

# **The EMF Research Book (draft edition)**

**A collection of theories and hypotheses for the study of biological and health  
effects of electromagnetic fields**

Mads Rohde

2024-11-09

# Table of contents

<b>Preface</b>	<b>4</b>
<b>1 Introduction (draft)</b>	<b>5</b>
<b>I Characteristics (draft)</b>	<b>6</b>
<b>2 Characteristics of electromagnetic fields and radiation</b>	<b>8</b>
2.2 Natural electromagnetism . . . . .	8
2.2.1 Space and the sun . . . . .	8
<b>3 Nomenclature (draft)</b>	<b>9</b>
<b>II Effects (draft)</b>	<b>10</b>
<b>4 Thermal theories (draft)</b>	<b>11</b>
<b>5 Non-thermal theories (draft)</b>	<b>12</b>
5.1 The interaction with specific biological components . . . . .	12
5.1.1 Melanin . . . . .	12
5.2 The Zeeman effect (Chiabrera et al. 2000) . . . . .	12
5.3 The Rouleaux Effect . . . . .	12
5.4 Microbiome . . . . .	12
<b>6 Ionizing radiation theories (draft)</b>	<b>13</b>
<b>7 Specific diseases (draft)</b>	<b>14</b>
7.1 Cardiovascular disease . . . . .	14
7.1.1 Blood pressure . . . . .	14
7.2 Cancer . . . . .	14
<b>8 Psychological theories (draft)</b>	<b>15</b>

<b>III Exposure assessment</b>	<b>16</b>
<b>9 Real world measurements (draft)</b>	<b>18</b>
9.1 5G exposure . . . . .	18
<b>10 Exposure in general (draft)</b>	<b>19</b>
10.1 Fifth generation mobile phone technology (5G) . . . . .	19
<b>IV Resources (draft)</b>	<b>20</b>
Identifying research gaps . . . . .	21
<b>11 Literature data (draft)</b>	<b>22</b>
11.1 Soviet research . . . . .	22
<b>12 Open data (draft)</b>	<b>23</b>
<b>13 EMF research around the world (draft edition)</b>	<b>24</b>
<b>14 Hypotheses(draft)</b>	<b>25</b>
14.1 List of novel hypotesises or research questions . . . . .	25
14.2 Long leaps and speculations . . . . .	25
<b>15 Terms to use (draft)</b>	<b>26</b>
<b>References</b>	<b>27</b>

# Preface

## Tip

*The best book for scientific ideas, including generating new ideas and bringing ideas to life – within the field of biological and health effects of electromagnetic fields (EMF).*

This is a collection of theories and hypotheses related to the study of biological and health effects of non-ionizing radiation.

The book is an open science project started in 2024 and is work in progress. A final edition may take years to complete. Scientists and authors familiar with the topic can contribute and will be credited for any contribution. If you want to contribute, you can simply submit additions and revisions at the book's [GitHub repository](#). Currently, I serve as the editor, but that may be changed if more experienced authors decide to contribute.

The book at this page will remain free. The book is licensed under [CC BY-NC-ND 4.0](#). Potentially, additional paperback, hard copy or e-book editions can be made available for sale at a future point in time.

The aim of the book is to be a comprehensive list of the theories and hypotheses related to non-ionizing radiation that can be used for researchers and others who want to familiar themselves with the topic; look up potential frameworks to interpret findings; or explore research gaps and possible new research questions and methods.

The aim is not to discuss specific research findings, but rather to provide a scope of theories. However, relevant scientific references for each theory should be included. But to support the progress of the development of this book, such lists may most often not be exhaustive, meaning that a theory may be included with one reference initially that is not necessarily the most updated and correct reference.

It is also not the aim that theories or hypotheses included should have been proven to be correct (or scientifically speaking, not haven been falsified). Theories that are speculative, or even wrong, may also be included, and the reader should be aware this. The reason for this is that ideas that have not yet been researched may have extra value in that they may point to research gaps, and theories that have proven wrong may prohibit other researchers to waste their effort following that same path.

# 1 Introduction (draft)

Electromagnetic fields are ...

**Part I**

**Characteristics (draft)**

This chapter ...

## 2 Characteristics of electromagnetic fields and radiation

### 2.1

### 2.2 Natural electromagnetism

#### 2.2.1 Space and the sun

*Coronal mass ejection (CME)*: Ejection of plasma mass from the sun. One often talks about flares, and flares of different strength, e.g. X1 to X100. The Carrington event (1859) is said to have been between X45 or X80 flare (ADD REFERENCE). One also talk about the KP-index – the geomagnetic storm index, with values like typically Kp5-Kp9.

