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**EFFECTS OF
POWER AND RADIO FREQUENCY
ELECTROMAGNETIC FIELDS
ON HUMAN PERFORMANCE**

- I : Power Frequency Effects on Melatonin levels,
Attention and Memory**
- II : Radio Frequency Effects on Melatonin Levels,
Cardiovascular Parameters, Aural Temperature,
Melatonin levels, Attention and Memory**

A DISSERTATION SUBMITTED IN PARTIAL
FULFILLMENT FOR THE DEGREE OF

**DOCTOR OF PHILOSOPHY
IN PHYSIOLOGY**

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DEDICATION

This thesis is dedicated to my mother, Olive Mobberley.

ABSTRACT

Humans have been exposed to manmade electromagnetic fields (EMFs) since electricity was first harnessed in the 1800s. This exposure has accelerated in the last few decades with the widespread use of electrical appliances producing 50/60 Hz power frequency EMFs. With the advent of cellular phones (900 or 1800 MHz) exposure frequencies have increased and wavelengths shortened. With this exposure has come a public concern over possible health effects from increasing exposure to EMFs, particularly in the radio frequency bands.

Experiment One exposed 29 subjects to an EMF of 50 Hz, 100 μ T, pulsed (one second on/one second off). Each subject attended at 12 p.m. and 12 a.m. on two consecutive days, a total of two control and two exposure sessions. Effects on salivary melatonin levels, and the cognitive parameters of working memory and attention were studied. Experiment Two exposed 50 subjects to almost the same protocol and experimental conditions. An additional control sample of saliva was obtained before each of the four sessions. There was no significant effect on attention or auditory working memory in either experiment. In Experiment One the presence of the EMF had no effect on salivary melatonin levels, including the subgroup of those with naturally low levels. In Experiment Two, a significant drop in melatonin levels was found for the day session, but only when compared to the same day control. This raised questions as to the reliability of using a separate day as a control due to excessive within-subject variation over the two days. There were no significant differences between male and female subjects in response to the EMF.

Experiment Three investigated possible effects from a commercially available digital 900 MHz band cellular phone on melatonin levels, aural temperature, blood pressure, heart rate and the cognitive parameters of attention and memory. Forty-three subjects attended a single evening session. Two exposure sessions were surrounded by three control sessions. This was done to compensate for the natural change that occurs in melatonin levels, temperature and cardiac readings during an evening. Results were averaged for control sessions then compared to the average for the exposure sessions. A statistically significant rise in aural temperature was noted in both ears when the phone was operating. The difference was significantly greater on the side the phone was held. Scores in an attention test were also significantly lower when the phone was in use. The reduced attention level has implications for the safety of using of cellular phones whilst driving. Heating of the head may have biological consequences depending on the depth of penetration. There was no perceived effect on melatonin levels, no gender effects or effects on those with naturally low melatonin levels. Neither cardiac readings or numerical working memory were effected by exposure to a cellular phone.

TABLE OF CONTENTS

Title page	i
Dedication	ii
Abstract	iii
Table of Contents	iv
List of Figures	vii
List of Tables	viii
Acknowledgements	x
Chapter 1 : Overview of the Thesis	1
Chapter 2 : Background Information on EMFs	3
Chapter 3 : Background Physiology and Psychology	10
Melatonin and the Pineal Gland	10
Attention and Memory	22
The control of Heart Rate and Blood Pressure	25
The control of Body Temperature	26
Chapter 4 :A Review of the Literature	
Introduction	27
Effects on Melatonin and the pineal gland	29
Psychophysiological Effects	42
Cardiovascular Effects	53
Thermal Effects from RF EMFs	57
Possible Mechanisms of Interaction	59
Summary	71
CHAPTER 5 : Experiment One	
Power Frequency EMF effects on Melatonin Levels and the Cognitive Parameters of Attention and Aural Working Memory	
Introduction	74
Materials and methods	79
Results	94
Discussion	104

CHAPTER 6 : Experiment Two

Power Frequency EMF effects on Melatonin Levels and the Cognitive Parameters of Attention and Aural Working Memory : A Follow-up Study	
Introduction	108
Materials and methods	109
Results	111
Discussion	130

Chapter 7: Radio Frequency Effects on melatonin levels, heart rate, Blood Pressure, Aural Temperature, Working Memory and Attention.

