

Music, Brains, Drugs & The Beatles

David Hattner, Portland Youth Philharmonic
Bill Griesar, PSU/OHSU/Northwest Noggin
Jeff Leake, PSU/NW Noggin



Charles Burchfield, Autumnal Fantasy

Northwest Noggin

Community outreach



Interdisciplinary neuroscience

We've met 85,000+ people 🤖

ALL VOLUNTEER ❤️

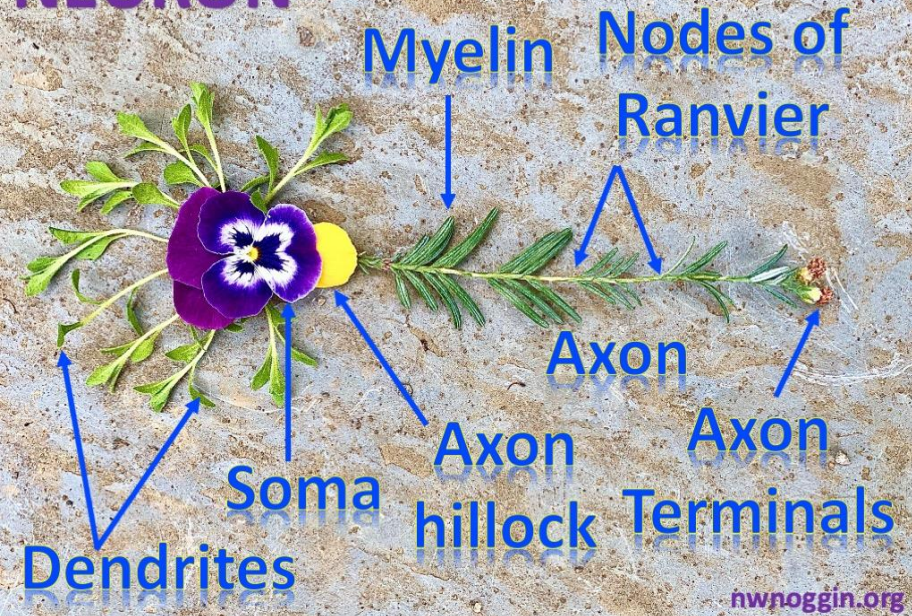
14 years! 😎

nwnoggin.org

Art & Brains!



NEURON



Where have we been!



PORTLAND AREA

Portland Public Schools
Vancouver Public Schools
Beaverton Public Schools
Evergreen Public Schools
Hillsboro Public Schools
David Douglas Public Schools
Parkrose High School
Reynolds High School
Oregon City High School
Tigard - Tualatin Public Schools
Columbia City Elementary
Pear Center for Homeless Youth
Bio Gift
SIN Chapter Mtg
Portland Art Museum
University Club
PLACE Gallery
Vancouver Symphony
Science on Tap
NOGGINFEST
Paragon Gallery
Bridge to Pathways, St. Helens
Doug Fir
Oregon Public Broadcasting (OPB)
Portland Tennis & Education Center
March for Science
STEAM Nights
Comic-Con
AMWA (American Medical Women's Association)
Providence Hospital BRAIN WATCH
Intel
Noggin Talks @ Velo Cult/Honey Latte/Floyd's Coffee
OMSI Brain Fair
PNCA Make + Think + Code
OHSU Brain Institute
Alzheimer's Association of Oregon
Legacy Research Institute
RACC Juice Awards
ONPRC
KQW News
Helen Gordon Child Development Center
Asian New Year in the Park
Oregon Youth Neuroscience Conference
Undergraduate Research Opportunity Fair
University Center for Excellence in Developmental Disabilities

WILLAMETTE VALLEY

Amity/Williamina High Schools
Canby School District
Eugene Public Schools
OAEA Conference
Oregon State University
University of Oregon
OPAHEC
MacLaren Youth Correction Facility
PCC Newberg
Coffee Creek Correctional Facility
Oregon Psychiatric Physicians Association
Oregon Senate testimony

CENTRAL/EASTERN OREGON

Eastern Oregon University
Sisters Public Schools
Roundhouse Foundation
Frontier county schools
Heppner & Lone Public Schools
NEOAHEC/La Grande
Caldera Arts

OREGON COAST

Astoria Public Schools
Warrenton Public Schools
Knappa Public Schools
Jewell School
Seaside Public Schools
Lincoln County Schools
Fort George Brewery
Street 14 Coffee
Siletz Valley Academy
Kids Make Theater/Liberty Theater
Girls Rock Coos Bay
Salishan (TRIO)

SOUTHERN OREGON

Indian Education Summer Camp
Grants Pass Public Schools
Southern Oregon University
SW Oregon Economic Summit

INTERNATIONAL

Universidad de Chile, Valparaíso Chile
Ciencia al Firo, Valparaíso Chile
Gordon Museum of Pathology, Kings College London
Sidmouth Science Festival, England
British International School, Gaza
Brain Olympics, the Netherlands



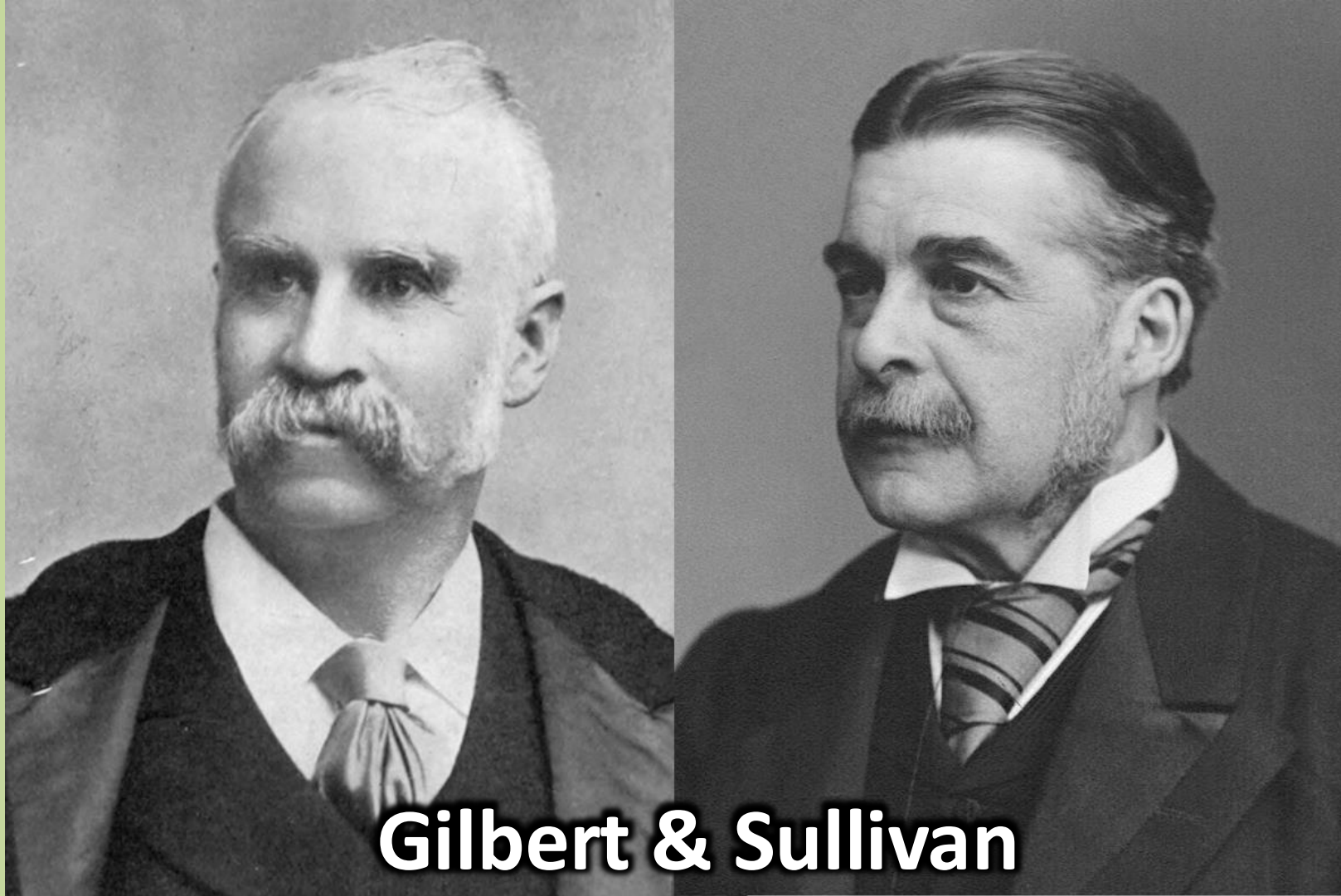
GO PLACES
EXAMINE BRAINS
ASK QUESTIONS
MAKE ART



