Serotonin Syndrome

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SESPRS
Southeastern Society of
Plastic and Reconstructive Surgeons

Serotonin Toxicity

In 1999

85% of clinicians had no CLUE what SS was

New York State Department of Health Code, Section 405, also known as the Libby Zion Law, is a regulation that limits the amount of resident physicians' work in New York State hospitals to roughly 80 hours per week.

Libby Zion

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Psychoactive Drugs in Plastic Surgery

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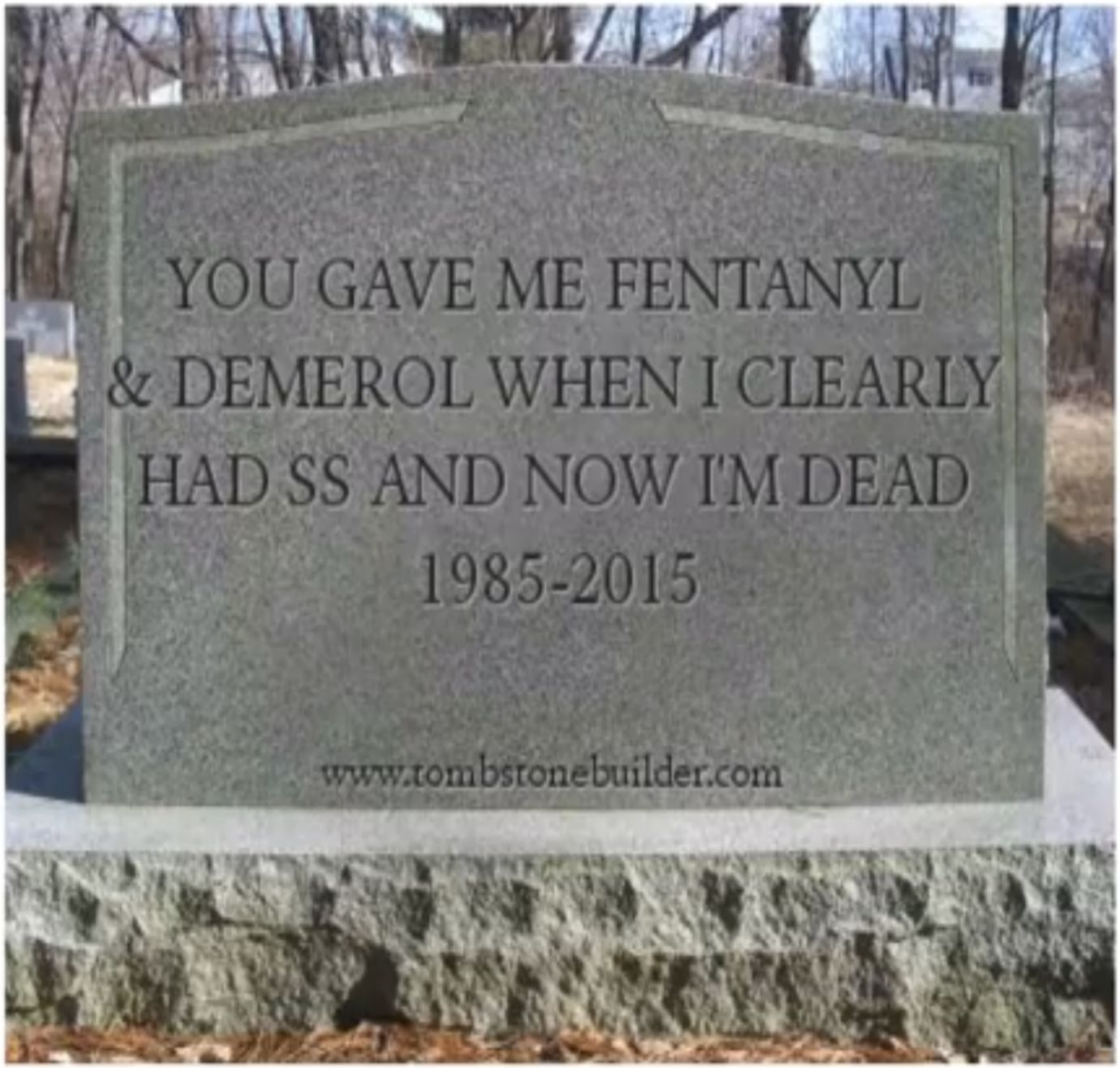
Like Elvis, Michael Jackson Died Of Serotonergic Medications

Dr. Ann Blake Tracy - Executive Director
International Coalition For Drug Awareness
DrugAwareness.org
6-26-9

As suspected, and now confirmed, Michael Jackson dead at age 50 do to Serotonin Syndrome as a result of 2 serotonergic medications - Zoloft (antidepressant) and Demerol (pain killer).

