

# 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**

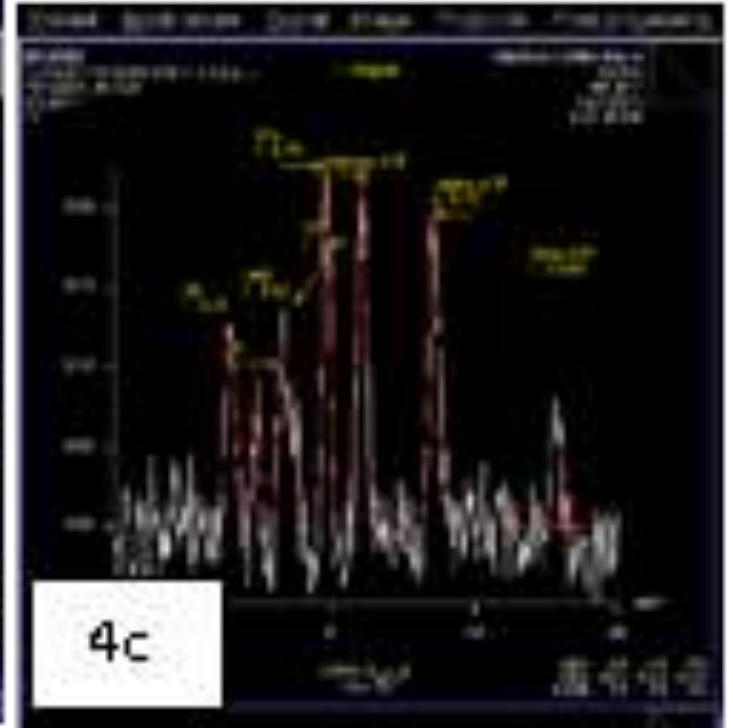
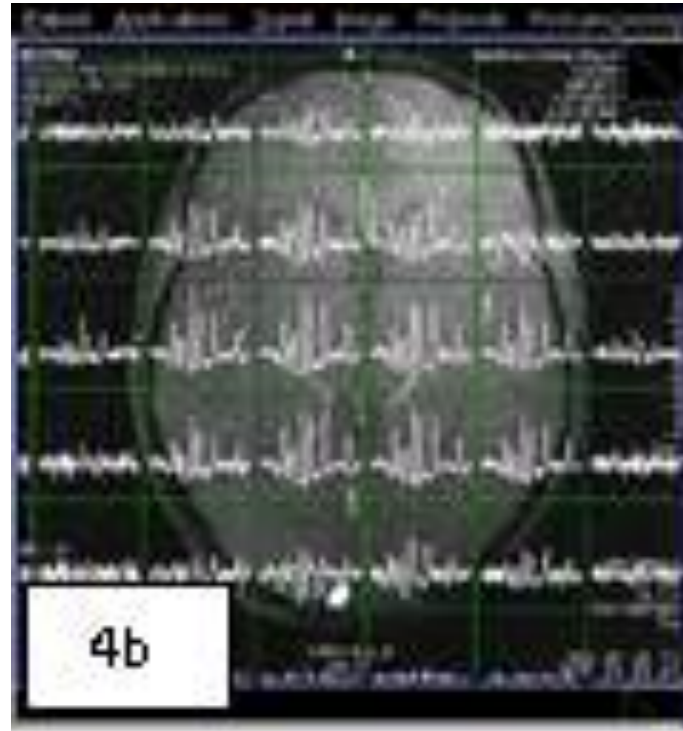
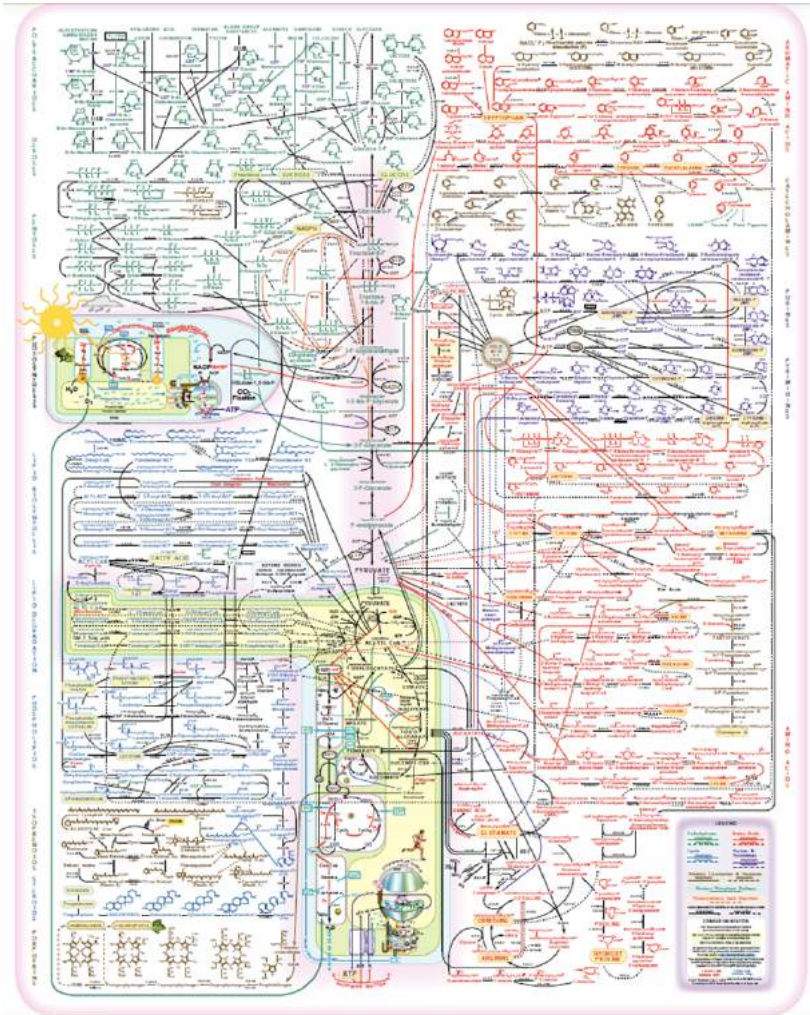
# Autism is Complex: Levels that are all involved AT THE SAME TIME