UNITED STATES

SIN conferences (San Diego, Washington, New Orleans, Chicago)
San Diego Unified Public Schools
Washington DC Public Schools
Chicago Public Schools
Eastern Washington, Davenport Public Schools
Society for Social Neuroscience conference, Chicago
Sidwell Friends School
NOGN (Neuroscience Outreach Group) @ NYU
Dana Foundation
Waikiki Elementary School, Hawaii
White House Frontiers Conference (Pittsburgh)
U.S. Congress
White House Office of Science & Technology Policy
Phillips Collection (DC)
TRIO conference, Boise ID
TRIO Conference, Bellevue WA
Boise State University





Gilbert & Sullivan



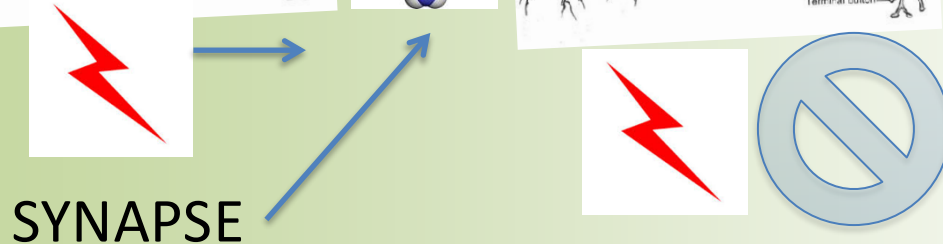
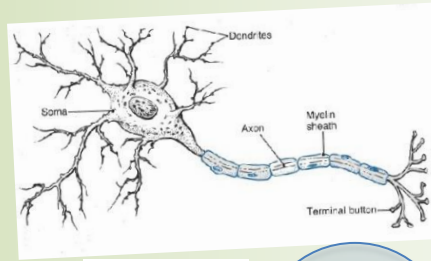
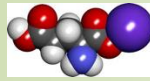
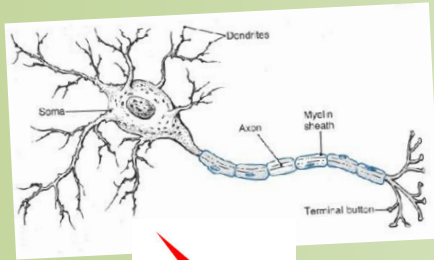
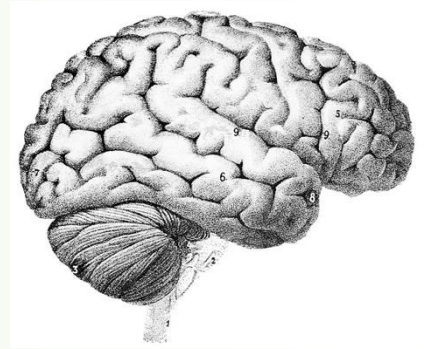
Sir Joseph Porter



The Lord Chancellor

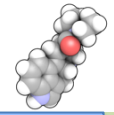
Your brain: made of cells

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

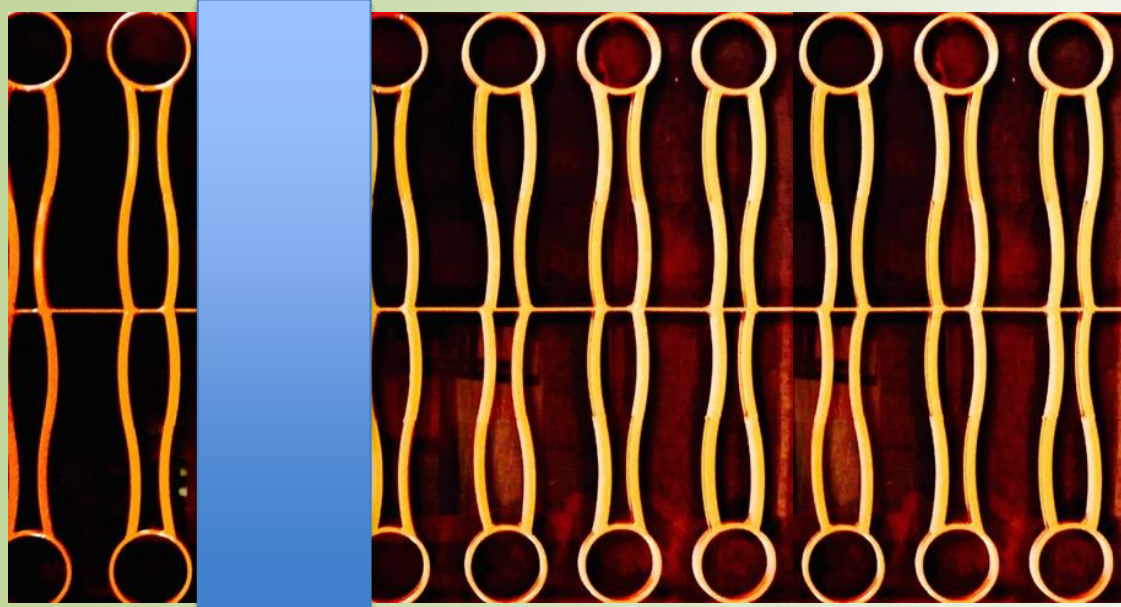


All cells have membranes

Neurotransmitter
or drug



Outside cells, including neurons



RECEPTOR: “Protein machine”

