

Autism and EMF? Plausibility of a Pathophysiological Link

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Theme: Interplay between Autism and EMF

- Figuring out **how** EMF impacts autism will help us understand **HOW** autism **WORKS**
- Figuring out **HOW** autism **WORKS** will sharpen how we look at EMF impacts.

Autism: From Static to Dynamic Encephalopathy

- From belief that autism is mainly to entirely sculpted or “hardwired” in utero

TO

- Idea that autism is GENERATED in an ongoing, moment-to-moment fashion by a vulnerable, physiologically challenged brain

- **AND EMF CAN BE A MOMENT-TO-MOMENT CHALLENGE TO AN ALREADY CHALLENGED BRAIN**

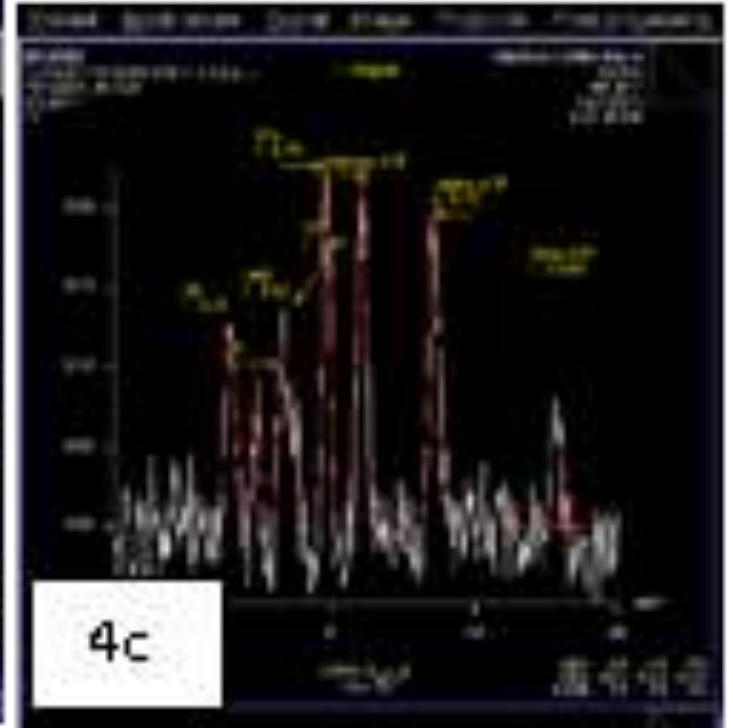
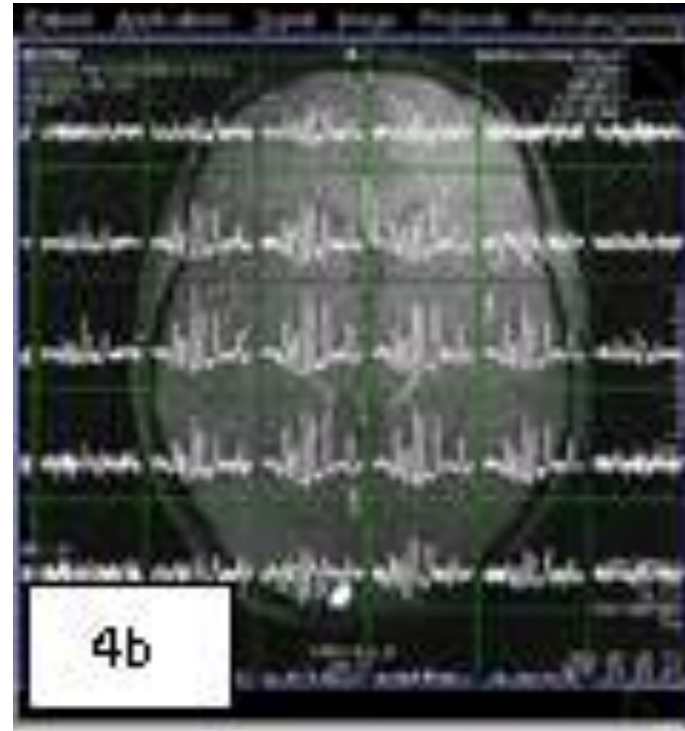
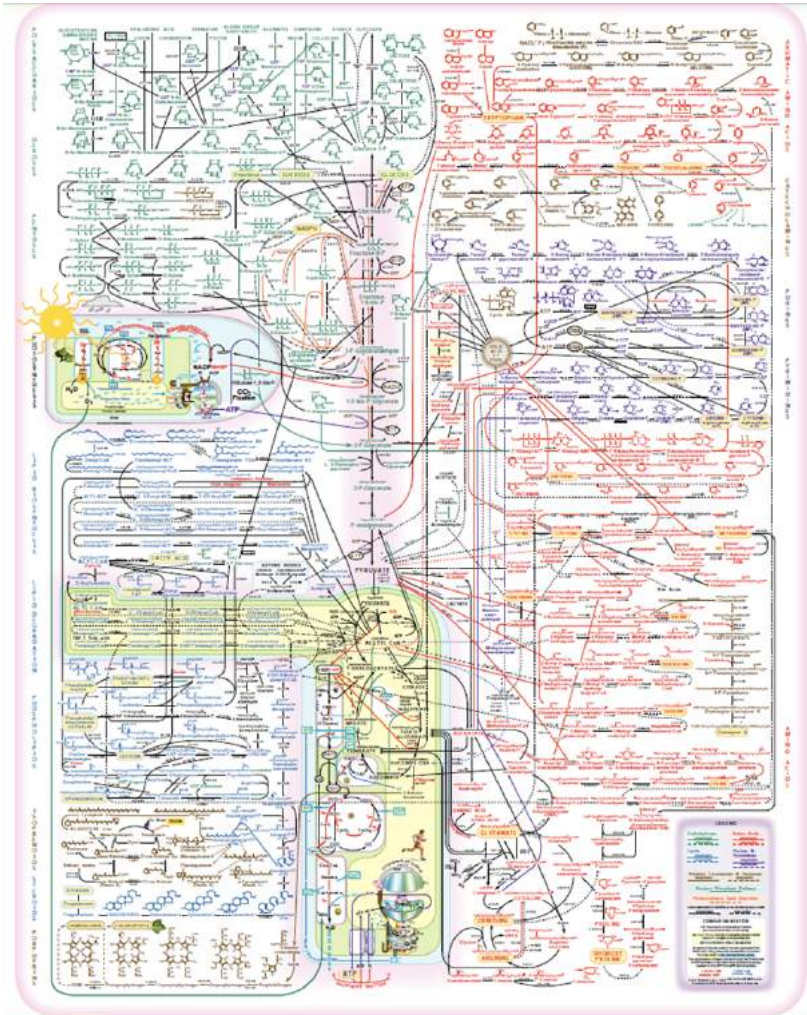
Autism is Complex: Levels that are all involved AT THE SAME TIME



