

**A REPORT OF AN RF-INDUCED
BIOLOGICAL EFFECT VERSUS AN
ADVERSE HUMAN HEALTH EFFECT:
SCIENCE VS. SPECULATION**

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Objective 1

Clarify the distinction between a biological effect reported to be due to a radio frequency exposure, and the suggestion of an adverse human health effect

A biological effect can potentially result from any physical, chemical, or biological interaction that leads to an alteration in the structure and/or electronic configuration of a molecule or an organelle in a cell.

This in turn could possibly lead to changes in:

- enzymatic and/or metabolic processes in a cell,**
- the organizational structure of functional biological sites in a cell, or**
- the structure and function of organelles in a cell.**

This could then possibly lead to alterations in one or more of the ongoing metabolic processes in the cell:

- signaling,**
- DNA replication,**
- RNA transcription,**
- protein translation,**
- modulation of RNA or protein molecules (post-transcriptional/translational modification, etc.) .**

Finally, any such change could possibly lead to the alteration of:

- **cell morphology,**
- **cell division (proliferation),**
- **cell viability,**
- **cell function.**

A Most Important Distinction

Any alteration (that leaves the cell viable) may be necessary for a change to occur within a cell, but it may not be sufficient for any outcome to be **expressed** by that cell.

The change may further require specific and substantial changes of other **coordinated** molecules or functions (in time or location), for the possible (or experimentally hypothesized) outcome to occur.

And What About Outside of the Cell?

If a change is expressed within a cell, resulting in a sequential change external to the cell (e.g., a secreted product), the latter may not be of a type or magnitude that can cause a change in:

- the tissue or organ in which the cell is a component,
- or in any other tissue or organ which is normally responsive to the induced change.

Therefore:

- If an in vitro effect is observed, it remains to be determined if the change reported leads to a physiological change in any organ function in vivo.

And What Else Must Be Considered:

A response observed in cells in vitro may not be the same as a response if the cells were in an organized tissue, where there can be **compensatory and **adaptive** mechanisms.**

Any physiological effect observed in vivo may or may not be in the normal range of variability for that physiological endpoint in humans.

And of the greatest importance, prior to speculation about an exposure “possibly causing” an adverse health effect...

Any biological or physiological effect would have to be examined to determine if it was:

- beneficial,**
- adverse,**
- or of no significance in humans.**

i.e., It is not scientifically valid to presume and speculate that a reported biological effect would be adverse to humans.

Objective 2:

Presentation of experimental details that are important to consider in designing experiments, and the information about these details that should be included in all publications.

- 1. Was a hypothesis or objective stated?**
- 2. Was the biological organism and its physiological status before, during and after exposure described?**
- 3. Were the engineering, dosimetry, and experimental methods reported in enough detail to allow the study to be:**
 - a) clearly understood?**
 - b) evaluated as to whether it was properly performed by investigators competent in engineering, dosimetry, and biological methodology?**
 - c) reproduced independently in another laboratory?**

- 4. Was the assay performed in accord with accepted protocols?**
- 5. Was the EMF exposure system adequately described?**
- 6. Were the physical parameters of the exposure reported, including frequency, mode (CW vs. PW), modulation, power, power density, location of sample relative to the far or near field, etc?**
- 7. Was the dose reported using the specific absorption rate (SAR)?**
- 8. Was the temperature measurement system described and appropriate?**
- 9. Was the temperature monitored during the exposure (vs. before or after)?**

- 10. Were both the temperature and the time at that temperature reported?**
- 11. Were independent treatment flasks (or samples) exposed?**
- 12. Was the experiment repeated?**
- 13. Were appropriate positive and negative (sham, incubator) controls performed and properly described?**
- 14. Was the data statistically analyzed, and was the analysis appropriate?**
- 15. Did the authors accept their own statistical result, or proceed to make statements about specific changes that were not statistically significant?**

There is a long history, in the debate over the possible adverse effects of emissions from RF sources (radar, microwave ovens, cell phones, etc.), of individuals (both the lay public and scientists) finding and listing titles of peer reviewed papers that, in the title, abstract or conclusions, point to potentially severe health problems.

There is also an extensive number of peer reviewed papers that lack or poorly describe many of the essential items listed above, which may or may not reflect poorly or incorrectly performed research.

In either event, the papers in the end lack merit, and are basically useless to both basic research and public health.

I therefore urge all of us, individually and collectively, to give the utmost attention to the details that I have described, so that those funds which are available for RF research can be spent in the best scientific manner possible.