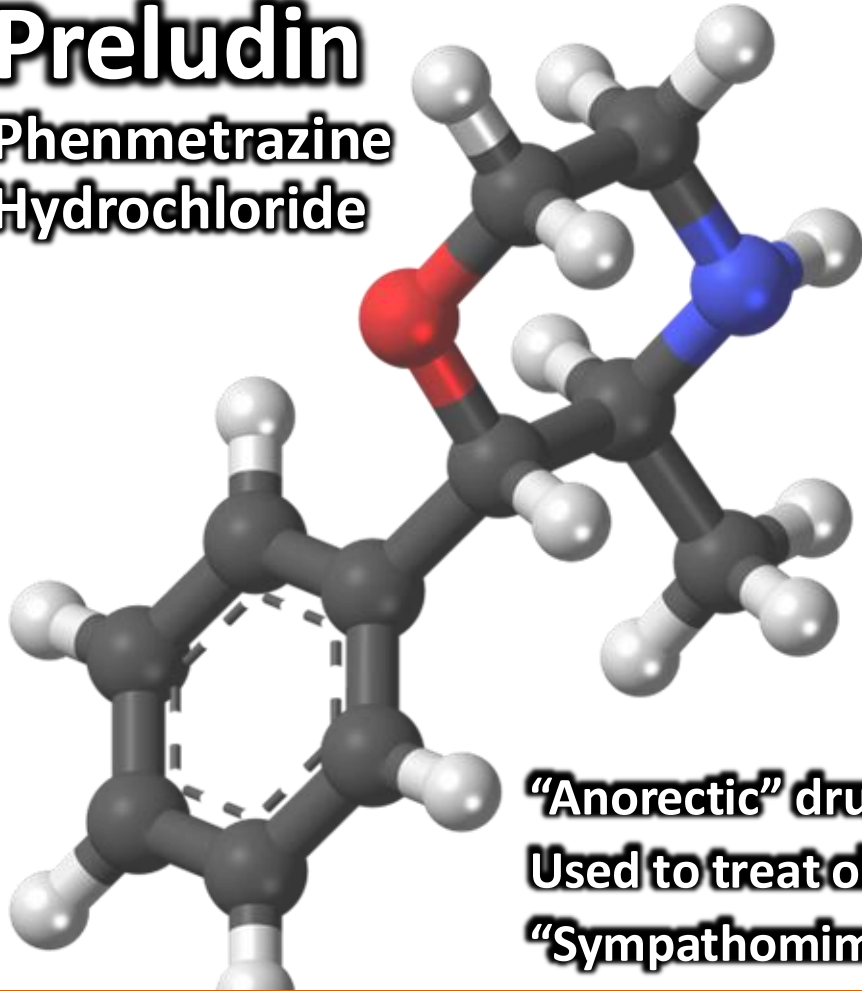
Inside cells

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...

Preludin

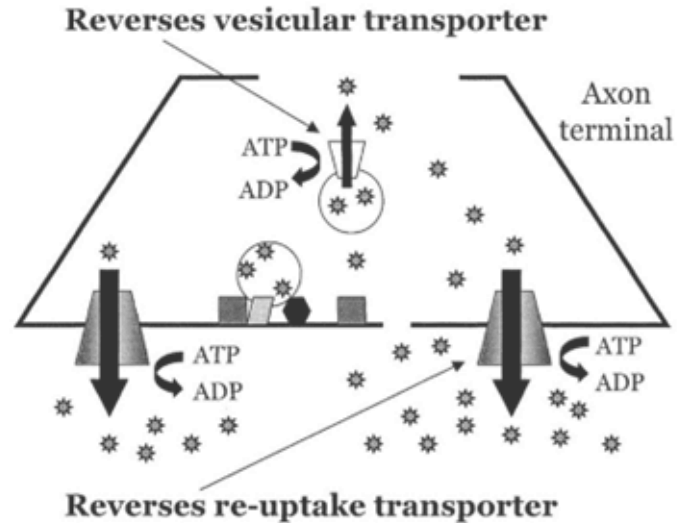
Phenmetrazine
Hydrochloride



“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...

