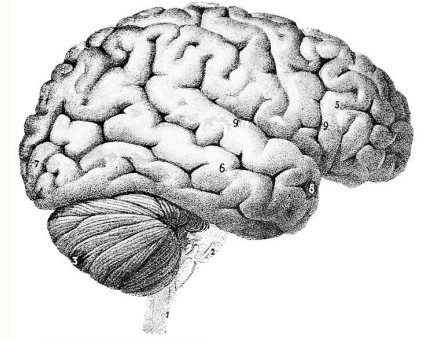
***What you do
has relevance
GO PLACES***



Gilbert & Sullivan

Your brain: made of cells

- Neurons
- Neurons carry *electrical* messages
- Neurons connect *chemically* across synapses
- Neurotransmitters

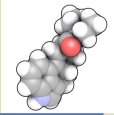


SYNAPSE

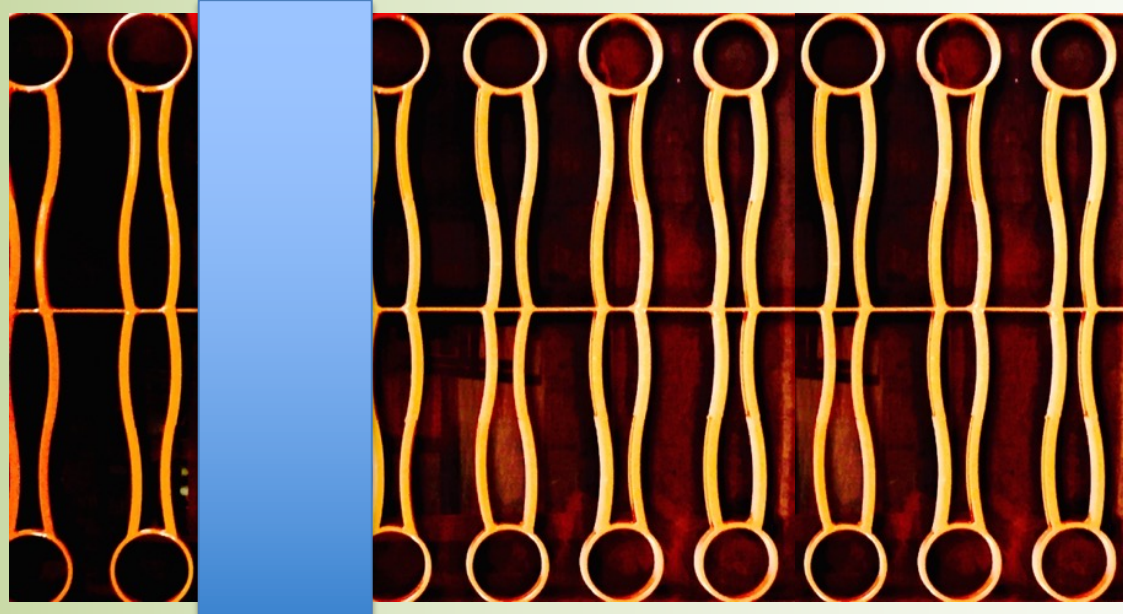


All cells have membranes

Neurotransmitter
or drug



Outside cells, including neurons



Many drugs, including psychedelics, cannot get through, but instead act at RECEPTORS to affect neuron function...

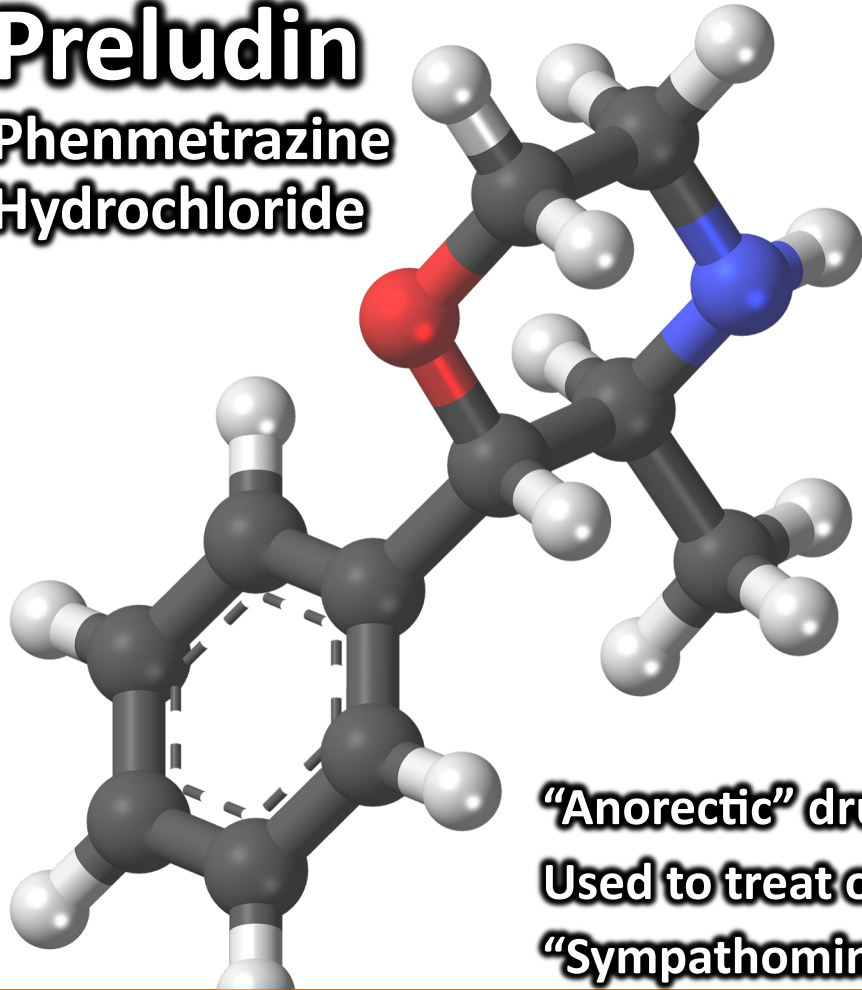
Drugs (chemicals) attach (or “bind”) to receptors, changing the activity of affected neurons...