Lisa Maire Presley has not only lost her father, but now also her Ex-husband, to the same basic combination of drugs: antidepressants and pain killers.

Michael Jackson lost his life due to the organ-stopping effect of Serotonin Syndrome thanks to a drug that should have been removed from the market decades ago - Demerol. A serotonergic medication similar in action to antidepressants, atypical antipsychotics, and other pain killers.

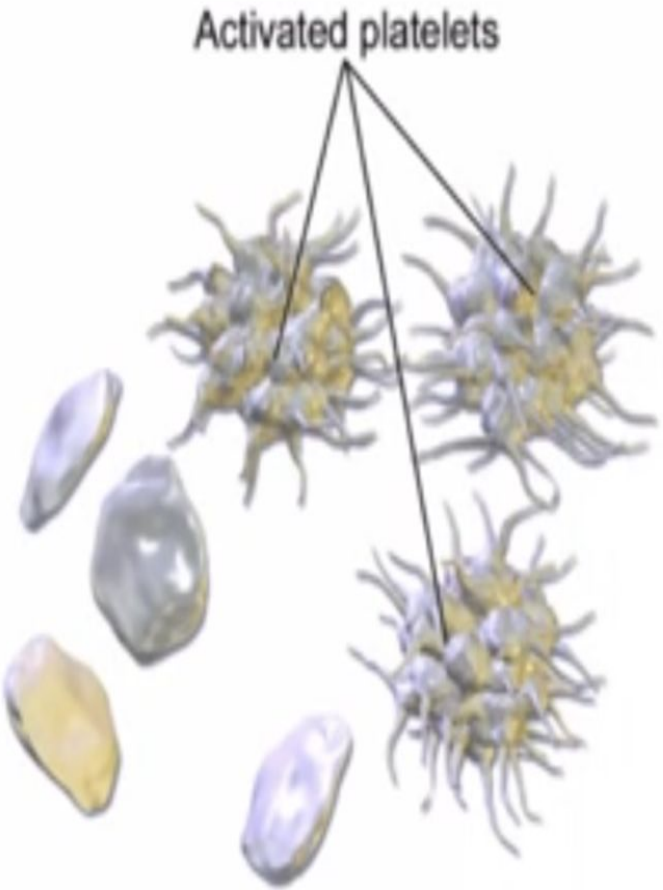

YOU GAVE ME FENTANYL
& DEMEROL WHEN I CLEARLY
HAD SS AND NOW I'M DEAD
1985-2015
www.tombstonebuilder.com

Mortality:

