

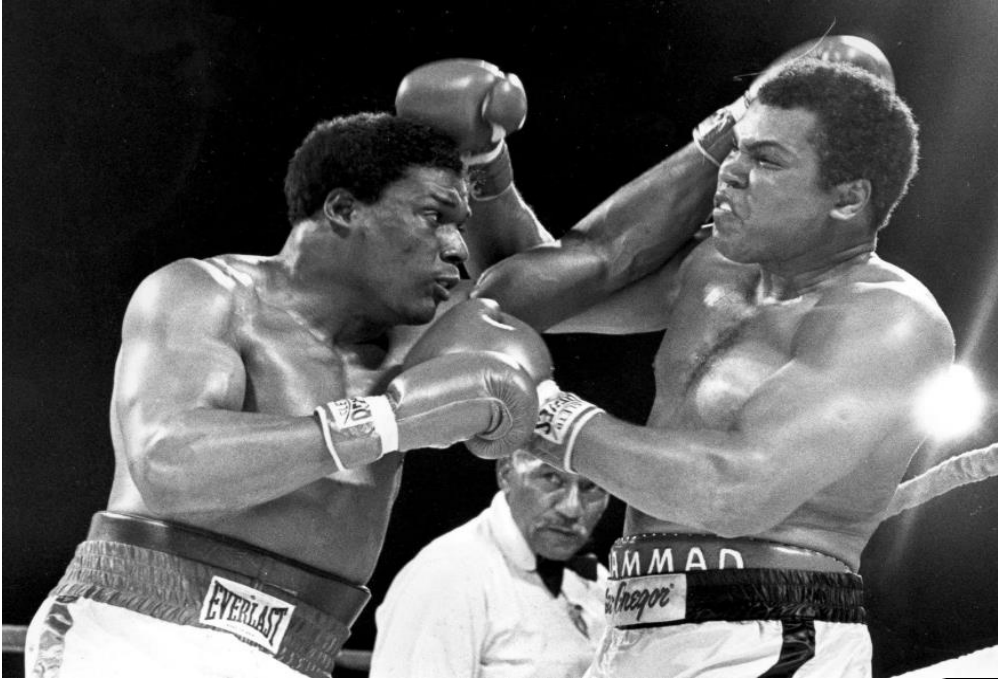


# Neuro-Inflammasome and TBI: Decreasing Inflammation For Neuroprotection and Repair

2:45 PM - 3:45 PM

**The Interplay Between Omegas and the Endocannabinoid System**

***Michael Lewis, MD, MPH, MBA, FACPM, FACN***  
***Colonel (Retired), U.S. Army***



?

?





?







**Seconds**

**Minutes**

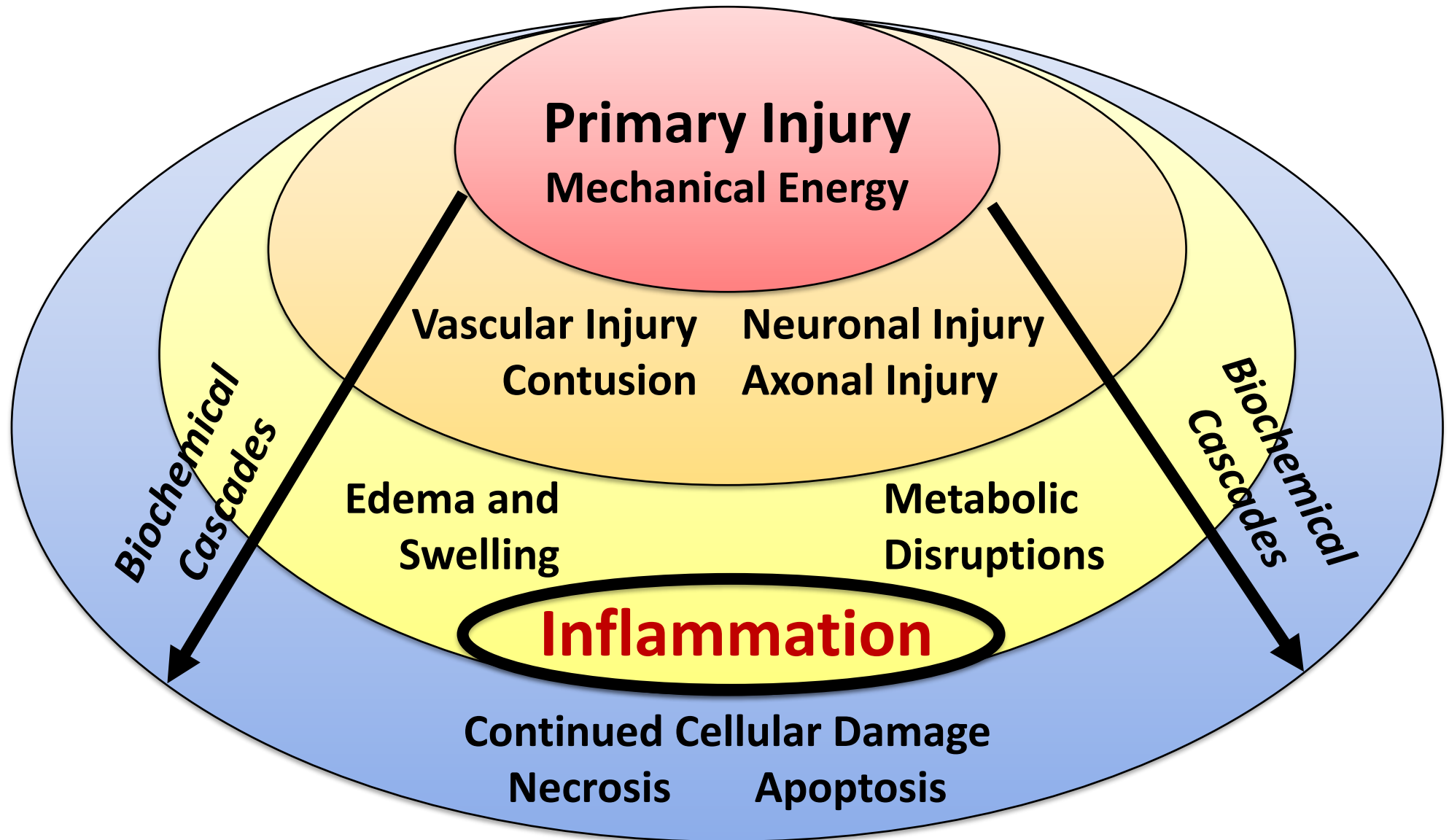
**Hours**

**Days**

**Weeks**

**Months**

**Years**





# Inflammation is the Driving Force to All Disease & Pain

Too little or too much isn't good

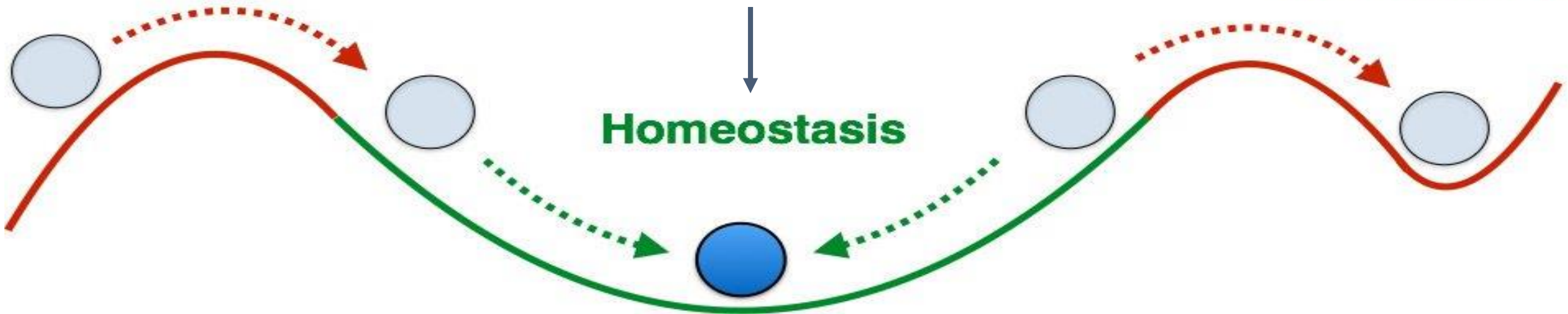
All illness is the function of  
inflammation out of homeostasis

**Inflammation**

The goal is  
always balance

**Chronic  
Inflammation**

**Homeostasis**





# Compromising Brain Health

- Trauma (TBI)
- Concussions
- Heart attack
- Stroke
- Near drowning
- Environmental toxins
- Chemotherapy
- Lack of oxygen
- Chronic stress
- Aging



# Symptoms of Poor Brain Health

- Headaches
- Anxiety
- Brain fog
- Memory problems
- Difficulty concentrating
- Trouble sleeping
- Fatigue
- Irritability
- Emotional
- Depression
- Dizziness
- Vision problems
- Ringing in the ears
- Sensitivity to light/noise





# So, what do we do after an injury?



- Mom of 18-yo TBI pt on CNN's Sanjay Gupta MD show: *"He lived, he survived, and now what?"*

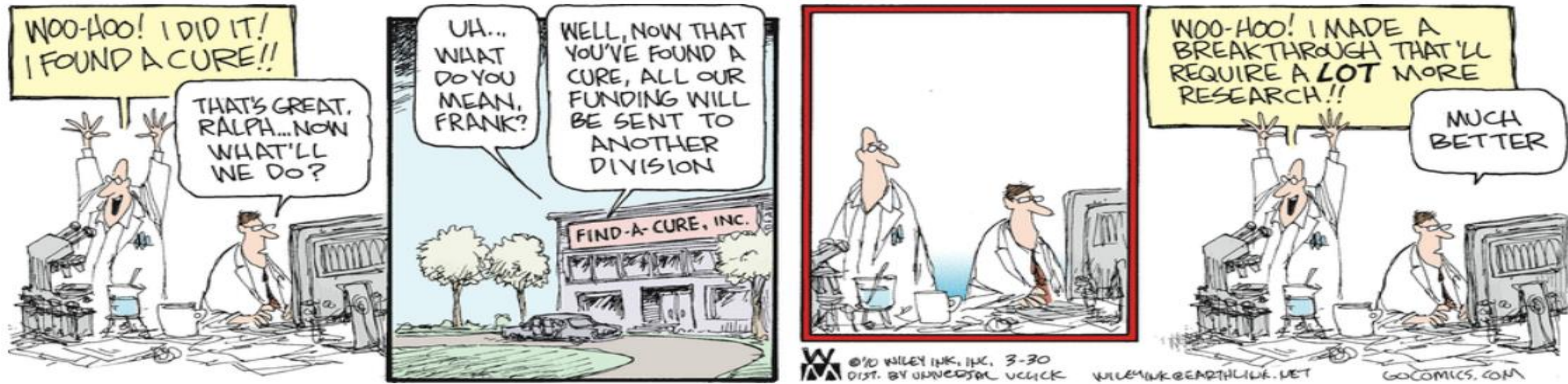
The problem is:

**there is nothing**

*"The art of medicine consists of keeping the patient amused while nature heals the disease."*

François-Marie Arouet (1694 - 1778)





**“Conventional medicine only takes survivors of TBI so far.... Unconventional therapies are not merely a reasonable option, they are a necessity.”**

**Joel Goldstein, *No Stone Unturned: A Father's Memoir of His Son's Encounter with TBI***

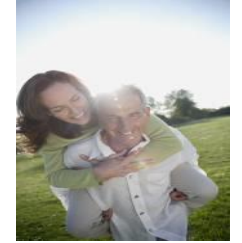


# How do we / CAN WE:

- **Manage Neuro-inflammation?**
- **Achieve neuro-protection?**
- **Foster neuro-regeneration?**



# Omega-3s: Important Thru-out Life



## Pregnancy

### Maternal Health & Outcomes

- Promotes maternal DHA
- Increases DHA content of breast milk
- Supports normal gestation
- Promotes fetal brain and eye development

## Infants & Children

### Brain Development & Function

- Improves visual acuity
- Promotes Cognitive performance

## Children & Adults

### Cardiovascular Heart Health

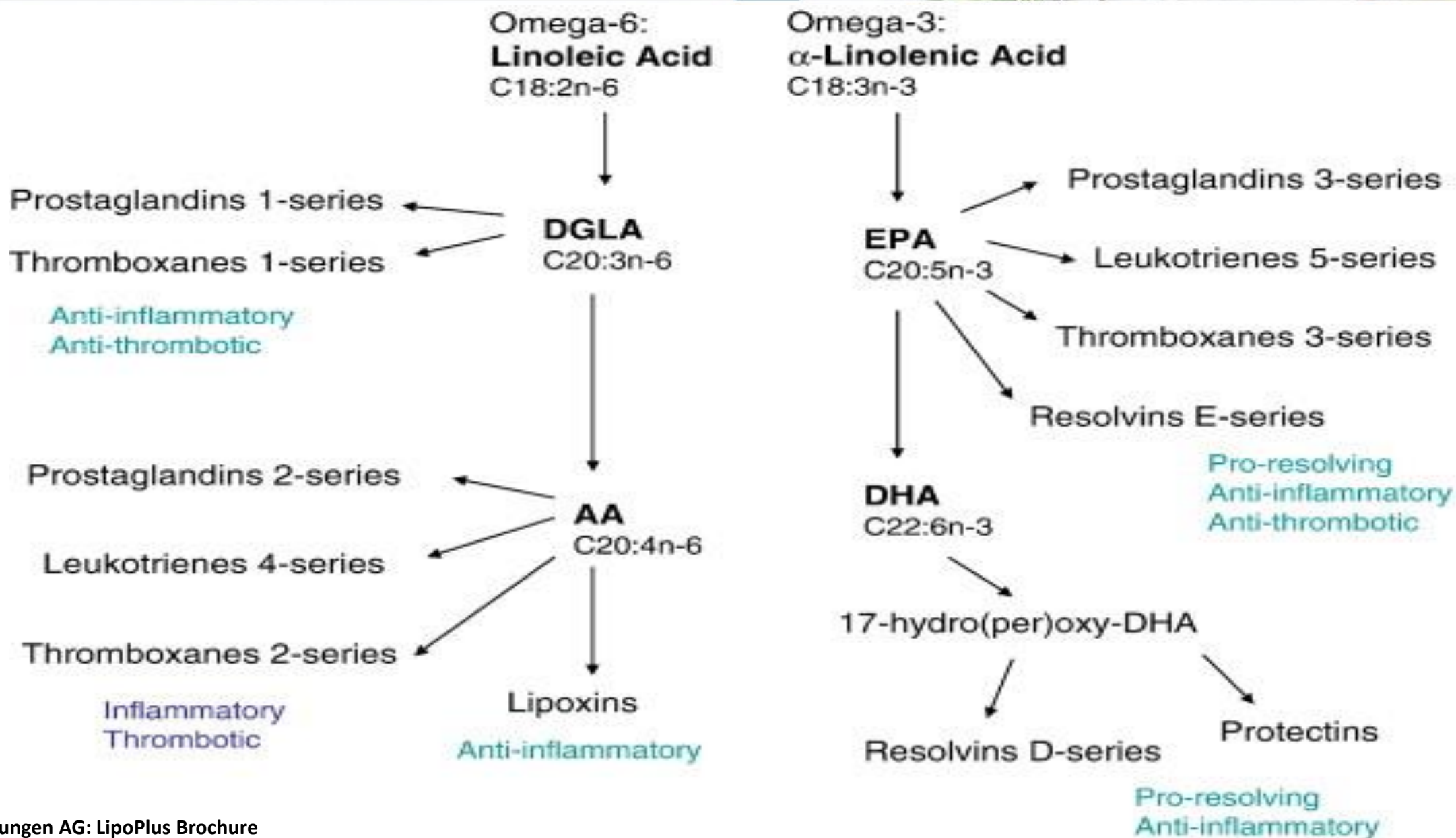
- Lowers triglycerides
- Increases HDL
- Improves blood vessel function