RECEPTOR: “Protein machine”

Inside cells

Preludin

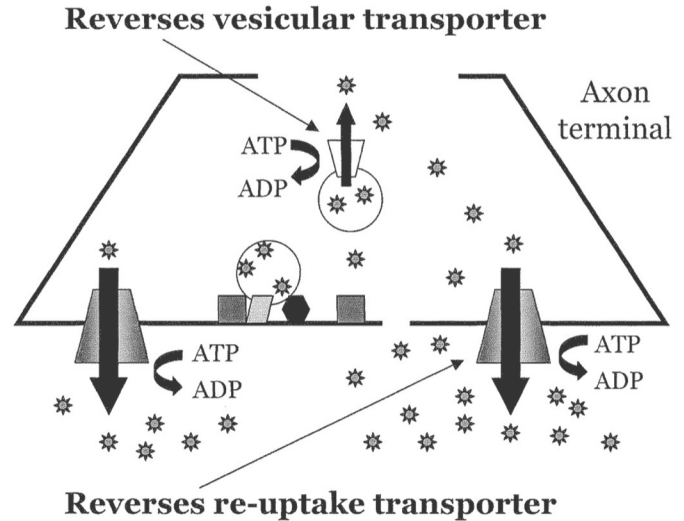
Phenmetrazine
Hydrochloride



“Anorectic” drug
Used to treat obesity
“Sympathomimetic”

Amphetamine/Meth reverse transporters

Especially at DA synapses...



Amphetamine reversal of both vesicular and re-uptake transporters cause massive DA increase in synaptic cleft...



She Loves You
I Want to Hold Your Hand

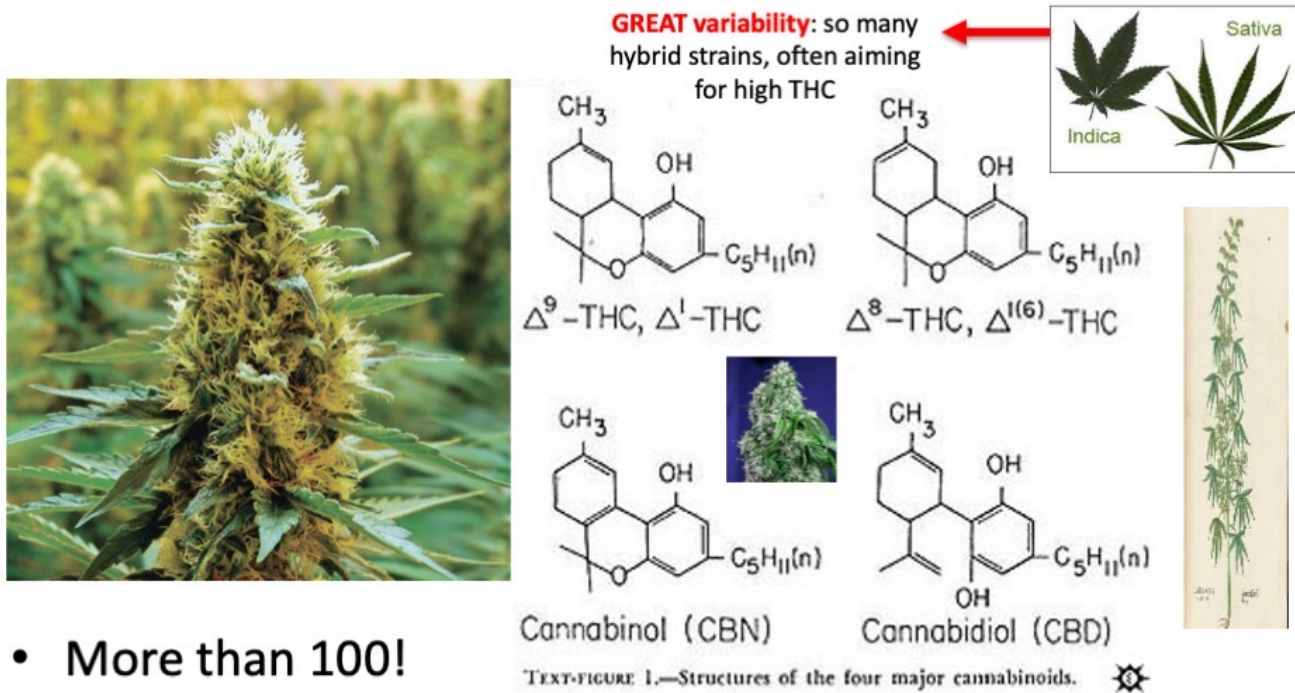
The Beatles 1963



CANNABIS

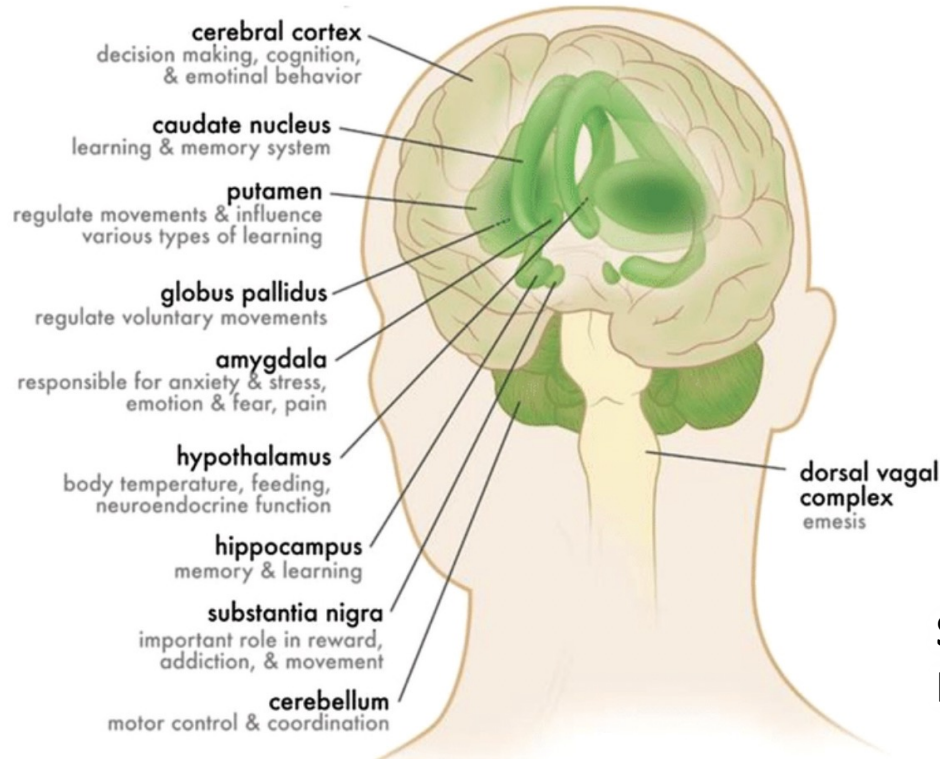
Cannabis contains cannabinoids

SOURCE: Cannabis, a complex plant: different compounds and different effects on individuals, Atakan (2012)



- More than 100!
- Concentrated in resin
- *Lots of variability*, depending on strain, other factors...