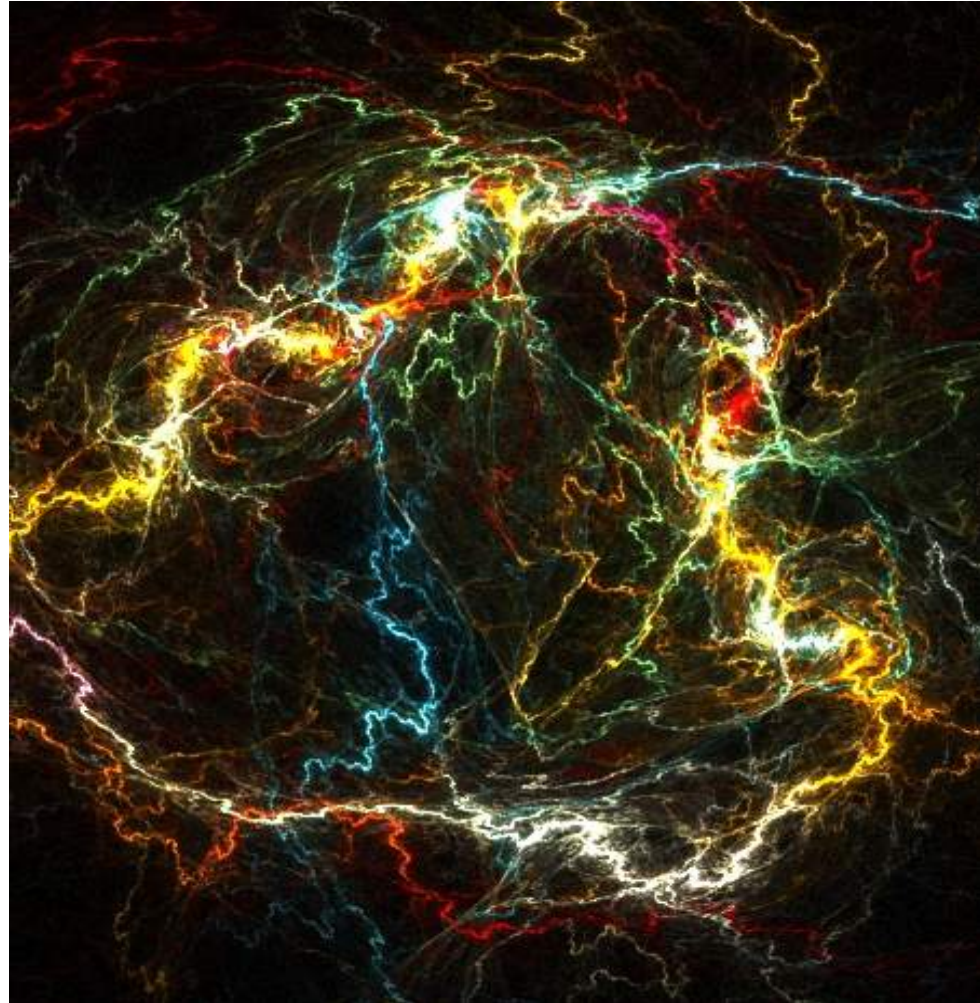
Creativity
Social interaction
Learning
Behavior
Brain as information system
Brain as wet physical organ
Organs
Cells
Chemistry
Genes and environment



