

Mitochondria: You Need Energy To Heal

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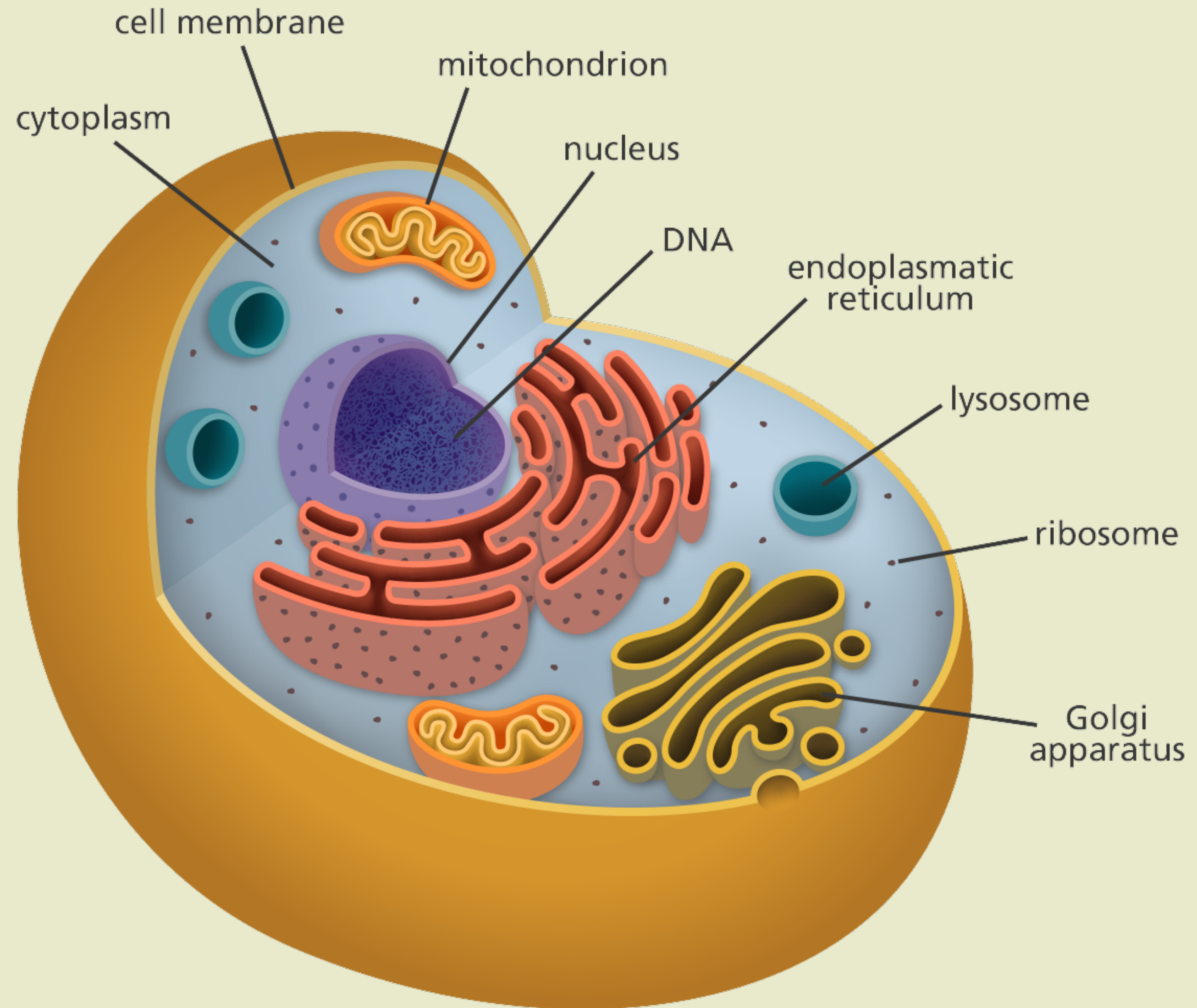
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Preface

- Chronic pain is a physical, biochemical, and mental / emotional process
- There are answers
- No matter how much you've tried, there's still more out there
- There is no one thing
- Mitochondrial health is a standard for all of my patients
- Viewer discretion advised: potentially boring info ahead

The Cell

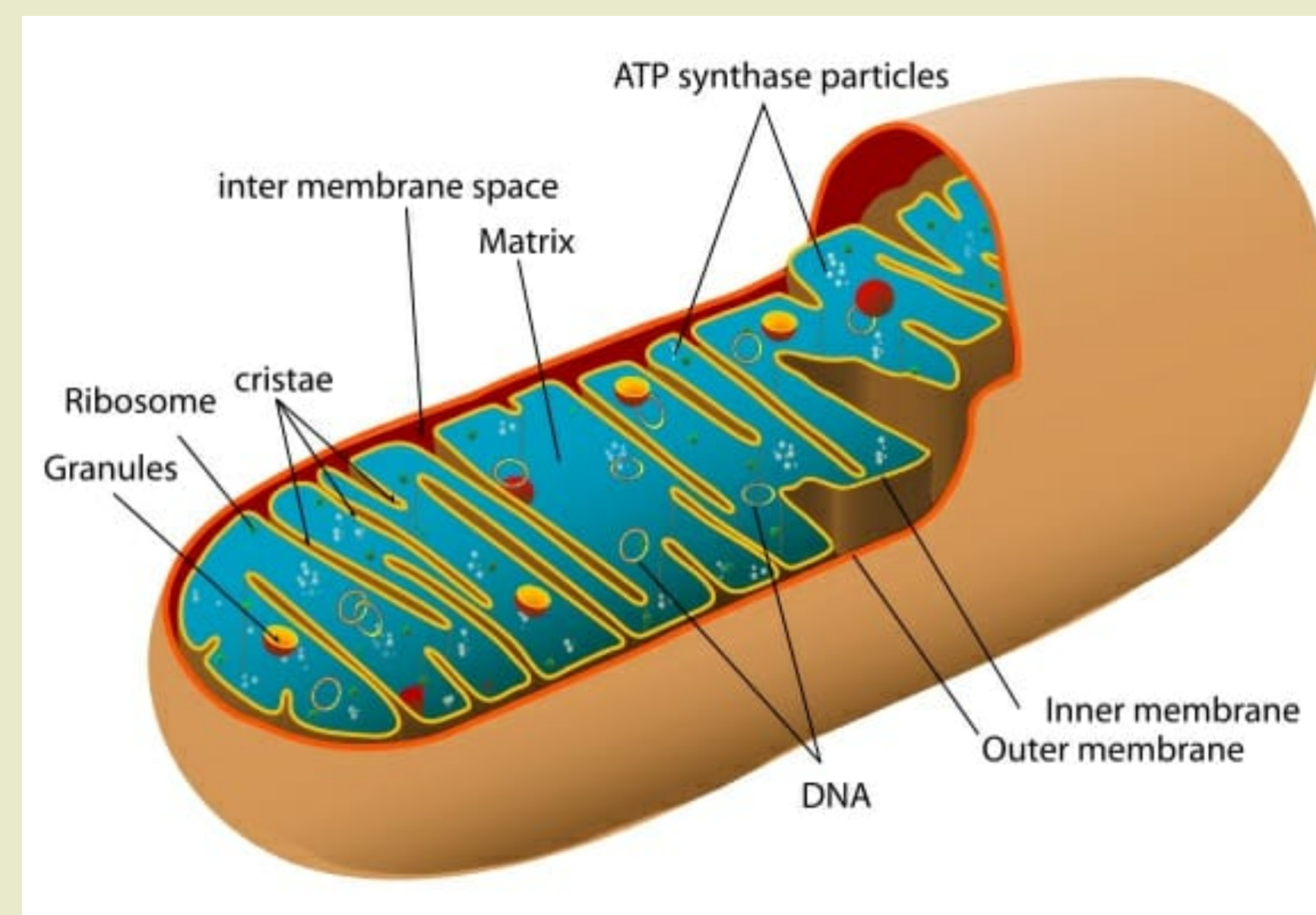
- Most basic unit of life
- Composed of organelles
 - The organs of the cell
 - Specific tasks
- Very complex
 - Energy consuming