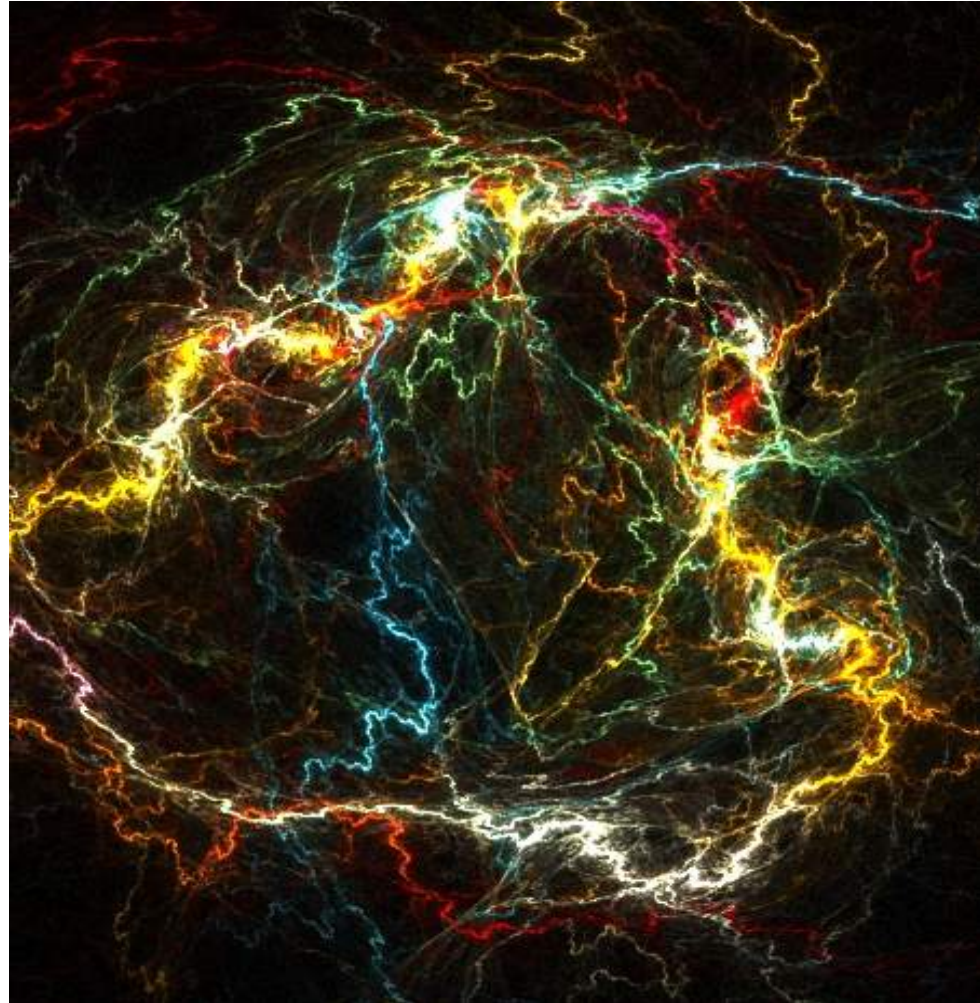
**Creativity**  
**Social interaction**  
**Learning**  
**Behavior**  
**Brain as information system**  
**Brain as wet physical organ**  
**Organs**  
**Cells**  
**Chemistry**  
**Genes and environment**