Cannabinoids act at cannabinoid receptors: CB1 and CB2



CB1 Receptors

Neocortex

Basal ganglia

Amygdala

Hypothalamus

Hippocampus

Cerebellum

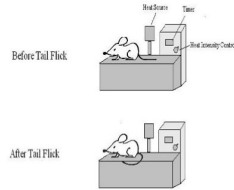
Susan R. B. Weiss, Katia D.
Howlett, Ruben D. Baler (2017)

Cannabinoids reduce pain

A large body of literature indicates that cannabinoids suppress behavioral responses to acute and persistent noxious stimulation...(Walker JM, Hohmann AG, 2005)

Co-administration of cannabinoids and opioids allows for pain relief with a lower opioid dose!

(e.g., Wilson AR, Maher L, Morgan MM, 2008)



More therapeutic effects



- **Appetite stimulation**
(e.g., Foltin, 1988; Grotenhermen, 2012)
Why is this therapeutic?
- **Nausea relief**
(e.g., Parker et al (2011); "The anti-emetic effect of cannabinoids has been shown across a wide variety of animals that are capable of vomiting in response to a toxic challenge." Also studies referenced by the National Cancer Institute at cancer.gov; though chronic use linked to hyperemesis syndrome; Soriano-Co M, 2010)

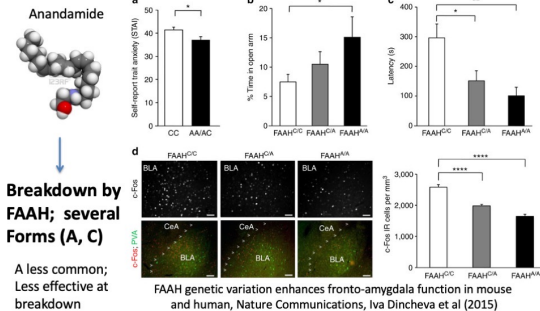
STILL MORE therapeutic effects



- **Multiple sclerosis**
 - E.g., "Current status of cannabis treatment of multiple sclerosis," Deutsch et al (2008)
- **Epilepsy**
 - E.g., "The case for medical marijuana in epilepsy," Maa (2014)
- **Cancer**
 - E.g., "The combination of cannabidiol and Δ9-THC enhances the anticancer effects of radiation in an orthotopic murine glioma model," Scott et al (2014)

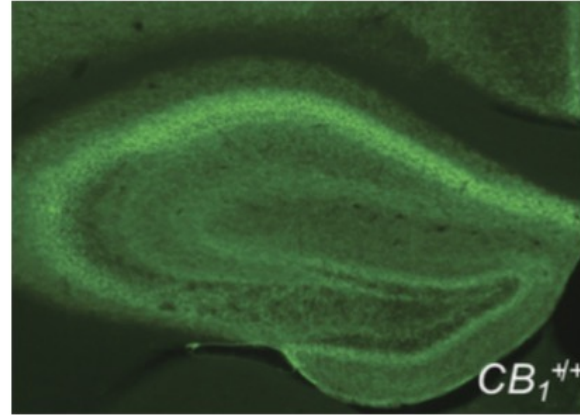
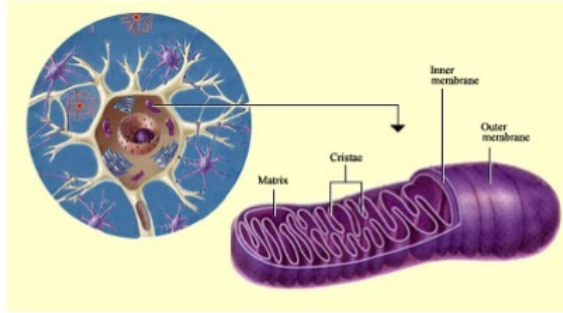
Anxiety: Genetic protection?

Decreased anxiety in humans and mice with FAAH C385A



A cannabinoid link between mitochondria and memory

Etienne Hebert-Chatelain, et al
Nature (2016)



Cellular activity depends on mitochondria
Mitochondria site of cellular respiration (ATP)
Mitochondria have many CB1 receptors (mtCB1)
Cannabinoid action at mtCB1 inhibits respiration
Hippocampus starved of energy (less ATP)
A mechanism for amnesia..?

1964



**I'm a Loser
I'll Follow the Sun
Nowhere Man
I'm Looking Through You
If I Needed Someone**

The Beatles



1965

Psychedelics

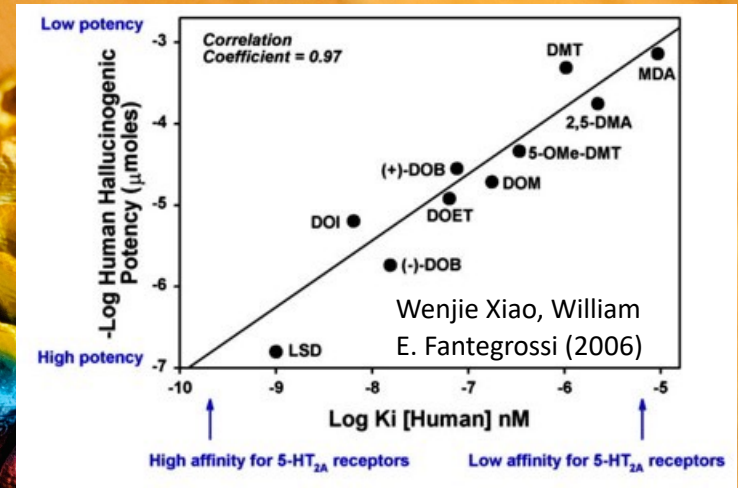
Chemicals that produce unusual perceptual and cognitive distortions.

Many derived from plants, though some are synthetic.