Introduction	137
Materials and methods	142
Results	154
Discussion	182

CHAPTER 8 : Final Discussion and Conclusions

Power Frequency EMFs	192
Cellular Phone Frequency EMFs	204
Recommendations for further research	215
Final Comments	218

APPENDICES

Appendix 1 : Expt. 1 Subjects Gender Information and melatonin	220
Subject Screening Questionnaire for Expt.s 1 & 2	221
Appendix 2 : Data relating to Experiment 2 and combined Expt. 1 & 2 data	223
2.1 Comparison of control samples at different times	224
2.2 Data on low excretors of melatonin	225
2.3 Subjects gender information and melatonin	226
2.4 Expt.s 1 & 2 combined results- melatonin	231
2.5 Expt.s 1& 2 combined results-low excretors	229
2.6 Expt.s 1 & 2 combined results-gender	231
2.7 Expt.s 1 & 2 combined results -aural memory	233
Appendix 3 : Data relating to Experiment 3.	235
3.1 Screening questionnaire	236
3.2 Raw Data- Temperature	237

	vi
3.3 Raw Data-Blood Pressure	247
3.4 Raw Data- Heart rate	259
3.5 Raw Data- Gender and Melatonin	265
3.6 Raw Data Melatonin	266
3.7 Melatonin-Profiles	268
List of Abbreviations	279
Reference List	280

LIST OF FIGURES

3.1	Control of the synthesis of melatonin in the pineal	14
3.2	Neural pathways linking the retina with the pineal	15
5.1	Electrical system used to generate the 50 Hz EMF	83
5.2	Top view of the booth configuration	83
5.3	Helmholtz coils calibration curve and regression analysis	86
5.4	Photograph of a subject seated in position	84
7.1	Photograph of the cell phone in use	145
7.2	Oscilloscope Tracing of the Cell Phone Output-Subject Talking	147
7.3	Oscilloscope Tracing of the Cell Phone Output-Subject Silent	148
7.4	Change in mean aural temperature over all subjects -Left ear	154
7.5	Change in mean aural temperature over all subjects -Right ear	154
7.6	Change in mean heart rate over all subjects during the experiment	160
7.7	Mean systolic blood pressure over all subjects	163
7.8	Mean pulse pressure over all subjects	166
7.9	Change in mean salivary melatonin levels	169
7.10	Mean attention scores over all subjects during the experiment	173
7.11	Mean number of words recalled over all subjects	176
7.12	Mean number of digits correct over all subjects	179