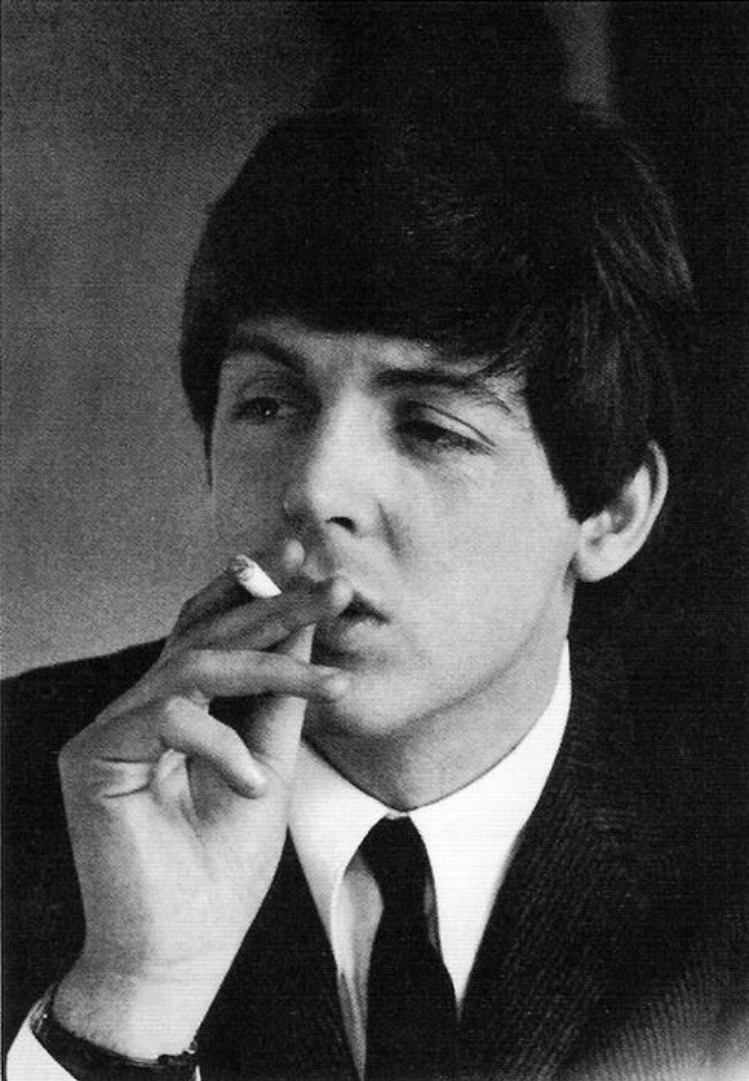


She Loves You
I Want to Hold Your Hand

The Beatles 1963

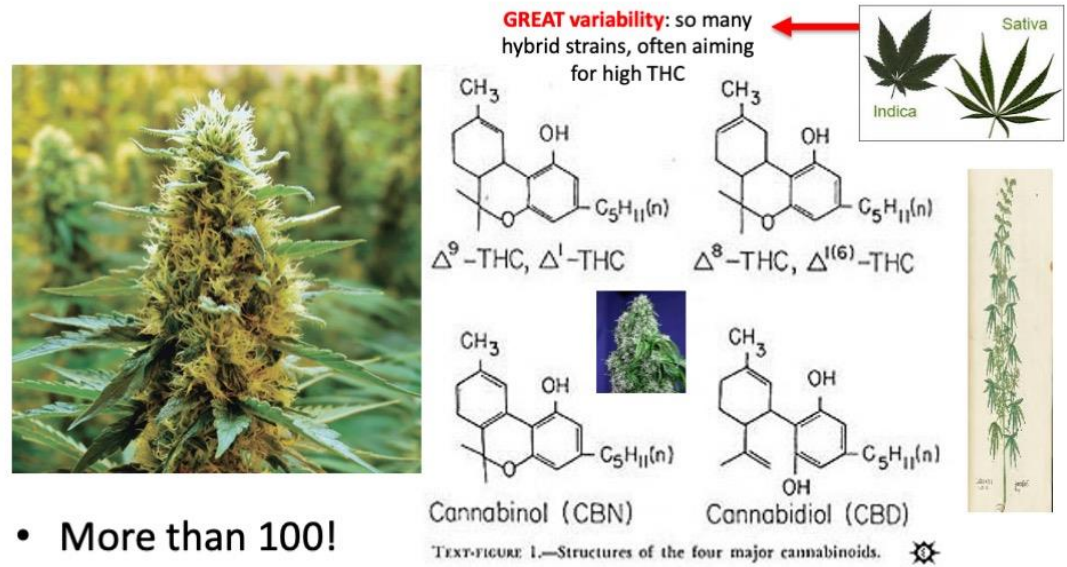


CANNABIS



Cannabis contains cannabinoids

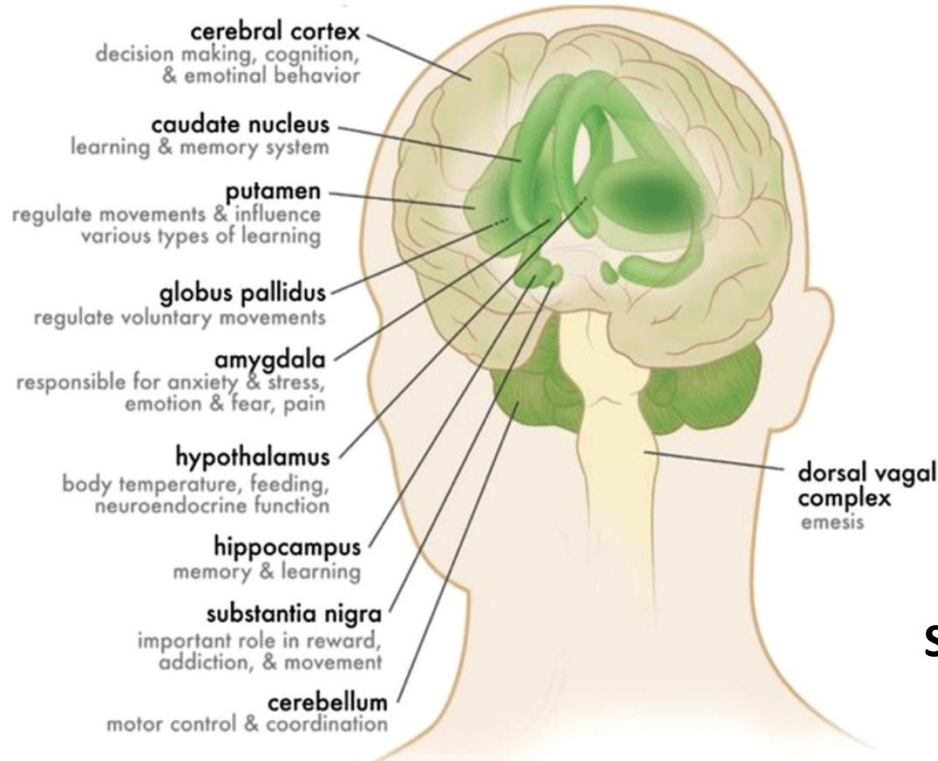
SOURCE: Cannabis, a complex plant: different compounds and different effects on individuals, Atakan (2012)



- 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)

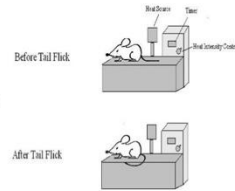


Cannabinoids reduce pain

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)



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)

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)



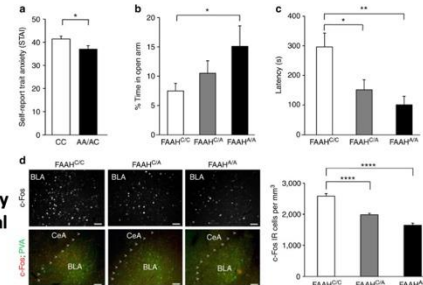
Anxiety: Genetic protection?

Decreased anxiety in humans and mice with FAAH C385A



Breakdown by FAAH; several Forms (A, C)

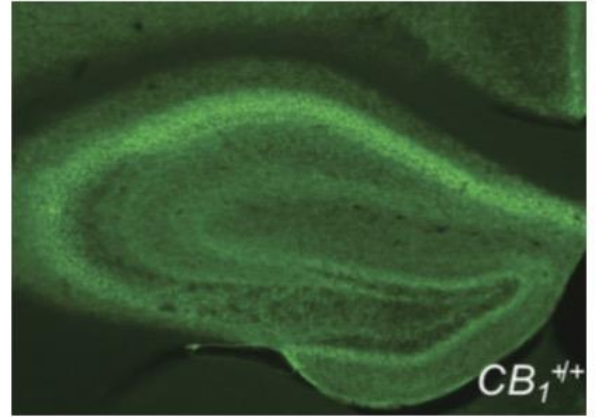
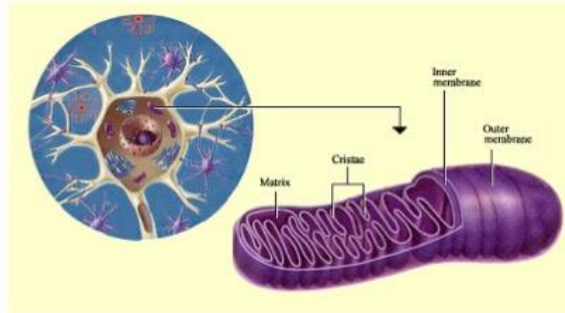
A less common;
Less effective at breakdown



FAAH genetic variation enhances fronto-amygdala function in mouse and human, Nature Communications, Iva Dincheva et al (2015)

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..?



Psychedelics

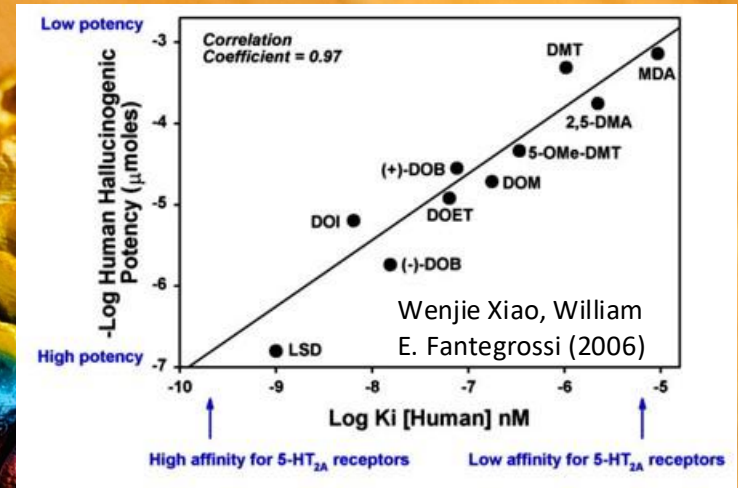
Chemicals that produce unusual perceptual and cognitive distortions.

Many derived from plants, though some are synthetic.

