

***PRE-FILED TESTIMONY
OF WILLIAM J. REA, M.D.
MPUC Docket No. 2011-00262***

1 **Q. Please state your name and business address.**

2 A. My name is William J. Rea, M.D. My address is:
3 Environmental Health Center
4 8345 Walnut Hill Lane, Suite 220
5 Dallas, TX 75231

6 **Q. Briefly state your occupation, educational background, current employment,
7 and professional experience.**

8 A. I currently serve as President of the Environmental Health Center, in Dallas, Texas.

9 I graduated from Otterbein College in Westerville, Ohio, and Ohio State
10 University College of Medicine in Columbus, Ohio. I then completed a rotating
11 internship at Parkland Memorial Hospital in Dallas, Texas. I held a general surgery
12 residency from 1963-67 and a cardiovascular surgery fellowship and residency from
13 1967-69 with The University of Texas Southwestern Medical School system, which
14 includes Parkland Memorial Hospital, Baylor Medical Center, Veteran's Hospital and
15 Children's Medical Center. I was also part of the team that treated Governor Connelly
16 when President Kennedy was assassinated.

17 From 1969 – 1972, I was assistant professor of cardiovascular surgery at the
18 University of Texas S.W. Medical School; from 1984-85 I was Chief of
19 Cardiovascular Surgery at the Veteran's Hospital. I held the position of adjunct
20 professor of environmental sciences and mathematics at the University of North
21 Texas, while from 1972-82 I acted as clinical associate professor of thoracic surgery
22 at The University of Texas Southwestern Medical School. I held the First World

1 Professorial Chair of Environmental Medicine at the University of Surrey, Guildford,
2 England from 1988 – 1998. I also served as adjunct professor of psychology and
3 guest lecturer at North Texas State University.

4 **Q. Are you a member of any professional organizations? If so, please list.**

5 A. I currently serve on the board and am president of the American Environmental
6 Health Foundation, vice president of the American Board of Environmental Medicine
7 and previously served on the board of the American Academy of Environmental
8 Medicine. I have also served on the Science Advisory Board for the U.S.
9 Environmental Protection Agency, on the Research Committee for the American
10 Academy of Otolaryngic Allergy and on the Committee on Aspects of
11 Cardiovascular, Endocrine and Autoimmune Diseases of the American College of
12 Allergists, Committee on Immunotoxicology for the Office of Technology
13 Assessment and on the panel on Chemical Sensitivity of the National Academy of
14 Sciences. I am a fellow of the American College of Surgeons, the American
15 Academy of Environmental Medicine, the American College of Allergists, the
16 American College of Preventive Medicine, the American College of Nutrition, and
17 the Royal Society of Medicine. I was awarded the Jonathan Forman Gold Medal
18 Award in 1987 for outstanding research in environmental medicine, The Herbert J.
19 Rinkle Award in 1993 for outstanding teaching, and the 1998 Service Award, all by
20 the American Academy of Environmental Medicine. I was named Outstanding
21 Alumnus by Otterbein College in 1991. Other awards include the Mountain Valley
22 Water Hall of Fame in 1987 for research in water and health, the Special
23 Achievement Award by Otterbein College in 1991, the Distinguished Pioneers in

1 Alternative Medicine Award by the Foundation for the Advancement of Innovative
2 Medicine Education Fund in 1994, the Gold Star Award by the International
3 Biographical Center in 1997, Five Hundred Leaders of Influence Award in 1997,
4 Who's Who in the South and Southwest in 1997, The Twentieth Century Award for
5 Achievement in 1997, the Dor W. Brown, Jr., M.D. Lectureship Award by the Pan
6 American Allergy Society and the O. Spurgeon English Humanitarian Award by
7 Temple University in 2002.