## Adults

### Brain & Eye Health & Function

- Less cognitive decline
- Lower risk of dementia
- Lower risk of age-related macular degeneration







**Plant food intake**

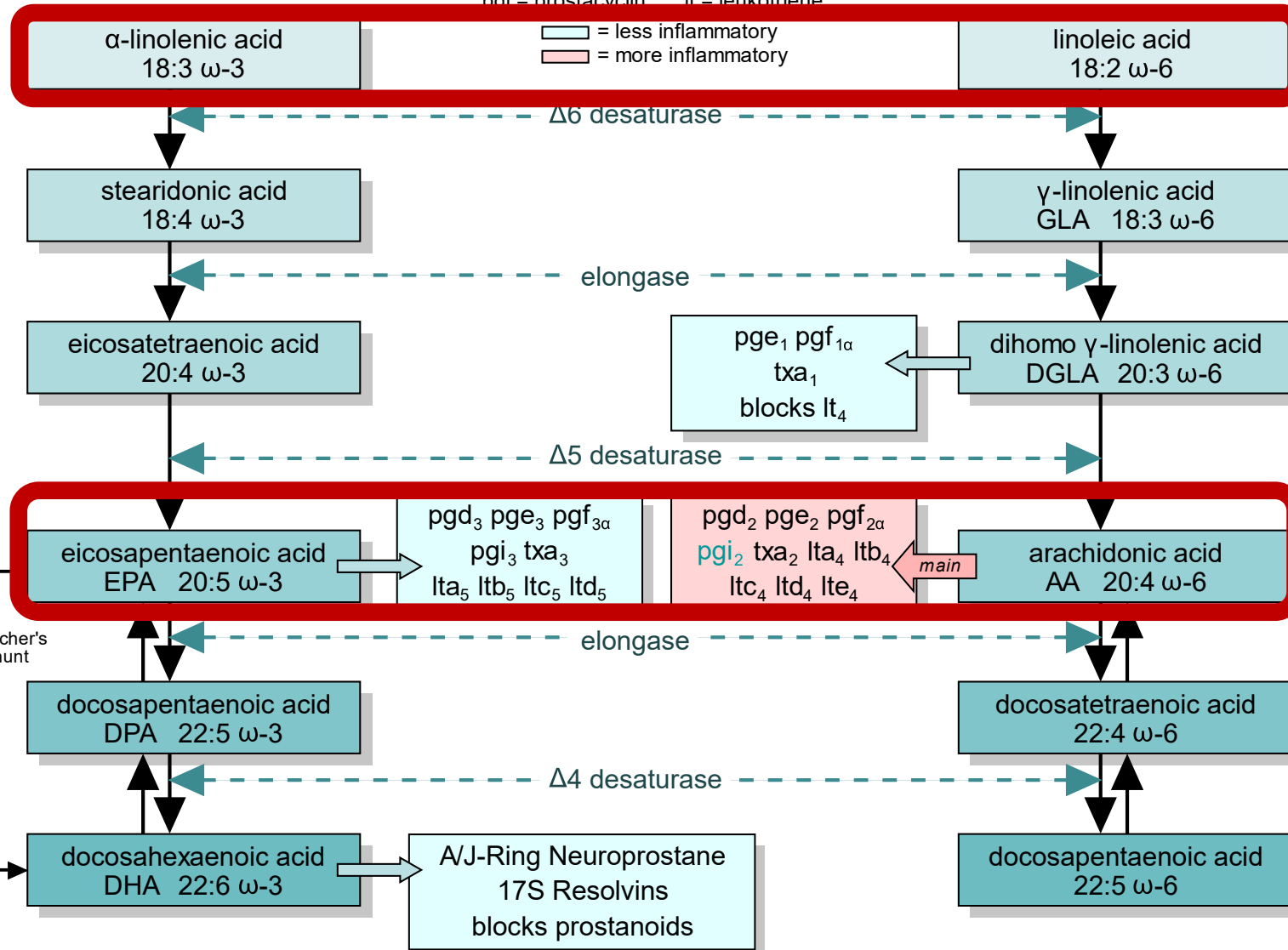
**Omega-3 family**

**Eicosanoids**

**Omega-6 family**

pg = prostaglandin tx = thromboxane  
pgi = prostacyclin lt = leukotriene

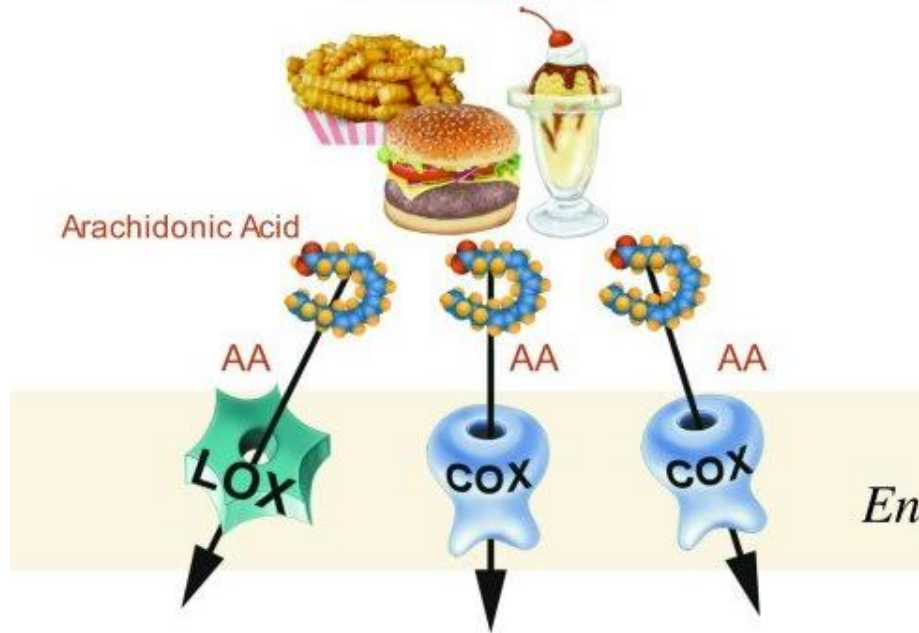
□ = less inflammatory  
□ = more inflammatory



**Eicosanoid  
Competition**



## Omega-6



### LTB-4

Leukotrienes-4 series

- Promotes inflammation
- Constricts airways
- Prolongs duration of inflammation

### TXA-2

Thromboxane-A2

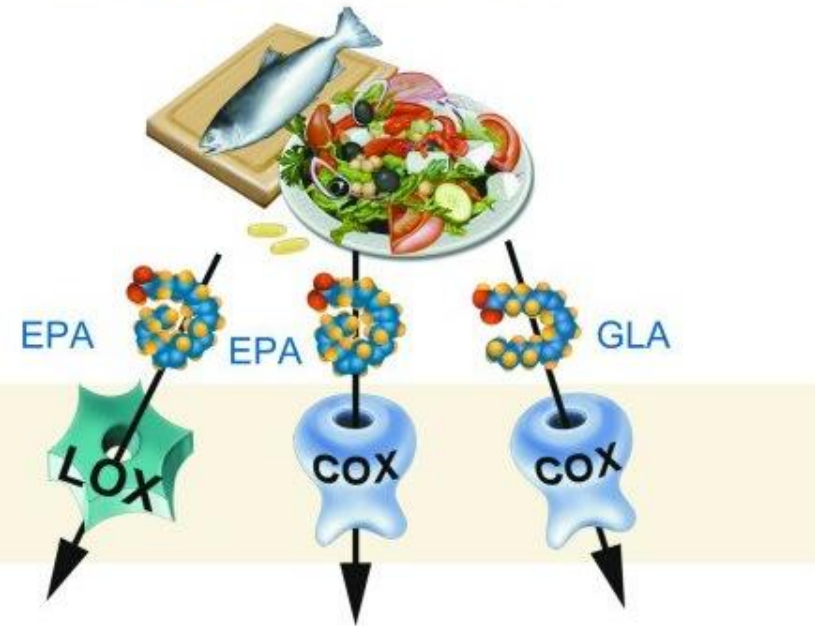
- Constricts blood vessels
- Constricts airways
- Increases blood clotting
- Reduces circulation

### PGE-2

Prostaglandin-E2

- Increases sensitivity to pain
- Increases swelling
- Induces fever
- Constricts blood vessels

## Omega-3 and GLA



### LTB-5

Leukotriene-5 series

- Relaxes blood vessels
- Increases circulation
- Relaxes airways
- Promotes anti-inflammatory response

### PGE-3

Prostaglandin-E3

- Improves circulation
- Decreases sensitivity to pain
- Relaxes blood vessels
- Promotes anti-inflammatory response

### PGE-1

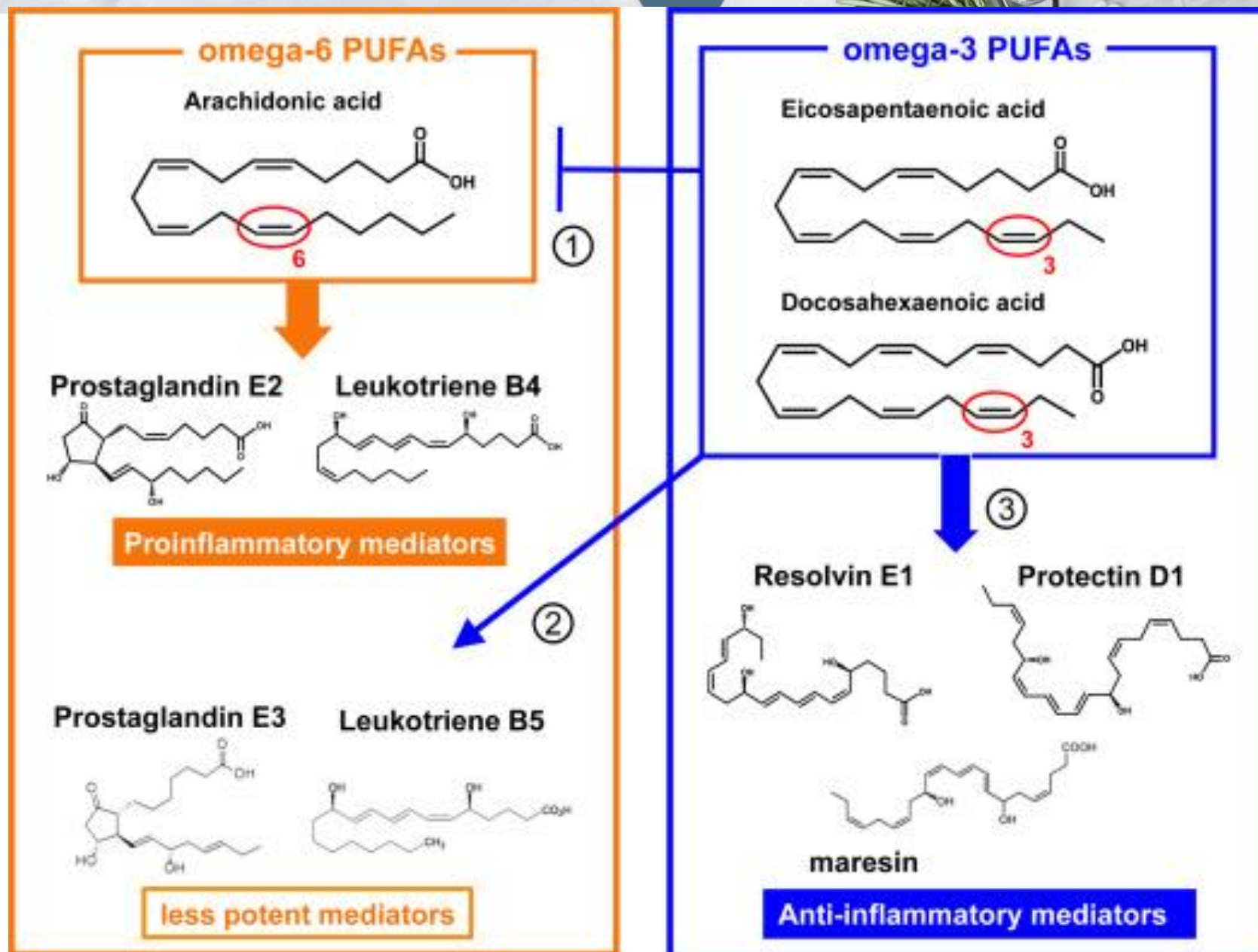
Prostaglandin-E1

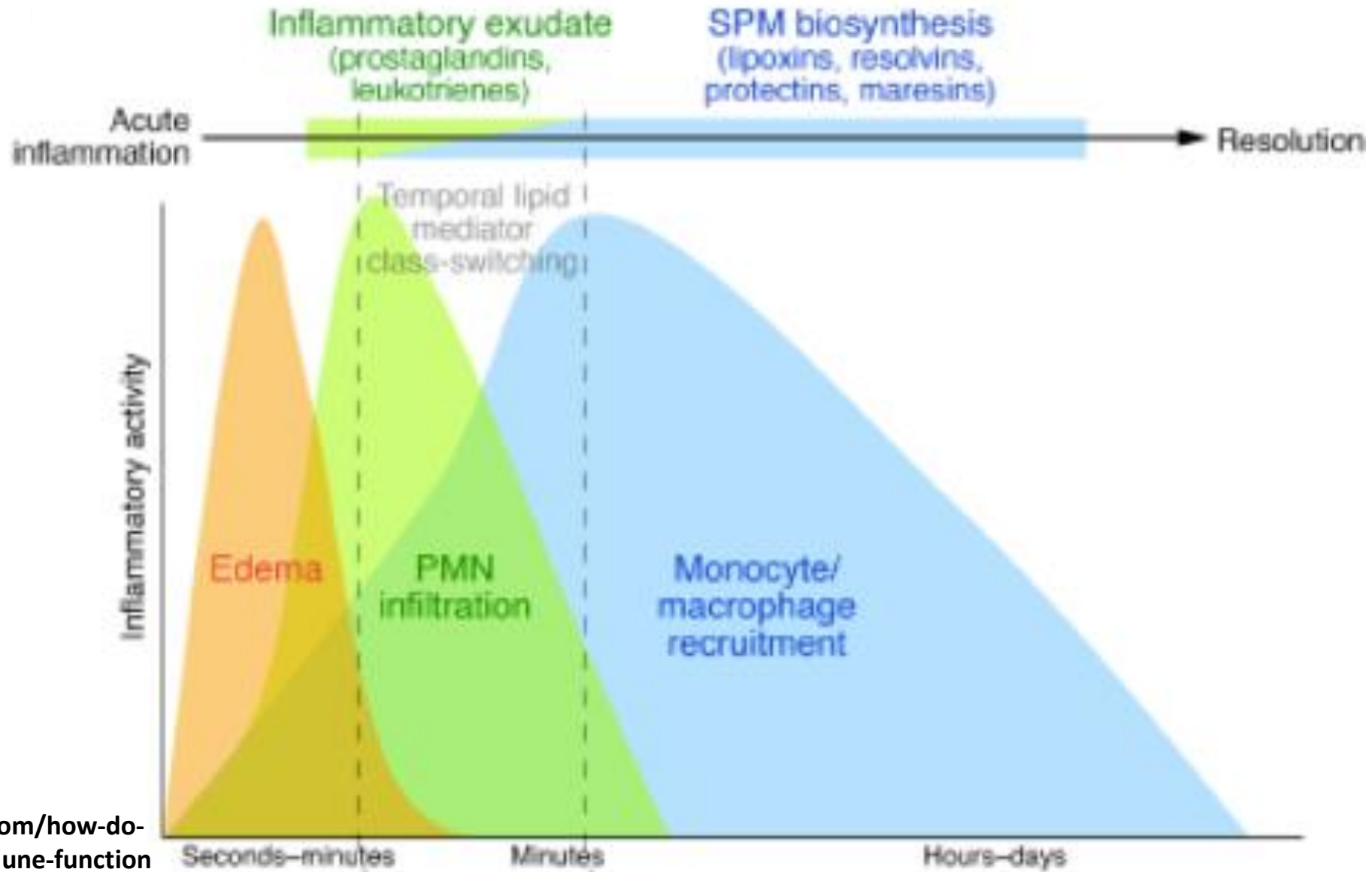
- Relaxes muscles spasms
- Reduces blood clotting
- Increases protective stomach secretions
- Improves circulation

