marijuana and the teen brain

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UCSD
FINAL EXAM = MIDTERM 3

LAST CLASS

NOT DURING

= FINALS
neuron

dendrites

Soma

Cell body

Axon

Terminal

Input

Output
Electrical voltage

mV

Rising phase

Falling

Resting potential

Recovery

Time

Subcutaneous
Sodium

Membrane

Natr

Falling

Rising

Natr

Axon hillock

K+ poll
Sodium

\[ \text{Na}^+ \]

**membrane**

**falling**

**rising**

**Nat**

**axon hillock**

\[ \text{K}^+ \text{ exits } \text{K}^+ \text{ potassium} \]
Why?

\[ \begin{align*}
\text{resting state} & \quad \text{Na}^+ \xrightarrow{\text{ton}} \\
\text{K}^+ & \quad \text{Na}^+ \xleftarrow{\text{tiny}} \\
\end{align*} \]

\[ \text{High} \quad \text{river} \quad \text{Low} \]
non-myelinated

passive propagation of action potential along the axon
myelinated

saccatory conduction

node of Ranvier

$\text{Na}^+$

$\text{K}^+$
How do endocannabinoids affect synaptic transmission?

- Pre-synaptic
- Post-synaptic

Voltage-dependent Ca++ channels open & Ca++ enters the terminal.

Xmtr is released from synaptic vesicle.

Xmtr binds to receptor and the channel opens.

Post-synaptic depolarization opens voltage-dependent Ca++ channels → which activates endocannabinoid synthesis.

Ca++
endocannabinoid signaling is critical during development
Brain maturation continues through adolescence.

- **Infancy**
- **Childhood**
- **Adolescence** (12-17 years old)
- **Adulthood**

Robust neurodevelopment and various brain structures and processes continue to develop and mature, including:

- Hippocampus
- Prefrontal cortex
- Synaptic pruning
- Receptor distribution
- Volumetric growth
- Myelination
CB₁ receptors increase dramatically from infancy to young adulthood.

- CB₁ receptor expression changes over time
- Dramatic increase during development
- Frontal cortex, striatum & hippocampus

Mato et al., 2003
endocannabinoid ligand expression changes during adolescence.

- AEA and 2-AG expression changes
- AEA – onset of puberty for females in hypothalamus
- 2-AG expression changes in PFC & N. Accumbens

Disruption of normative endocannabinoid signalling during adolescence may have long-standing consequences on adult brain function.

Mato et al., 2003
what now?

- hypothalamus
- basal ganglia
- ventral striatum
- amygdala
- brainstem
- cortex
- hippocampus
- cerebellum