8 **Q. Have you authored any papers or journal articles?**

9 A. I have authored five medical textbooks, *Chemical Sensitivity* (V. 1-4), *Reversibility of*
10 *Chronic Degenerative Disease and Hypersensitivity*, V. 1: *Regulating Mechanisms of*
11 *Chemical Sensitivity*, *Optimum Environments for Optimum Health and Creativity*, and
12 co-author of *Your Home, Your Health and Well-Being*, more than 150 peer reviewed
13 research papers related to the topic of thoracic and cardiovascular surgery as well as
14 that of environmental medicine. A full list is shown on my *curriculum vitae* attached
15 as Exhibit A.

16 **Q. Briefly describe your work and experience related to the study of**
17 **electromagnetic fields and radio frequency waves in the 30 MHz to 300 GHz**
18 **range ("RF"), and about their potential effects on humans. Please describe the**
19 **study you conducted on electromagnetic hypersensitivity in 1991 and the results.**

20 A. The 1991 study was a multiphase study that was performed to find an effective
21 method to evaluate electromagnetic field (EMF) sensitivity of patients. *See* Rea WJ,
22 Yagin P, Fenyves EJ, Sujisawa I, Samadi N, Ross GH. Electromagnetic field
23 sensitivity. *J Bioelect* 10, 241-256, 1991 (attached as Exhibit B). The first phase

1 developed criteria for controlled testing using an environment low in chemical,
2 particulate, and EMF pollution. Monitoring devices were used in an effort to ensure
3 that extraneous EMF would not interfere with the tests. A second phase involved a
4 single-blind challenge of 100 patients who complained of EMF sensitivity to a series
5 of fields ranging from 0 to 5 MHz in frequency, plus 5 blank challenges. Twenty-five
6 patients were found who were sensitive to the fields, but did not react to the blanks.
7 These were compared in the third phase to 25 healthy naïve volunteer controls. None
8 of the volunteers reacted to any challenge, active or blank, but 16 of the EMF-
9 sensitive patients (64%) had positive signs and symptoms scores, plus autonomic
10 nervous system changes. In the fourth phase, the 16 EMF-sensitive patients were
11 rechallenged twice to the frequencies to which they were most sensitive during the
12 previous challenge. The active frequency was found to be positive in 100% of the
13 challenges, while all of the placebo tests were negative. We concluded that this study
14 gives strong evidence that electromagnetic field sensitivity exists, and can be elicited
15 under environmentally controlled conditions. Since then we have studied several
16 hundred patients who complained of EMF sensitivity and have found that indeed they
17 were.

18 **Q. Have you reviewed the joint testimony of William H. Bailey, Ph.D. and Yakov**
19 **Shkolnikov, Ph.D. (“Exponent”), dated September 19, 2012?**

20 **A. Yes.**

21 **Q. Do you agree with Exponent’s critique of your 1991 study? Exponent states:**
22 **“the claim that this study is a double blind study is not wholly accurate (WHO,**
23 **2007).” p. 42**

1 A. The screening tests were not double blind because you cannot screen double blind.
2 However, the group for the final tests for EMF was not only double blind but were
3 done two times. Therefore, the findings were highly significant for the presence of
4 EMF in this group of patients.

5 Smith, Monro, Choy have several studies on the existence of EMF sensitivity
6 which would confirm our observations (*See Exhibit B, references 1-12*). The
7 literature is very extensive on EMF sensitivity. See also, McCarty DE, Carrubba S,
8 Chesson AL, Frilor C, Gonzalez-Toledo E, Marino AA. 2011. Electromagnetic
9 hypersensitivity: Evidence for a novel neurological syndrome. *Internat J Neurosci*
10 121: 670-676. As a cardiac surgeon, I have seen the benefits and adverse reactions to
11 EMF in thousands of patients. We have shocked hearts or used pacemakers which are
12 electronic sources bringing the patient back to life.