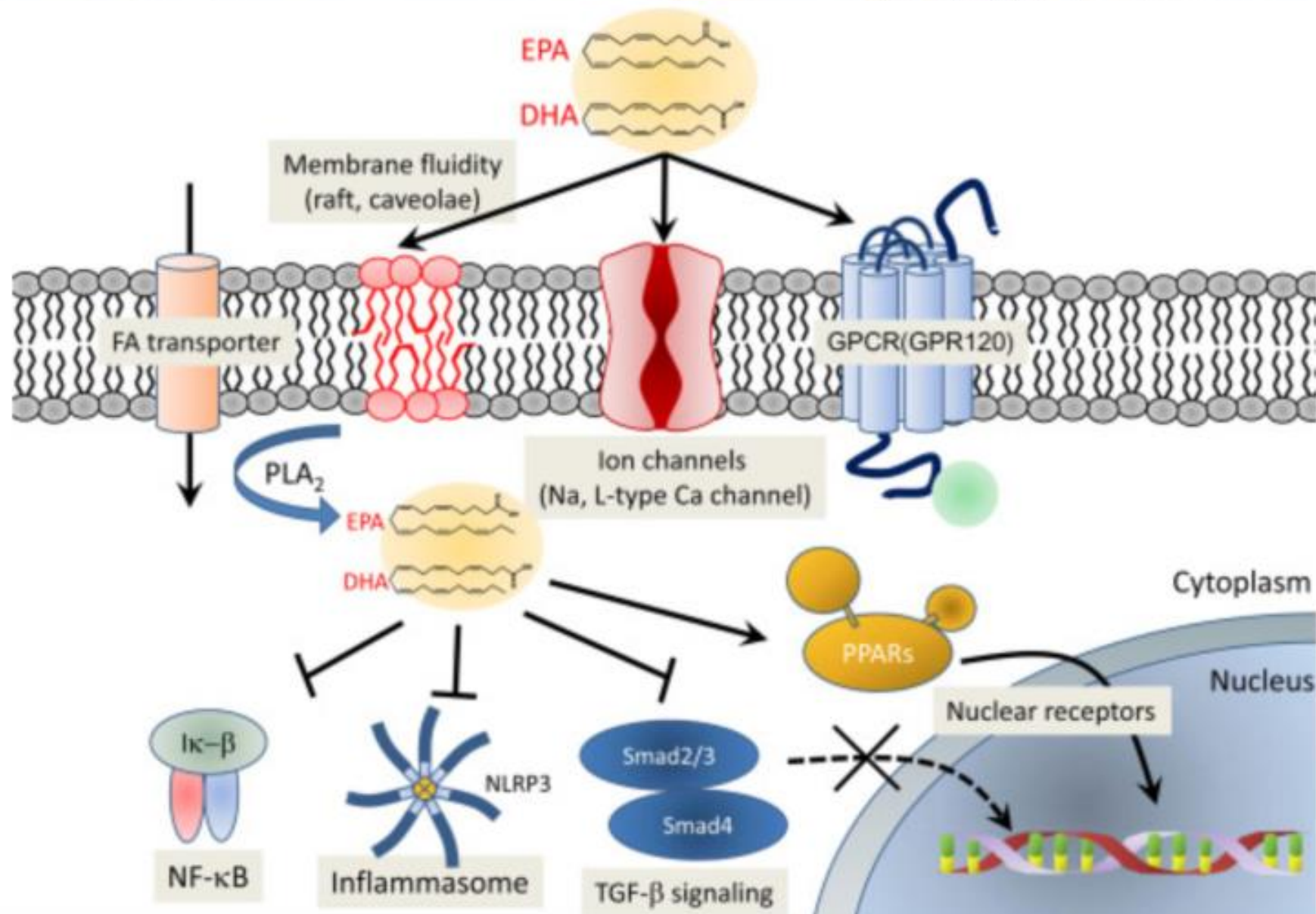
PRO-INFLAMMATORY

ANTI-INFLAMMATORY









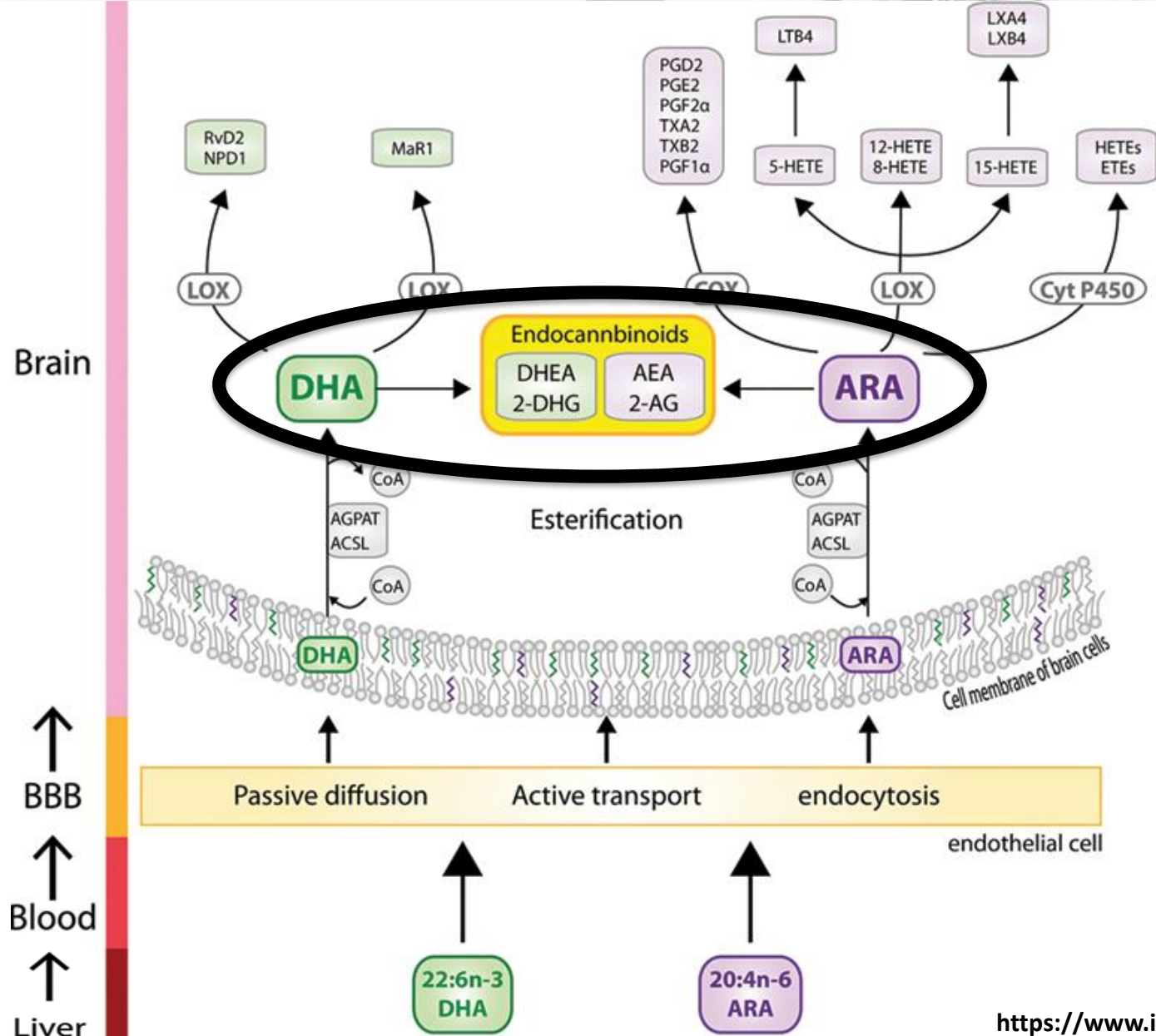




# The interplay between

**1- Omegas and our  
Endocannabinoid System?**

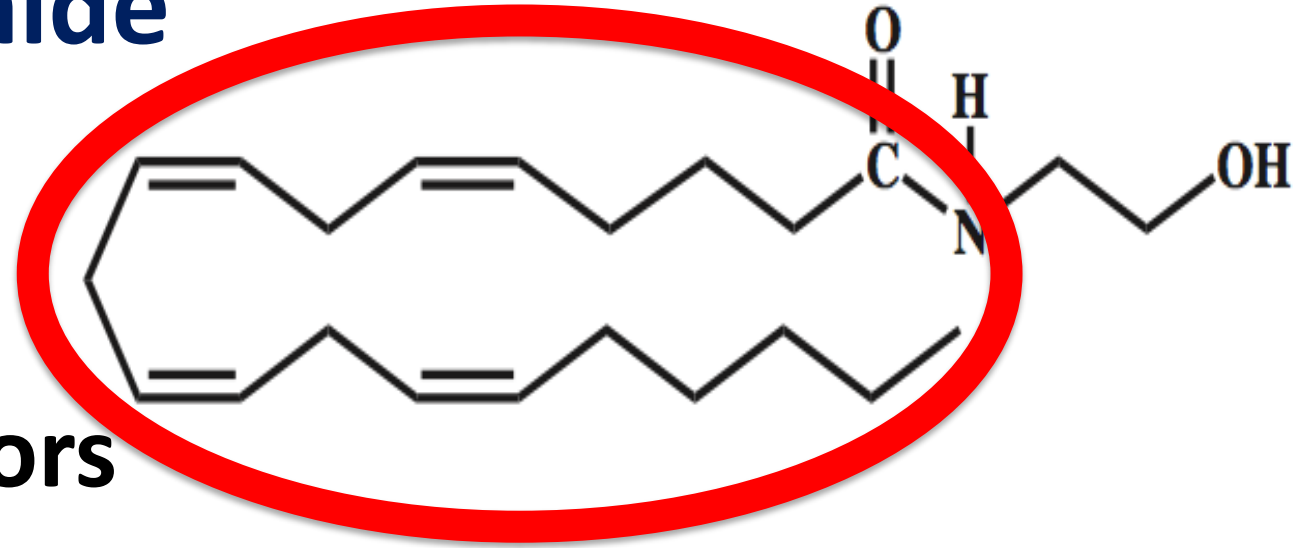
**2- Cannabinoids and Omegas?**





# Arachidonoyl ethanolamide

- aka: Anandamide (AEA)
- Activity CB1>>CB2 receptors
- Short half-life (minutes) – *made on demand*
- Pleasure/euphoria/“runner’s high”
- Made from/broken down into Arachidonic Acid







# Anandamide (AEA) $\longleftrightarrow$ Arachidonic Acid (AA)

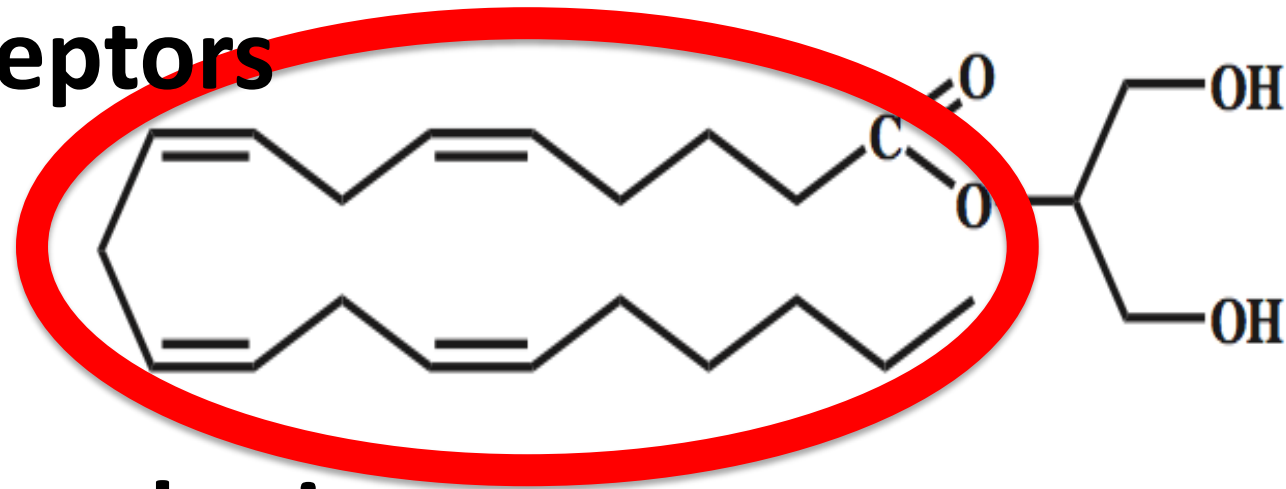
- Stimulates appetite  $\longrightarrow$  **FAT**
- Decreases brain function  $\longrightarrow$  **DUMB**
- Our pleasure molecule  $\longrightarrow$  **HAPPY**