THE MOLECULAR, METABOLIC BRAIN



THE ELECTRIC, FUNCTIONAL BRAIN

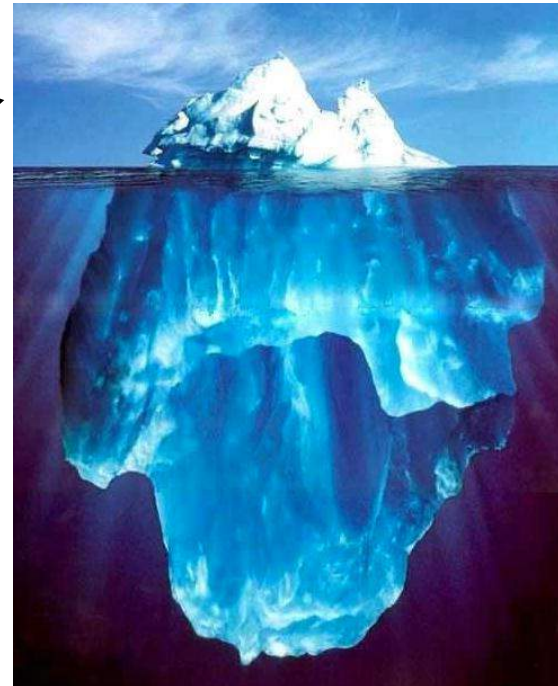


Whole Body Systems Model: Behavioral Symptoms **Emerge** from Problems with **Underlying Functions**