<https://www.yourgenome.org/facts/what-is-a-cell/>

Mitochondria: The Powerhouse of the Cell

- Hundreds-thousands per cell
- Cellular respiration
 - Creating energy from the food we eat and the oxygen we breath
 - Main fuel source
- Likely the most energy producing things in the universe
 - Produce 10,000x more energy per gram than the sun
- By weight we are 10% mitochondria
- Mitochondria decline with age

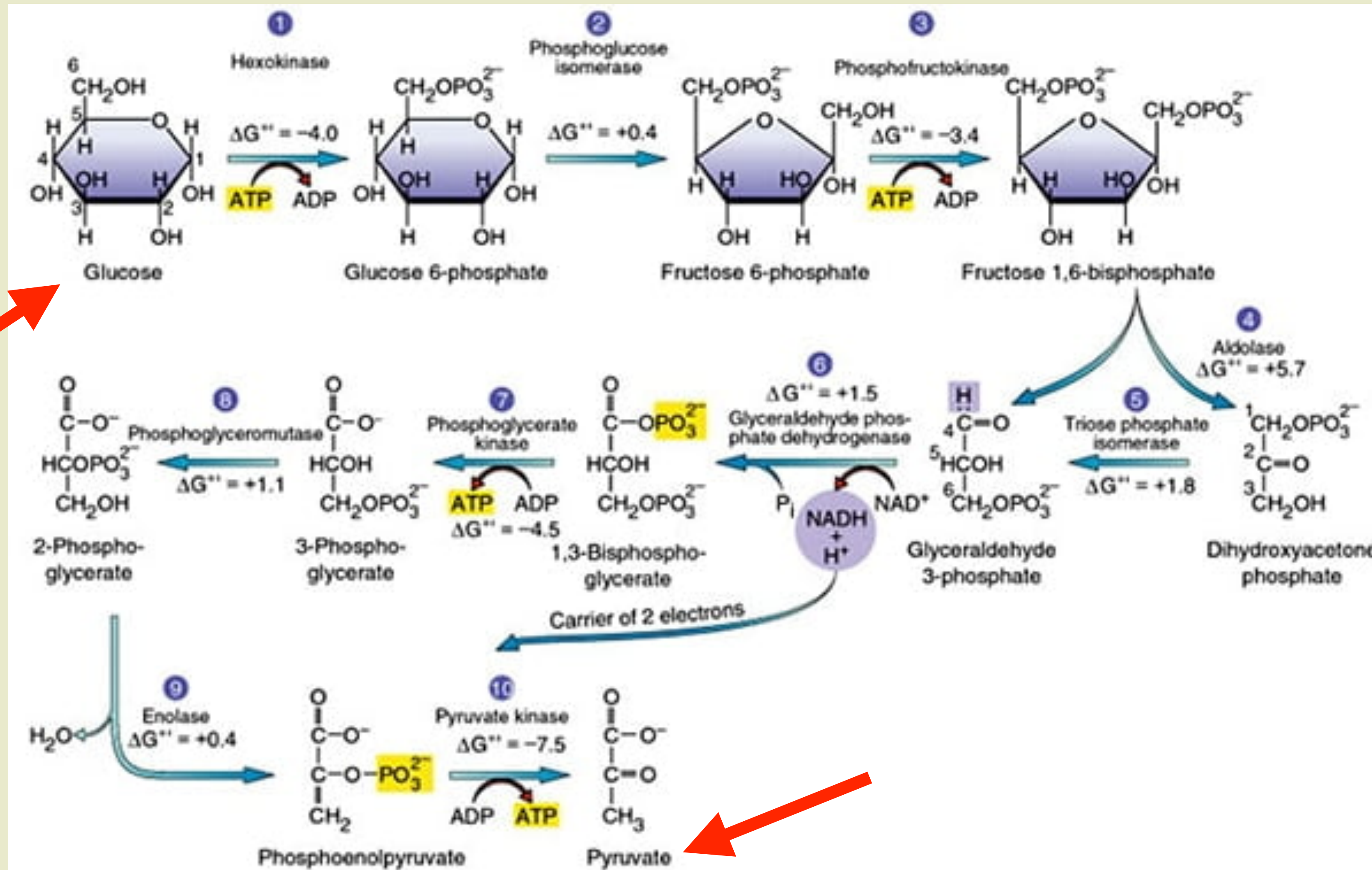


Conditions Associated With Mitochondrial Dysfunction

- Cardiovascular Disease
 - Angina, hypertension, congestive heart failure, diastolic dysfunction
- Stroke
- Neurodegenerative disorders
 - Dementia, Alzheimer's, Parkinson's, Huntington's disease
- Depression
- ADD / ADHD
- Type 2 Diabetes
- Aging skin / wrinkles
- Infertility
- Macular degeneration
- Glaucoma
- Cancer