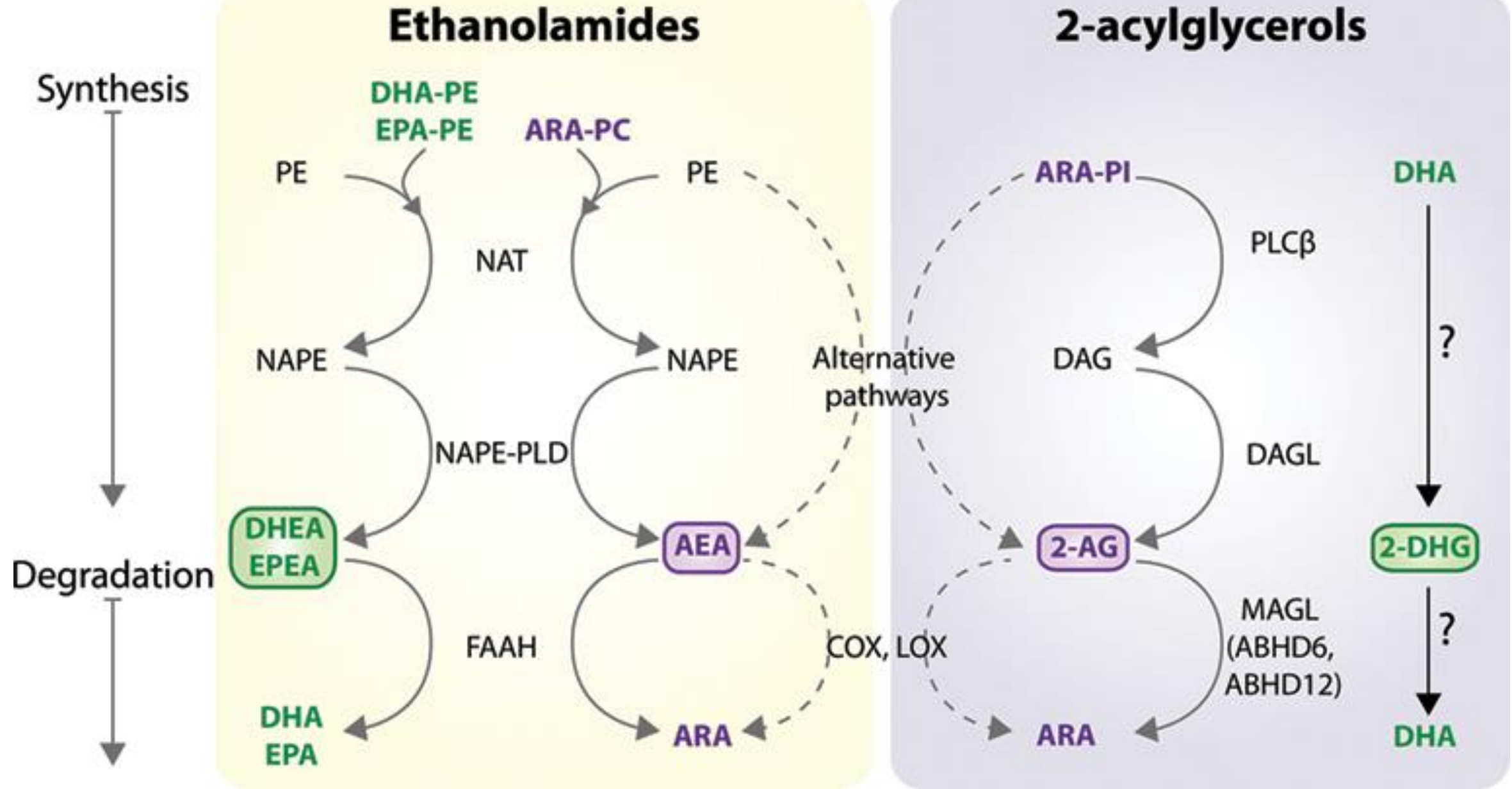




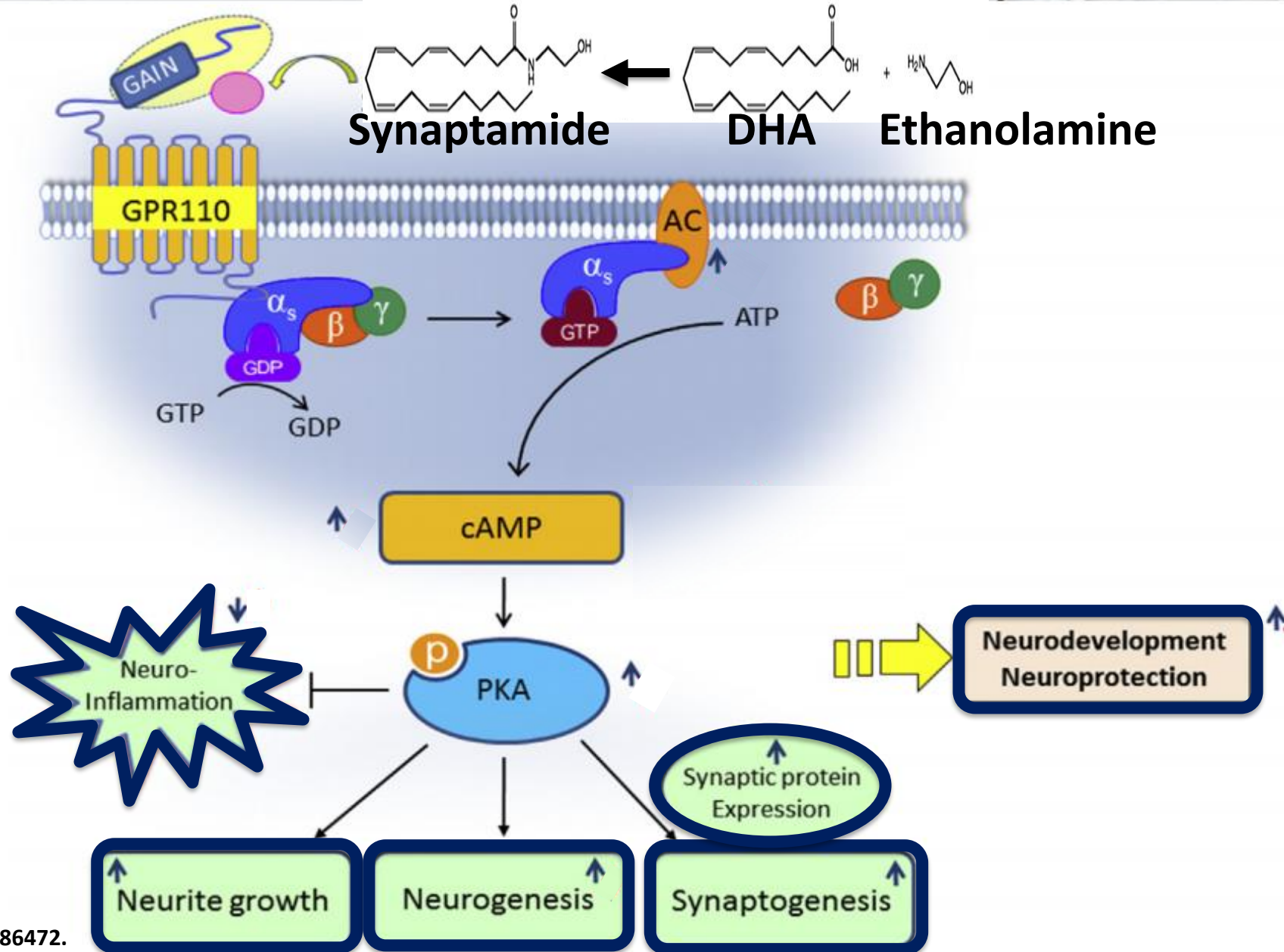
## 2-arachidonoyl glycerol (2-AG)

- 200 times more 2-AG than anandamide
- Full agonist for CB1R & CB2R
- Main activator of CB2 receptors
- Reduces inflammation
- Neuroprotective
- Communication: gut flora to brain





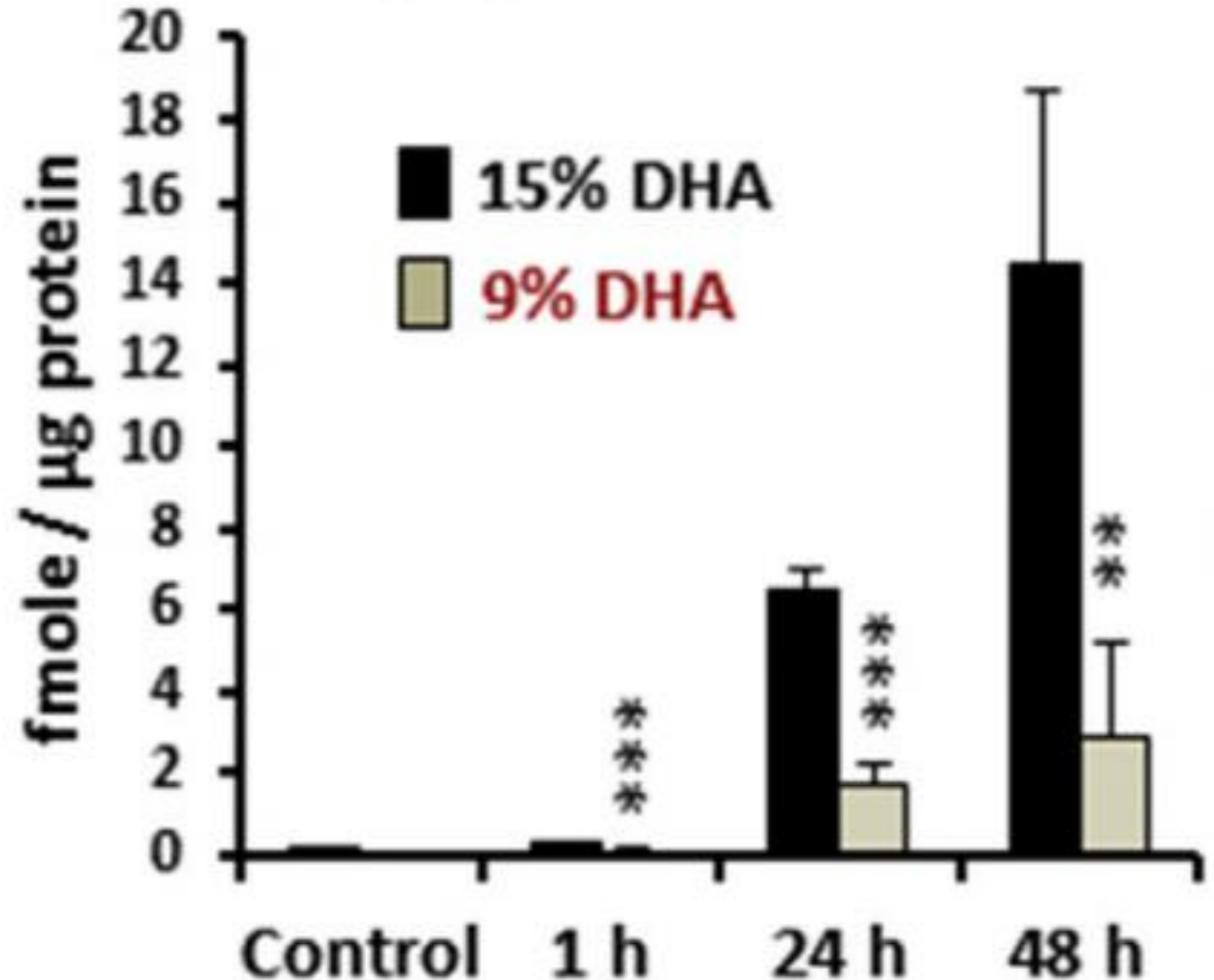






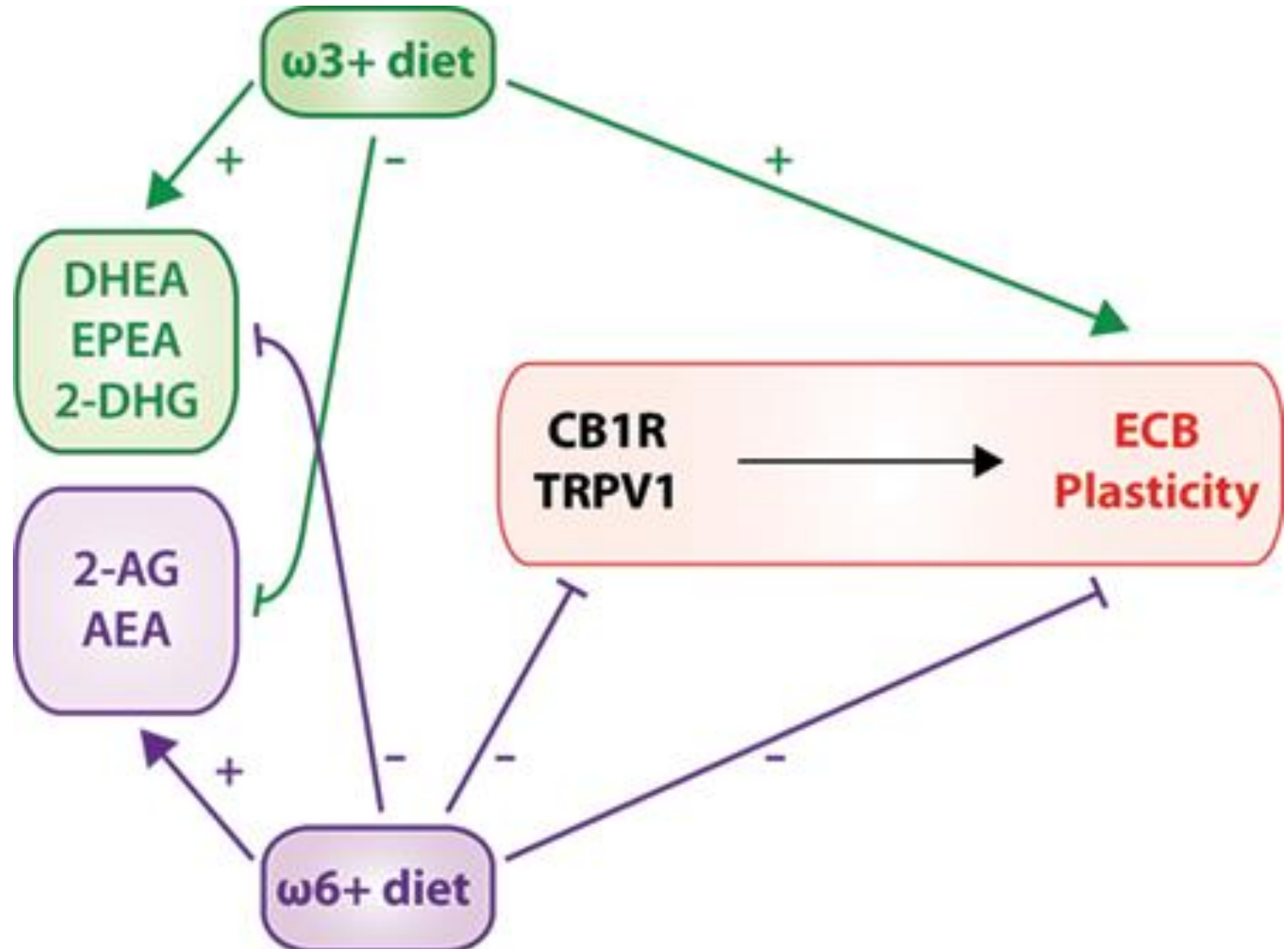
# Dose-Response Relationship Between DHA and Synaptamide in the Brain

