Nonlinearity and EMF Responses

Electromagnetic exposures do not produce tissue effects in a linear way. Many of our normal physiologic functions behave in nonlinear ways, and our environmental EMF exposures are multiple and complex. Our tissues respond only to certain frequencies, or certain intensities -- or a number of related factors -- in some conditions but not others.

Unlike testing for the adverse effects of a substance, where our responses may (but don't always) depend on the amount of exposure or bioaccumulation, the effects of exposure(s) to EM fields -- on some measurable parameters -- is not simply "dose-related".

Policy-making on issues of personal health and community safety does not account for these real effects.

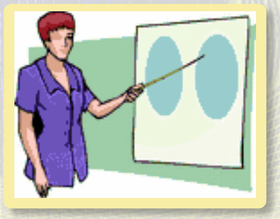
The mechanisms responsible for the nonlinear effects are unknown, according to Dr. Blackman. The biological responses more closely resemble responses to a chemical combination of varying ingredients than to a single substance.

[Carl Blackman, Frequency Limitations]

[L. Brizhik: Non-thermal EMF effects and living nonlinear mechanisms]

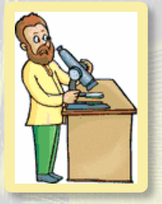
[Cindy Sage: Similarities, Ionizing and Non-Ionizing EMF effects, low doses]

[Dr. Andrew Marino: EMF should be studied for nonlinear effects]



Living organisms are not simple

- We are not at equilibrium
- Exposures are cumulative
- Our tissues have varying conductivity
- We have other exposures/factors
  - Age
  - Illness
  - Gender
  - Medication
  - Nutritional status
  - Genetic polymorphism



Other studies

- [Chicken exposures]
- [Nonlinear EEG response]
- [Complexity of interactions]
- [RF, tissue responses not linear]
- [A critical review of the literature]
- [Consistent nonlinear responses]
- [Nighttime exposure and cardiac rhythm]
- [Nonlinear transduction of EMF in rabbits]
- [Nonlinear magnetic response in humans]
- [Nonlinear dynamic law and EMF changes]
- [Nonlinear heart rate variability, EMF of GSM]
- [Searching for the Perfect Wave, mixed results]
- [Combination of linear and nonlinear responses]
- [Nonlinear adaptive phenomena after exposure]
- [Nonlinear effects of EMR at cell membrane level]
- [Nonlinear response of the immune system to ELF]
- [Immune system is nonlinear, EMF response nonlinear]

[Concepts: Linear and Nonlinear]

THE BIOLOGIC EFFECTS OBSERVED DEPENDED ON SOME VALUES OF THE VARIABLES, BUT NOT OTHERS.

Biologic effects tested:

- *Calcium efflux in brain cells*
- *Neurite outgrowth*
- *DNA synthesis*
- *Imprinting (chickens)*
- *Postnatal sensitivity*
- *Therapeutic responses*
- *Sensitive subgroups*

Variables affecting response:

- *Some intensities, not others*
- *Some frequencies, not others*
- *Inclusion of earth's magnetic field, or not*
- *Some temperatures, not others*
- *Frequencies in prenatal exposures*
- *Relative orientations of AC and DC fields*
- *Some combinations of AC and DC fields*
- *Sine wave vs. pulsed waves*
- *Some pulse frequencies, not others*
- *Some pulse widths, not others*
- *Some pulse heights, not others*
- *Some chicken strains, not others*
- *Some genetic predispositions, not others*

EMF exposures are not simple

WE ARE VARIABLE
EXPOSURES ARE VARIABLE
EXPOSURES ARE COMPLEX
RESPONSES ARE NONLINEAR

- Low frequencies
- High frequencies
- Mixed and variable frequencies
- Carrier waves, plus carried information
- High frequencies modulated at low frequencies
- [Modeling EMF effects include nonlinear ones]
- [Carl Blackman, calcium ions, EMF, nonlinearity]
- [2012 Review: effects at high and low exposures]
- [Effects of two different wave forms, one study]
- [RF and ELF effects may combine, add complexity]
- [Old RAND Memo: Intro. to nonlinear EMF effects]
- [ELF, MW both DNA toxic, different mechanisms]
- [Effects, EMF on osteoblasts depends on waveform]

Home: Oscillatorium
Newest version: this map
Date of this update: 11-26-15

Related Maps:

- [EMF Hormesis]
- [Therapeutic EMF]
- [Multiple-Hit Model]