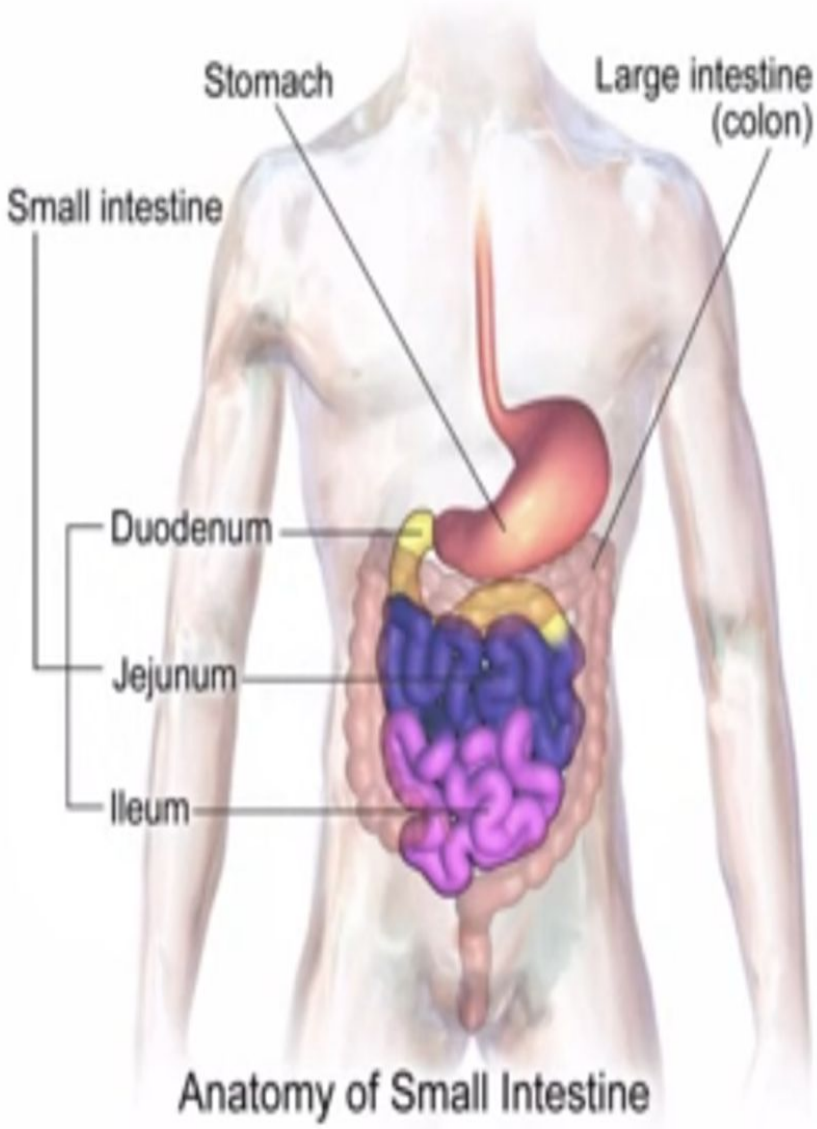
2-12%

Serotonin
$C_{10}H_{12}N_2O$
NH_2
HO
N
H

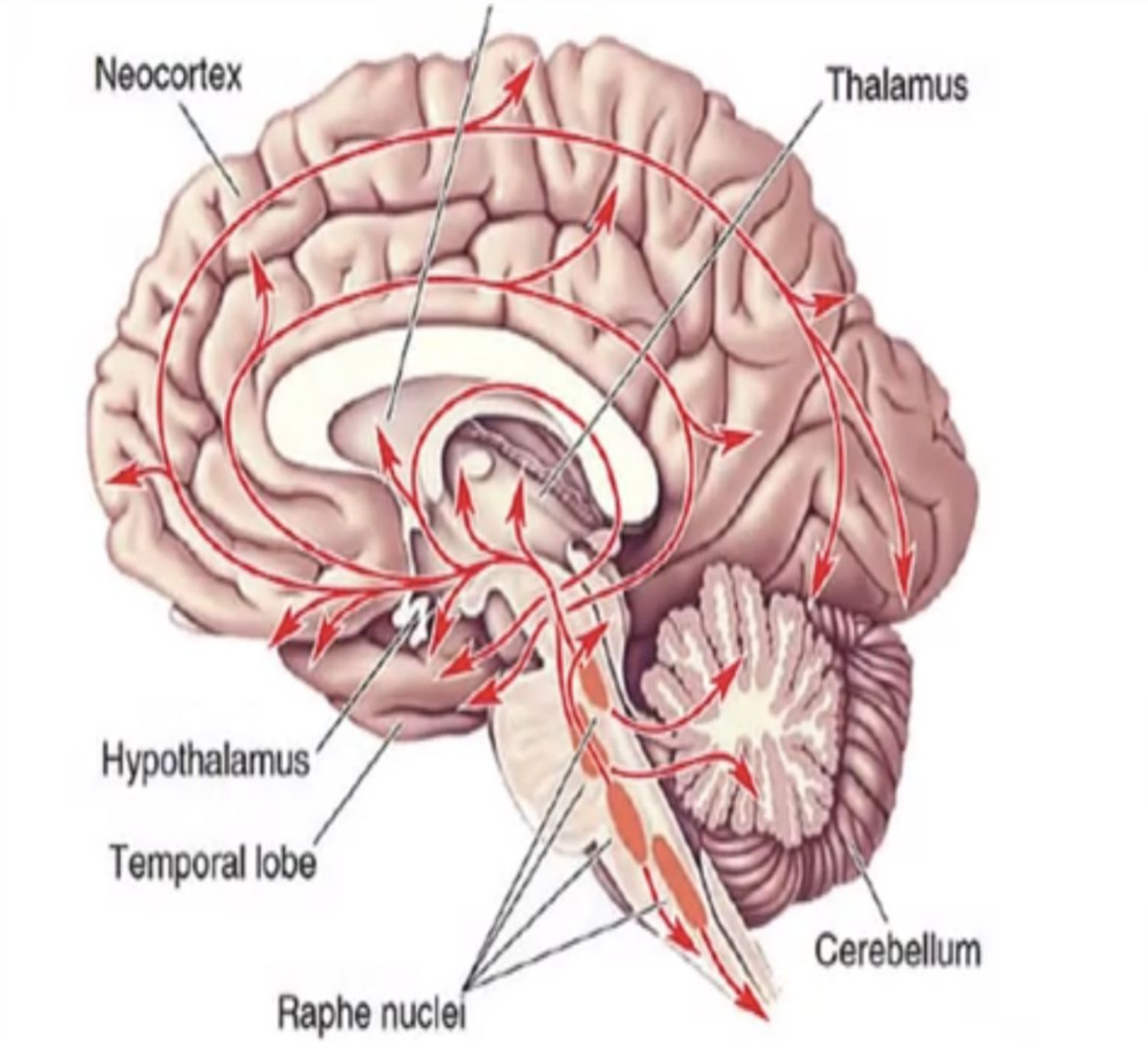
How?