**VISIBLE Social
& Behavioral
SYMPTOMS
are OUTPUT**

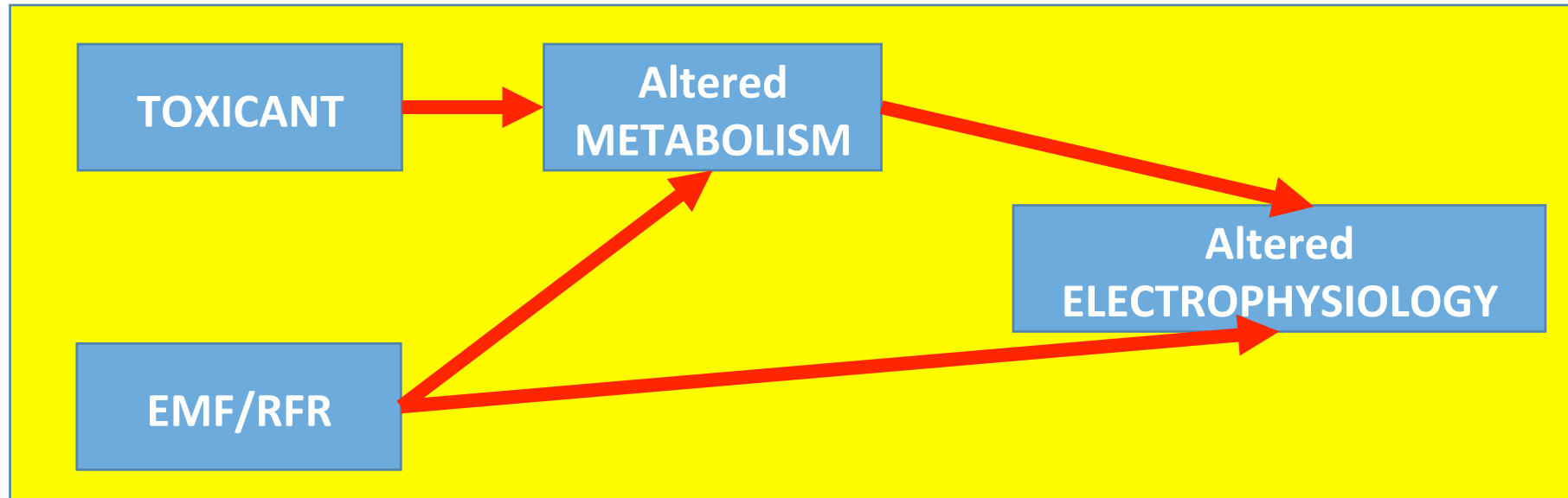


**DISTURBANCE OF
CORE
UNDERLYING
BODY
FUNCTIONS are
GENERATORS**



Ziggarut model: <http://www.texasautism.com/>

How noxious exposures can contribute to ONGOING DEGRADATION OF BRAIN FUNCTION



**altered sensation, cognition, emotion, behavior EVERY DAY —
Not just altered “brain development”**

Herbert, Sage, “Autism: Plausibility of a Pathophysiological Link,” *Pathophysiology* 2013 (see also www.bioinitiative.org)

PARALLELS between Autism and EMF mechanisms: *PATHOPHYSIOLOGY*

**Parallels alone do not prove causation
But in aggregate they strongly suggest
contribution to severity and incidence**

For more details see:

Herbert, M. R. and C. Sage (2013). "Autism and EMF? Plausibility of a pathophysiological link - Part I." *Pathophysiology* 20(3) (publications page, www.marthaherbert.org with additional link to 2 pp published summary for general audience) or Herbert and Sage section in www.bioinitiative.org