## Synaptamide in Brain





It always comes  
down to balance

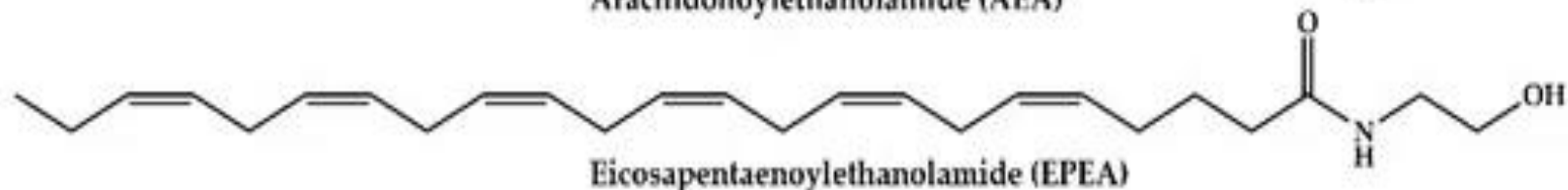
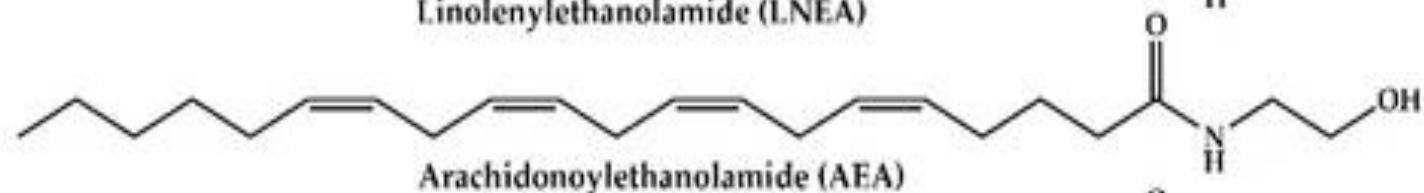
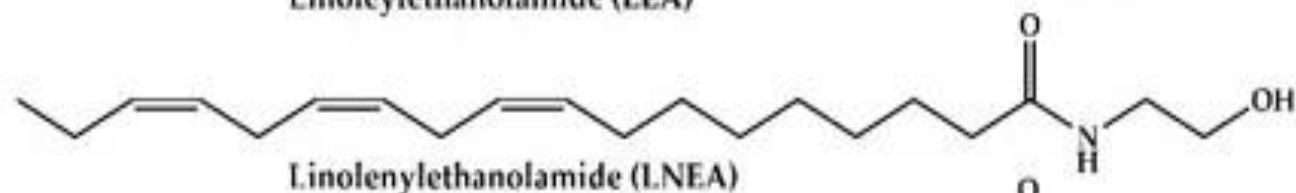
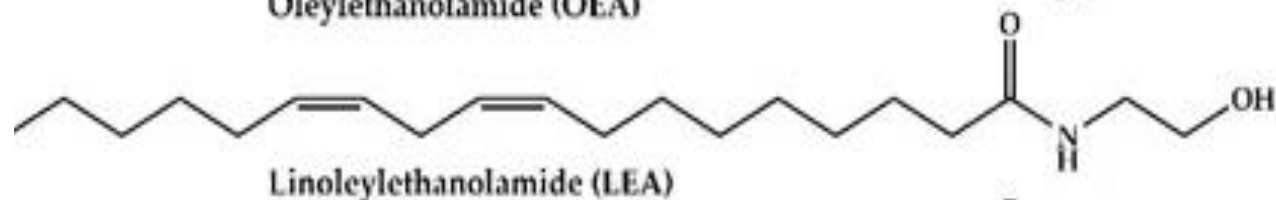
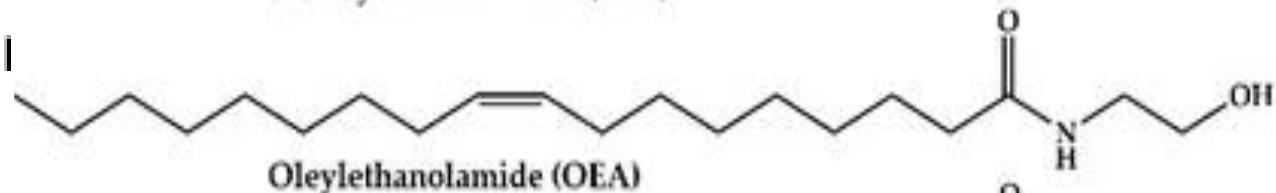
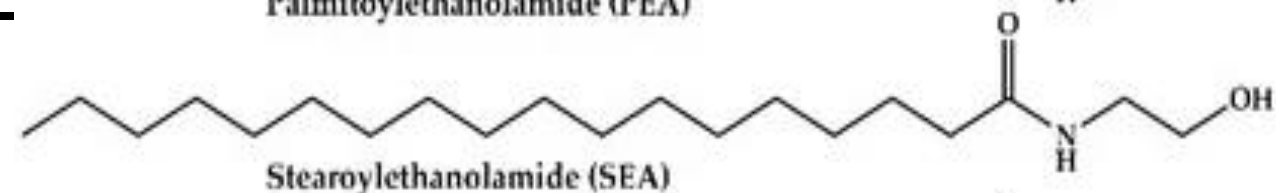
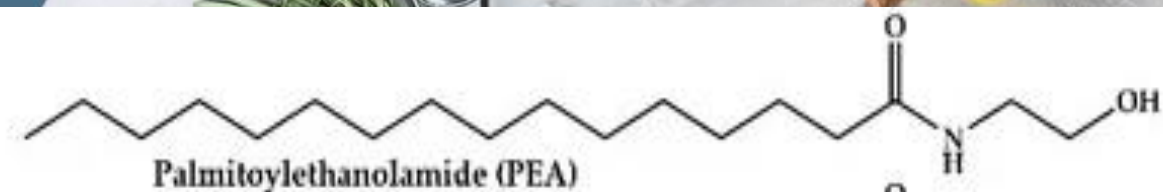


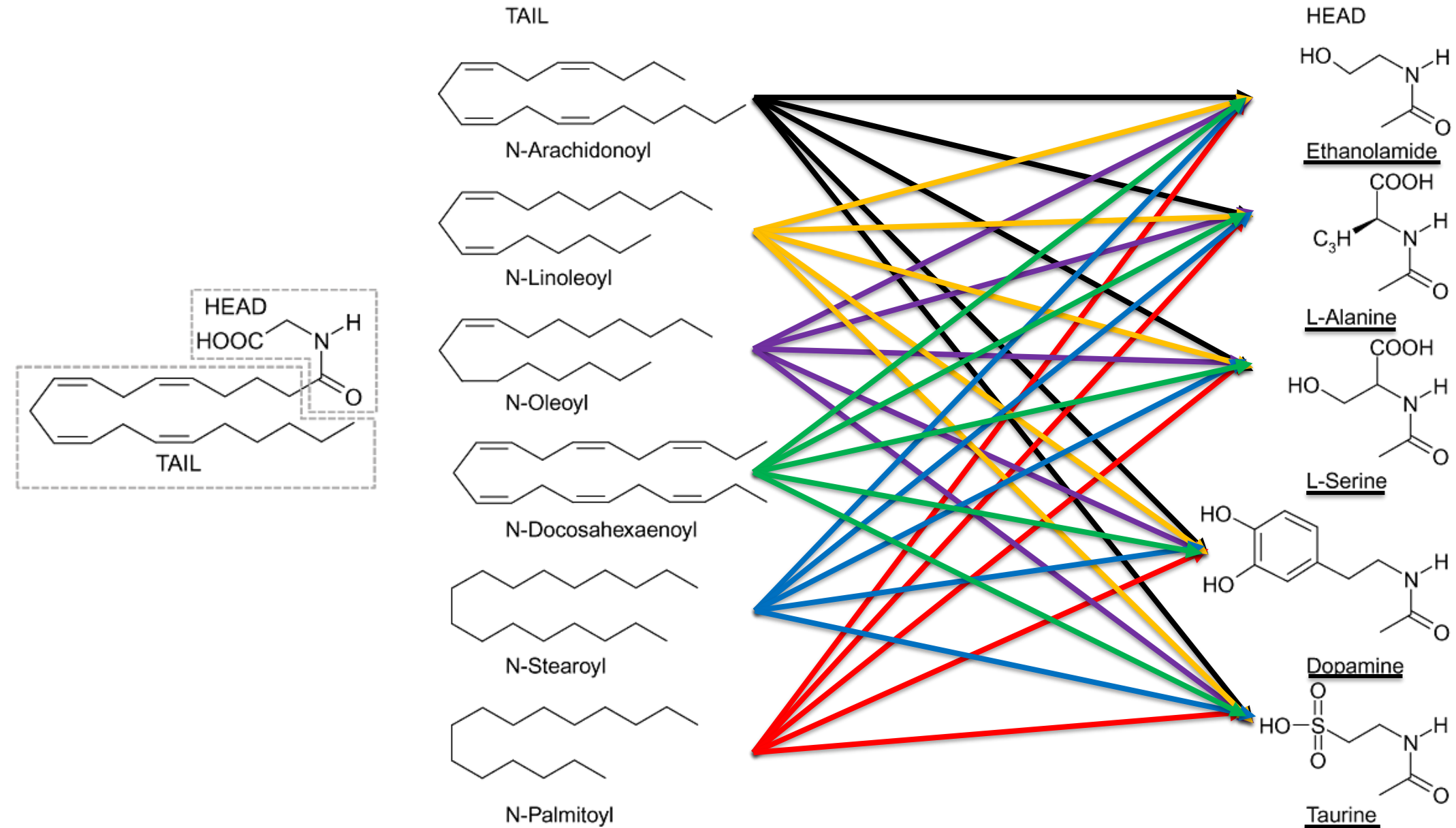




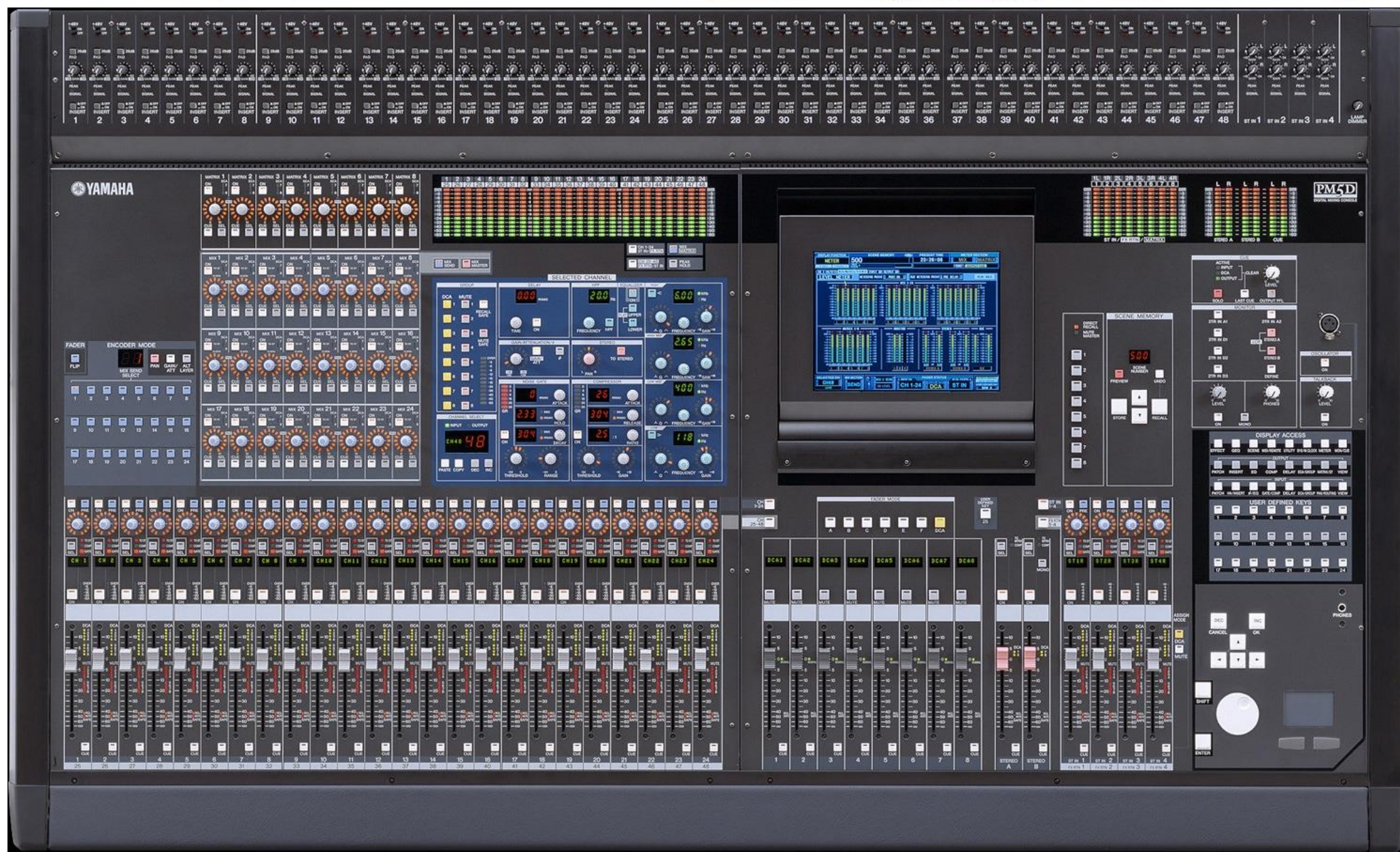


Common name	Shorthand nomenclature	Typical source
Caprylic acid	8:0	Coconut oil
Capric acid	10:0	Coconut oil
Myristic acid	14:0	Coconut oil
Palmitic acid	16:0	Olive oil, soyabean oil, fish oil
Oleic acid	18:1 <i>n</i> -9	Olive oil, soyabean oil
Linoleic acid	18:2 <i>n</i> -6	Soyabean oil
$\alpha$ -Linolenic acid	18:3 <i>n</i> -3	Soyabean oil
EPA	20:5 <i>n</i> -3	Fish oil
DHA	22:6 <i>n</i> -3	Fish oil