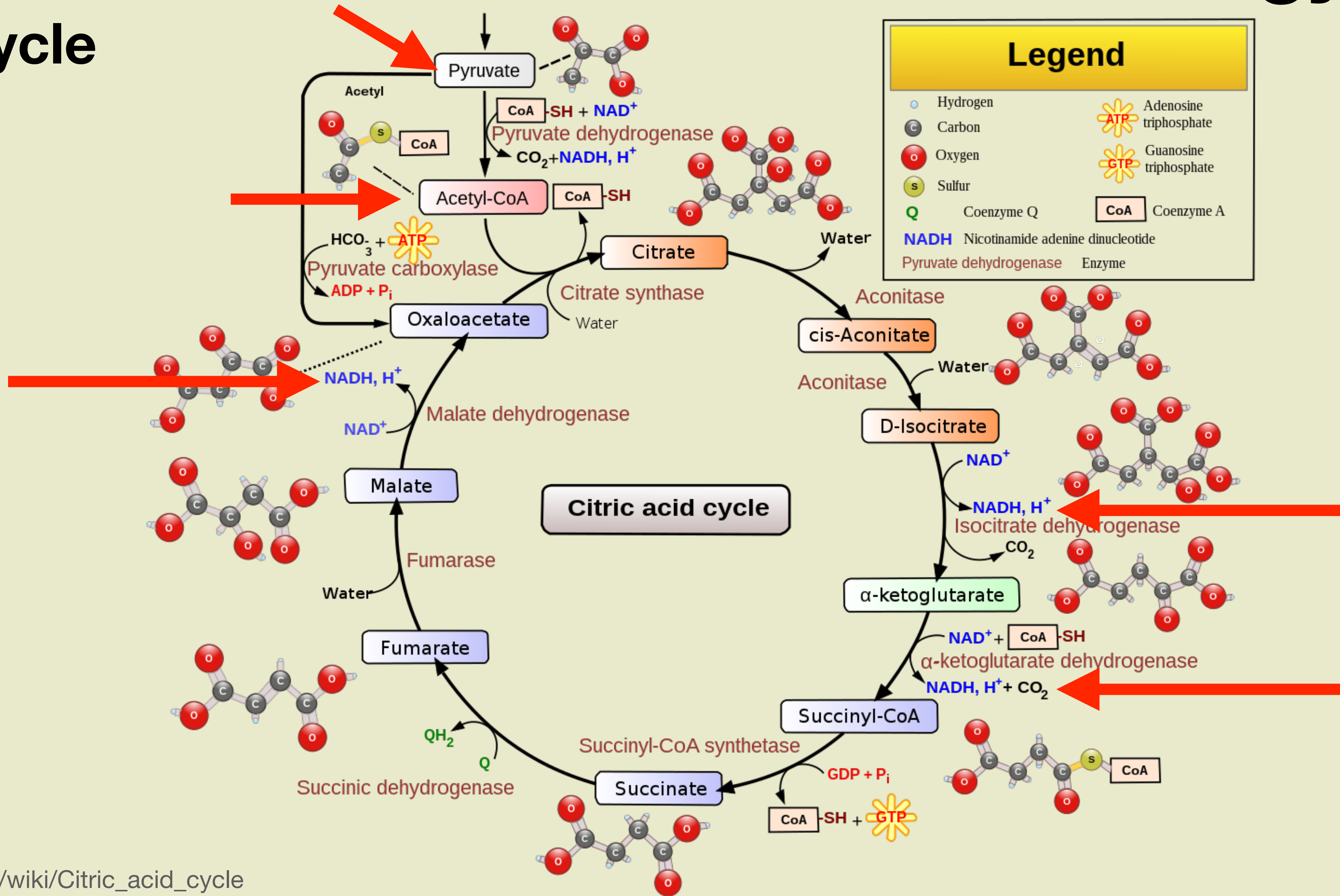
How Do Mitochondria Produce Energy?