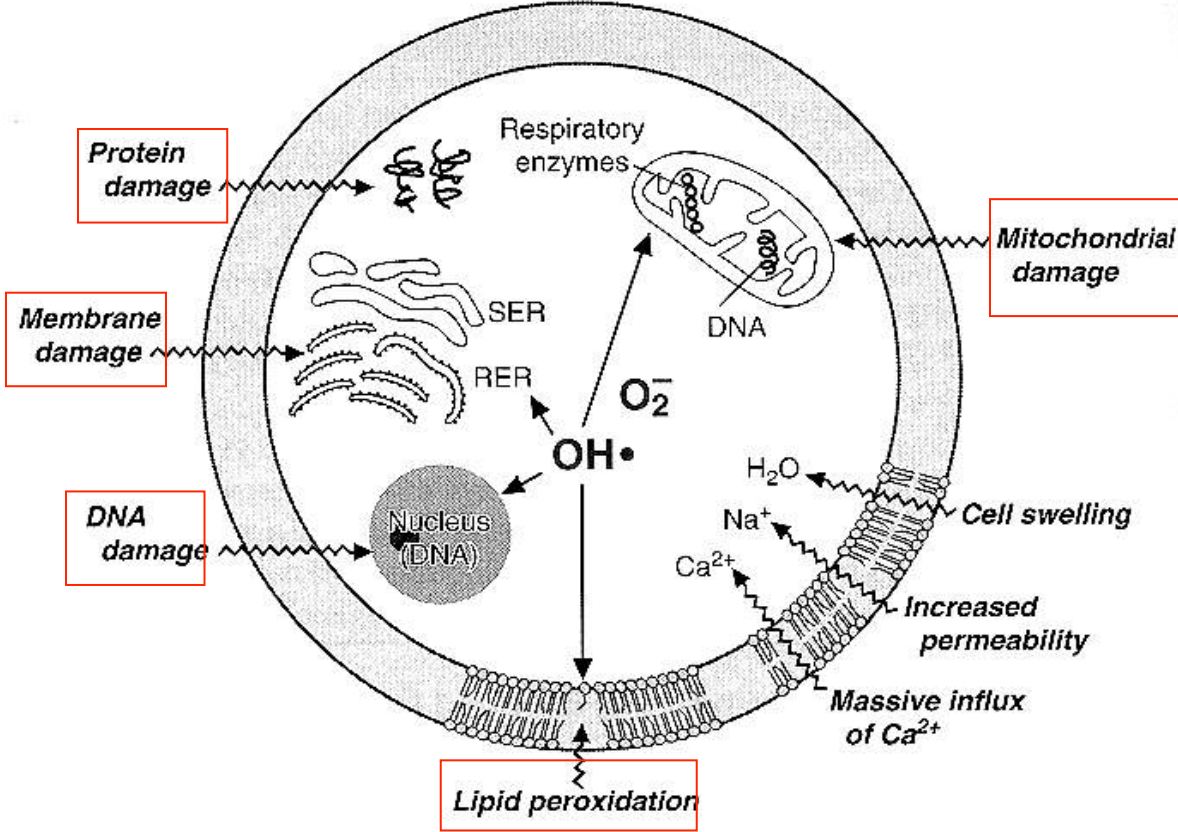
Metabolic/molecular damage that can be caused by EMF is parallel to problems we see in autism

EMF/RFR Impacts

Autism

- Cellular stress
- Stress protein responses (heat shock proteins)
- Membrane and channel dysfunction
- Calcium channel dysfunction
- Junctions between cells break apart causing leakiness through barriers (like blood-brain barrier and gut-blood barrier)
- Genetic alterations / mutations can be caused by EMF