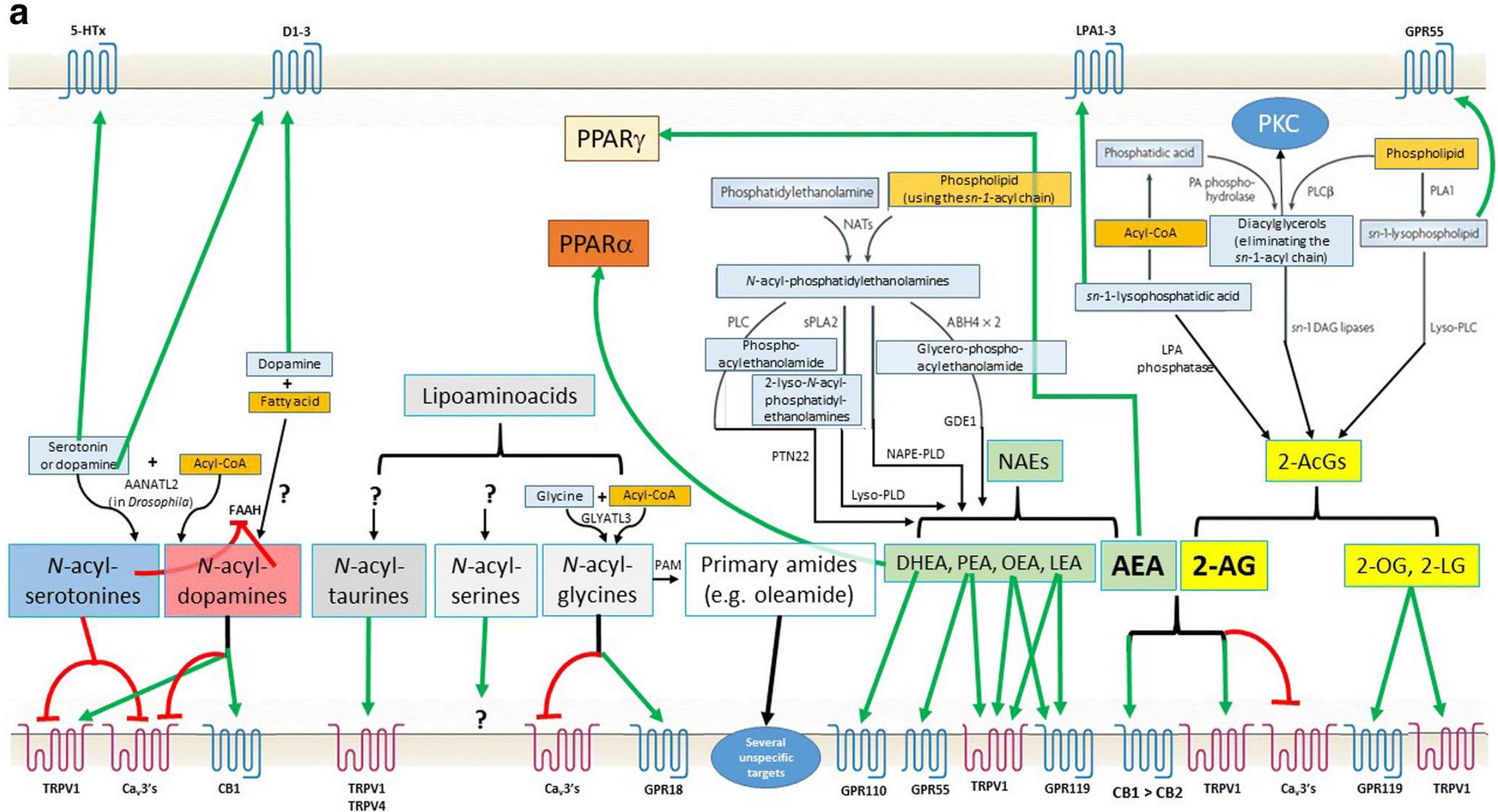














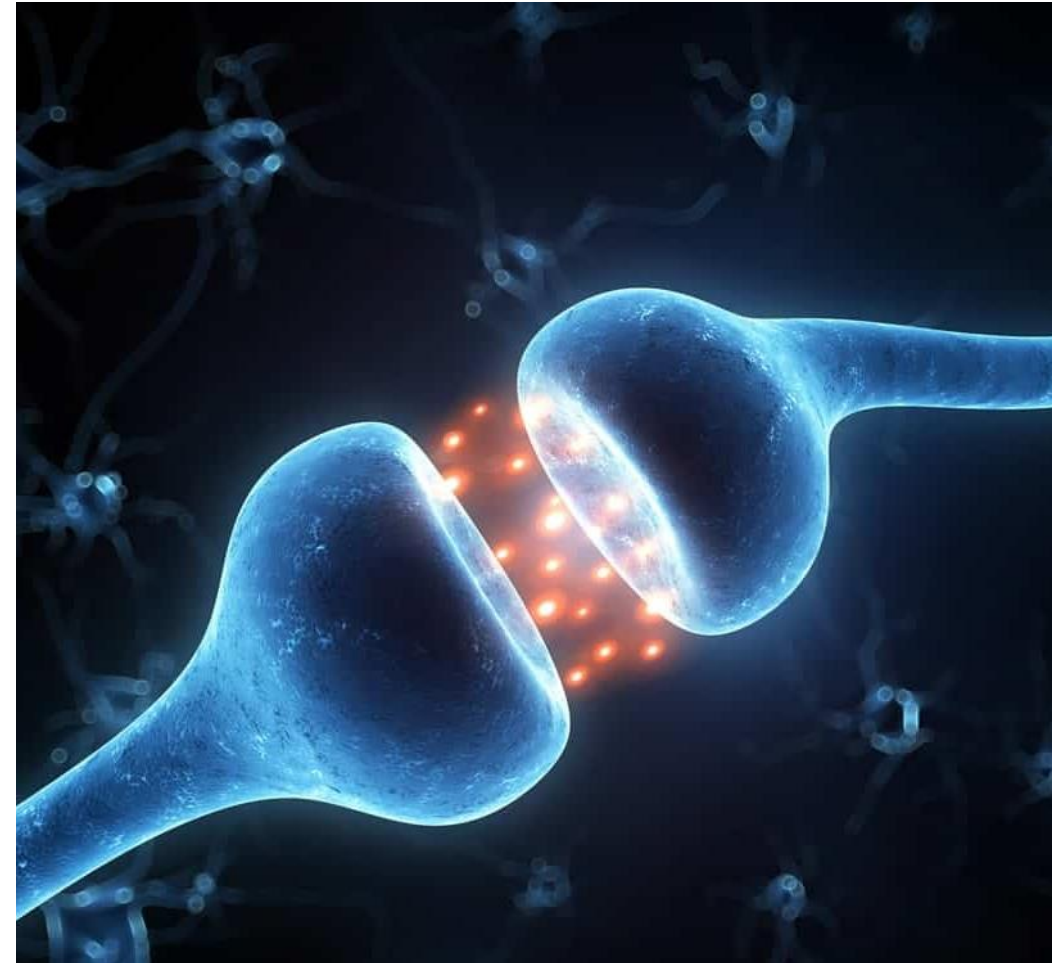
# *N*- Palmitoyl ethanolamine (PEA)

PEA is an endogenous  
fatty acid amide

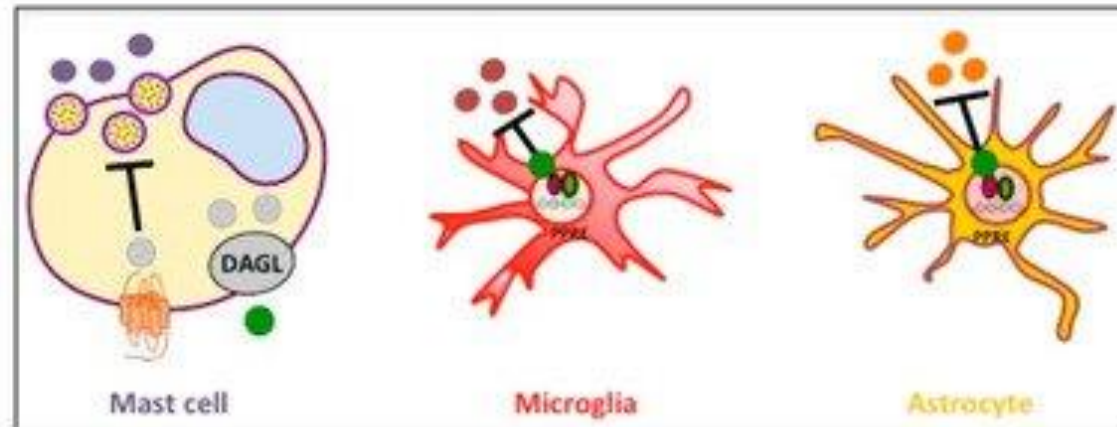
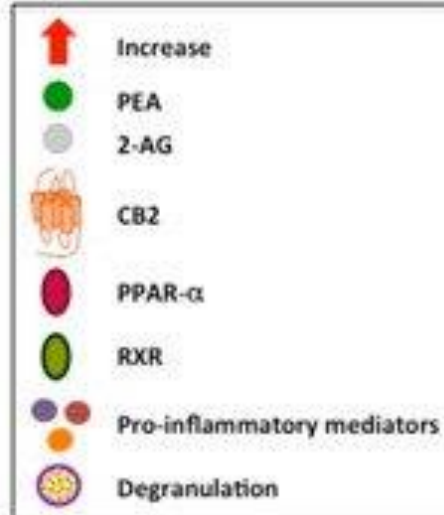
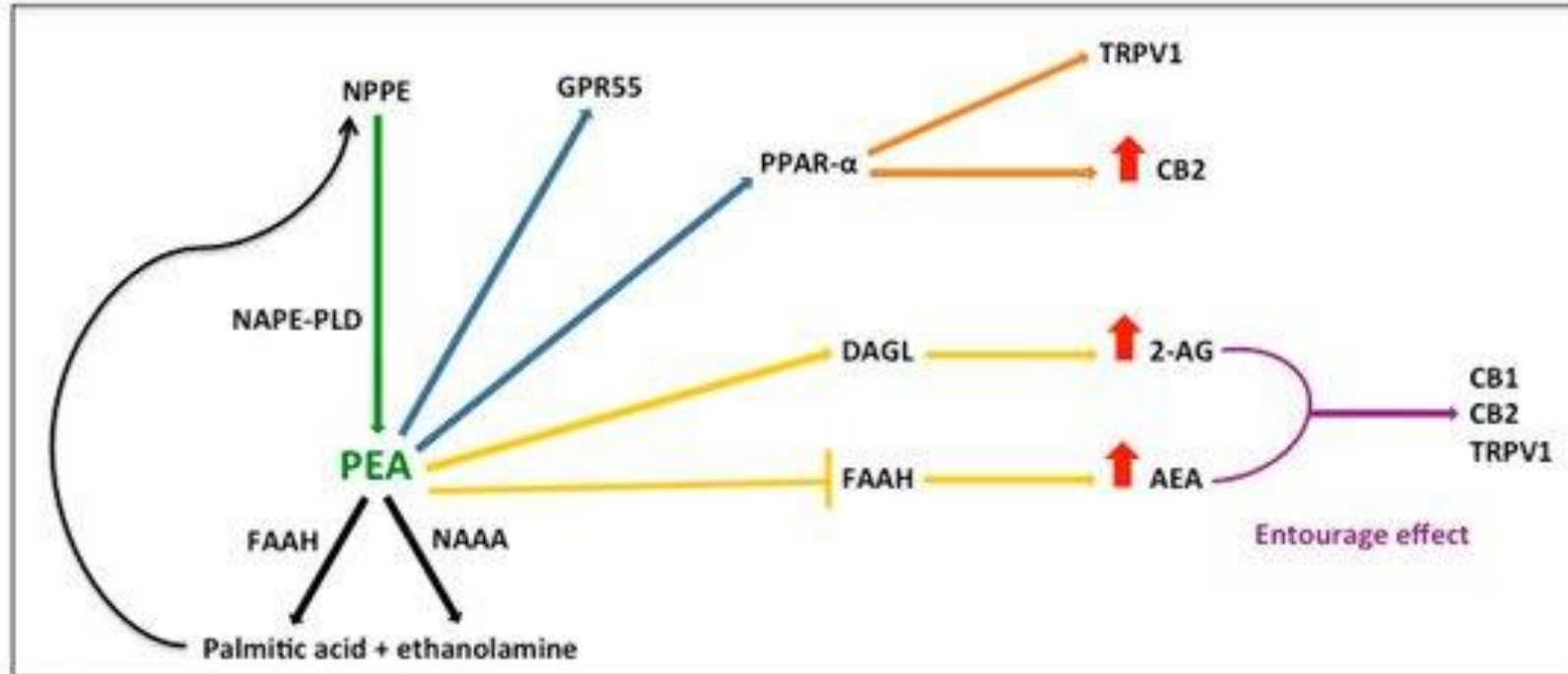
PEA is naturally produced  
in the human body

Levels of PEA drop in response  
to pain, stress and inflammation

PEA reduces local  
inflammation and pain









# Let's get clinical





# Evaluating and Treating TBI

**Importance of Diet  
&  
Exercise**

**Targeted  
Nutritional  
Therapy**

**New and  
Interesting  
Diagnostics**

**Other  
Interesting  
Therapies**

**Correcting  
Pituitary  
Dysfunction**



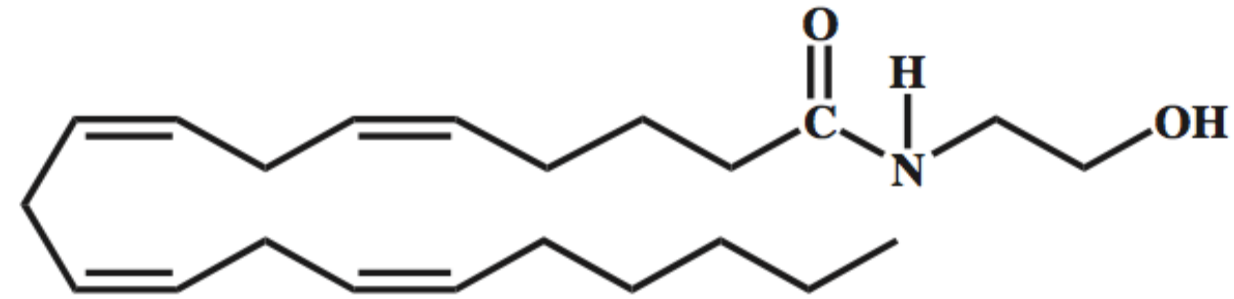


# The Omega-3 Protocol

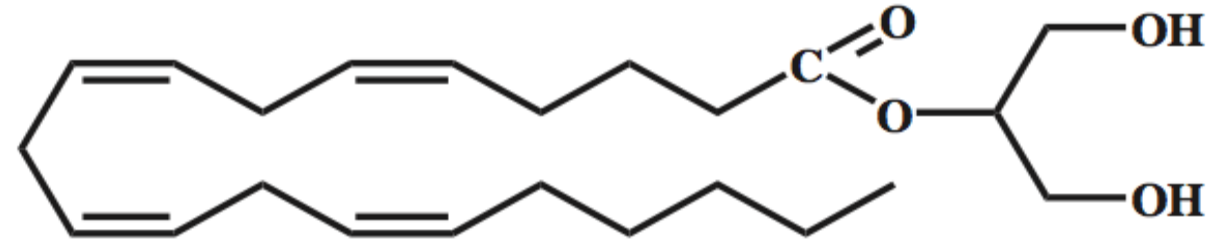
- Use a concentrated triglyceride omega-3 product
- One “dose” equals 3000 mg of EPA/DHA combined
- One dose three times a day for a week (9000 mg)
- One dose two times a day the next week (6000 mg)
- One dose as an ongoing maintenance dose  
and for prevention of head injury



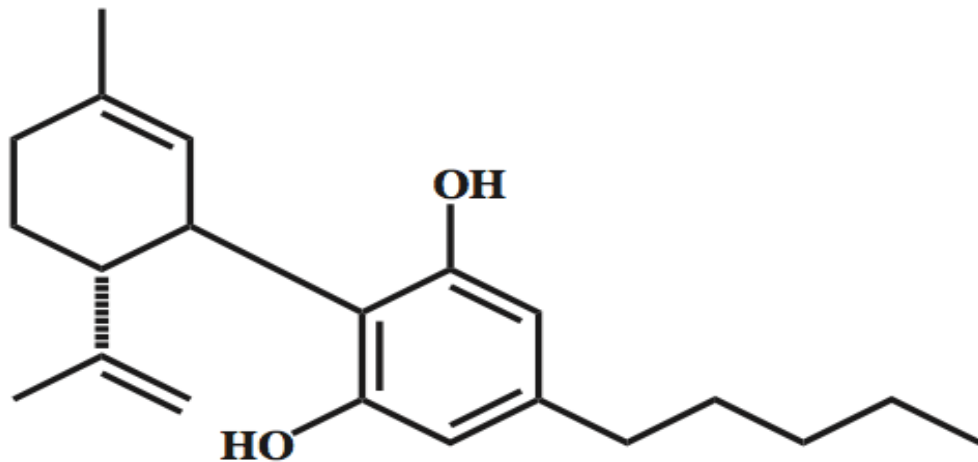
# Endocannabinoids



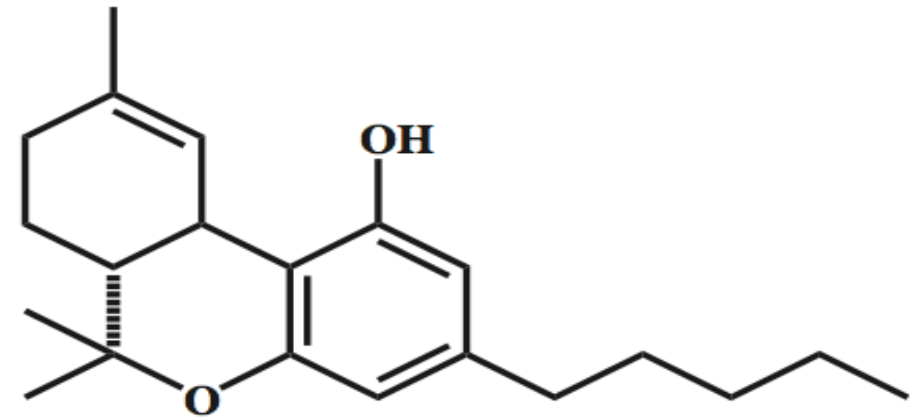
**Arachidonoyl ethanolamide (anandamide)(AEA)**