Platelets



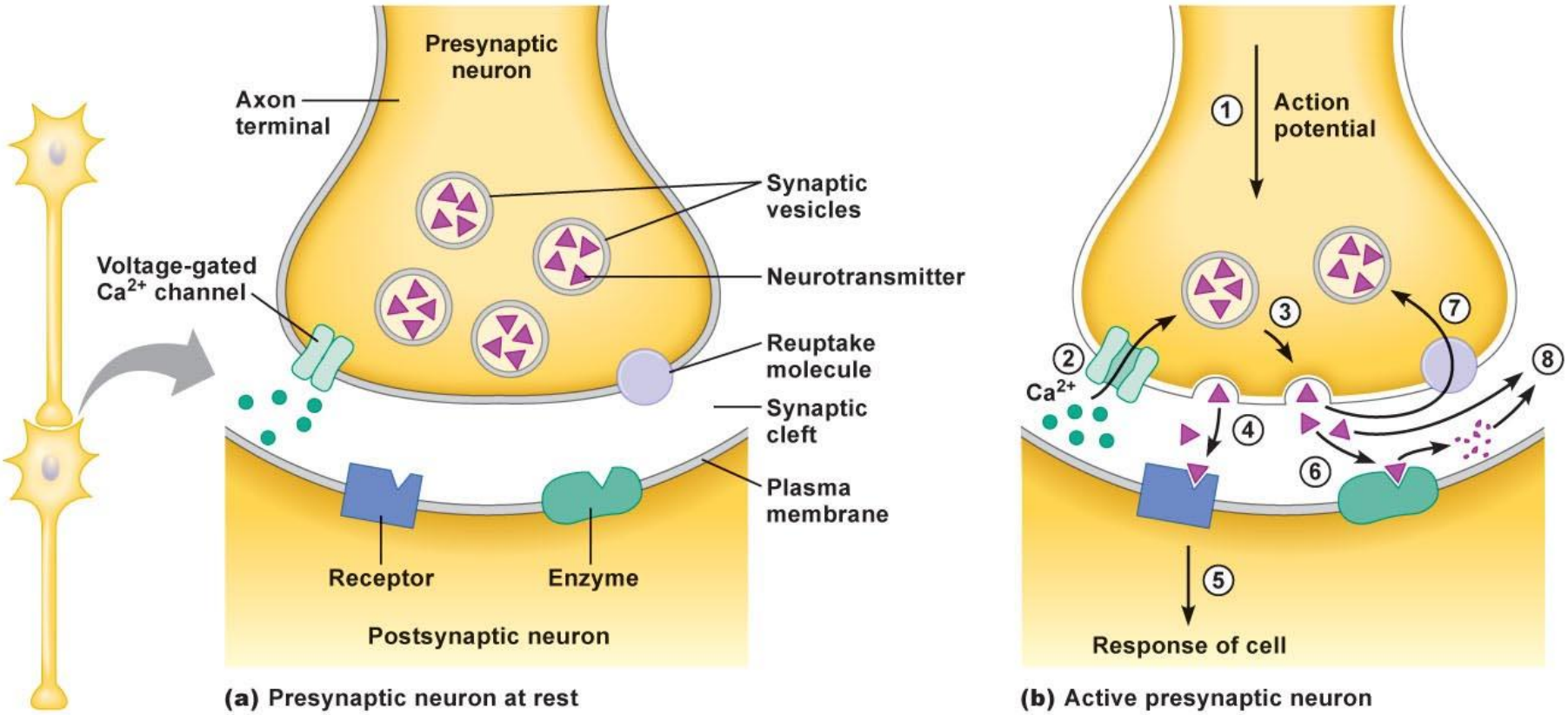
Anatomy of Small Intestine


Neocortex
Thalamus
Hypothalamus
Temporal lobe
Cerebellum
Raphe nuclei

What is Serotonin Syndrome?