Injury at the cellular level



James

EMF degradation of cell functional systems is similar to what we see in autism

EMF/RFR Impacts

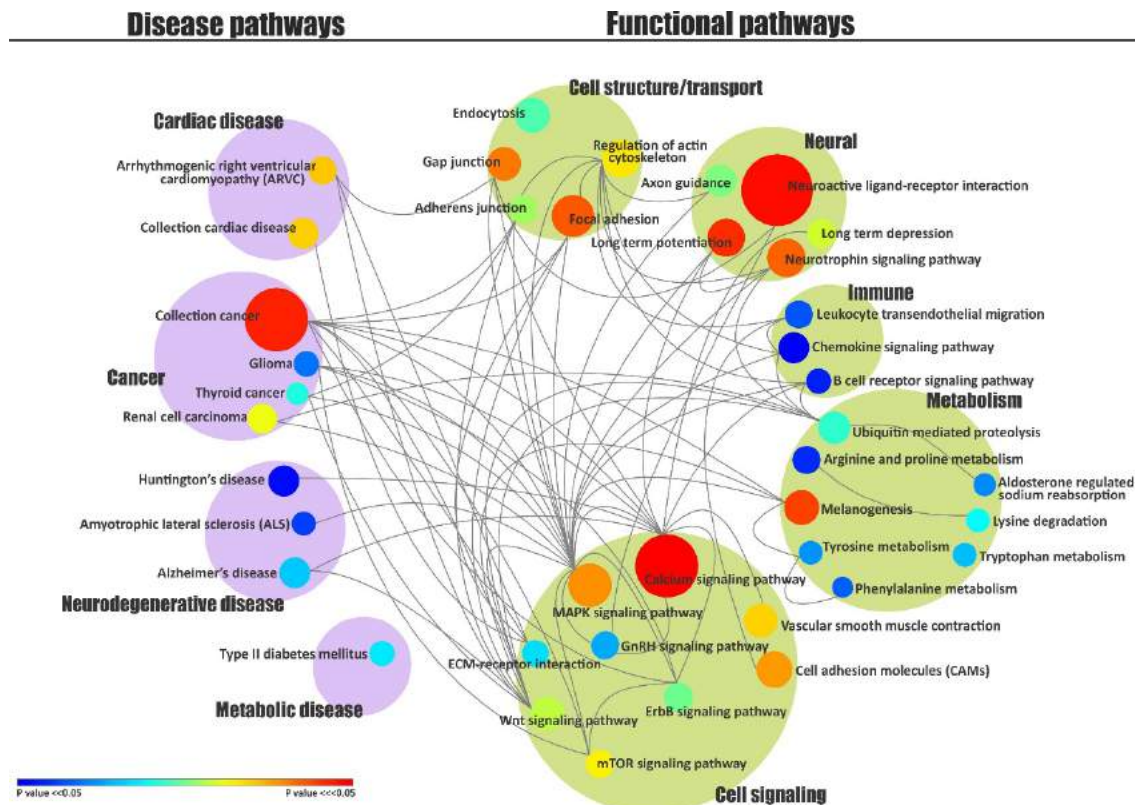
Autism

- Mitochondrial dysfunction
- Melatonin regulation dysfunction
- Disturbed immune function
- Degradation and even death of brain cells
- Impacts on brain glucose metabolism

EMF + Toxins = Increased Inflammation

- **Voltage gated calcium channels on cell membranes**
 - **EMF -> calcium influx into cells -> nitric oxide**
- **Chemicals/toxins activate NMDA receptors**
- **Both of these mechanisms lead to increased inflammation**

Genes and Pathways are profoundly interconnected



- A cell is like a city, and pathways are like streets
- Hubs are like major intersections or traffic circles
- Problems with HUBS are like traffic jams in critical places: they can proliferate widely in the system

Wen et al., PLOS ONE, 2016 April

EMR/RFR is associated with immune changes

Autism is associated with disturbed Immune Function

EMF/RFR Impacts

- Association with large immunohistological changes in mast cells
 - E.g., increased histamine, chymase, tryptase
- Relation to cellular damage and impaired tissue repair
- Benchmark immune indicators occur under low level exposures

Autism

- Genetic and epigenetic contributors
- Heterogeneous manifestations
 - Some autoimmune
 - Some rarely get sick
 - Rashes, eczema, allergies, psoriasis common
- Neuroinflammation and glial activation
- Association of immune response of infection in pregnancy to autism risk
- Immune and behavior changes associated

Electrophysiology at the pivot point

Think of EMF as a brain irritant.