Mescaline, psilocin, DMT, LSD

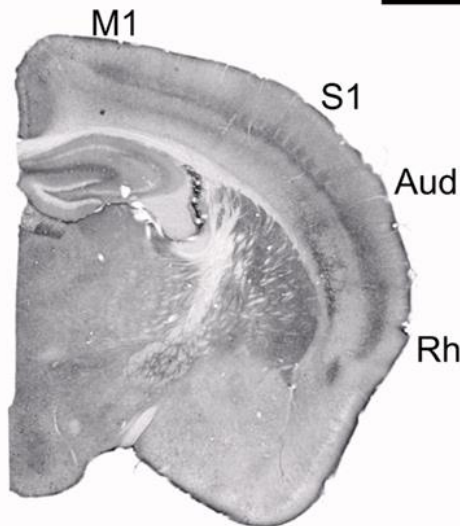
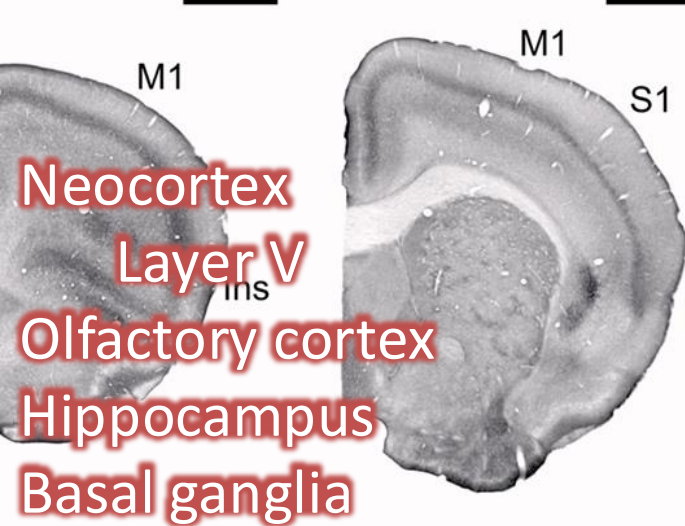
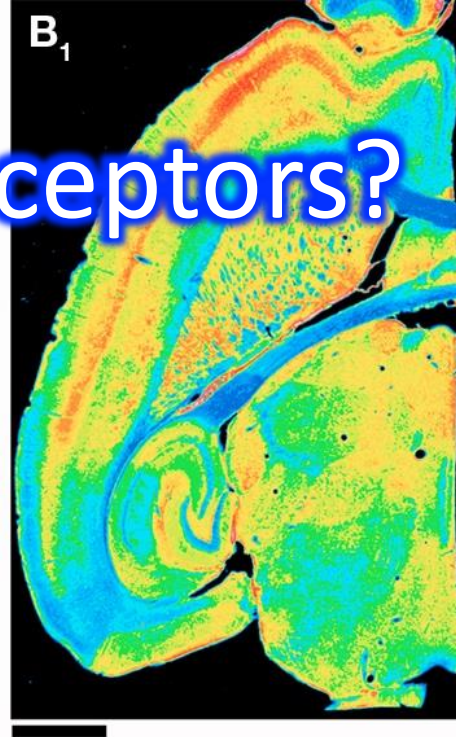
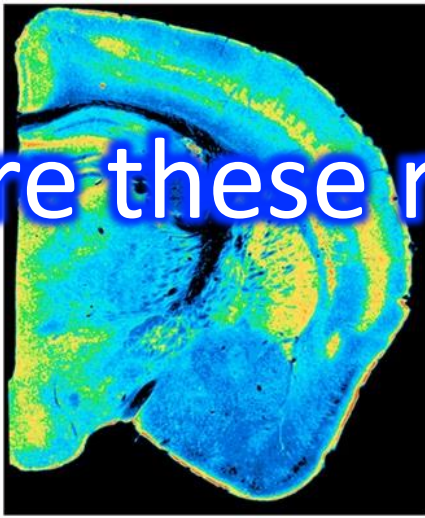
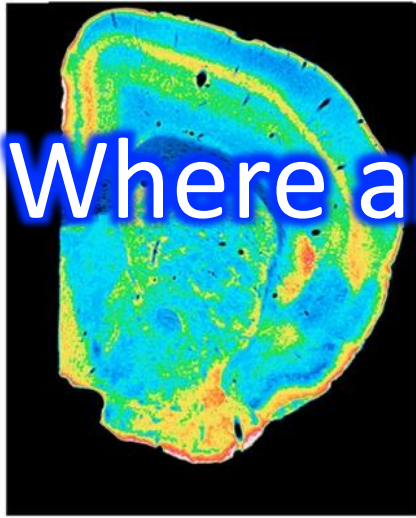
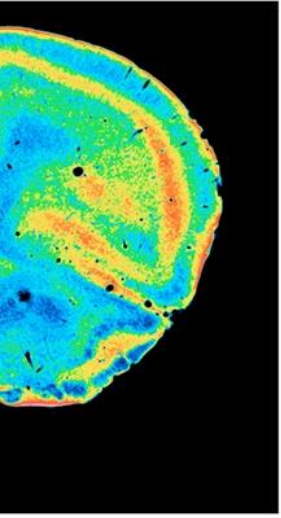


Most psychedelics are agonists at ONE type of SEROTONIN receptor (5-HT_{2A})

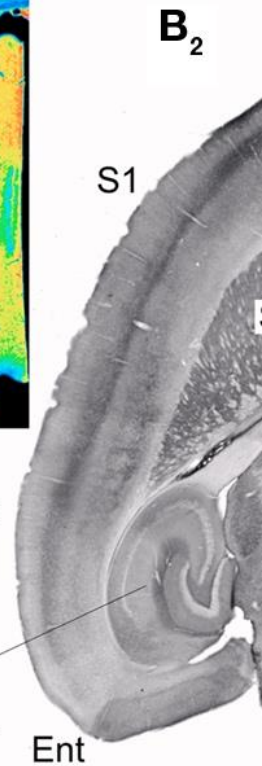


Potency linked directly
to hallucinogenic effects

Where are these receptors?



Thalamus
Cerebellum
Brainstem
Spinal cord



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”