Glycolysis



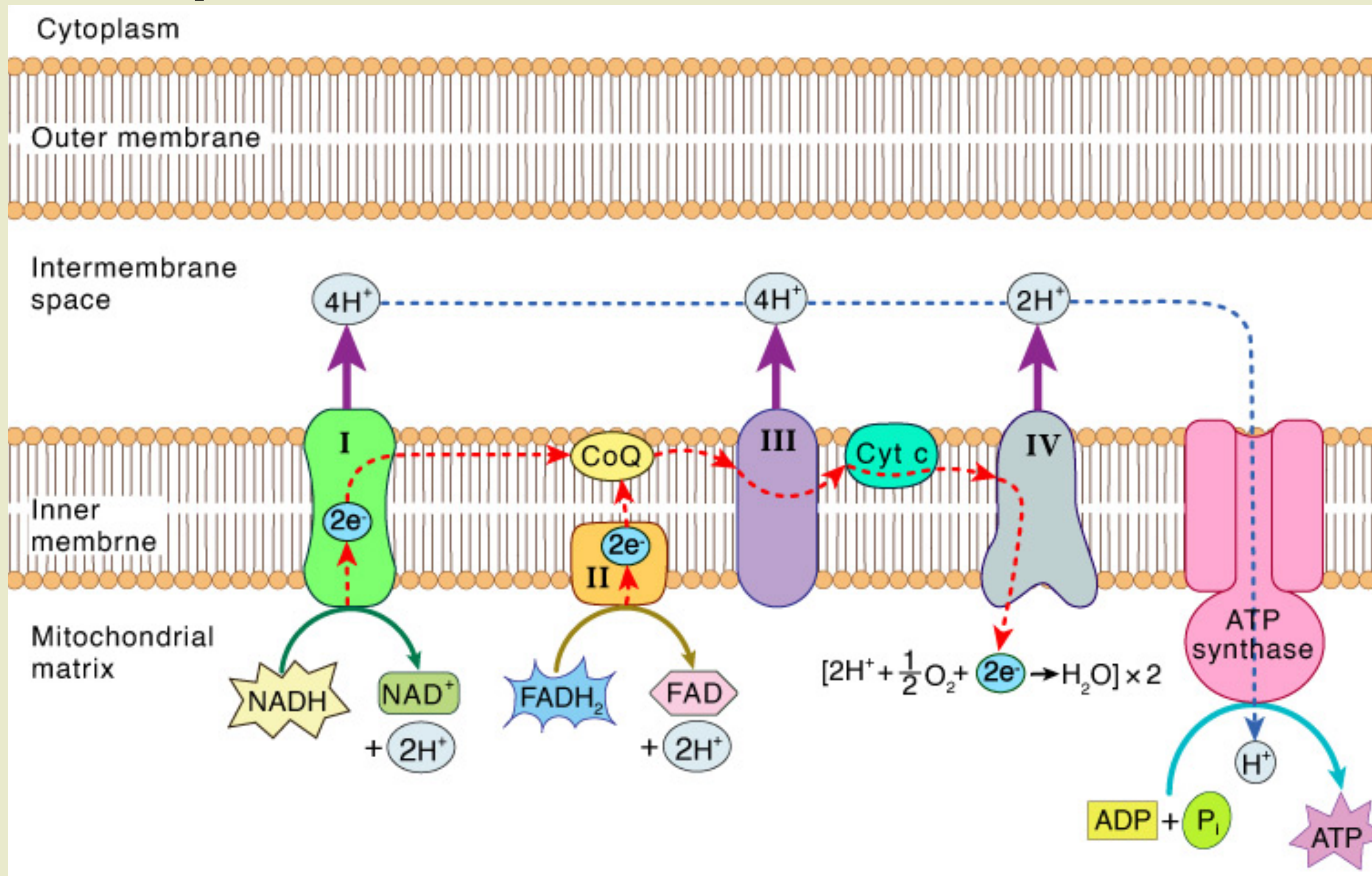
How Do Mitochondria Produce Energy?

TCA Cycle

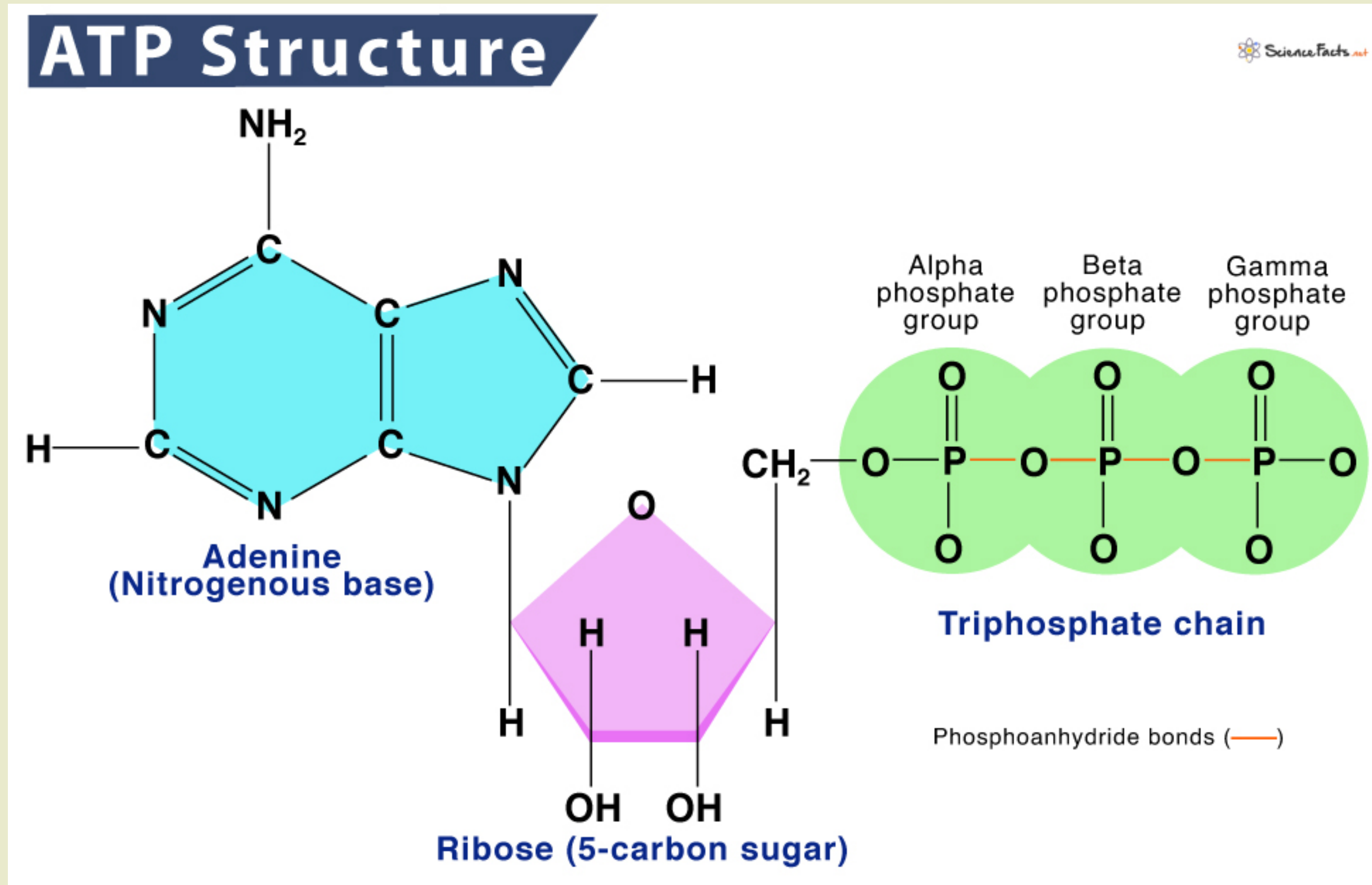


How Do Mitochondria Produce Energy?