It is a condition characterized by increased stimulation of the central nervous system and peripheral serotonin receptors, caused by excessive serotonin in the human body.

Mydriasis



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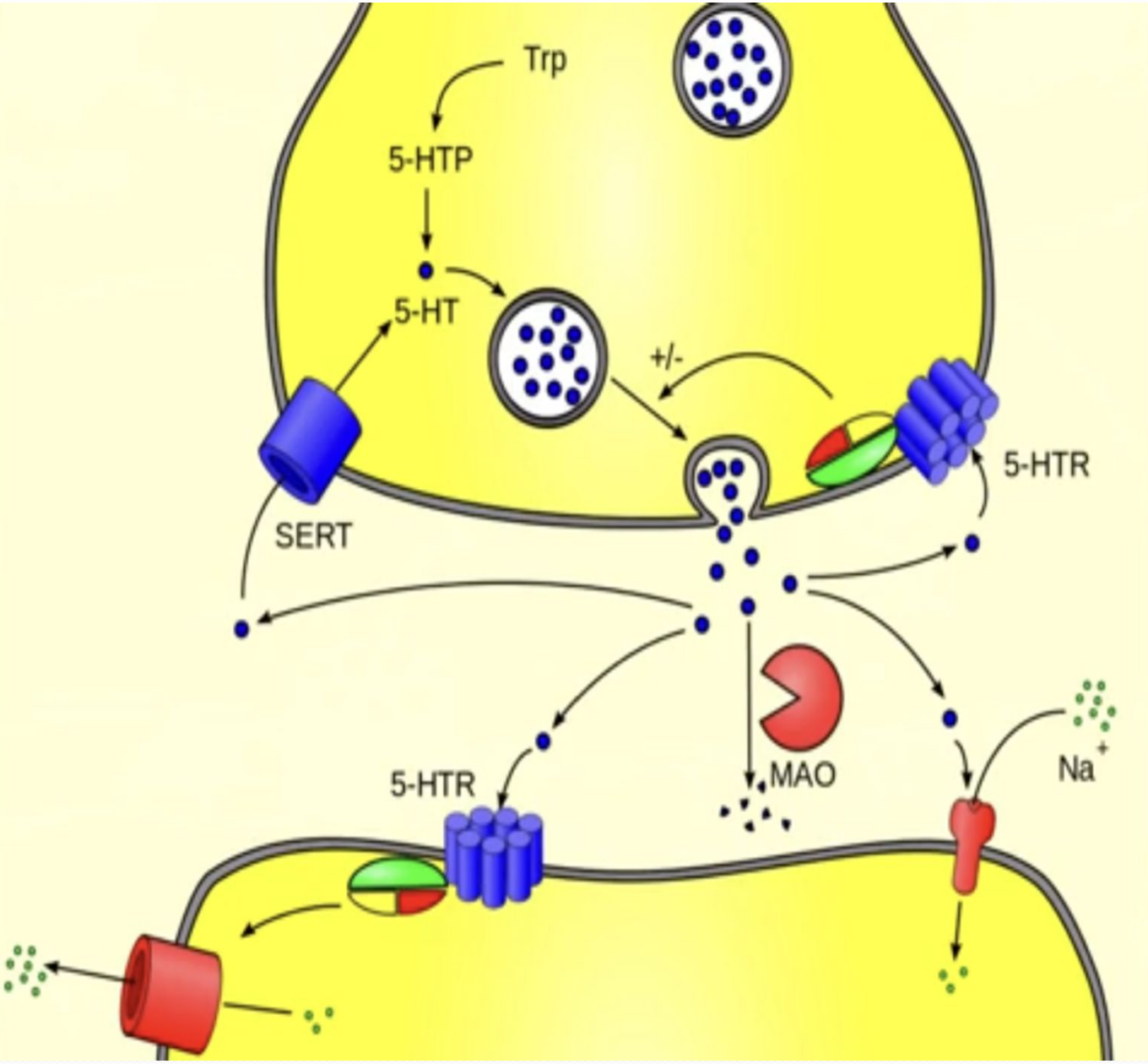
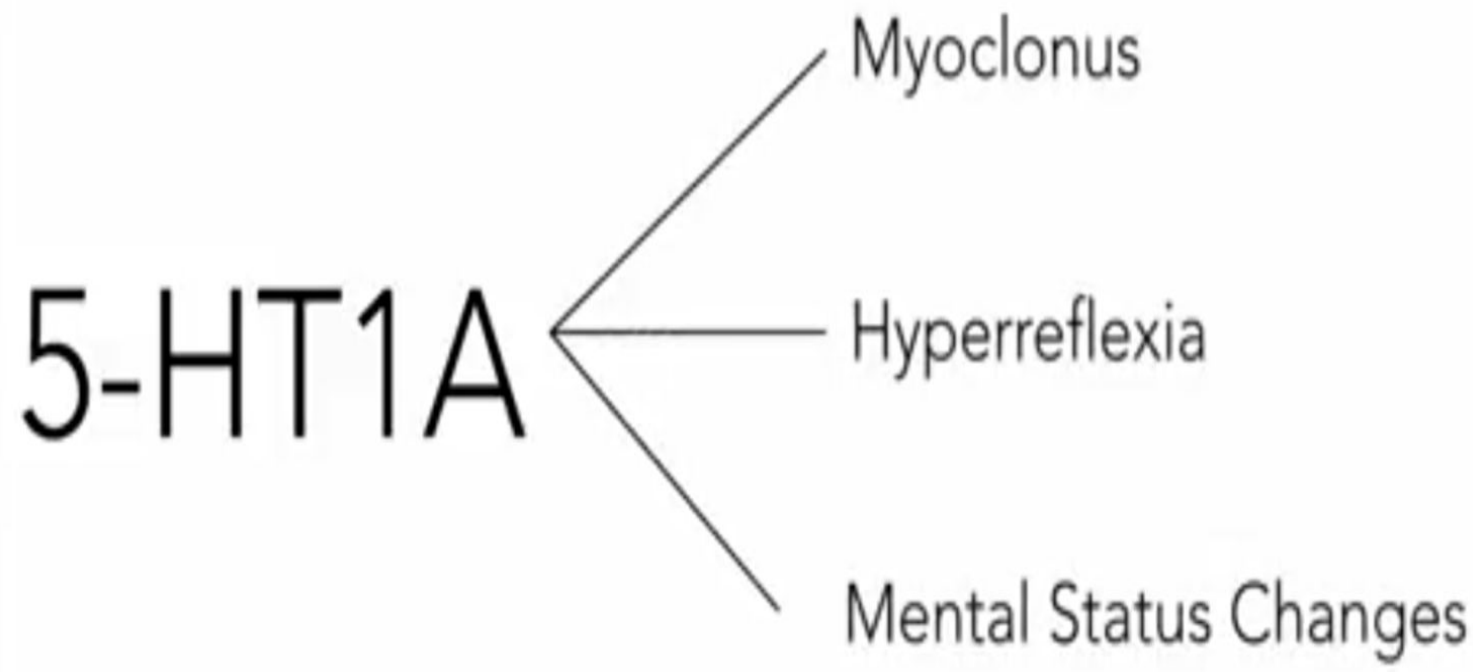
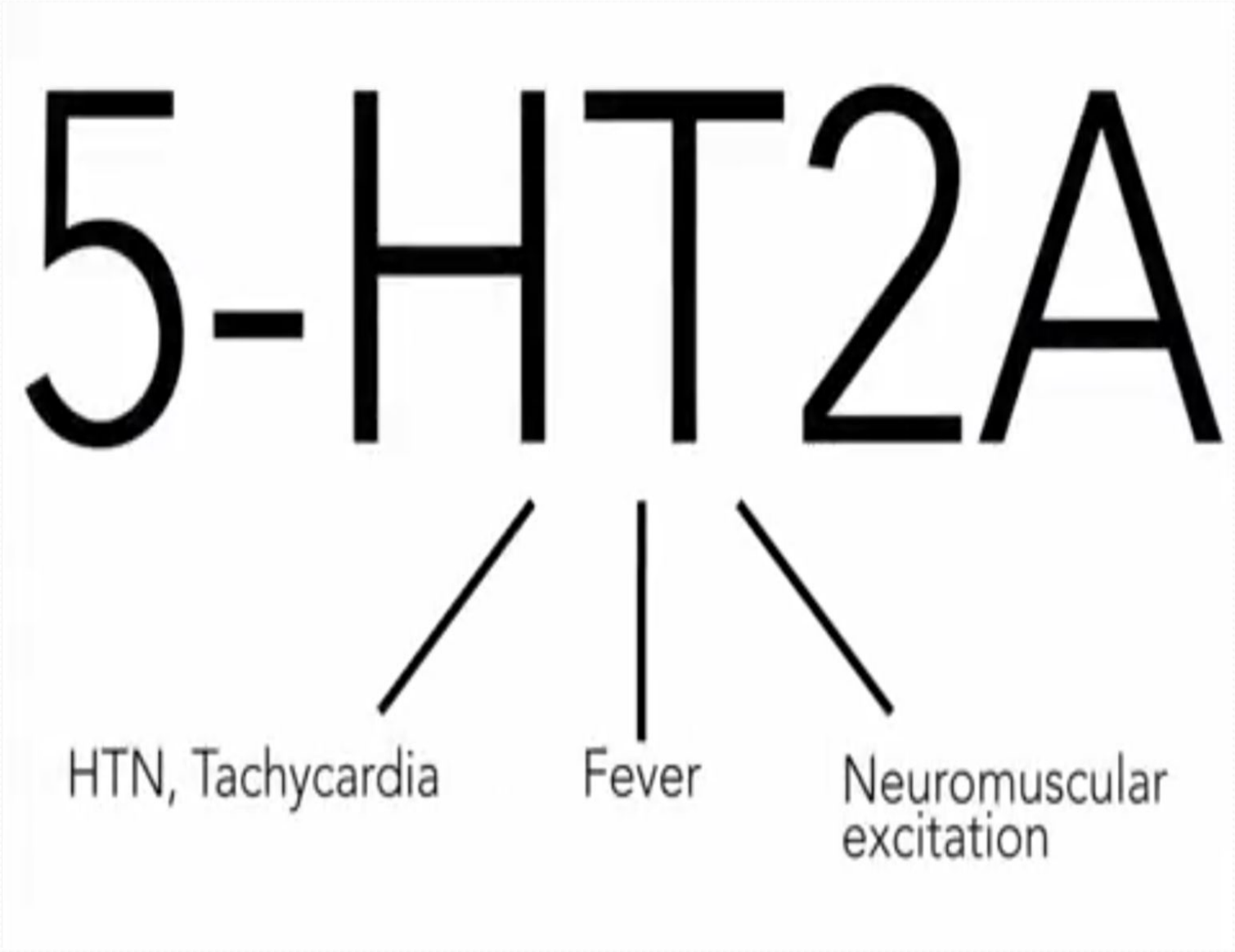