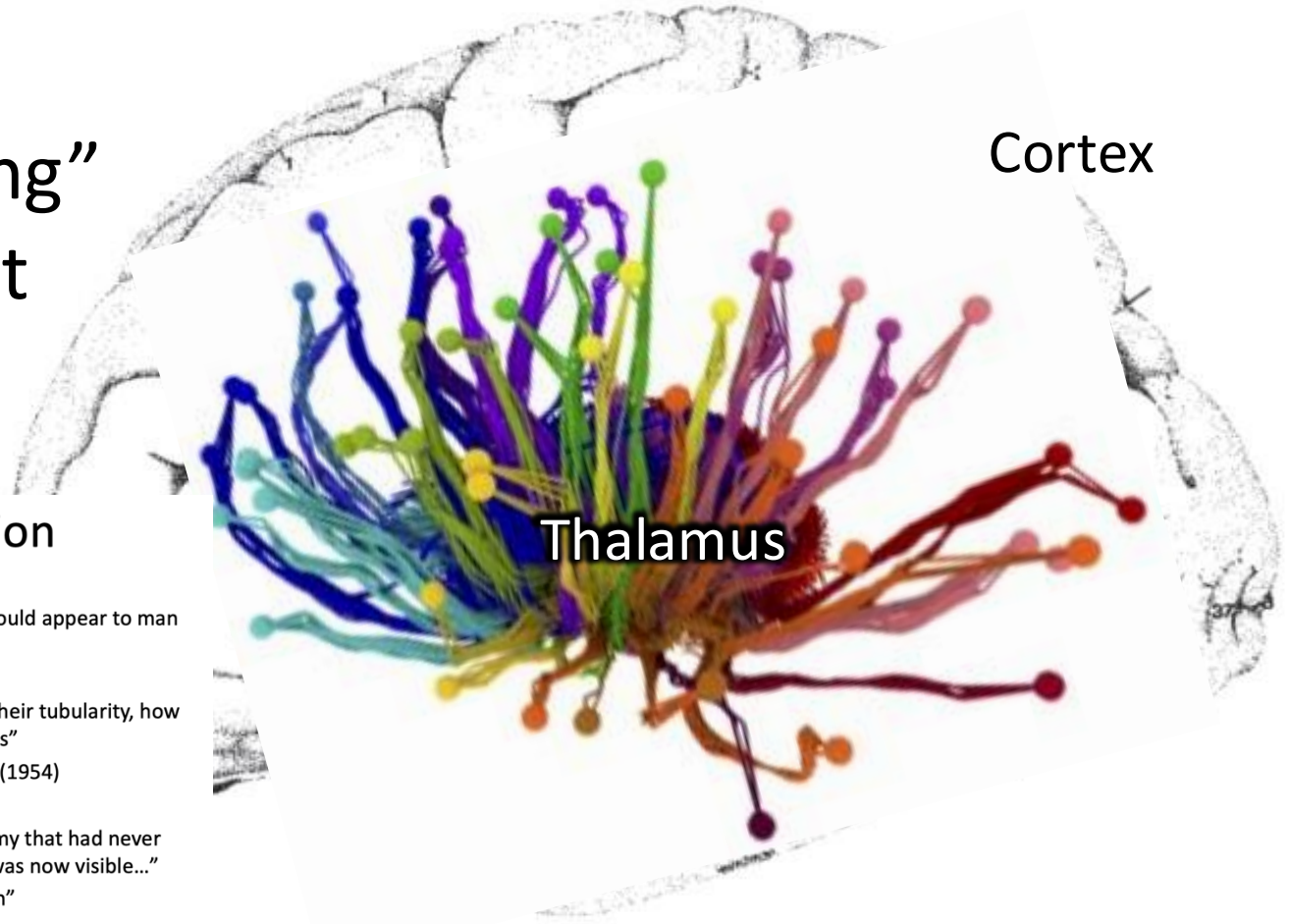
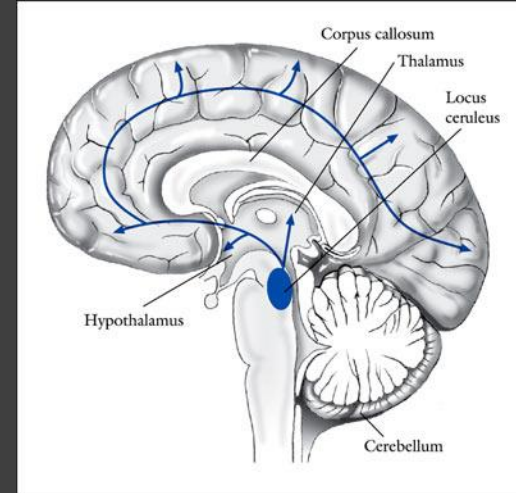


Image courtesy of the Allen Institute for Brain Science

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

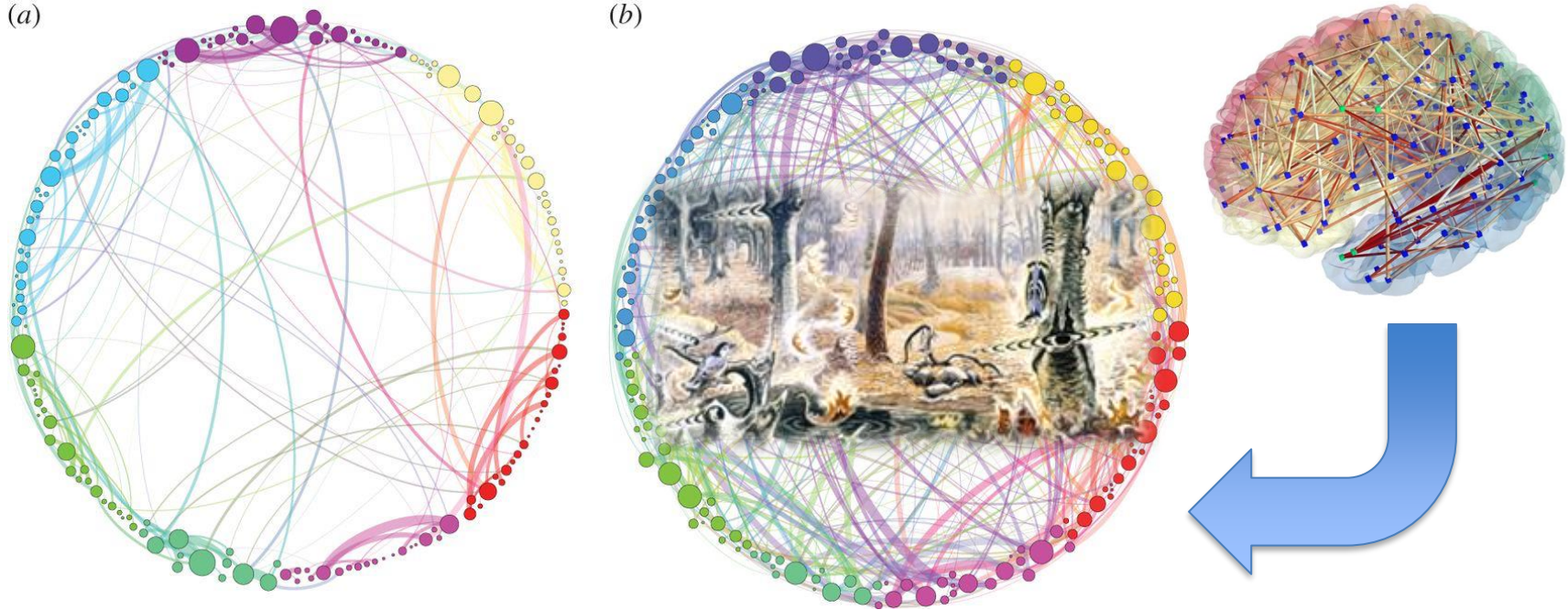


“...it is of interest that the systemic administration of LSD, mescaline, or other psychedelic hallucinogens in rats, although decreasing spontaneous activity, produces a paradoxical facilitation of the activation of LC neurons by sensory stimuli...”
(Aghajanian 1980; Rasmussen & Aghajanian 1986)