# THE MOLECULAR, METABOLIC BRAIN



# THE ELECTRIC, FUNCTIONAL BRAIN

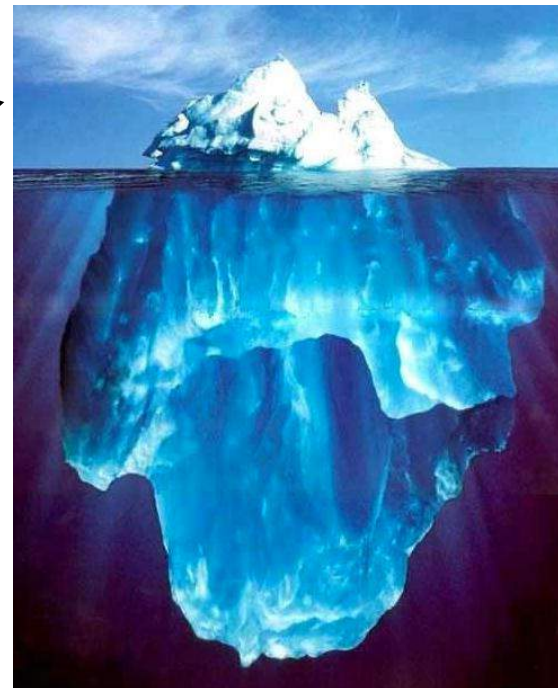


# Whole Body Systems Model: Behavioral Symptoms **Emerge** from Problems with **Underlying Functions**

**VISIBLE Social  
& Behavioral  
SYMPTOMS  
are OUTPUT**

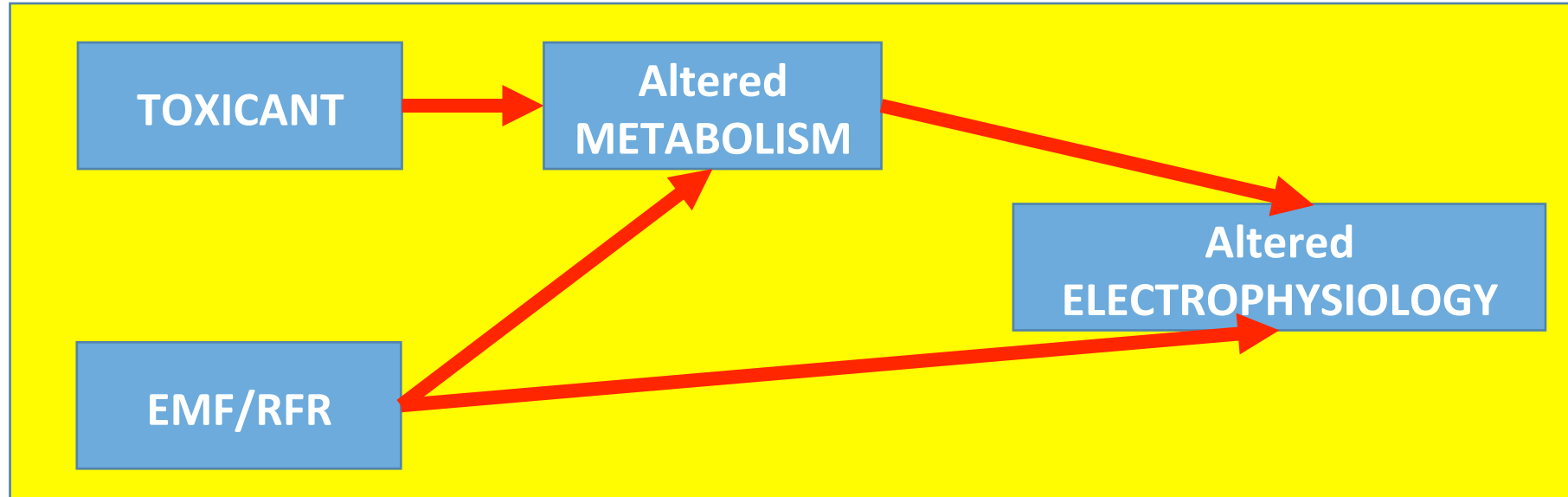


**DISTURBANCE OF  
CORE  
UNDERLYING  
BODY  
FUNCTIONS are  
GENERATORS**