Electron Transport Chain



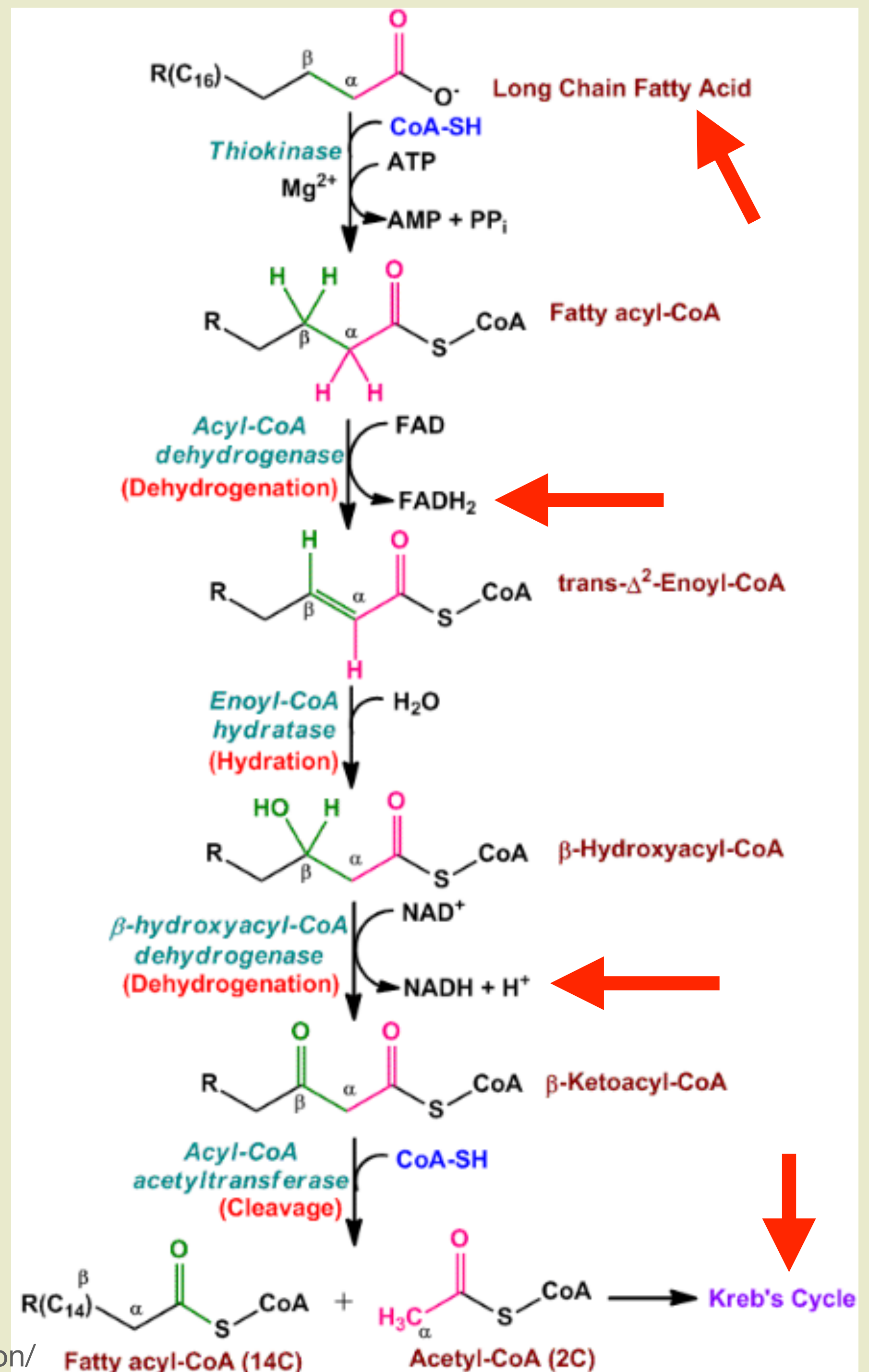
Adenosine Triphosphate



Fat Is Your Friend

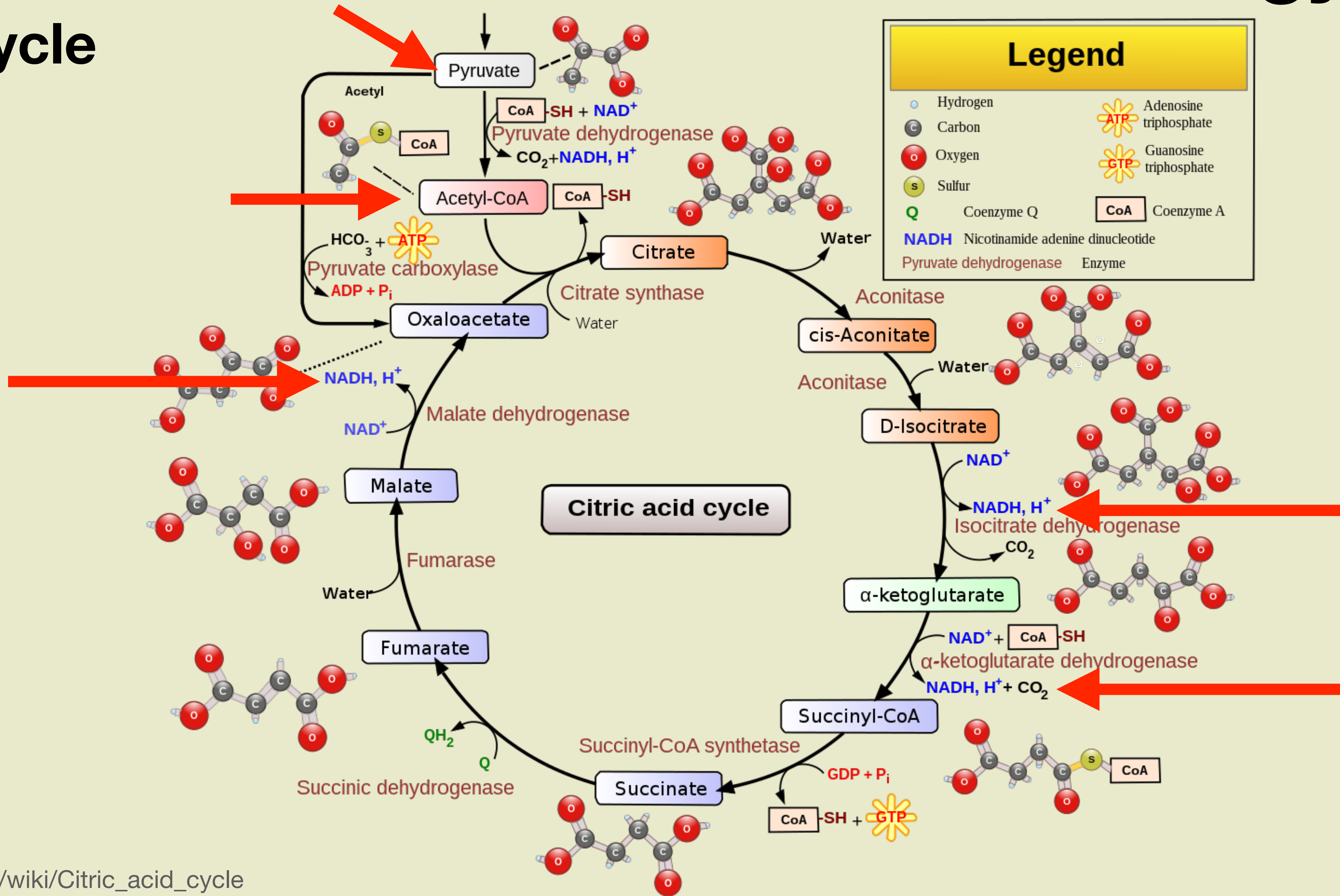
Beta Oxidation

- Fatty acids responsible for 60-70% energy production