*Ordinary
stimuli become
extraordinary*

Greater functional connectivity

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



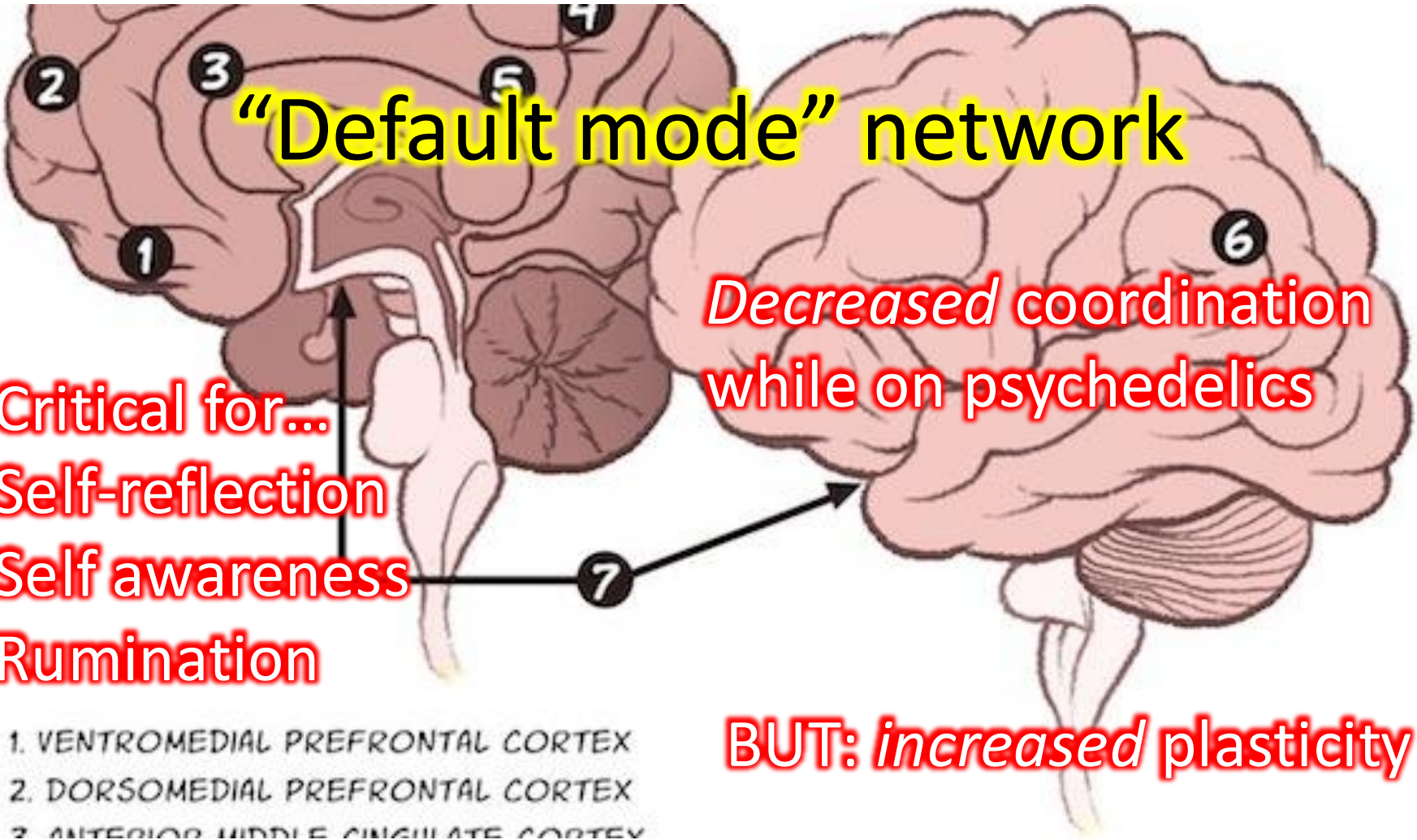
“there is an increased integration between cortical regions in the psilocybin state...One possible by-product of this greater communication across the whole brain is the phenomenon of synesthesia which is often reported in conjunction with the psychedelic state...”

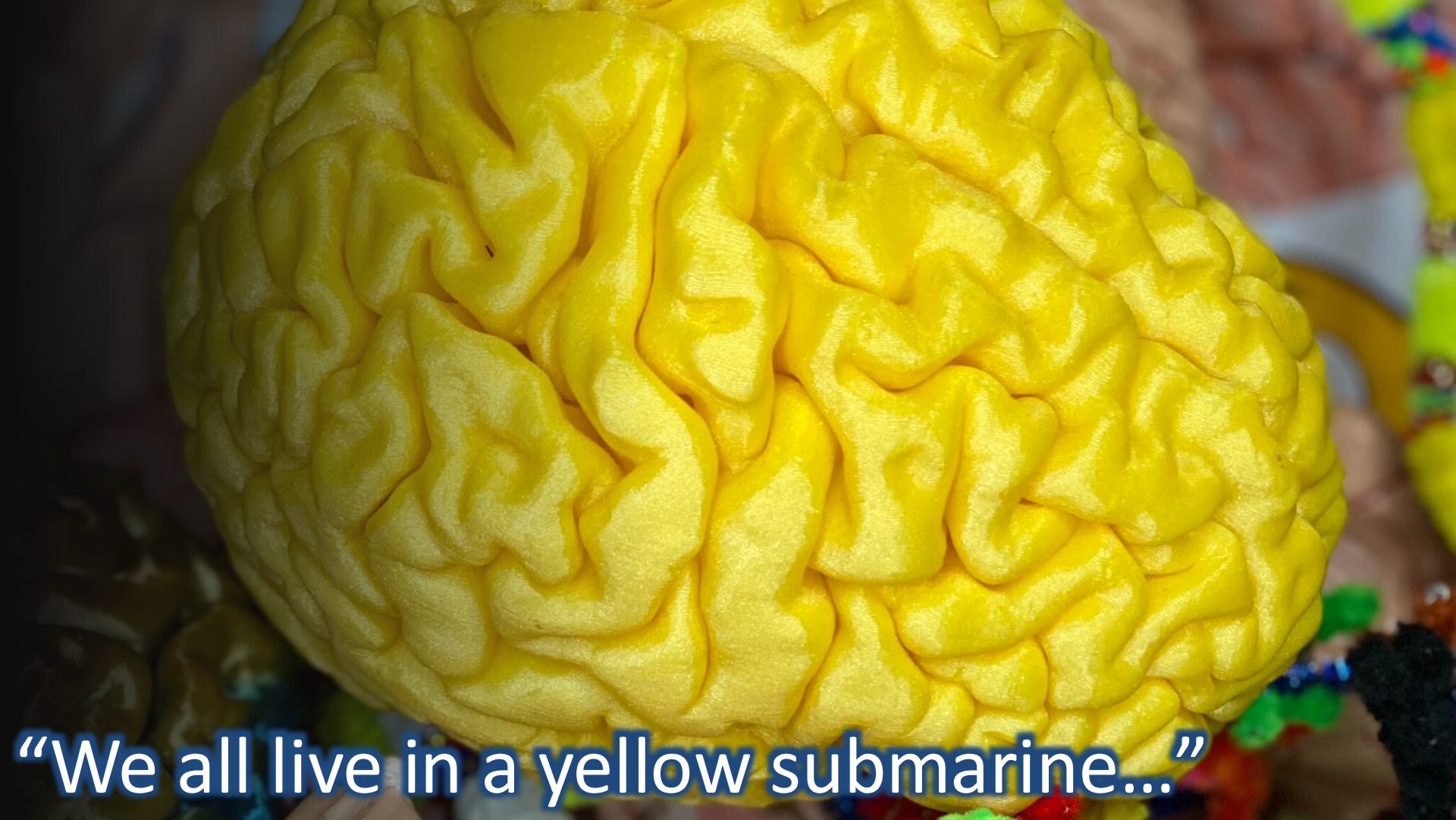
"Default mode" network

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 yellow, wrinkled object that resembles a brain or a piece of coral. The surface is covered in numerous small, rounded, and interconnected folds, giving it a highly textured appearance. The color is a bright, uniform yellow. The background is dark and out of focus, with some colorful, indistinct shapes visible on the right side.