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](http://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](http://www.marthaherbert.org) with additional link to 2 pp published summary for general audience)  
or Herbert and Sage section in [www.bioinitiative.org](http://www.bioinitiative.org)

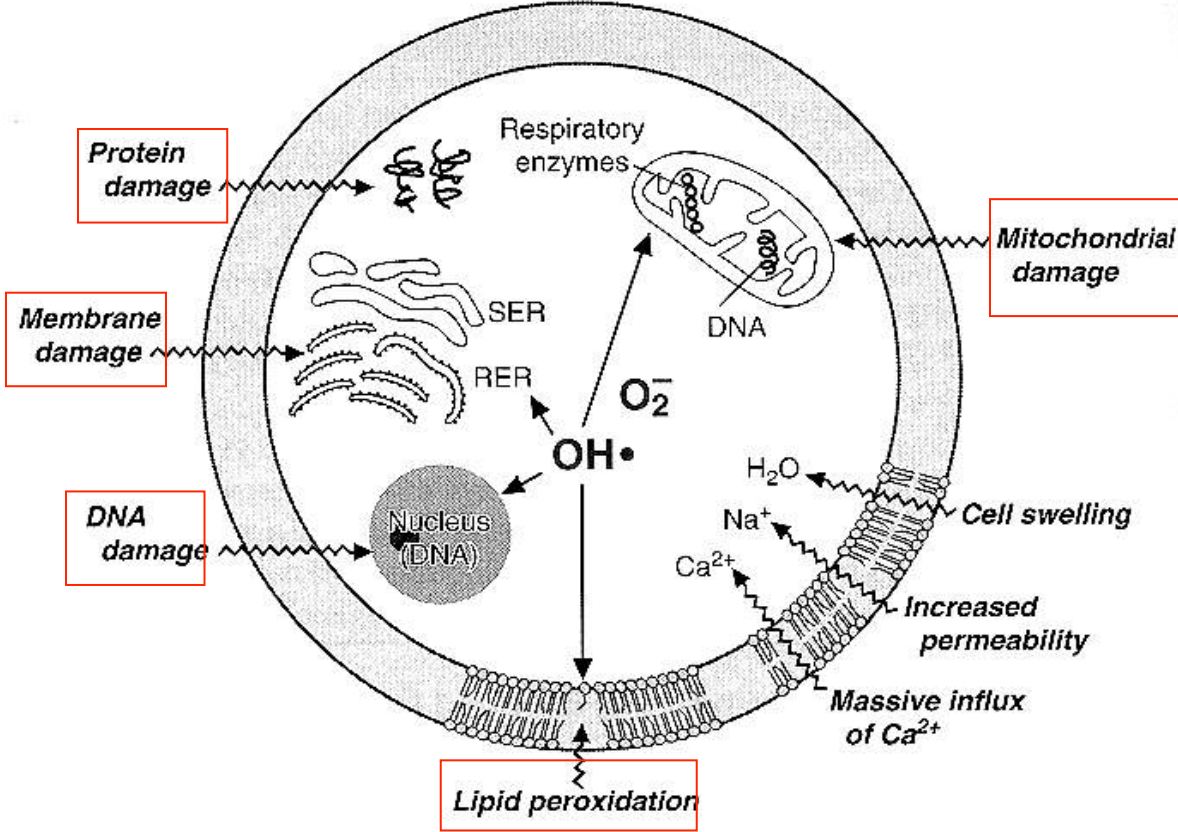
# Metabolic/molecular damage that can be caused by EMF is parallel to problems we see in autism

