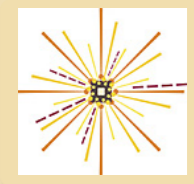


Mitochondria -- tiny organelles found in almost all cells of the body -- create almost all of the energy used by the body from the food we eat and the oxygen we breathe. Internal membranes work and oscillate in a rapid, complex, multi-step dance of ATP production, free radical generation and scavenging. When the balance shifts as a result of damage to structures and/or alterations in timing, dysfunction and pathology result.

EMF has been shown to affect mitochondrial function and structure; the effects on organisms may vary from no obvious symptoms to terrible fatigue and serious disease.



[Glutathione oxidation trigger](#)

[Oscillator dependent on ROS](#)

[Small systems, chemical reactions oscillate](#)

[Mito oscillations in physiology and pathology](#)

[Mitochondrial reticulum, natural EM response](#)

[Mitochondrial oscillators, ROS communications](#)

HOW DOES EMF AFFECT MITOCHONDRIA?

ROS - reactive oxygen species
COX - cytochrome c oxidase
CYC - cytochrome c

MW damages mitochondrial membrane chem. bonds
MW increases ROS damage to membranes
Membrane potential may disappear, ATP synthesis stops
MW induces swelling, cavitation, damaged cristae
MW downregulates COX gene expression
MW increases Ca⁺⁺ overload, injures structures
MW reduces COX activity
MW increases CYC caspase activity, apoptosis
ATP production is decreased, MW dose-dependent
MW induces damage to mitochondrial DNA
Mitochondrial protective signaling pathways activated



Mitochondria, in cell and enlarged

Mitochondrial oscillators

[ELF, degeneration](#)

[ELF, missing cristae](#)

[RF/MW, DNA damage](#)

[EF, liver cell mitochondria](#)

[ELF, swelling, chrySTALLIZATION](#)

[EF, respiratory activity changes](#)

[ELF, RNA and protein changes](#)

[HF, cytochrome oxidase effects](#)

[ELF, alteration of DNA synthesis](#)

[ELF, mitochondrial lipid changes](#)

[RF/MW, apoptosis, mitochondria](#)

[RF/MW edematous mitochondria](#)

[EMP, membrane lipid peroxidation](#)

★ [MW, mitochondrial DNA damage](#)

[HF, peripheral, central mitochondria](#)

[UHF, SHF, oxphos changes, swelling](#)

★ [ELF, MF, cancer, mitochondria, ATP](#)

★ [MW, dose-dependent CYC, apoptosis](#)

[EM, intracellular respiratory chain effects](#)

★ [HF-EMF, sperm, mitochondrial marker](#)

[EMF, varying organelle responses to fields](#)

[2.1 GHz, apoptosis, mitochondria, human breast](#)

[Pulsed EF depolarizes mitochondrial membranes](#)

[UHF affects electron transport chain, mitochondria](#)

[EF, mito membranes more vulnerable than cell membranes](#)

[RF, apoptosis, caspase-independent mitochondrial pathway](#)

[ELF, effects on human sperm motility mediated by mitochondria](#)

[Difference in membrane and mitochondrial effects from EMF frequencies](#)

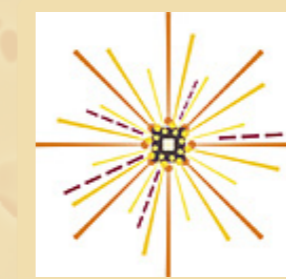
EMF studies

[Mitochondria: Sensors of Environmental Aggressions](#)

Mitochondria, EMF Damage: Structure and Function

[Summarized in article](#)

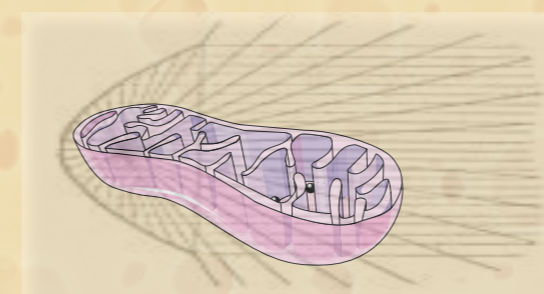
What are mitochondria?