- One molecule of glucose = 38 ATP
- One fatty acid molecule = 129 ATP



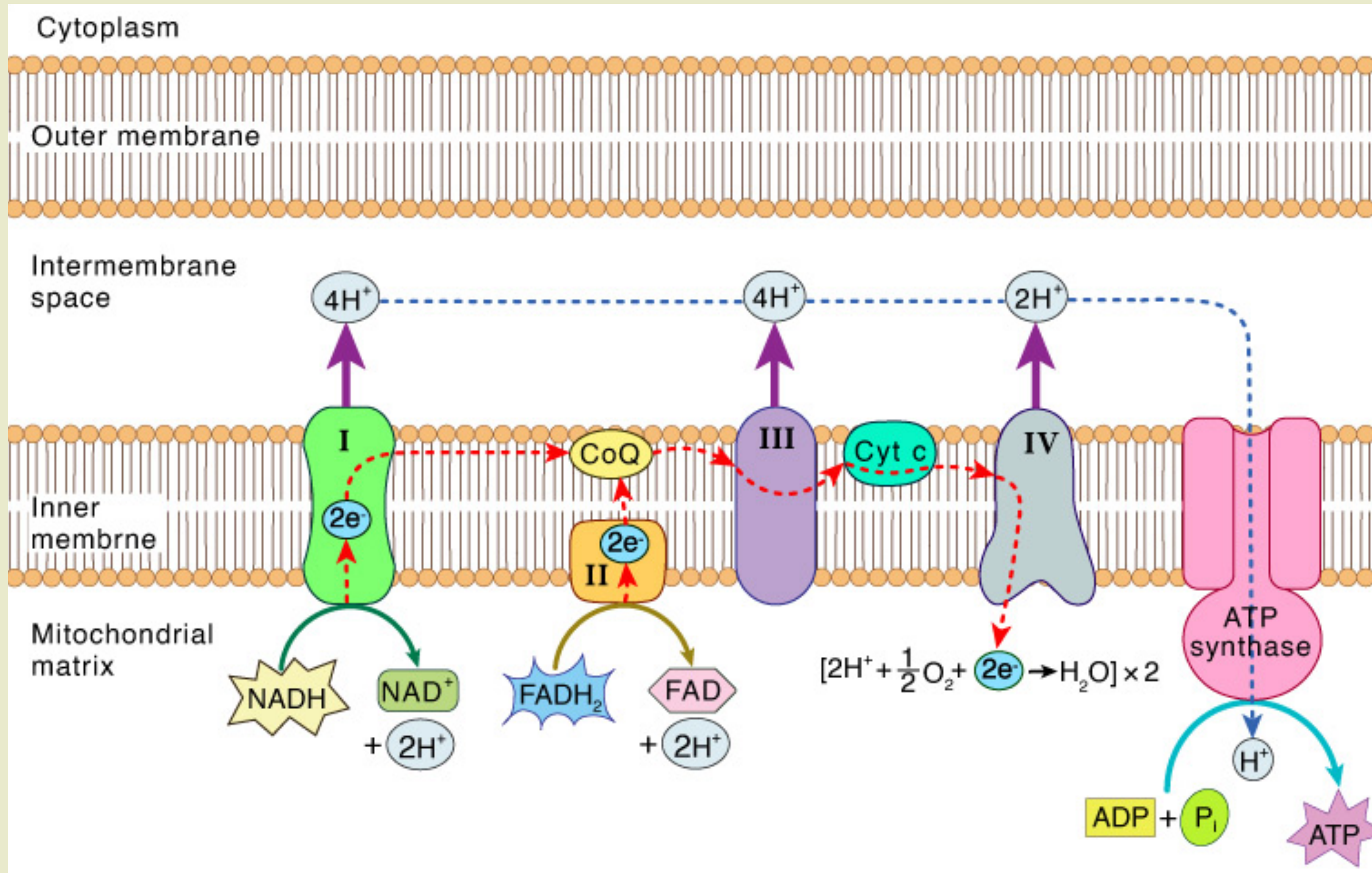
How Do Mitochondria Produce Energy?

TCA Cycle



How Do Mitochondria Produce Energy?