*Cosmic microwave background radiation (CMB(R))*: (LOOK UP AND IMPROVE TERMINOLOGY AND ABBREVIATION, NOT SURE IF THIS IS USED OR COMMONLY USED)



### **3 Nomenclature (draft)**

# **Part II**

## **Effects (draft)**

## **4 Thermal theories (draft)**

## **5 Non-thermal theories (draft)**

### **5.1 The interaction with specific biological components**

#### **5.1.1 Melanin**

### **5.2 The Zeeman effect (Chiabrera et al. 2000)**

### **5.3 The Rouleaux Effect**

### **5.4 Microbiome**

A hypothesis about how the microbiome can be affected by exposure to anthropogenic electromagnetic fields and create health effects, may first have been presented in a conference abstract in 2022, for a conference in Sogn og Fjordane in Norway (Manzetti 2022)

## **6 Ionizing radiation theories (draft)**

## 7 Specific diseases (draft)

### 7.1 Cardiovascular disease

#### 7.1.1 Blood pressure

Cell phone calls, and thus radiofrequency radiation, may be related to the development of high *blood-pressure* (hypertension) , according to a large study using data from the UK Biobank (Ye et al. 2023). Radiation exposure can be assumed to be strongly affected by cell phone usage. Confounding factors and other explanatory models can always exist. Mecanistic models for how a blood pressure increase can happen due to radiofrequency radiation, is a topic for future studies, – and such studies will increase the confidence in the findings from epidemiological studies on cell phone usage or similar exposure, and blood pressure.

### 7.2 Cancer

## **8 Psychological theories (draft)**

## **Part III**

# **Exposure assessment**





## 9 Real world measurements (draft)

### 9.1 5G exposure

2022:

- Columbia, SC, USA (Koppel and Hardell 2022)

2024:

- Stockholm, Sweden, 2024 (Hardell and Koppel 2024)

# 10 Exposure in general (draft)

## 10.1 Fifth generation mobile phone technology (5G)

*Non-user exposure:*

A 2023 study performed measurements “near two 5G New Radio (NR) base stations, one with an Advanced Antenna System (AAS) capable of **beamforming** and the other a traditional microcell.” (emphasizement/bold part added)(Aerts et al. 2023).

They found that exposure was in general lower for non-users than for users, but that “for the non-user, the difference lies in whether they are in a beam or not” and that when there are many users around the base station exposure can generally increase for the non-user.

**Part IV**

**Resources (draft)**

In this part of the book, various resources that can aid in research on electromagnetic fields. The various chapters holds resources such as information on literature databases, open data and scientific communities around the world.

## Identifying research gaps

If you are interested in conducting new research on EMFs, the table below with *the seven research gaps* from Miles (2017) may aid you. What research gap *type* do you find to be the most important within EMF science?

Research Gap Type	Definition
Evidence Gap (Contradictory Evidence Gap)	Results from studies allow for conclusions in their own right, but are contradictory when examined from a more abstract point of view [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Knowledge Gap (Knowledge Void Gap)	Desired research findings do not exist [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Practical-Knowledge Gap (Action-Knowledge Conflict Gap)	Professional behavior or practices deviate from research findings or are not covered by research [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Methodological Gap (Method and Research Design Gap)	A variation of research methods is necessary to generate new insights or to avoid distorted findings [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Empirical Gap (Evaluation Void Gap)	Research findings or propositions need to be evaluated or empirically verified [Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Theoretical Gap (Theory Application Void Gap)	Theory should be applied to certain research issues to generate new insights. There is lack of theory thus a gap exists [Müller-Bloch & Kranz, 2014; Jacobs, 2011; Müller-Bloch & Kranz, 2014; Miles, 2017].
Population Gap	Research regarding the population that is not adequately represented or under-researched in the evidence base of prior research (e.g., gender, race/ethnicity, age, etc.) [Robinson, et al, 2011].
Sources	Robinson, Saldanha, & McKoy (2011); Müller-Bloch & Kranz, (2015); Miles, (2017).

# 11 Literature data (draft)

## 11.1 Soviet research

In the earliest time of EMF science, much research was done in the Soviet Union.

Big portions of this body of research may not be available in literature databases. As a starting point of an exploration of the Soviet research, below is a list of some sources discussing this literature.

- Glaser and Dodge (1976)
- D. I. McRee (1979)
- Donald I. McRee (1980)
- Kositsky, Nizhelska, and Ponezha (2001)
- Kostoff (2019)
- Kostoff (2020)

## **12 Open data (draft)**

## **13 EMF research around the world (draft edition)**



# 14 Hypotheses(draft)

## 14.1 List of novel hypotheses or research questions

- Can RF radiation increase strength of risk from UV light exposure?

## 14.2 Long leaps and speculations

Here are some speculative theories or ideas. The ideas are only scientific in so far that they are possible to test and disprove (falsify). They might be stimulating, engaging or just fun or provocative to read.