13 **Q. Are you familiar with other research studies and writings on the subject?**
14 **Briefly describe the body of research and published literature on the subject of**
15 **which you are familiar.**

16 A. Becker's studies on the Electromagnetic Healing of bones and tissues⁽¹⁾; Marino's
17 studies on the EMF healing of tissue⁽¹⁻⁹⁾; Smith's⁽¹⁰⁾ and Monro's⁽¹¹⁾ studies on the
18 presence of EMF sensitivity; Havas studies on EMF⁽¹²⁻¹⁷⁾.

19 **Q. Did some of these studies involve exposure to RF in or near the 2.4 GHz range?**

20 A. Yes.

21 **Q. Exponent testified that there is no scientific basis for concluding that EHS may**
22 **be caused by exposure to electromagnetic radiation. Here are some of their**

1 **statements: “A number of well-conducted laboratory studies show no relation**
2 **between the health symptoms experienced by some individuals and RF EMF**
3 **exposure” (p. 29) . . . “that electromagnetic field hypersensitivity had not been**
4 **documented as reproducible as asserted by AAEM and the claim for improved**
5 **ability to detect fields was contradicted by a meta-analysis of the available**
6 **literature and the WHO’s assessment of research on this topic.” (p. 35). Do you**
7 **agree with these assertions and opinions?**

8 A. No. Unfortunately, these studies as I understand, were not performed on sensitive
9 humans but on animals.

10 These assertions by Exponent witnesses are not true. If you have properly
11 environmentally controlled unpolluted rooms, you can reproduce EMF sensitivity.
12 The exponents show a gross ignorance of the physiology of EMF. It is well known in
13 the field of cardiovascular surgery the difference between life and death and the
14 electromagnetics. I have shocked multiple patients back to life using small amounts
15 of electricity. Many patients respond to heavy shocks, others to extremely small
16 shocks. This observation holds for the spectrum of electrosensitivity.

17 **Q. Are there any plausible scientific explanations for a causal link between EHS**
18 **and exposure to electromagnetic radiation?**

19 A. Yes, the body runs on electromagnetic waves. This is the way it communicates.
20 Most physicians know about EEG, brain waves, EMG muscle and nerve conduction
21 and EKG cardiac waves. This is common knowledge in our society. Extra cellular
22 barrier regulates the flow of ions Na^+ , K^+ , and Ca^{++} into and out of the cell. Influx of

1 Ca⁺⁺ into the cell coupled with protein kinase with phosphorylation increase
2 sensitivity to 1000 times⁽¹⁸⁾.

3 **Q. Are there any peer-reviewed studies that would support such a causal link or**
4 **mechanism?**

5 A. Yes! See attached list of studies.

6 **Q. Please describe your work with people who report EHS symptoms? Have you**
7 **had patients who report EHS symptoms related to smart meters?**

8 A. Yes! We have had many people who report their symptoms after the smart meters
9 have been installed. These are wide ranging from fibromyalgia to pain syndromes
10 and confusion, difficulty thinking, short term memory loss, and severe fatigue. Some
11 have an increase in heart arrhythmias, muscle spasms, severe numbness and tingling
12 in peripheral nerves. Many of my patients report that they began experiencing
13 symptoms before they were aware that a smart meter had been installed.

14 **Q. How do you confirm that patients' symptoms are related to EMF sensitivity?**

15 A. By conducting the EMF challenge testing developed in our 1991 study.

16 **Q. What treatments do you recommend for patients with EMF sensitivities and how**
17 **do the patients respond to treatment?**

18 A. At the present time, treatment has been avoidance of the smart meters, vitamin and
19 mineral supplementation, mineral intradermal neutralization. The high percentage of
20 patients experiencing positive results confirms that the diagnosis and treatment are
21 effective.

22 **Q. Have objective guidelines been developed for diagnosing and treating people**
23 **with EHS and other EMF related health problems?**

1 A. Objective guidelines have been developed for diagnosing people's sensitive to EMF,
2 including the following.

- 3 1. History of symptoms from exposures to EMF.
- 4 2. Positive findings physical exam.
- 5 3. Symptoms away from EMF generators.
- 6 4. Reproduction of symptoms and signs on controlled EMF challenge.