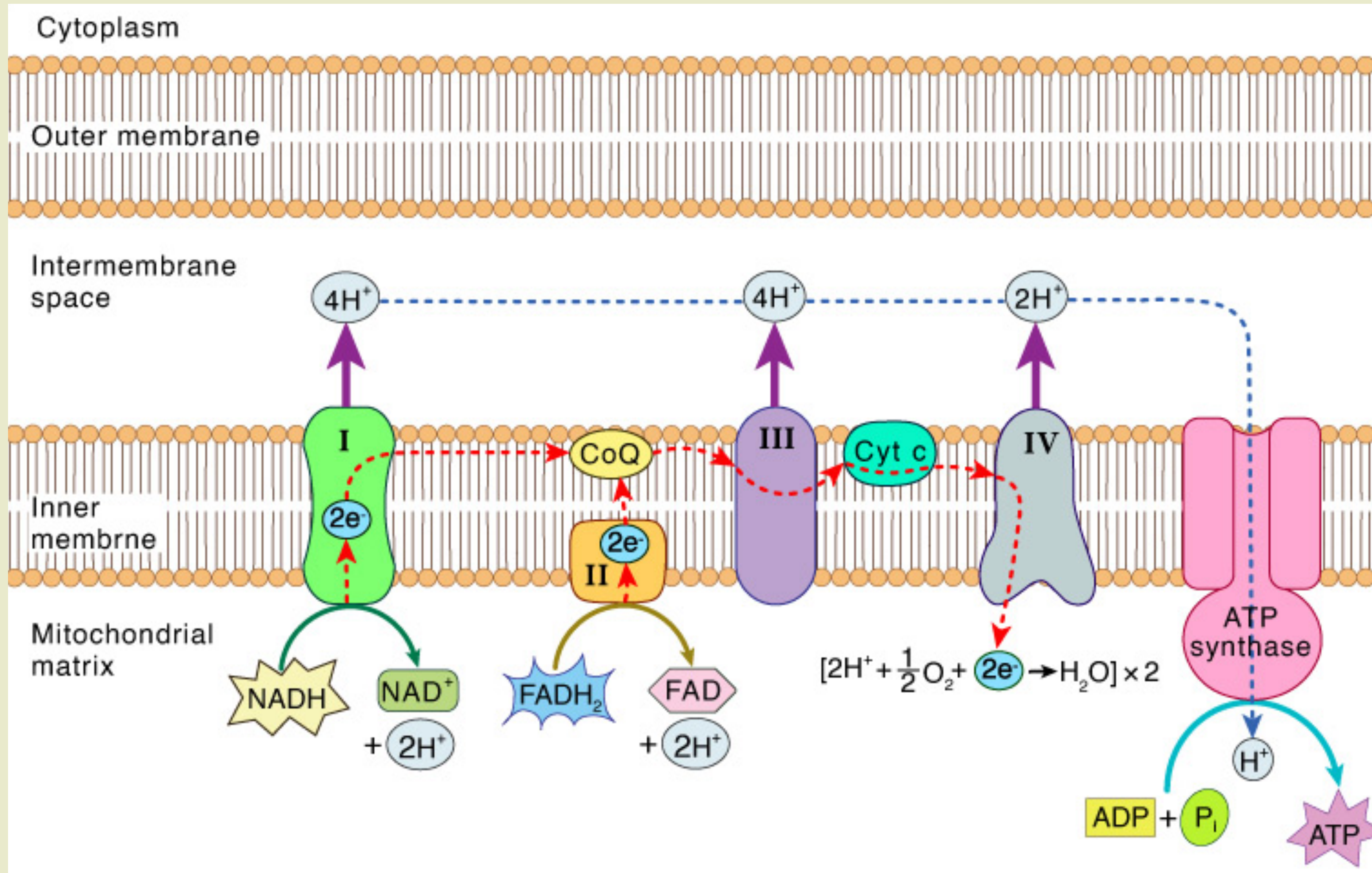
Electron Transport Chain



Why Mitochondrial Dysfunction Is So Bad

- You need ATP (energy) to do everything
 - It takes more energy to heal a damaged tissue than to operate a healthy one
 - It takes more energy to relax a muscle than to contract one
- ETC biggest source of endogenous free radicals

Free Radical Production



What Damages Your Mitochondria

Medications

- Corticosteroids
- Aspirin
- Acetaminophen (Tylenol)
- Diclofenac (Volteran, Voltarol, Diclon, Dicloflex, Difen, Cataflam)
- Fenoprofen (Nalfon)
- Indomethacin (Indocin, Indocid, Indochron E-Rm, Indocin - SR)
- Naproxen (Aleve, Naprosyn)
- Bupivacaine
- Lidocaine
- Propofol
- Angina medications
- Anti-anxiety medications
- Anti-arrhythmic medications
- Antibiotics
- Antidepressants
- Antipsychotics
- Cholesterol medications
- Dementia medications
- Diabetes medications
- Seizure medications
- Mood stabilizers
- Parkinson's medications