Mescaline, psilocin, DMT, LSD

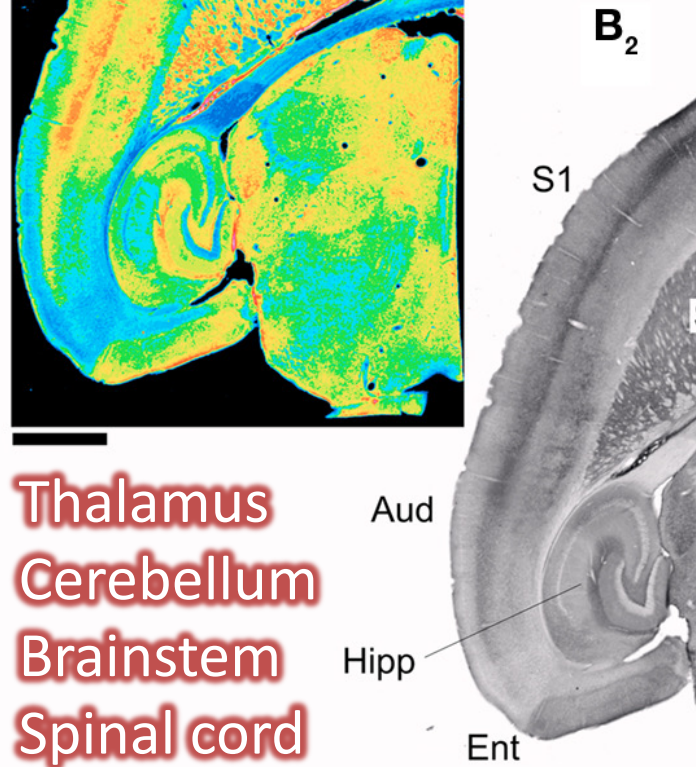
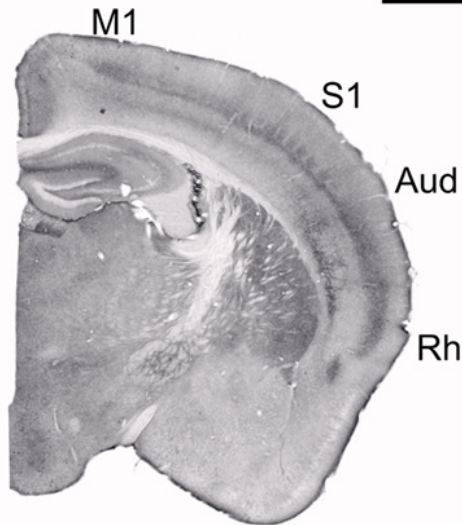
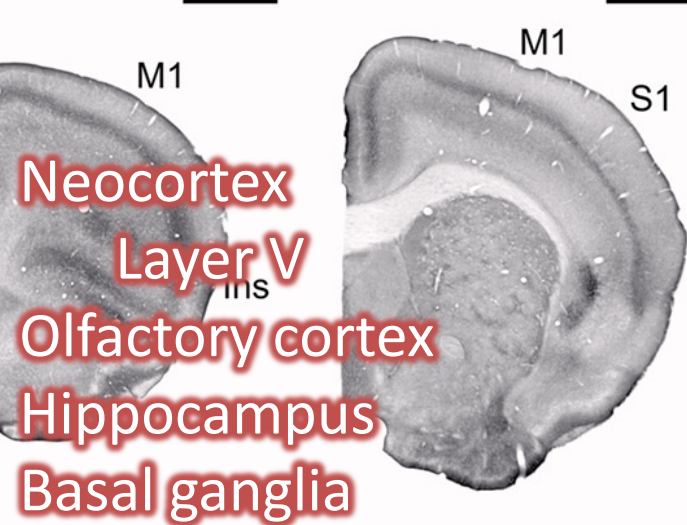
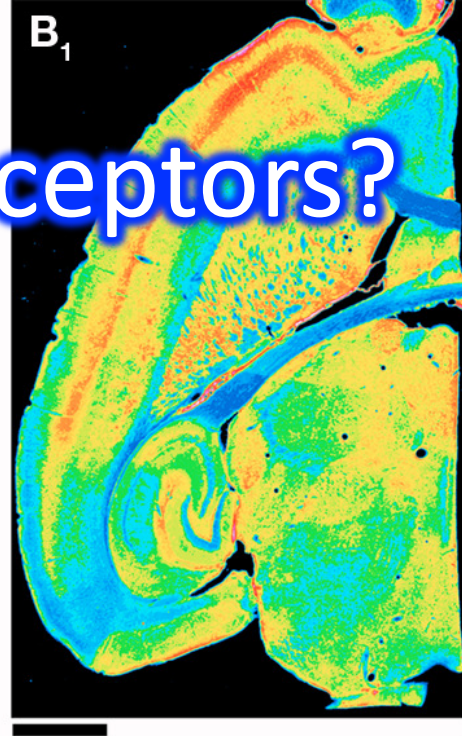
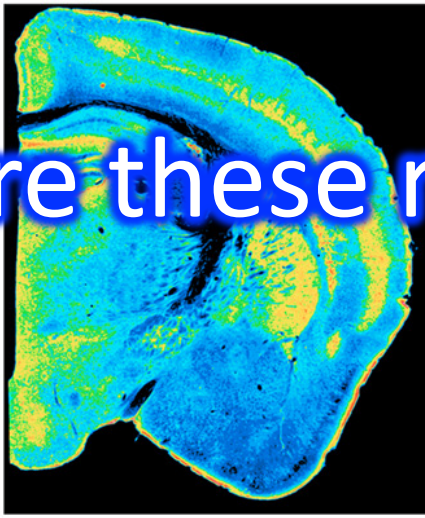
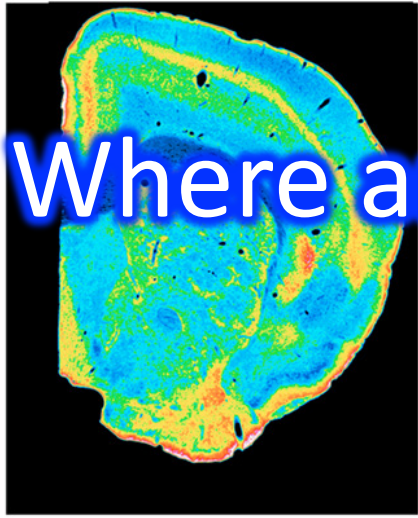
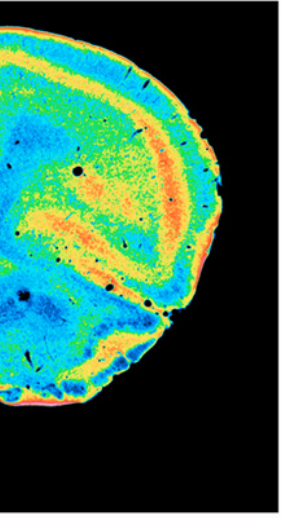


Most psychedelics are agonists at ONE type of SEROTONIN receptor (5-HT_{2A})



Potency linked directly to hallucinogenic effects

Where are these receptors?