7 **Q. In your opinion, is there a scientific basis for concluding that RF emissions from**
8 **smart meters could trigger adverse symptoms in people who have developed**
9 **EHS?**

10 A. Yes

11 **Q. In your opinion, is there a scientific basis for concluding that exposure to the**
12 **emissions from the smart meters over time could contribute to the development**
13 **of EHS and other adverse health effects, particularly for children, the elderly**
14 **and others who may be more susceptible, such as persons with immune**
15 **deficiencies?**

16 A. Yes! People with immune irregularities such as low T-cells, low gamma globulins
17 have been seen to not tolerate EMF and nerve sensitization to sensory nerves.

18 **Q. Based on your knowledge of RF and smart meter technology, would you want an**
19 **RF-emitting smart meter on your home?**

20 A. No.

Dated this 29 day of January, 2013.

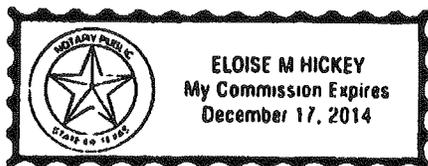


William J. Rea

STATE OF TEXAS
DALLAS, ss:

January 29, 2013

Personally appeared the above-named William J. Rea, M.D., and stated under oath that the foregoing Affidavit made by him is true and based upon his own personal knowledge, information or belief, and so far as upon information and belief, he believes the information to be true. Before me,



Eloise M. Hickey
~~Notary Public~~ Attorney-at-Law
Eloise M. Hickey
Name Typed or Printed
My Commission Expires: 12/17/14

References

1. Becker, R.O. and Marino, A.A. *Electromagnetism & Life*. Albany: State University of New York Press. 1982.
2. Carrubba, S. Frilot, C., Chesson, A. and Marino, A. Detection of nonlinear event-related potentials. *J. Neurosci. Meth.* 157:39-47, 2006.
3. Carrubba, S. Frilot, C., Chesson Jr., A.L. and Marino, A.A. Evidence of a nonlinear human magnetic sense. *Neuroscience.* 144:356-367, 2007.
4. Carrubba, S. Frilot, C., Chesson Jr., A.L., Webber Jr., C.L., Zbilut, J.P. and Marino, A.A. Magnetosensory evoked potentials: consistent nonlinear phenomena. *Neuroscience Research.* 60:95-105, 2008.
5. Carrubba, S. Frilot II, C., Chesson Jr., A.L. and Marino, A.A. Mobile-phone pulse triggers evoked potentials. *Neurosci. Lett.* 469:164-168, 2010.
6. Carrubba, S. Frilot, C., Hart, F.X., Chesson Jr., A.L. and Marino, A.A. The electric field is a sufficient physical determinant of the human magnetic sense. *Int. J. Radiat. Biol.* 85:622-632, 2009.
7. Marino, A.A., Nilsen, E. and Frilot, C. Localization of electroreceptive function in rabbits. *Physiol. Behav.* 79:803-810, 2003.
8. Frilot II, C., Carrubba, S. and Marino, A.A. Magnetosensory function in rats: localization using positron emission tomography. *Synapse.* 63:421-428, 2009.
9. Kolomytkin, O.V., Dunn, S., Hart, F.X., Frilot, C., Kolomytkin, D. and Marino, A.A. Glycoproteins bound to ion channels mediate detection of electric fields: a proposed mechanism and supporting evidence. *Bioelectromagnetics.* 28:379-385, 2007.
10. Smith, Cyril W. 2010:June 4. Chemical Sensitivities in EMS Patients. Presentation in 28th Annual International Symposium on Man and His Environment in Health and Disease, "The Chemical Mechanisms Leading to EMF Sensitivity," June 3-6, 2010. Dallas, Texas.
11. Monro, Jean, 2010: June 4. DNA Adducts and Mitochondrial Function:Biochemical Studies of ATP→ADP. Mitochondrial Translocator Function. Presentation in 28th Annual International Symposium on Man and His Environment in Health and Disease, "The Chemical Mechanisms Leading to EMF Sensitivity," June 3-6, 2010. Dallas, Texas.
12. Havas, Magda, 2010: June 4. Dirty Electricity: The Missing Link. Presentation in 28th Annual International Symposium on Man and His Environment in Health and