What Damages Your Mitochondria

Toxins

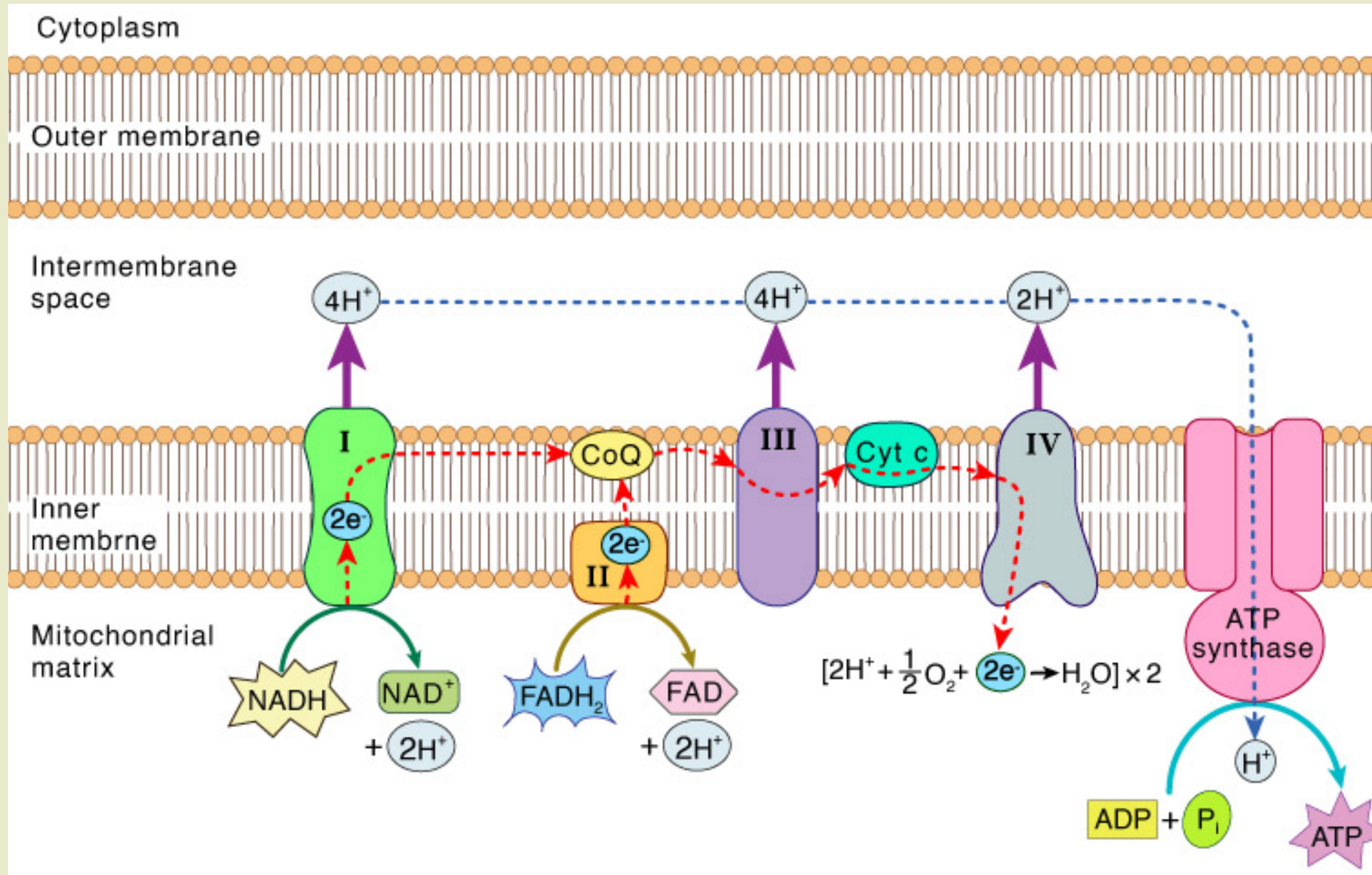
- Alcohol reduces ATP production by 12%
- Bisphenols (BPA)
- Phthalates
- Pesticides and Herbicides
- Food colorings

What Damages Your Mitochondria

Lifestyle

- Sedentary lifestyle
 - Exercise (movement) to use up ATP stores and prevent free radicals
 - Movement after eating is crucial
- Low oxygen produces free radicals
 - Why breathing techniques are effective for chronic pain

Free Radical Production



What Damages Your Mitochondria

Chronic Pain

- Excitotoxicity
 - In chronic pain the brain becomes more sensitive to the excitatory neurotransmitter glutamate
 - Increases energy demand
 - Increases free radical production
 - Death to mitochondria

Symptoms of Mitochondrial Dysfunction

- Migraines
- Muscle weakness
- Poor muscle tone
- Poor balance
- Muscle cramps
- Low endurance
- Chronic fatigue

Chronic Pain Specific

Fibromyalgia

- Fibromyalgia is a disorder characterized by widespread musculoskeletal pain accompanied by fatigue, sleep, memory and mood issues.
- Many researchers believe that repeated nerve stimulation causes the brain and spinal cord of people with fibromyalgia to change. This change involves an abnormal increase in levels of certain chemicals in the brain that signal pain.

-Mayo Clinic

Chronic Pain Specific Fibromyalgia

- It's a mitochondrial issue!
 - Capillaries thicken
 - Decrease oxygen saturation
 - Drains ATP pool
 - Switch from oxidative phosphorylation to anaerobic glycolysis
 - Lactic acid build up
- Need D-ribose to restore ATP pool

Chronic Pain Specific

Chronic Fatigue

- Switch from aerobic respiration via fatty acids to anaerobic respiration via glucose
 - Produces lactic acid
 - No more glucose to make D-ribose for ATP synthesis

Nutrients

D-ribose

- Building block of ATP
- If you can't generate ATP quickly enough you run out of it
- Cannot get enough from food or ourselves to make a meaningful difference
- Milk, dairy, eggs, mushrooms
- 3-5g/day

Nutrients

PQQ

- Stimulates growth of new mitochondria
- Protect against oxidative damage
- Anti-inflammatory
- Neuroprotectant
- Stimulates nerve growth factor (NGF)
- Kiwi, parsley, green tea, tofu, natto, DARK chocolate
- 20mg/day

Nutrients

CoQ10

- Single most important nutrient for mitochondrial health
- Can produce it ourselves, but difficult to make and less as we age
- Rate limiting step of the ETC
- Take with statins, beta blockers
- Do not take with warfarin
- Meat and fish
- 1g/day

Nutrients

L-carnitine

- Transports fatty acids into the mitochondria
- Removes lactic acid
- Meat and fish
- 500mg/day

Nutrients

Magnesium

- 70-80% of people deficient
- Muscle relaxer
- Synthesis and stabilization of ATP (Mg-ATP)
- 400mg/day of Mg glycinate

Nutrients

Antioxidants

- Alpha-Lipoic Acid (ALA)
 - Master antioxidant of mitochondria
 - Refrigerated R-lipoic acid
 - Flax seed, chia seed, walnuts
 - 100mg/day
- Glutathione
 - Most abundant antioxidant
 - Building blocks from whole foods
 - 300mg/day

Note on Supplements

- These are just recommended doses based on research articles
- Therapeutic doses are based on
 - Deficiency
 - Absorption
 - Need
- University of Mississippi Study

Boost Your Mitochondria

Diet

- High fat diet
- Cool it on the carbs and sugar
- Caloric restriction
 - 10-40%
 - 2007 study
 - 25% caloric reduction, moderate exercise for 4 months
 - 67% increase mitochondrial density
 - 59% insulin sensitivity improvement
 - 2011 Study
 - 600 calories per day for 8 weeks
 - 100% type 2 diabetes reversal

Boost Your Mitochondria

Lifestyle

- Exercise (movement)
 - Creates more mitochondria
 - Produce fewer free radicals
 - HIIT
- Breathing exercises

Boost Your Mitochondria

Lifestyle

- Massage
- Cold exposure
- 75>66 degrees at night
- Cannabis
 - CBD and THC

Boost Your Mitochondria

Cold Laser



Thank You!

- Any Questions?