**2-arachidonoyl glycerol (2-AG)**



**Cannabidiol (CBD)**

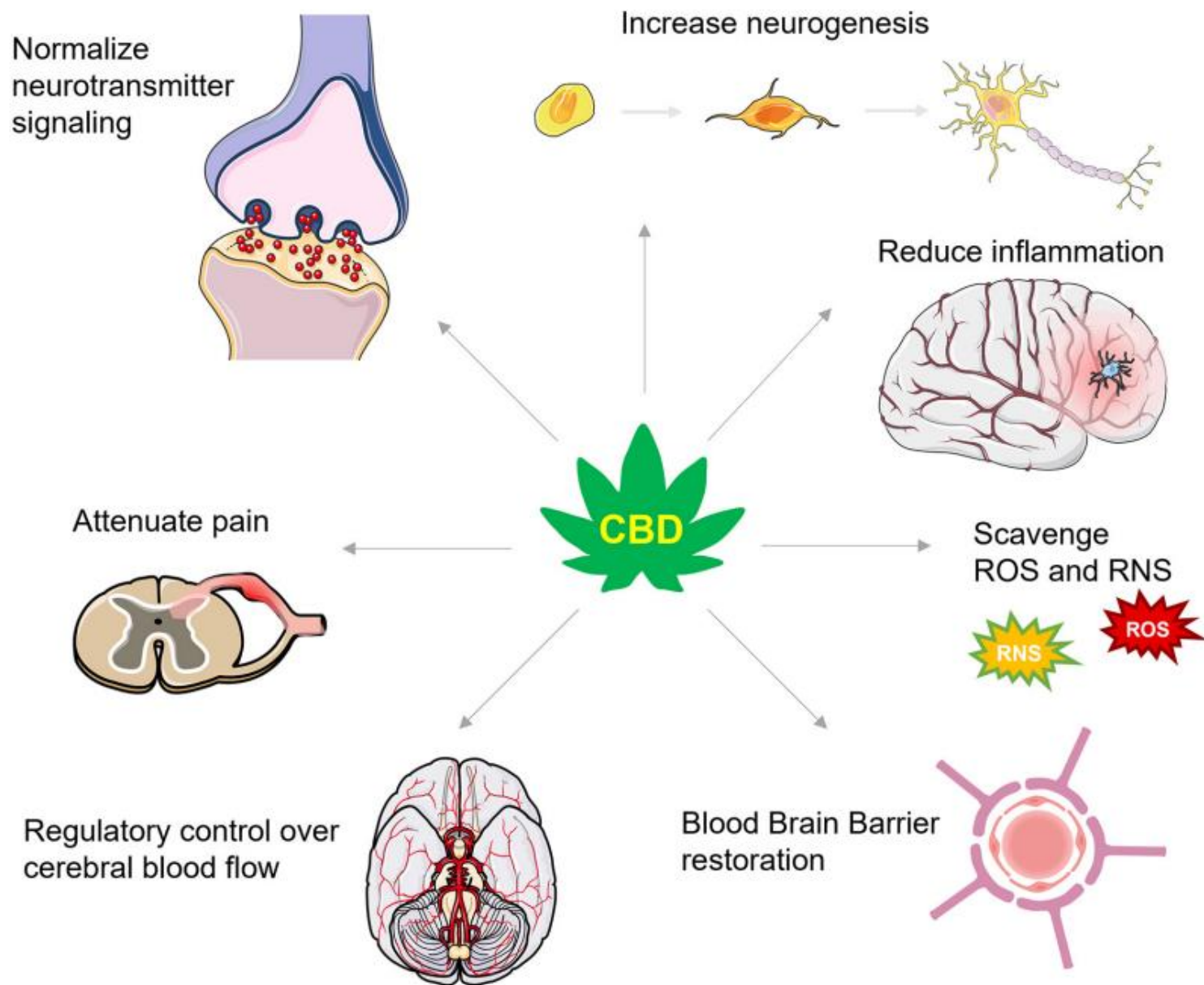


**$\Delta^9$ -tetrahydrocannabinol ( $\Delta^9$ -THC)**

**Phytocannabinoids**



# CBD's Actions in TBI







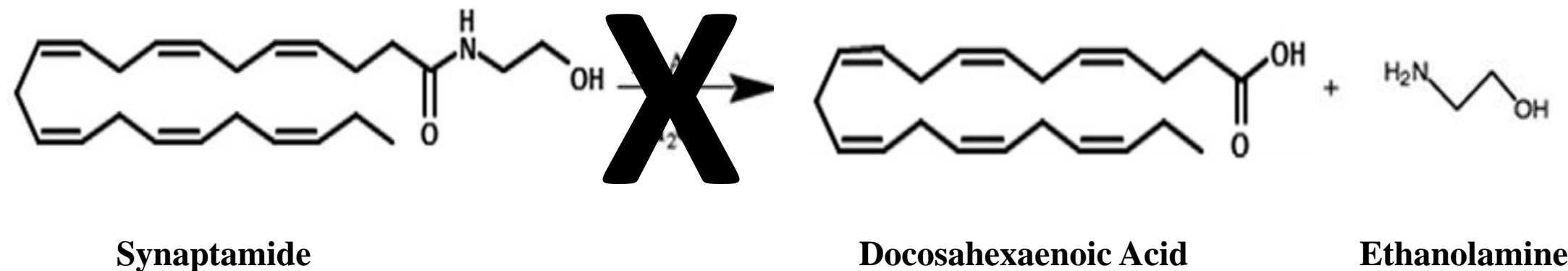
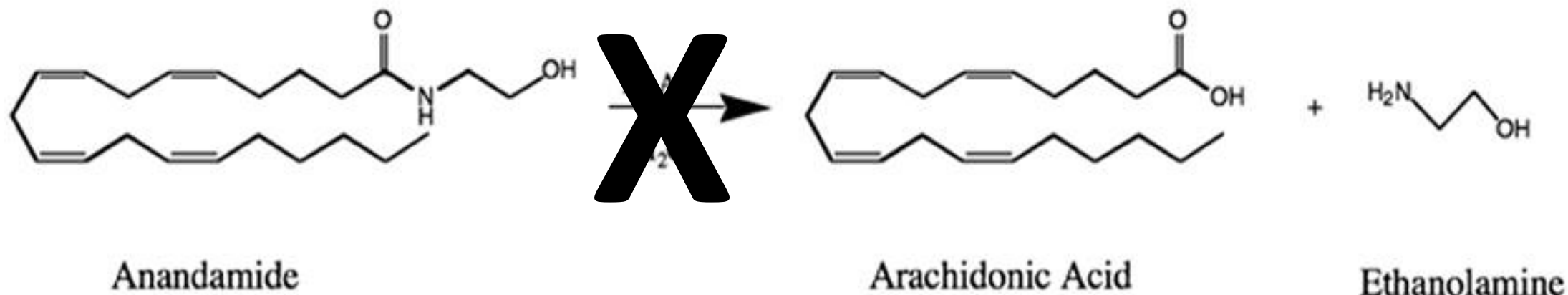
# CBD Mechanisms of Action

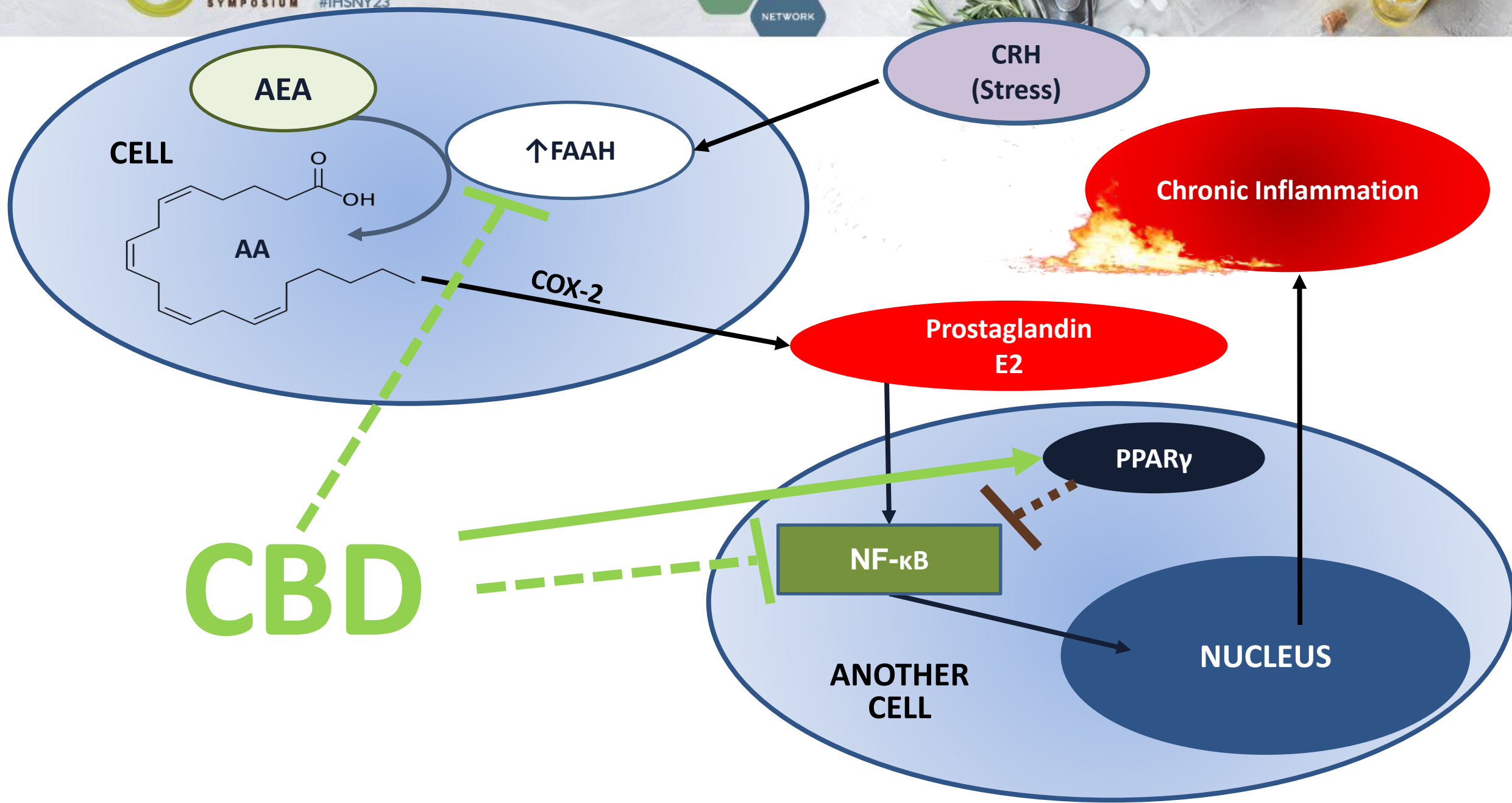
There are over 65 known receptors and targets for CBD.

Dr. Vincenzo Di Marzo calls CBD “the Swiss Army Knife.”

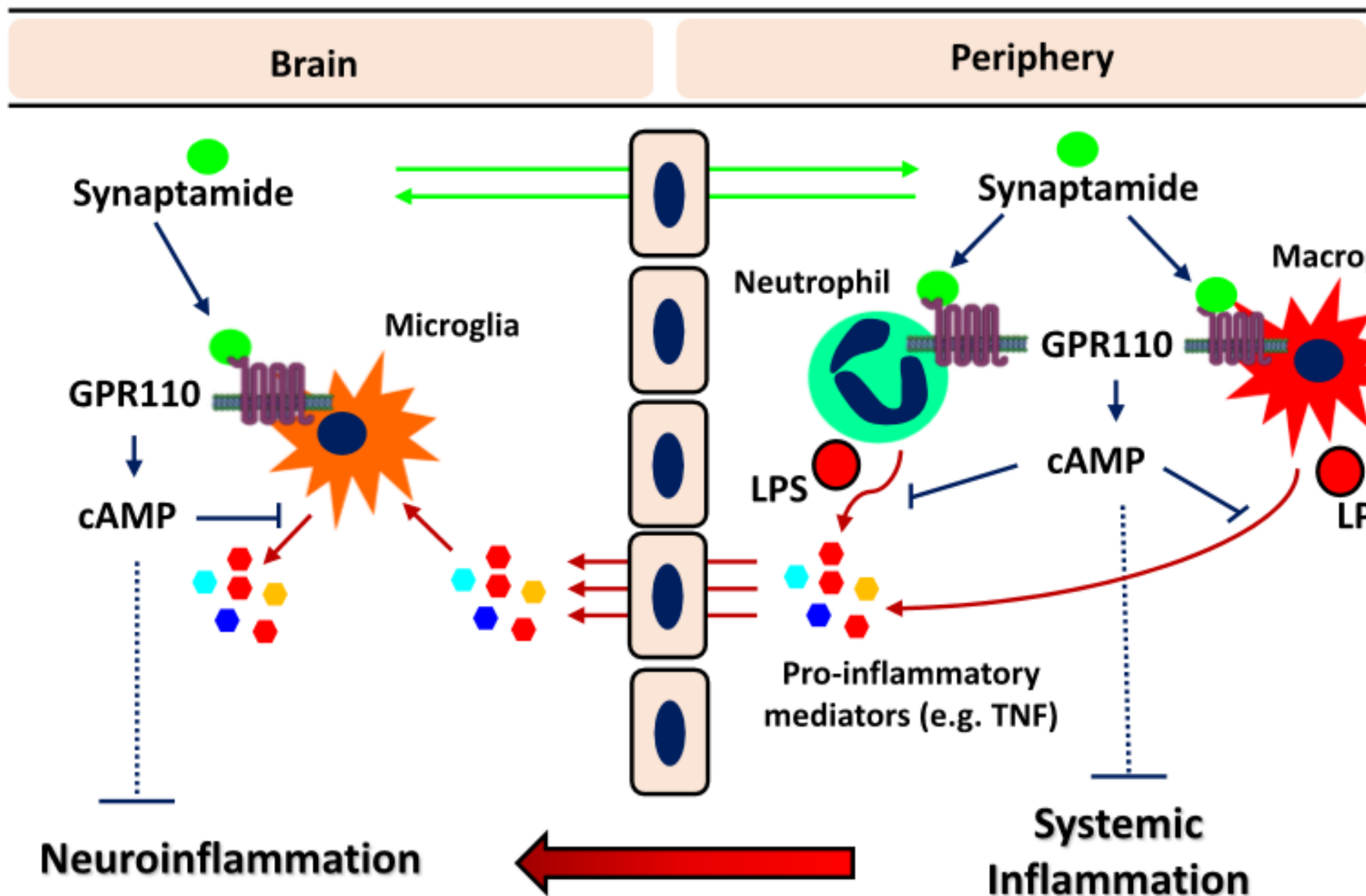
	Serotonin 5HT1A	Vanilloid TRVP-1	Adenosine 2A2	GPR55	FAAH inhibition	Antioxidant
Agonist	★	★	★			
Antagonist				★		
Receptor- Independent					★	★
Regulates	depression sleep appetite	pain inflammation body temperature	cardio- vascular other neuro- transmitters	bone density blood pressure cancer cell proliferation	ECB tone	Neuro- protection