## 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

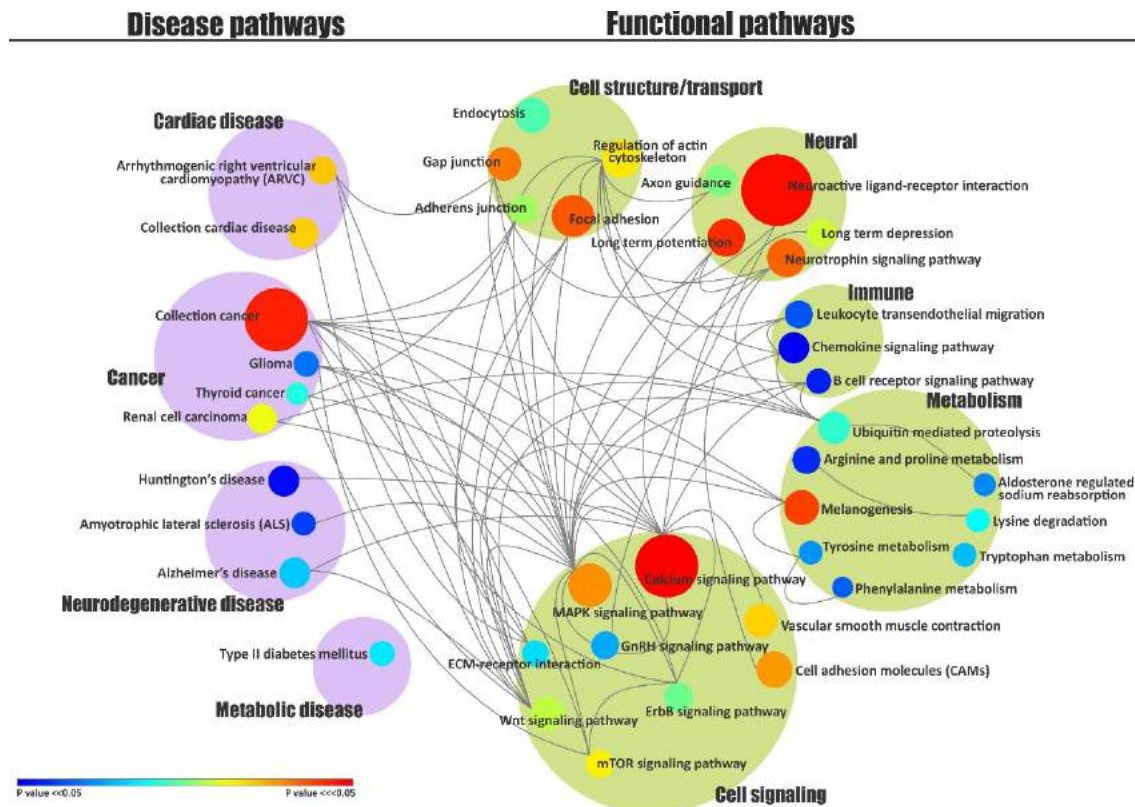
## Autism

- 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

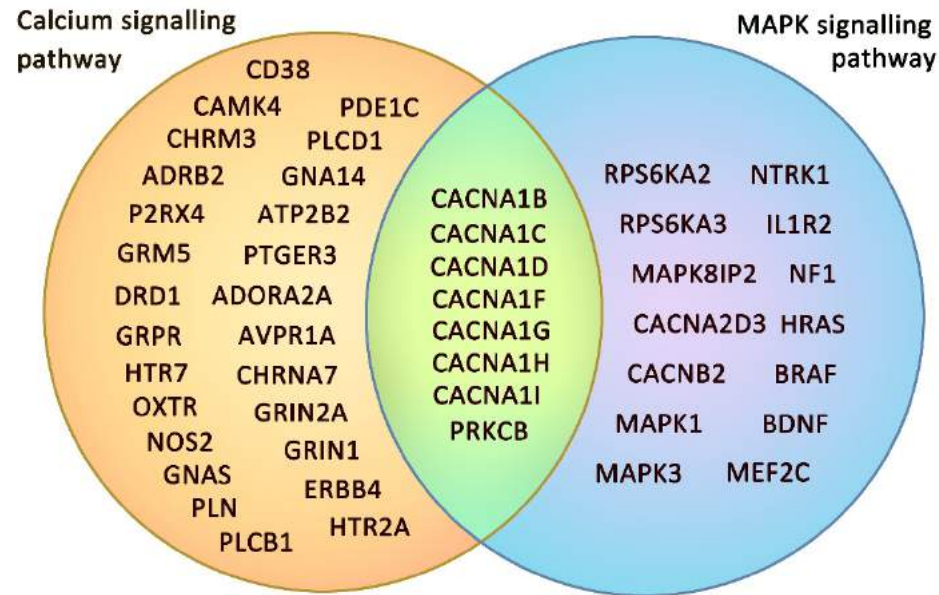


- A cell is like a city, and pathways are like streets
- Hubs are like major intersections or traffic circles