Disease, "The Chemical Mechanisms Leading to EMF Sensitivity," June 3-6, 2010. Dallas, Texas.

13. Havas, M. 2008: Dirty Electricity Elevates Blood Sugar Among Electrically Sensitive Diabetics and May Explain Brittle Diabetes. *Electromagnetic Biology and Medicine*, Vol. 27(2), pp. 135-146.
14. Havas, M. and A. Olstad, 2008. Power Quality Affects Teacher Wellbeing and Student Behavior in Three Minnesota Schools. *Science of the Total Environment*, Volume 402, Issues 2-3, 1 September 2008. pp. 157-162.
15. Havas, M. 2006. Electromagnetic Hypersensitivity: Biological Effects of Dirty Electricity with Emphasis On Diabetes and Multiple Sclerosis. *Electromagnetic Biology and Medicine*, 25: 259-268.
16. Havas, M. and R. Frederick. 2009. What are GS Units? <http://www.youtube.com/watch?v+vbebpRvwd8k>.
17. Havas, M. and D. Stetzer. *Dirty Electricity and Electrical Hypersensitivity: Five Case Studies*. World Health Organization Workshop on Electricity Hypersensitivity, Prague, Czech Republic, 2-26 October, 2004.
18. Szallasi, A., and P.M. Blumberg. 1999. Vanilloid (Capsaicin) receptors and mechanisms. *Pharmacological Reviews* 51: 151-211.

**WILLIAM REA
EXHIBIT A**

WILLIAM J. REA, M.D.

**Bus: 8345 Walnut Hill Lane
Suite 220
Dallas, Texas 75231-4262
214/368-4132**

PERSONAL: Born: Jefferson, Ohio
February 2, 1935

COLLEGES: Otterbein College
Westerville, Ohio
Graduated with B.S. and B.A., 1958

Ohio State University College of Medicine
Columbus, Ohio
Graduated with M.D., 1962

INTERNSHIP: Parkland Memorial Hospital
Dallas, Texas
Rotating Internship: 1962 - 1963

RESIDENCIES: University of Texas Southwestern Medical School
- General Surgery Residency 1963-1967
Parkland Memorial Hospital
Baylor Medical Center
Veteran's Hospital
Children's Medical Center
University of Texas Southwestern Medical School
- Cardiovascular Surgery Fellowship and Residency
1967-1969

LICENSURE: License #D2294, Dallas County, Texas
License #35-02-5922-R, Franklin County, Ohio
License #R-3120, Poinsetc County, Arkansas
License #036-085797, Fangamon County, Illinois

**TEACHING
APPOINTMENTS:** First World Professorial Chair, Environmental
Medicine, Robens Institute, University of
Surrey, Guildford, Surrey, England, 1988 - 1995
Adjunct Associate Professor of Environmental
Sciences and Mathematics at the University of
Texas, 1984 - 1985
Chief of Surgery, Brookhaven Hospital, Dallas,
Texas, 1980 - 1981
Clinical Associate Professor of Thoracic Surgery,
University of Texas Southwestern Medical School,
1972 - 1982

William J. Rea, M.D.