Psychedelics affect the “gating” of sensory input

Changes in perception

“If the doors of perception were cleansed, everything would appear to man as it is, infinite” - William Blake

“The legs, for example, of that chair - how miraculous their tubularity, how supernatural their polished smoothness”
- Aldous Huxley, “The Doors of Perception” (1954)

“I looked around me and noticed details of physiognomy that had never struck me before. Each pore in my companion’s skin was now visible...”
- Solomon Snyder, “Drugs and the Brain”

“I clapped my hands and saw sound waves passing before my eyes”
- Solomon Snyder, “Drugs and the Brain”

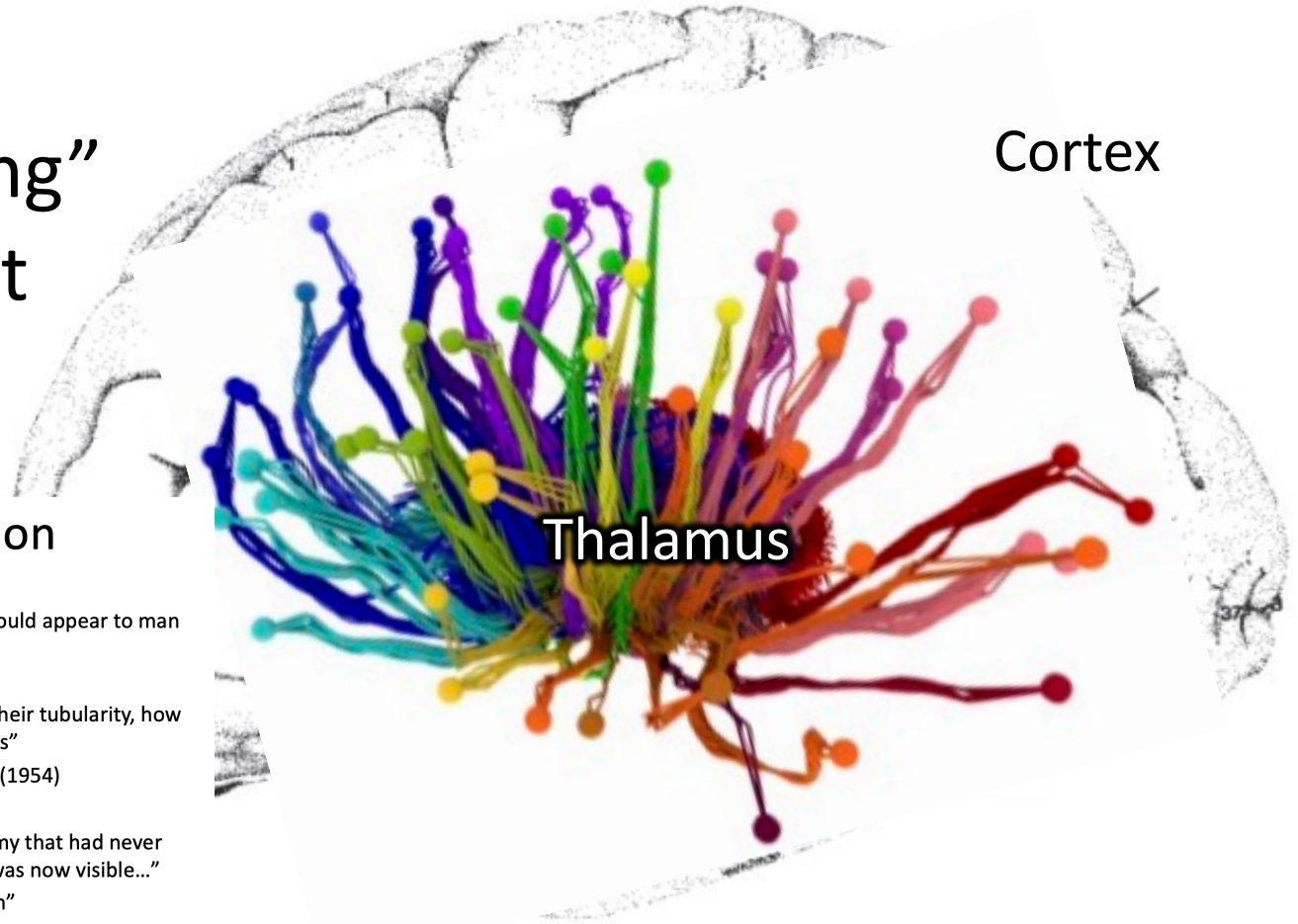
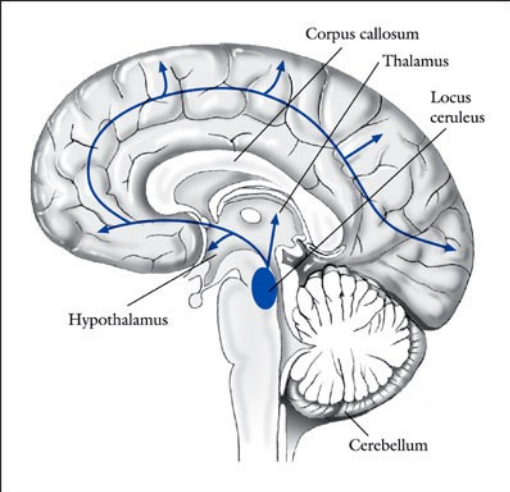


Image courtesy of the Allen Institute for Brain Science



Psychedelics Enhance Sensory Responses in the Locus Coeruleus (LC) via 5-HT_{2A} Receptors