- 1) Today, all have their own phones. Particularly with the introduction of the fifth generation of mobile technology (5G) and beamforming, being close to others can increase exposure.

If it is so that RF-EMF is a stressor, a question becomes, can there be *subliminal conditioning* (*pavlovian*), where the body experience stress when close to others, and thus starts to associate being close to others as stressful.

How can such a theory be tested? Rats can be mounted with their own mini “mobile phone” with beamforming technology in a rat city with transmission antennas around the “city”. Control groups do not have their own phone. Will the rats become less social?

# 15 Terms to use (draft)

Many phenomena within this research field have a diverse nomenclature.

In this chapter we list various terms with examples on usage.

- *electromagnetic radiation*

electromagnetic radiation emitted by wireless communication devices

From (Leszczynski 2025)

# References

- Aerts, Sam, Kenneth Deprez, Leen Verloock, Robert G. Olsen, Luc Martens, Phung Tran, and Wout Joseph. 2023. "RF-EMF Exposure Near 5G NR Small Cells." *Sensors (Basel, Switzerland)* 23 (6): 3145. <https://doi.org/10.3390/s23063145>.
- Chiabrera, A., B. Bianco, E. Moggia, and J. J. Kaufman. 2000. "Zeeman-Stark Modeling of the RF EMF Interaction with Ligand Binding." *Bioelectromagnetics* 21 (4): 312–24. [https://doi.org/10.1002/\(sici\)1521-186x\(200005\)21:4%3C312::aid-bem7%3E3.0.co;2-#](https://doi.org/10.1002/(sici)1521-186x(200005)21:4%3C312::aid-bem7%3E3.0.co;2-#).
- Glaser, Zorach R., and Christopher H. Dodge. 1976. "Biomedical Aspects of Radiofrequency and Microwave Radiation: A Review of Selected Soviet, East European, and Western References." In *Biologic Effects of Electromagnetic Waves: Selected Papers of the USNC/URSI Annual Meeting (Boulder, Colorado, Oct. 20-23, 1975)*, 2–34. HEW Publications (FDA) 77-8010 and 77-8011.
- Hardell, Lennart, and Tarmo Koppel. 2024. "Spots with Extremely High Radi-ofrequency Radiation After Deployment of 5G Base Stations in Stockholm, Sweden." *Ann Clin Med Case Rep* 14 (4): 1–8.
- Koppel, Tarmo, and Lennart Hardell. 2022. "Measurements of Radiofrequency Electromagnetic Fields, Including 5G, in the City of Columbia, SC, USA." *World Academy of Sciences Journal* 4 (3): 22. <https://doi.org/10.3892/wasj.2022.157>.
- Kositsky, Nikolai Nikolaevich, Aljona Igorevna Nizhelska, and Grigory Vasil'evich Ponezha. 2001. "Influence of High-Frequency Electromagnetic Radiation at Non-Thermal Intensities on the Human Body." *No Place To Hide-Newsletter of the Cellular Phone Taskforce Inc* 3 (1): 1–33.
- Kostoff, Ronald N. 2019. "Adverse Effects of Wireless Radiation."
- . 2020. "The Largest Unethical Medical Experiment in Human History."
- Leszczynski, Dariusz. 2025. "Wireless Radiation and Health: Making the Case for Proteomics Research of Individual Sensitivity." *Frontiers in Public Health* 12 (January). <https://doi.org/10.3389/fpubh.2024.1543818>.
- Manzetti, Sergio. 2022. "On the Potential Underlying Cause of Electromagnetic Field Hypersensitivity: A Connection to the Gut Microbiome."
- McRee, D. I. 1979. "Review of Soviet/Eastern European Research on Health Aspects of Microwave Radiation." *Bulletin of the New York Academy of Medicine* 55 (11): 1133–51.
- McRee, Donald I. 1980. "Soviet and Eastern European Research on Biological Effects of Microwave Radiation." *Proceedings of the IEEE* 68 (1): 84–91.
- Miles, D. Anthony. 2017. "A Taxonomy of Research Gaps: Identifying and Defining the Seven Research Gaps." In *Doctoral Student Workshop: Finding Research Gaps-Research Methods and Strategies, Dallas, Texas*, 1–15.

Ye, Ziliang, Yanjun Zhang, Yuanyuan Zhang, Sisi Yang, Mengyi Liu, Qimeng Wu, Chun Zhou, Panpan He, Xiaoqin Gan, and Xianhui Qin. 2023. “Mobile Phone Calls, Genetic Susceptibility, and New-Onset Hypertension: Results from 212 046 UK Biobank Participants.” *European Heart Journal - Digital Health* 4 (3): 165–74. <https://doi.org/10.1093/ehjdh/ztad024>.