Trp
5-HTP
5-HT
+/-
5-HTR
SERT
MAO
5-HTR
Na+

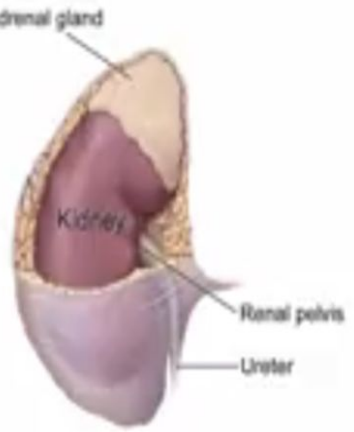
5-HT2A

5-HT1A

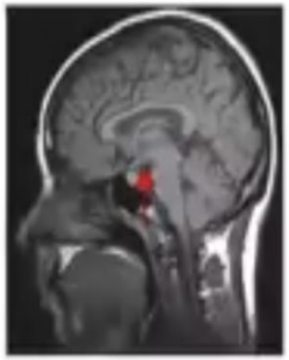

5-HT1A
Myoclonus
Hyperreflexia
Mental Status Changes


5-HT2A
HTN, Tachycardia
Fever
Neuromuscular excitation

HTN, Tachycardia →



Neuromuscular excitation ←



Fever

Why is SS so hard to diagnose?

How to diagnose?

SEROTONIN
ophan, serotonin is primari
he neurotransmitter

Hypertension

Tachycardia

Tremors

Differential

GALERIE
DES
PEINTRES
FLAMANDS
TOME
GALERIE
DES
PEINTRES
FLAMANDS
TOME
POLWHELE'S
HISTORY
OF
DEVONSHIRE
MANNERS
CUSTOMS
OF THE
RUSSIANS

NMS

Longer onset

Neuroleptics

nl/diminished reflexes

NMS

Anti-cholinergic

Malignant hyperthermia

Sympathomimetic

Sepsis

Opiod withdrawal

CNS infection

Delirium Tremens

Physical exam
Lab tests
Imaging

Decision Rules

Sternbach

Hunter

Hunter Serotonin Toxicity Criteria

Patient has taken serotonergic agent AND meets one of the following criteria:

- Spontaneous clonus
- Inducible clonus + [agitation or diaphoresis]
- Ocular clonus + [agitation or diaphoresis]
- Tremor + hyperreflexia
- Hypertonia + temperature > 38 C + [ocular clonus or inducible clonus]

Serotonergic med

+

AMS

Increased NM tone

Autonomic instability

Cognitive

Autonomic

Neurologic

Which Drugs?