# CBD blocks FAAH keeping Anandamide around longer



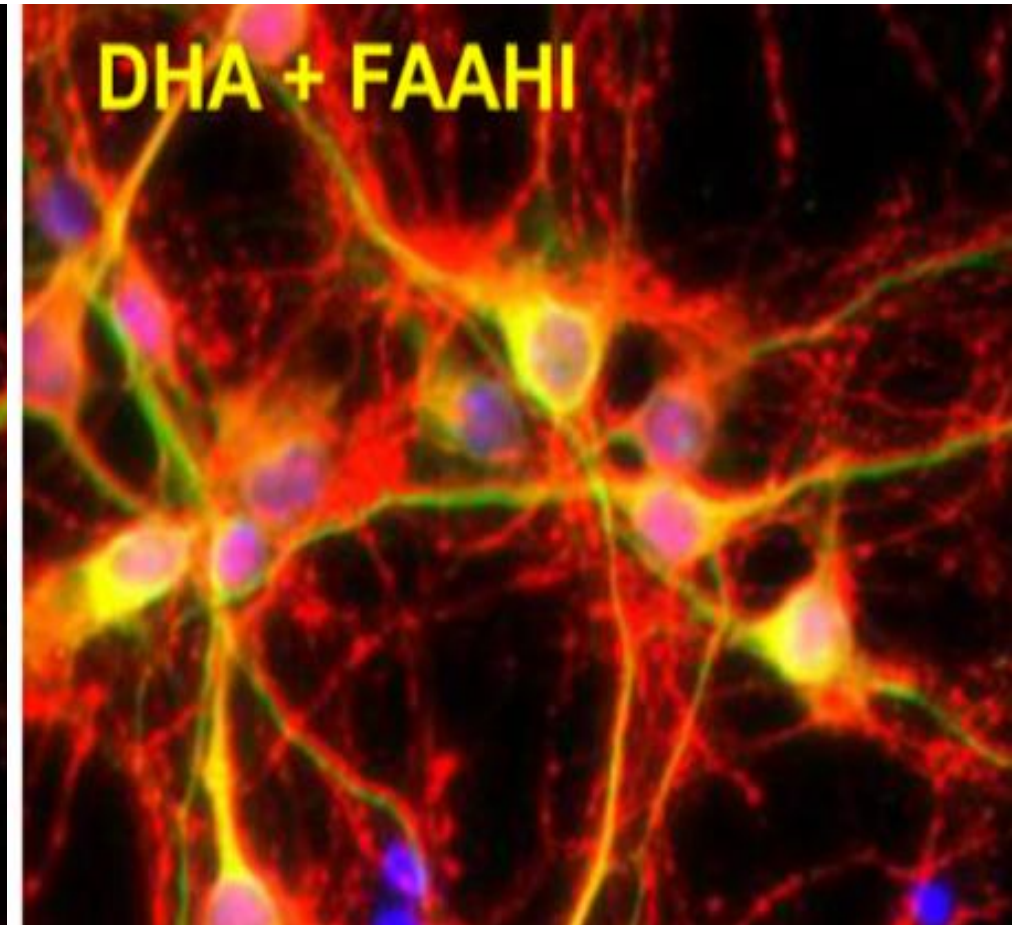
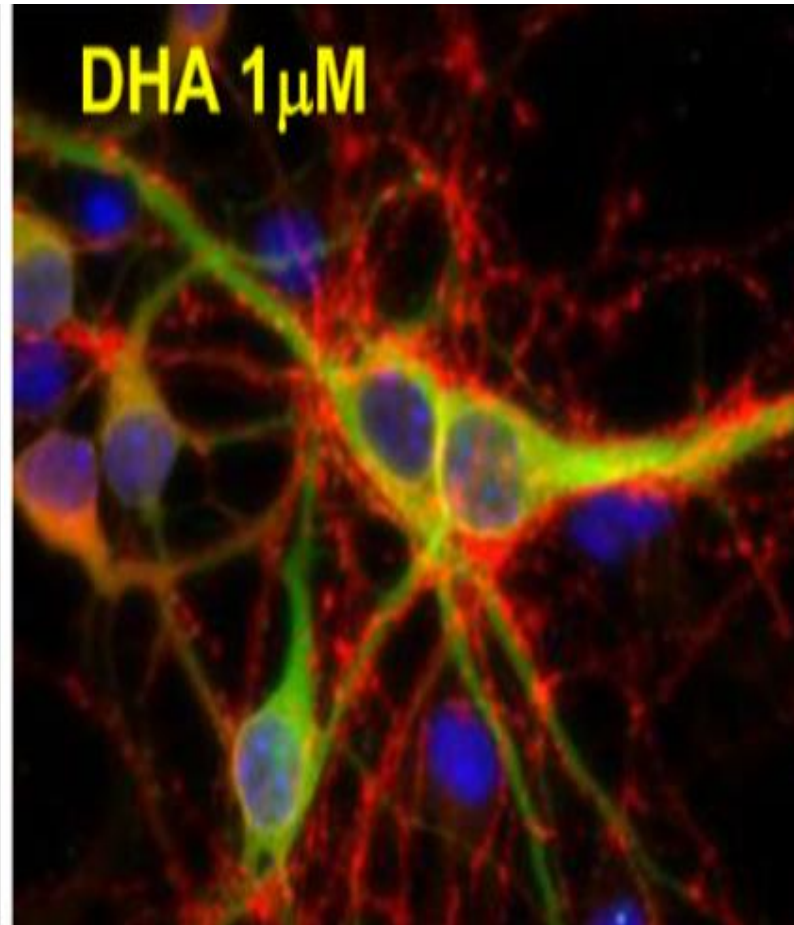
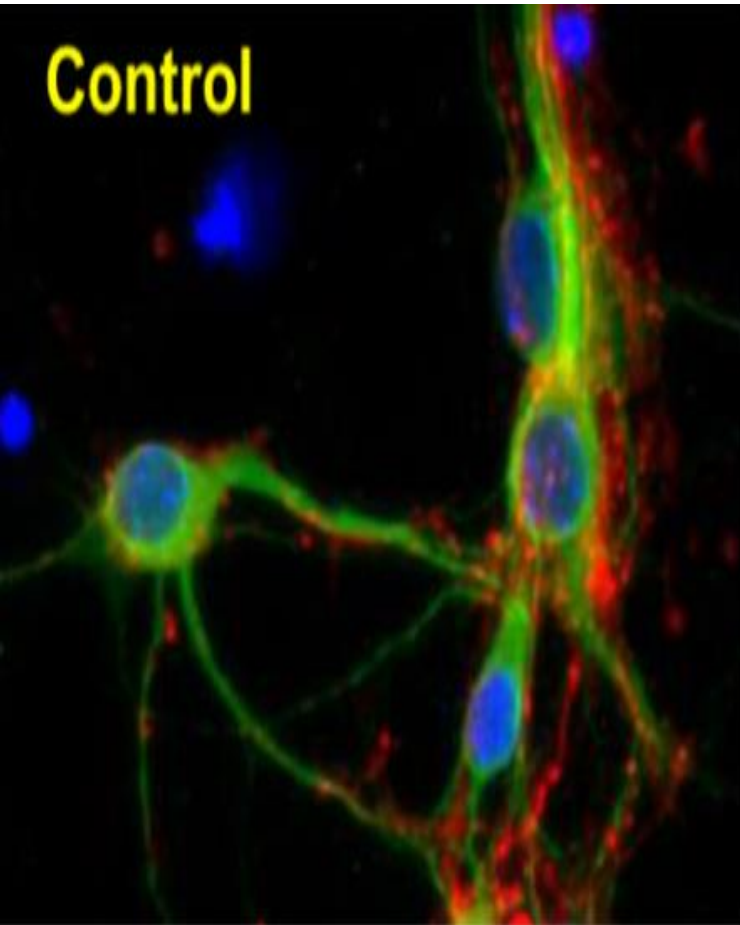








# Neurons, DHA, and Inhibitors





# Cannabis Americana



AS ACT

We are m  
Sativa from A  
tested by cap  
to the fluid ex  
Fluid Extr  
physiologically  
with perfect  
market it at a  
fluid extract C

PARKE  
HOME O

CANNABIS

(Catalogue No

physiologically; strength  
of the U. S. P. soli

DOSE— $\frac{2}{3}$  grain (.0

FROM THE LABORATORY  
THE WM S. MERRE  
CINCINNATI

**VICTOR**  
SERIAL NO. 519  
**INFANTS RELIEF.**  
Formula of Dr. P. D. Fahrney,  
Contains per fluid ounce:  
**CANNABIS INDICA,**  
FOL. 11-4 GRAINS,  
**SWEET SPIRITS OF NITRE,**  
20 MINIMS.  
**CHLOROFORM, 5 MINIMS.**  
**For all LOOSENESS of BOWELS**



FLUID EXTRACT  
CANNABIS INDICA

ELI LILLY & CO.  
INDIANAPOLIS  
U. S. A.

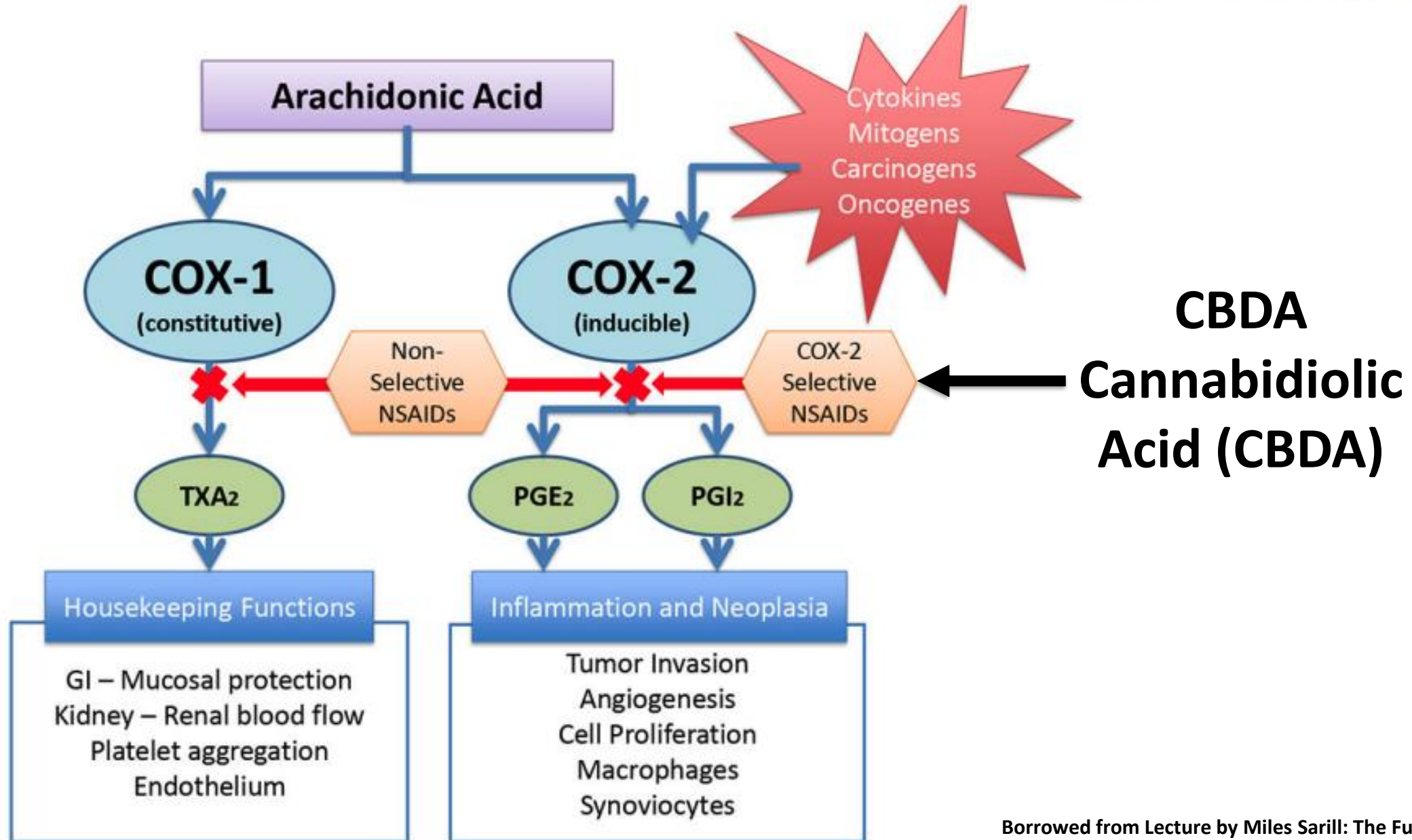
SOLID EXTRACT  
CANNABIS AMERICANA

LY TESTED  
(American Grown)  
A mild and powerful Narcotic  
1 grain

ELI LILLY & CO., INDIANAPOLIS, U. S. A.

Guaranteed by Eli Lilly & Co., under Food and  
Drugs Act, June 30, 1906. Guaranty No. 87.







# What Other Supplements Work in TBI?

(This is by NO means a complete list!!!)

- **Creatine, CoQ10, PQQ – mitochondrial function** Life Sci 2019 Sep 15;233:116684
- **Protein/BCAA's – support BDNF** Life Sci 2019 Sep 15;233:116684
- **Vitamin D – neuroprotective** Transl Neurosci. 2021 Dec 15;12(1):533-544
- **Probiotics – gut-brain connection** Front Immunol. 2021 Dec 24;12:800796
- **Magnesium – support neurotransmitters, sleep** Nutrients. 2021 Jan 30;13(2):463
- **N-acetyl-cysteine – supports glutathione** Front Neurosci. 2021 Mar 23;15:635483
- **PhosphatidylSerine – neurosupport** Front Aging Neurosci. 2022 Aug 3;14:975176
- **Mushrooms (maitake, etc) – cognitive support** J Clin Transl Res. 2021 Aug 4;7(4):575-620
- **Bacopa & other Botanicals – focus & nootropic** Curr Neuropharmacol. 2021;19(9):1442-1467



If you've been diagnosed with a concussion or other head injury,

**CLICK HERE TO READ THE**

**Omega-3 Protocol**

[www.brainhealtheducation.org/newsletter](http://www.brainhealtheducation.org/newsletter)

## Latest News

Latest Brain Health News  
and Information



### GOED Exchange 2014

Dr. Lewis' presentation at GOED Exchange 2014 on the innovative uses for Omega-3s for concussions and TBI.