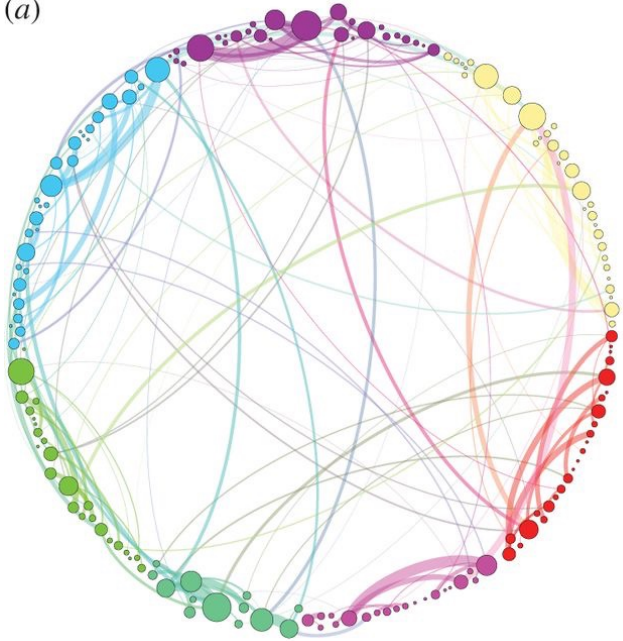
*Ordinary
stimuli become
extraordinary*

“...it is of interest that the systemic administration of LSD, mescaline, or other psychedelic hallucinogens in rats, although decreasing spontaneous activity, produces a paradoxical facilitation of the activation of LC neurons by sensory stimuli...”
(Aghajanian 1980; Rasmussen & Aghajanian 1986)

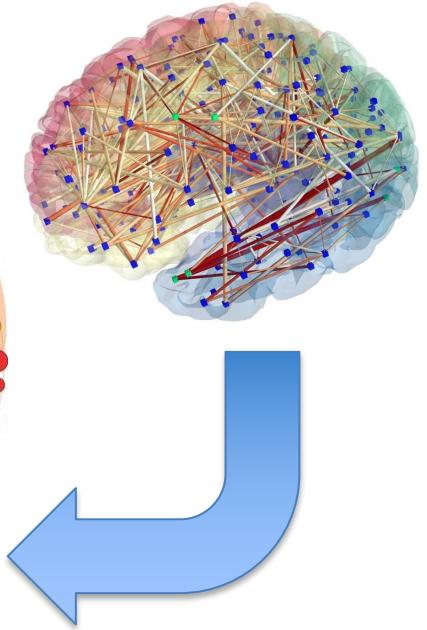
Greater functional connectivity

Homological scaffolds of brain functional networks, G. Petri, et al (2014)

(a)



(b)



“there is an increased integration between cortical regions in the psilocybin state...One possible by-product of this greater communication across the whole brain is the phenomenon of synesthesia which is often reported in conjunction with the psychedelic state...”

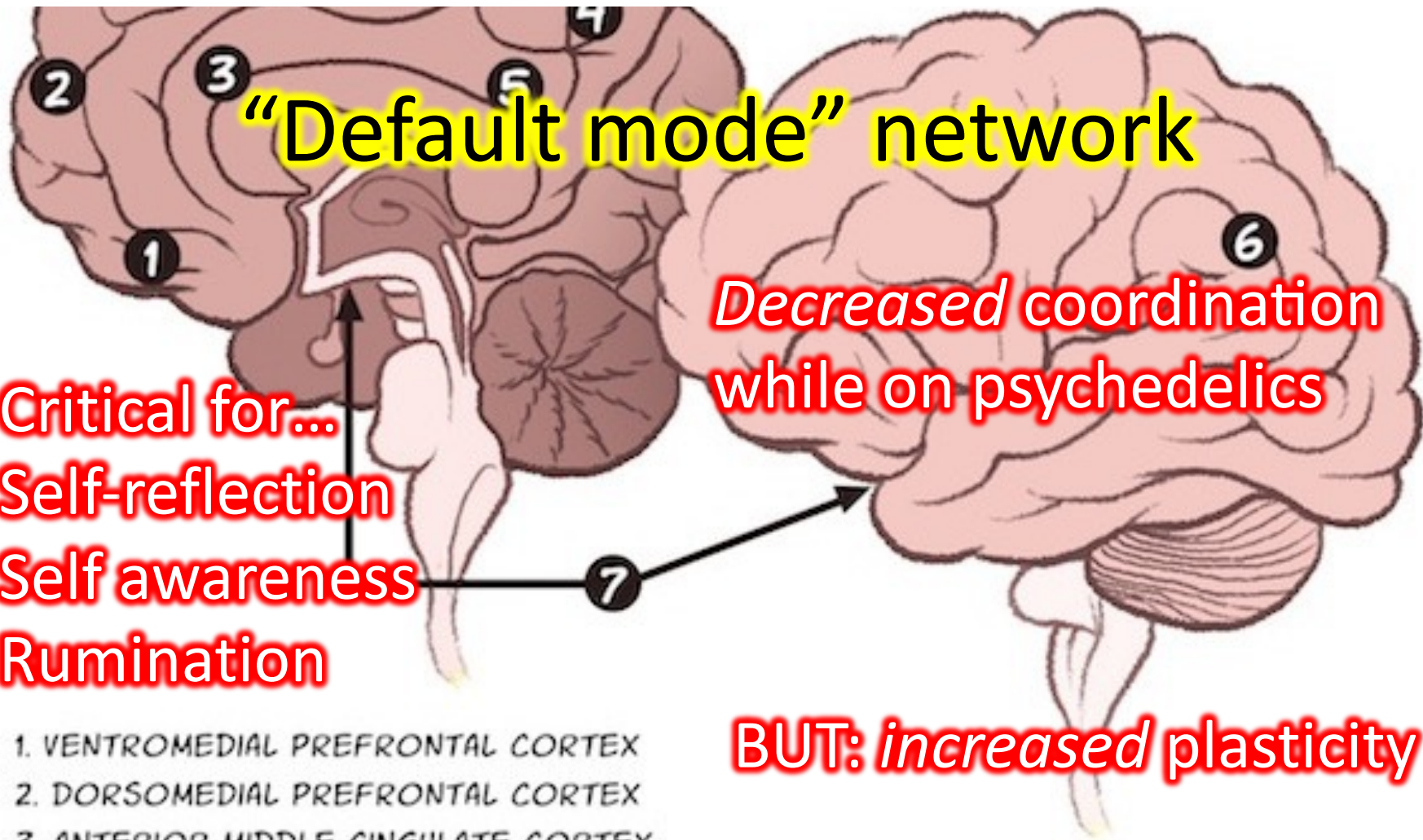
"Default mode" network

Critical for...
Self-reflection
Self awareness
Rumination

*Decreased coordination
while on psychedelics*

BUT: increased plasticity

1. VENTROMEDIAL PREFRONTAL CORTEX
2. DORSOMEDIAL PREFRONTAL CORTEX
3. ANTERIOR MIDDLE CINGULATE CORTEX



A close-up photograph of a human brain model, which is painted a vibrant yellow. The brain's characteristic folds and grooves are clearly visible. The model is set against a blurred background of colorful, abstract shapes. At the bottom of the image, a blue text overlay with a white outline reads: "We all live in a yellow submarine..."