Table 3. Mechanisms of Serotonin Syndrome and the Drugs Associated with Each

Mechanism	Associated Drugs
Inhibit Serotonin Uptake	**Amphetamines/weight loss drugs:** phentermine
	Antidepressants: bupropion, nefazodone, trazodone
	Antiemetics: granisetron, ondansetron
	Antihistamines: chlorpheniramine
	Certain opiates: levomethorphan, levorphanol, meperidine, methadone, pentazocine, pethidine, tapentadol, tramadol
	Drugs of abuse: cocaine, MDMA ("Ecstasy")
	Herbal supplements: St. John's wort (*Hypericum perforatum*)
	Over-the-counter cold remedies: dextromethorphan
	SNRIs: desvenlafaxine, duloxetine, venlafaxine
	SSRIs: citalopram, escitalopram, fluoxetine, fluvoxamine, paroxetine, sertraline
	TCAs: amitriptyline, amoxapine, clomipramine, desipramine, doxepin, imipramine, maprotiline, nortriptyline, protriptyline, trimipramine
Inhibit Serotonin Metabolism	**Anxiolytics:** buspirone
	Herbal supplements: St. John's wort (*Hypericum perforatum*)
	MAOIs: furazolidone, isocarboxazid, linezolid, methylene blue, phenelzine, selegiline, Syrian rue, tranylcypromine
	Triptans: almotriptan, eletriptan, frovatriptan, naratriptan, rizatriptan, sumatriptan, zolmitriptan
Increase Serotonin Synthesis	**Amphetamines/weight loss drugs:** phentermine
	Dietary supplements: L-tryptophan
	Drugs of abuse: cocaine
Increase Serotonin Release	**Antidepressants:** mirtazapine
	Amphetamines/weight loss drugs: phentermine
	Certain opiates: meperidine, oxycodone, tramadol
	Drugs of abuse: MDMA ("Ecstasy")
	Over-the-counter cold remedies: dextromethorphan
	Parkinson disease treatment/amino acid: L-dopa
Activate Serotonin Receptors	**Anxiolytics:** buspirone
	Antidepressants: mirtazapine, trazodone
	Antimigraines: dihydroergotamine, triptans
	Certain opiates: fentanyl, meperidine
	Drugs of abuse: LSD
	Mood stabilizers: lithium
	Prokinetic agents: metoclopramide
Inhibit CYP450 Microsomal Oxidases	**CYP2D6**
	Inhibitors: fluoxetine, sertraline
	Substrates: dextromethorphan, oxycodone, phentermine, risperidone, tramadol
	CYP3A4
	Inhibitors: ciprofloxacin, ritonavir
	Substrates: methadone, oxycodone, venlafaxine
	CYP2C19
	Inhibitors: fluconazole
	Substrates: citalopram

LSD, lysergic acid diethylamide; MAOI, monoamine oxidase inhibitor; MDMA, methylenedioxymethamphetamine; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant.

Numerous!

BRAIN DIRECTED NUTRITION
brainMD
BY DANIEL AMEN, MD
SEROTONIN
MOOD SUPPORT
Supports Healthy Mood
and Serotonin Balance*
120 CAPSULES
DIETARY SUPPLEMENT

TABLE – SELECTED DRUGS ASSOCIATED WITH SEROTONIN TOXICITY

Antidepressants	Opioids	Triptans	Drugs of Abuse	Miscellaneous
Monoamine Oxidase Inhibitors (MAOIs)	Meperidine	Sumatriptan	Cocaine	Linezolid
Tricyclic Antidepressants (TCAs	Fentanyl	Rizatriptan	Amphetamines	Dextromethorphan
Selective Serotonin Reuptake Inhibitors (SSRIs)	Pentazocine	Zolmitriptan	MDMA (Ecstasy)	Lithium
Serotonin–norepinephrine reuptake inhibitors (SNRIs)	Burenorphine			Tryptophan
St. John's Wort	Tramadol			L-Dopa
Buproprion				
Trazadone				

SSRI/SNRI
Street Drugs
Dextromethorphan
Narcotics (some)
Linezolid

Narcotics (some)

Tramadol
Fentanyl → **SS**
Meperidine

Narcotics (some)

Tramadol → **Most common (15%)**

Meperidine → **HL ~ 30hrs**

Narcotics (some)

Codeine
Hydrocodone → No SS
Morphine

Treatment

Airway

Breathing

Circulation

Cyproheptadine

- ANTI-HISTAMINE
- ANTI-SEROTONIN

- https://www.youtube.com/watch?v=c-3_rTvwPco&feature=youtu.be

ZOLOFT
DISTA
3105
PROZAC
20 mg

Thank you for attending today's presentation

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