**TEACHING
APPOINTMENTS:**

Assistant Professor of Thoracic Surgery,
University of Texas Southwestern Medical
School 1969 - 1972
Chief of Thoracic Surgery, Veteran's Hospital
1969 - 1972
Guest lecturer, University of Texas at Dallas 1985 -
1988, Adjunct Professor of Environmental Sciences
Guest lecturer, North Texas State University, 1980,
1982 - 1988 - Adjunct Professor of Psychology
Adjunct Professor, Department of Occupational
and Environmental Health, The University of
Oklahoma, 1992 - 1993
Regional Clinical Faculty, Kirksville College of
Osteopathic Medicine, 1994 - 1996
Consultant, Institut fur Umweltkrankheiten, Bad
Emstal, Emstal, Germany
Regional Clinical Faculty, Kirksville College of
Osteopathic Medicine, 1995 - 1997
Professor of Medicine, Capital University of
Integrative Medicine, Washington, D.C., July 1,
1997 - 2005

PRACTICE:

Private Practice - June 1, 1973 to present

CERTIFICATION:

American Board of Surgery Certification
April 1, 1968, Certificate #15416
American Board of Thoracic Surgery
April 4, 1970, Certificate #2137
American Board of Environmental Medicine
August 20, 1988, Certificate #003
American Board Certification, Disability Analyst,
#5513-01

**MEDICAL SOCIETY
MEMBERSHIPS:
Past/Present**

American Medical Association
Texas Medical Association
Dallas County Medical Society
American Heart Association (Golden Heart
Member)
American Lung Association
American Society of Artificial Internal Organs
Pan American Medical Association
Society of Thoracic Surgeons
Correspondence Society of Surgeons
American Board of Surgery
American Board of Thoracic and
Cardiovascular Surgery

William J. Rea, M.D.

MEDICAL SOCIETY

MEMBERSHIPS:

Past/Present

Association for Academic Surgery
American Academy of Environmental Medicine
Pan American Allergy Society
American Occupational Medical Association
American Association for Clinical Immunology
and Allergy
American Institute of Medical Climatology
Huxley Institute for Biosocial Research
American College of Nutrition
American College of Surgeons
Chirurgio Society
The New York Academy of Sciences
The American College of Preventive Medicine
Oklahoma College of Occupational Medicine
(Section on Environmental Medicine)
Society of Integrative Medicine
International Society for Heart and Lung
Transplantation
The International Society for the Study of
Subtle Energies and Energy Medicine
American College of Occupational and
Environmental Medicine

FELLOWSHIPS:

Fellow, American College of Surgeons
Fellow, American Academy of Environmental
Medicine
Fellow, American College of Preventive
Medicine
Fellow, American College of Nutrition
Fellow, Royal Society of Medicine
(Cardiothoracic Section)
Fellow, American College of Forensic Examiners
Institute
Honorary Fellow, International Academy of
Preventive Medicine
Affiliate Fellow, American Academy of
Otolaryngic Allergy
Distinguished Fellow, American Academy of
Cardiology

MEMBERSHIPS/

OFFICES HELD:

Past/Present

Director, Environmental Health Center -
Dallas
President, American Environmental Health
Foundation

William J. Rea, M.D.

**MEMBERSHIPS/
OFFICES HELD:
Past/Present**

Past President, Board of Directors,
Pan American Allergy Society 1988-1989
Vice President of the Board, American
Board of Environmental Medicine
Chief of Surgery, Brookhaven Medical Center
Member, Science Advisory Board, The United
States Environmental Protection Agency
Member, Research Committee, American
Academy of Otolaryngic Allergy
Member, Board of Directors and Past President,
American Academy of Environmental Medicine
Member, American Association for the
Advancement of Science
Member, The Smithsonian Society
Member, National Advisory Board, American
Security Council
Member, National Geographic Society
Member, Technology Committee, American
College of Allergists
Member, Food Allergy Committee, American
College of Allergists
Member, Editorial Board, Clinical
Ecology, Archives for Human Ecology in
Health and Disease
Member, Committee on Aspects of
Cardiovascular, Endocrine & Autoimmune
Diseases, American College of Allergists
Member, Board of Advisers, CAMPRO - The
Center for Accelerated Medical Progress,
Inc.
Editorial Board, Journal Bioelectricity and
Electromagnetic Fields - Marino
Member, Human Ecology Action League Director,
ECHO-HAVEN
Member, World Research Foundation
Member, Chief Executive Officer's Club
Editorial Advisory Board, Medical Nutrition
National Board of Directors - Natural Food
Associates
Northwest Coalition for Alternatives to
Pesticides
Chief Patron, Ecosystem Research Foundation in
Pakistan
Member, Mycotoxin Steering Committee, World
Health Organization
Board of Scientific Directors, Brain
Allergy Research