- Problems with HUBS are like traffic jams in critical places: they can proliferate widely in the system

Wen et al., PLOS ONE, 2016 April

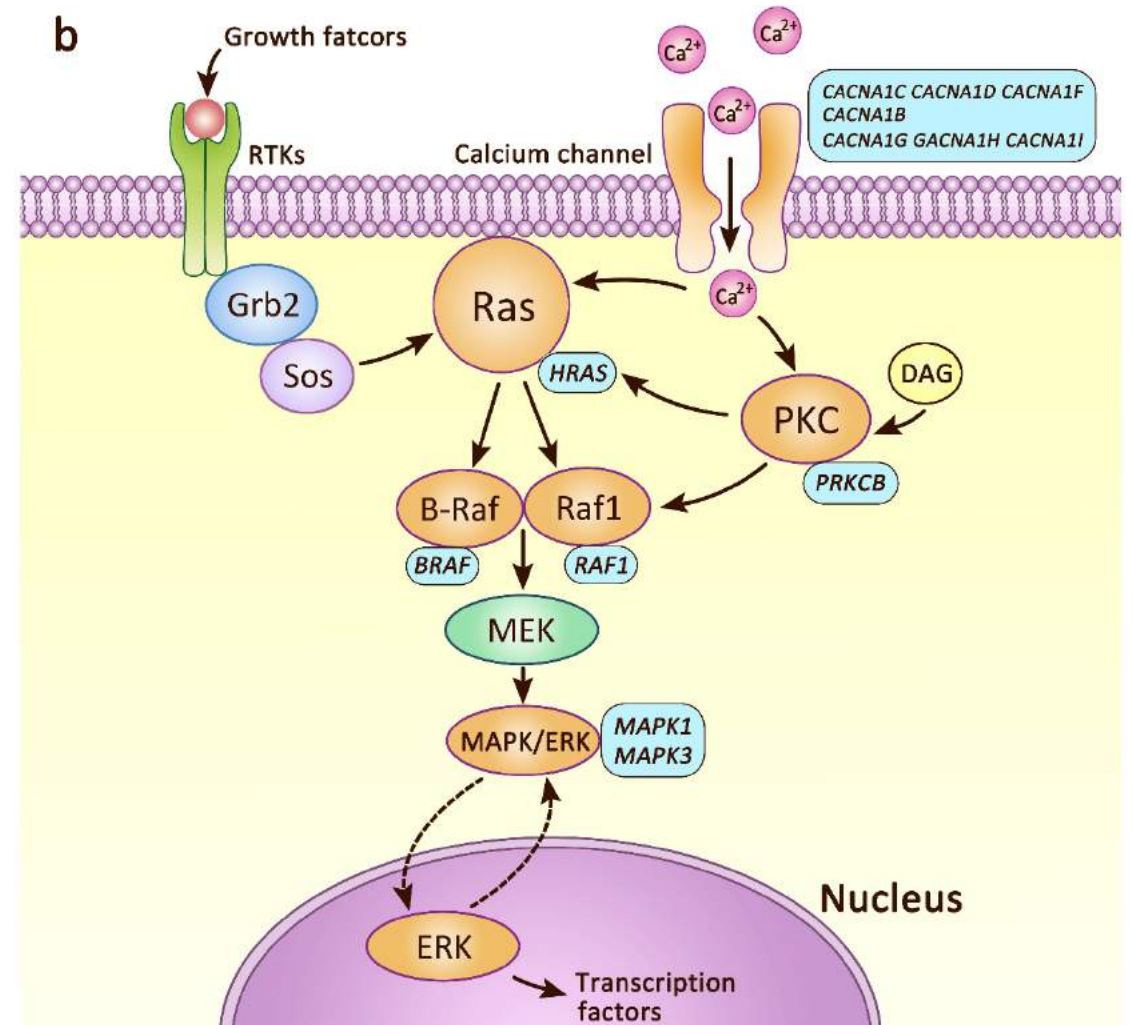
# Hub autism pathways overlap in calcium signaling which is a major mediator of EMF disruptions