“We all live in a yellow submarine...”

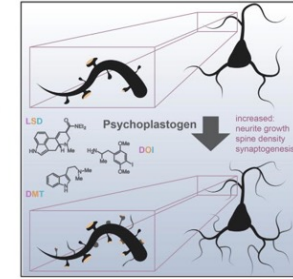
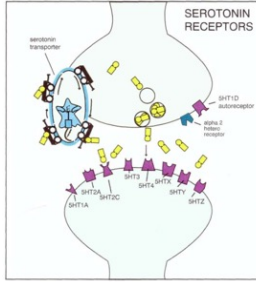


Got To Get You Into my Life
Yellow Submarine
I'm Only Sleeping
Love You Too

The Beatles

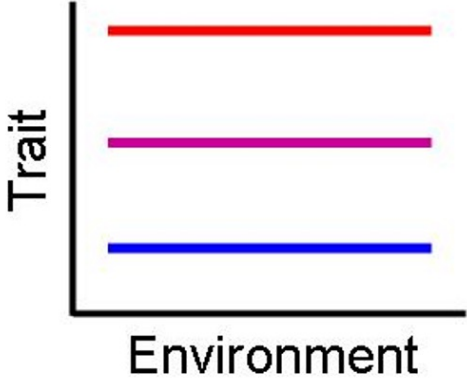
Psychedelics & Environments

Psychedelics → Serotonin Systems → Neuronal Plasticity

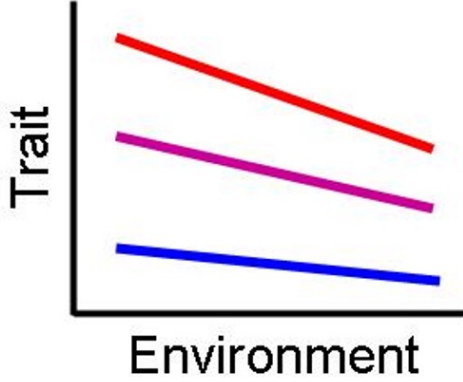


Psychedelics & Environments

No Plasticity



Plasticity



Psychedelics & Environments

Set & Setting



Psychedelics & Environments



The Efficacy of Music Therapy

Judith H. Wakim, EdD, RN, CNE, Stephanie Smith, MSN, CRNA, Cherry Guinn, EdD, RN

Undergoing a procedure that requires anesthesia can be anxiety provoking. Anxiety is associated with increases in heart rate and blood pressure and other changes that can have a negative impact preoperatively; during the induction, maintenance, and emergence phases of anesthesia; and postoperatively. Music therapy is a nonpharmacological intervention that has the ability to reduce anxiety levels in some patients. This review presents research studies that have been conducted on the effects of music therapy for patients in different clinical settings. In general, the majority of the published articles reviewed revealed that listening to music was beneficial to the patient no matter the setting. Offering a music selection to patients before anesthesia could enhance its positive effect. Peri-anesthesia nurses could easily develop a protocol for different situations where patients will be exposed to interventions where the use of general or local anesthesia is expected.

Keywords: *Perianesthesia anxiety, music therapy, nonpharmacological anxiolytic.*

© 2010 by American Society of PeriAnesthesia Nurses





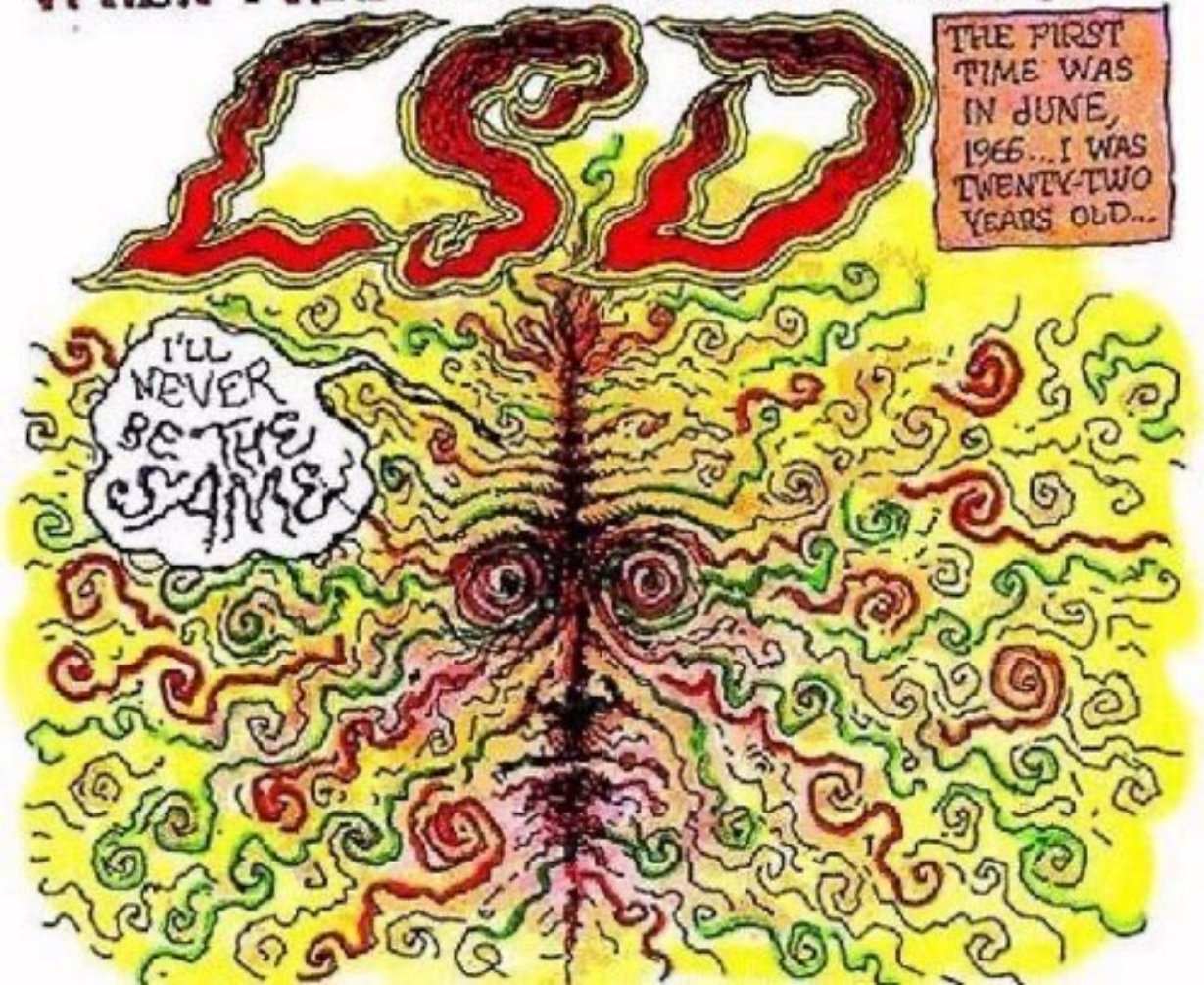
**Hey Bulldog
Only a Northern Song
Your Mother Should Know**