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

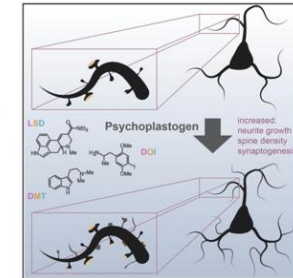
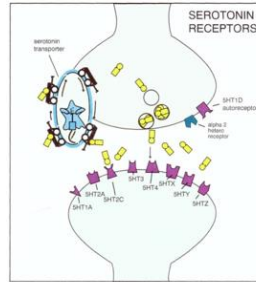


Got To Get You Into my Life
Yellow Submarine
I'm Only Sleeping
Love You Too

The Beatles

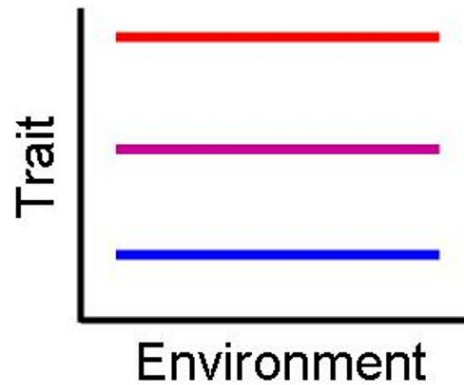
Psychedelics & Environments

Psychedelics → Serotonin Systems → Neuronal Plasticity

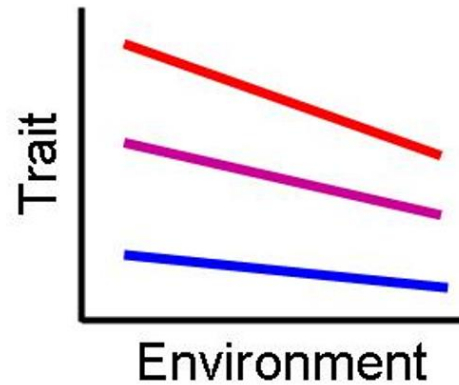


Psychedelics & Environments

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. Perianesthesia 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.*

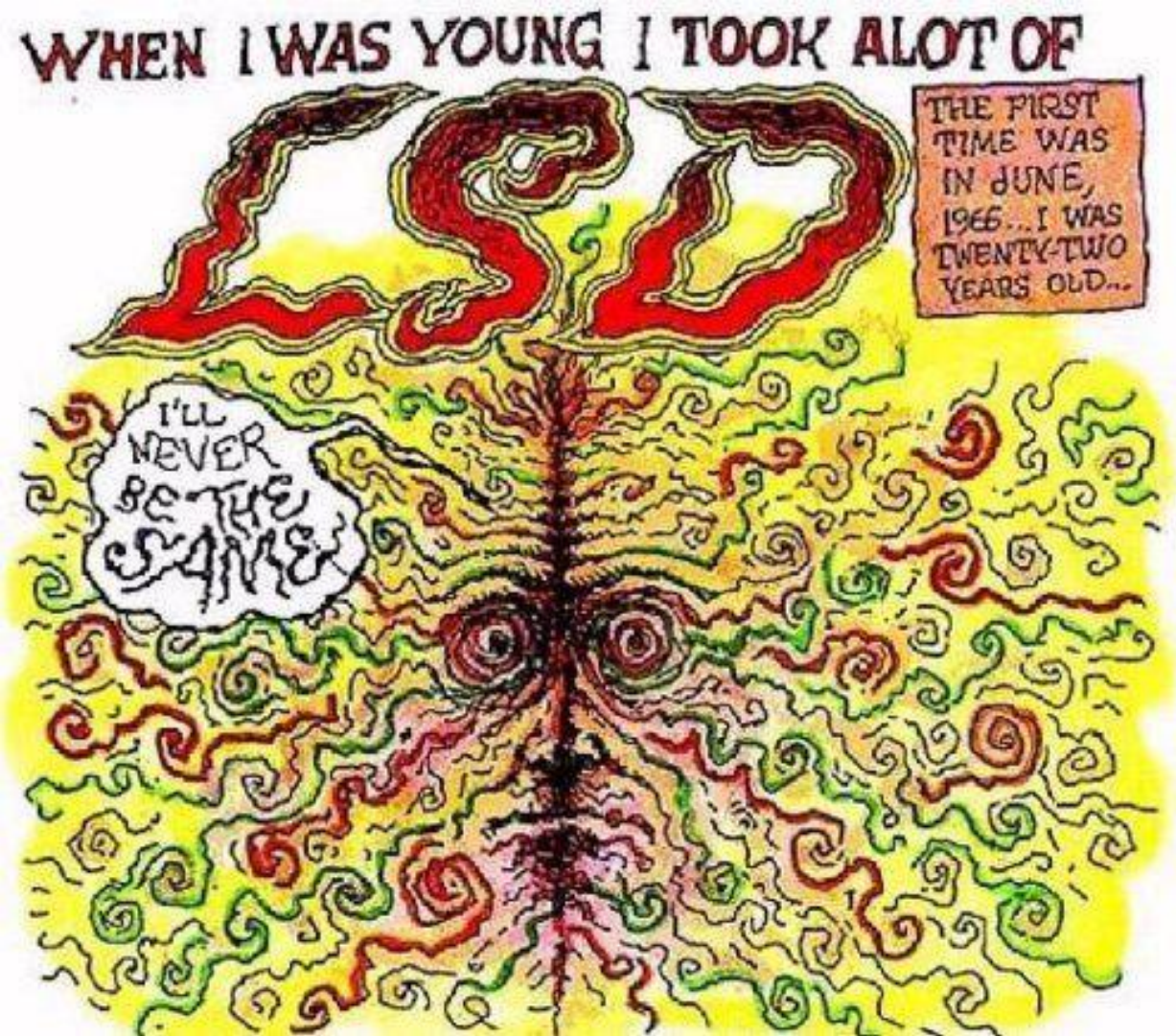
© 2010 by American Society of PeriAnesthesia Nurses





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

The Beatles



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

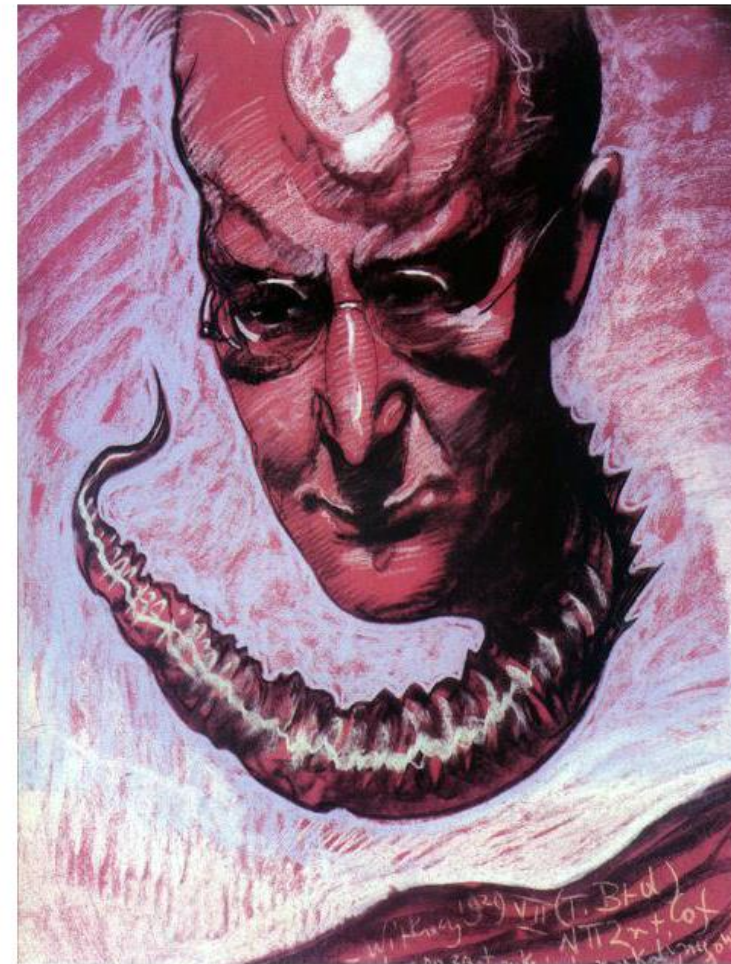


Stanislaw Witkacy "Teodora
Bialynickiego-Birul" 1929



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