a



Wen et al., PLOS ONE, 2016 April

b



# 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

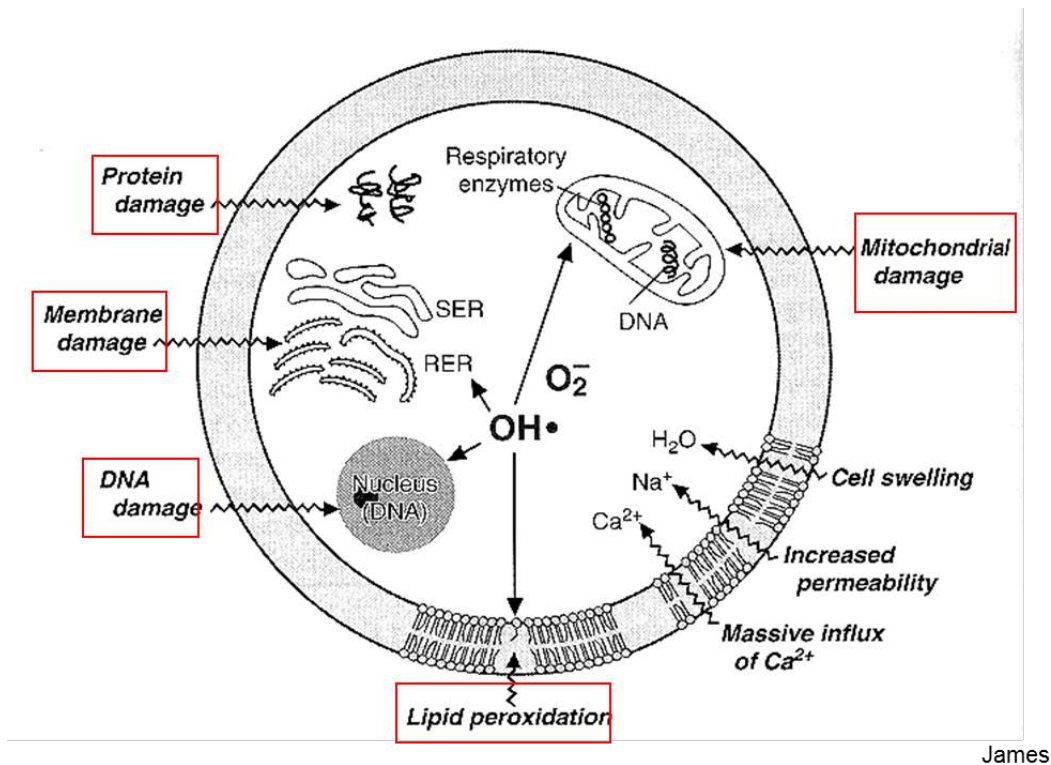
## EMF/RFR Impacts

## 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**