The Beatles

WHEN I WAS YOUNG I TOOK ALOT OF

THE FIRST
TIME WAS
IN JUNE,
1966... I WAS
TWENTY-TWO
YEARS OLD...

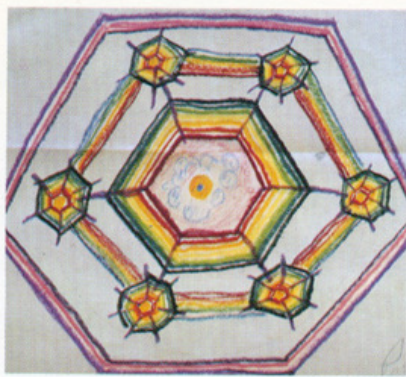
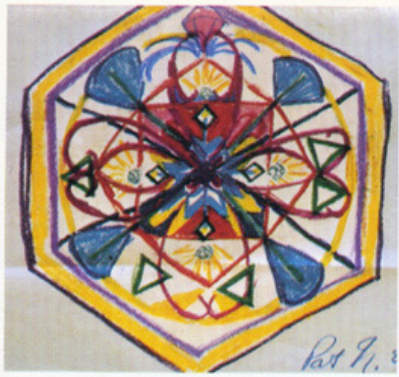
I'LL
NEVER
BE THE
SAME



Robert Crumb "LSD"

Is there a link between creativity and hallucinogens?

Distortion of body extremities is illustrated in a sophisticated way by a professional painter. This drawing was executed by a well-known Czech artist after the recovery from LSD intoxication.



Mandalas created before (left) and during (right) an LSD session conducted in 1972 at the Maryland Psychiatric Center

In 1952 László Mátéfi described how an experimental subject under the influence of a hallucinogen experienced a discrepancy between his intention and performance while making a portrait:

I see the object correctly but draw it falsely; my hands won't follow it.... This desire to paint is harder and harder for me to perform since the expanse of my experience pulls me more and more into it. Myself, the drawing, and the surroundings create a unity--and that hinders me because I cannot concentrate on the model. I have the need to bring everything including the painted picture into the surface of the image. Had the painting process been more of a technical success, I would have been able to produce a fantastically good work

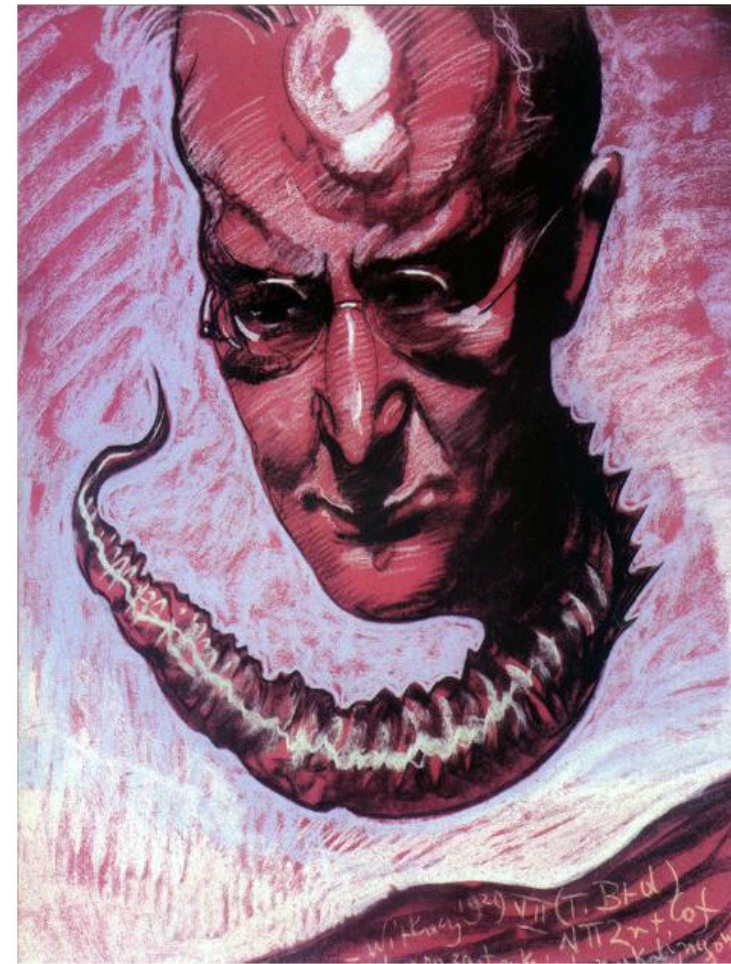


Stanislaw Witkacy "Teodora Bialynickiego-Birul" 1929



Witkacy made this portrait under the influence of mescaline.

Witkacy made this portrait under the influence of peyote.



Stanislaw Witkacy "Neny Stachurskiej" 1929



Marijke Dunham, outfits for the Beatles

“Drugs were a big part of it, the aesthetic has a bad name due to that. I mean Van Gogh painted his strange paintings and there’s been no mention of drugs, but drugs definitely had an influence as far as the cause was concerned, with the strange moving lines, definitely ... and since I’m not ashamed about it I don’t have to hide it. That’s where it comes from.” -*Marijke Dunham*

"I didn't take LSD, I didn't want to be that far from my senses" -*Peter Blake*





**PORTLAND YOUTH
PHILHARMONIC**

DAVID HATTNER, MUSICAL DIRECTOR