MITOCHONDRIA: STRUCTURES, FUNCTIONS, OSCILLATIONS, AND EMF

[Cancer, Mitochondria, Disturbed Bio-EMF](#)

[Autism and EMF: Mitochondrial dysfunction, in part](#)



EARLY ATP DECREASE

Some reported signs

Aging

Fatigue

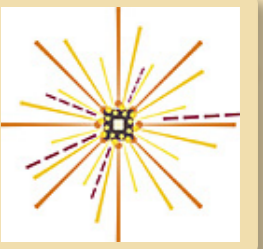
Fibromyalgia

Shortness of breath

Soreness after exercise

Healing, repair slows down

"... within a certain range, the degree of mitochondrial structural damage positively correlates with the dose of MW radiation." Yan-Hui Hao et al

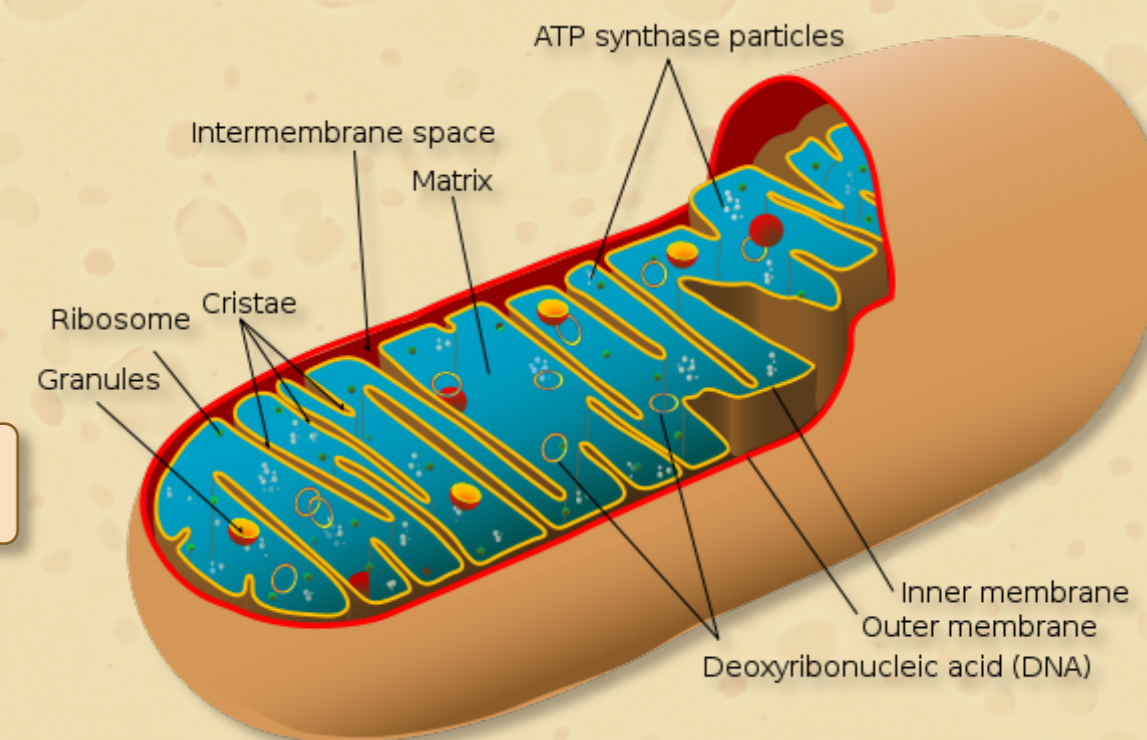


★ [Mitochondrial Stress](#)

[What Do Mitochondria Do?](#)

[Center stage in cell biology](#)

[Muscle Mitochondrial Power Grid](#)



Home: [Oscillatorium](#)
Newest version: [this map](#)
Date of this update: 11-14-17

PUTTING SOME PIECES TOGETHER ABOUT EMF EFFECTS ON US

We know the effects of EMF on our tissues are nonlinear.
We know that free radicals are created during EMF exposures.
We know that DNA and RNA are damaged.
We know that calcium movement is altered.
We know that energy is required to respond to these effects.
We know that mitochondria have their own DNA.
We know the mitochondria create most of our cellular energy (ATP).
We know mitochondria have other very important functions in cells.
We know mitochondrial structures are vulnerable to EMF.
We know that mitochondria naturally oscillate as they work.
We don't know if EMF directly alters mitochondrial oscillations.
We know that free radical shifts will disturb oscillations.
We know that oscillatory disturbance is associated with pathology.