LIST OF TABLES

4.1	Studies reporting suppression effects on melatonin from 50/60 Hz exposure in rats	32
4.2	Studies reporting nil effects on melatonin from 50-60 Hz EMF exposure in rats	33
4.3	Studies on the effects of power frequency EMFs on melatonin Production, other animal species	34
4.4	Studies on the effects of power frequency EMFs on melatonin in humans	38
4.5	Studies on the effect of radio frequency EMFs on melatonin in humans	41
4.6	Studies on the effects of power frequency EMFs on cognitive tasks	47
4.7	Studies on the effects of RF EMFs on cognitive tasks in Humans	51
4.8	Effects of RF EMFs on Cardiovascular Parameters in Humans	56
4.9	The Effect of Cellular Phone Use on Head Temperature in Humans	58
5.1	Expt.1. Effects of Power Frequency Fields on salivary melatonin	96
5.2	RIA sensitivity levels for experiment one	95
5.3	Expt. 1. Effects of Power Frequency Fields on Aural Memory-2 letter	98
5.4	Expt. 1. Effects of Power Frequency Fields on Aural Memory-3 letter	99
5.5	Expt. 1. Effects of Power Frequency Fields on Aural Memory-4 letter	100
5.6	Expt. 1. Effects of Power Frequency Fields on Attention-Day	102
5.7	Expt. 1. Effects of Power Frequency Fields on Attention-Night	103
6.1	Expt. 2. Effects of a 50 Hz EMF on salivary melatonin	113
6.2	Expt. 2. Effects of a 50 Hz EMF on salivary melatonin-same day control	115
6.3	Expt. 2. Effects of a 50 Hz EMF on the salivary melatonin rise	116
6.4	RIA assay sensitivity levels for experiment two	117
6.5	Expt. 2. Effects of Power Frequency Fields on Attention-Day	119
6.6	Expt. 2. Effects of Power Frequency Fields on Attention-Night	120
6.7	Expt. 2. Effects of Power Frequency Fields on Aural Memory-2 letter	124
6.8	Expt. 2. Effects of Power Frequency Fields on Aural Memory-3 letter	126
6.9	Expt. 2. Effects of Power Frequency Fields on Aural Memory-4 letter	128
7.1	Expt. 3. ANOVA analysis. On the Effects of cell phone use on Aural Temperature	155
7.2	Expt. 3. Effects of Cell Phone use on Aural Temperature-left ear	156
7.3	Expt. 3. Effects of Cell Phone use on Aural Temperature-right ear	158

	ix
7.4	Expt. 3. Effects of Cell Phone use on Temperature between ears 159
7.5	Expt. 3. ANOVA analysis of the effects of Cell Phone use on Heart Rate 160
7.6	Expt. 3. Effects of Cell Phone use on Heart Rate 161
7.7	Expt. 3. ANOVA analysis of the effects of Cell Phone use on systolic B.P. 163
7.8	Expt. 3. Effects of Cell Phone Use on Systolic Blood Pressure 164
7.9	Expt. 3. Effects of Cell Phone Use on Pulse Pressure 167
7.10	Expt. 3. ANOVA analysis of the effects of Cell Phone use on Pulse Press. 129
7.11	Expt. 3. Effects of Cell Phone use on Salivary Melatonin 171
7.12	Expt. 3. ANOVA Log analysis of the effects of Cell Phone use on Salivary Melatonin 169
7.13	RIA sensitivity for experiment four 170
7.14	Expt. 3. ANOVA analysis of the effects of Cell Phone use on Attention 136
7.15	Expt. 3. Effects of Cell Phone Use on Attention 174
7.16	Expt. 3. Effects of Cell Phone Use on Delayed Word Recall 177
7.17	Expt. 3. ANOVA analysis of the effects of Cell Phone use on Delayed Word Recall 176
7.18	Expt. 3. The effects of Cell Phone use on Numerical Working Memory 180
7.19	Expt. 3. ANOVA logit analysis of the effects of Cell Phone use on Numerical Working Memory 138
Appendix 2	
2.1	Comparison of control samples at different times 224
2.2	Data on low excretors of melatonin 225
2.3	Subjects gender information and melatonin 226
2.4	Expt.s 1 & 2 combined results- melatonin 231
2.5	Expt.s 1& 2 combined results-low excretors 229
2.6	Expt.s 1 & 2 combined results-gender 231
2.7	Expt.s 1 & 2 combined results -aural memory 233
Appendix 3	
3.2	Expt. 3. Raw Data-Temperature 237
3.3	Expt. 3. Raw Data-Blood Pressure 247
3.4	Expt. 3. Raw Data- Heart rate 259
3.5	Expt. 3. Raw Data- Gender and Melatonin 265
3.6	Expt. 3. Raw Data Melatonin 266
3.7	Expt. 3. Melatonin-Profiles 268

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