NERVOUS SYSTEM AND BRAIN: Parallels between EMF impacts and ASD findings

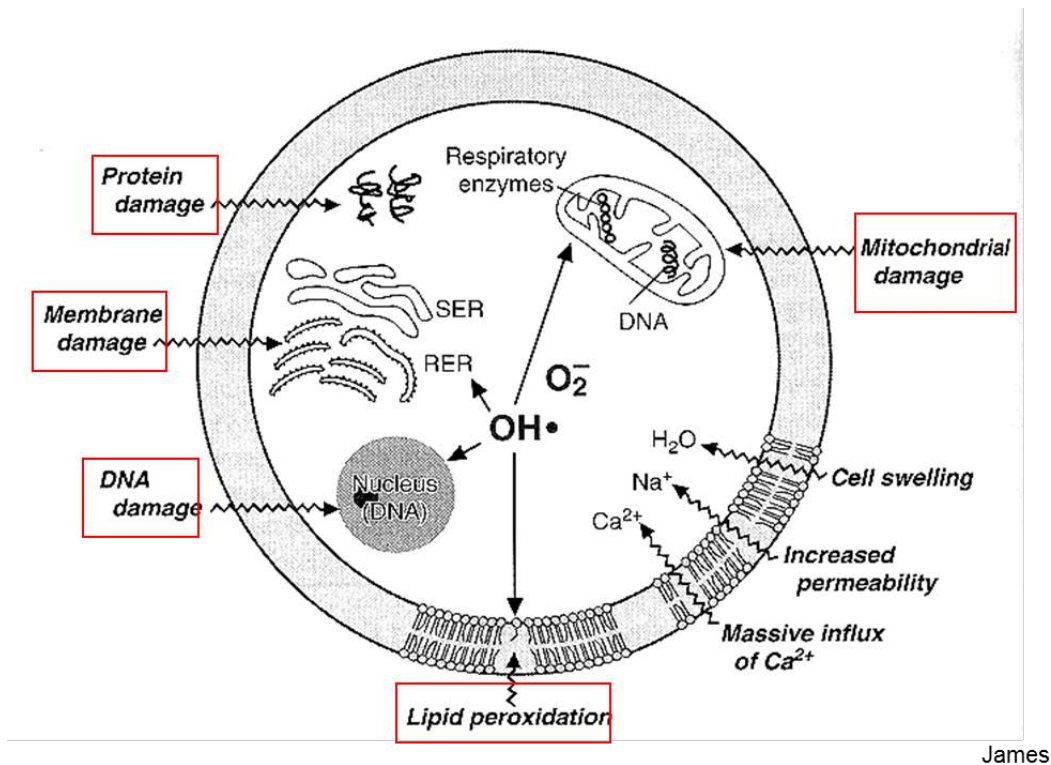
EMF/RFR Impacts

Autism

- Disturbed sleep architecture
- Disturbed sleep and reduced sleep quality
- Altered brain wave synchrony, power, coherence
- Increased seizure vulnerability
- Increased autonomic nervous system reactivity

Summary of parallels between EMF/RFR impacts and dysfunctions we find in autism

Injury at the Cellular Level



Disturbances across levels

- Molecular
- Metabolic
- Mitochondrial
- Immune
- Stress and Sleep
- Brain wave activity and organization

Conclusions

Physiological dysfunctions found in autism are parallel to the documented stressful impacts of EMF/RFR on core cell and nervous system functions.

Therefore:

- **EMF is likely to make autism's cellular, metabolic and nervous system physiological dysfunctions worse**
- **Hypothesis:**
 1. **EMF is a contributor to causing and worsening autism**
 2. **Reducing EMF exposures should reduce severity and incidence of autism**