William J. Rea, M.D.

**MEMBERSHIPS/
OFFICES HELD:
Past/Present**

Member, Human Ecology, Academy of
Technological Science of Russian Federation
Scientific Advisory Board, Biosphere II
Editorial Board, Journal of Environmental
and Waste Management
Advisory Board, Price-Pottenger Nutrition
Foundation
Advisory Board, Latitudes
Editorial Board, Management of Environmental
Quality
Honorary Member, Nutrition For Optimal Health
Association
Member, Overseas Editorial Board, Journal
of Environmental Biology
Director, Orthomolecular Health-Medicine
Editorial Board, Journal of Long-Term Effects
of Medical Implants
Advisor to Board, American Academy of
Environmental Medicine
Editorial Board, Alternative Therapies in
Health and Medicine

**SPECIAL
AWARDS:**

The Jonathan Forman Gold Medal Award by
the American Academy of Environmental
Medicine - 10/31/87
Mountain Valley Water Hall of Fame, Hot
Springs, Arkansas 1987
The Special Achievement Award by
Otterbein College - 06/15/91
The Herbert J. Rinkel Award by the
American Academy of Environmental
Medicine, 10/11/93
The Distinguished Pioneers in Alternative
Medicine Award by the Foundation for the
Advancement of Innovative Medicine Education
Fund - 5/1/94
Gold Star Award by the International
Biographical Center, December 1997
Five Hundred Leaders of Influence, 1997
Who's Who In the South and Southwest, 1997
The Twentieth Century Award For Achievement, 1997
American Board of Environmental Medicine Service
Award 1998

SPECIAL

Dor W. Brown, Jr., M.D. Lectureship Award, Pan

William J. Rea, M.D.

AWARDS: American Allergy Society, March 2002
O. Spurgeon English Humanitarian Award, Temple University, October 2002
Professor Emeritus of Integrative Medicine, Capital University of Integrative Medicine, June 2006.

PUBLICATIONS

1. Rea, W.J. and Robertson, W.O.: Serum Salicylate Levels (their importance in predicting toxicity). Ohio Medical Journal 59: July, 1963.
2. Rea, W.J., Graview, L. and Jennings, R.L.: Liver Angioma of Neonate. American Journal of Surgery 112: pp. 777; November, 1966.
3. Sugg, W.L., Rea, W.J., Ecker, R.R., Rose, E., Webb, W.R. and Shaw, R.R.: Penetrating Wounds of the Heart: An Analysis of 459 Cases. Journal of Thoracic Cardiovascular Surgery 56: pp. 531-545; October, 1968.
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5. Chawla, Narinder, P.S., Rea, W.J. and Shapiro, W.: The Use of an Implanted Demand Pacemaker in Bradyarrhythmias. Archives of Internal Medicine 124: pp. 593-599; November, 1969.
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8. Rea, W.J., Wyrick, W., McClelland, R.N. and Webb, W.R.: Intravenous Hyperosmolar Alimentation. Geriatrics Digest 7: September 28, 1970 (Abstract).
9. Rea, W.J. and Wyrick, W.: Necrotizing Fasciitis. Annals of Surgery 172: pp. 957-964; December, 1970.

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10. Rea, W.J., Wyrick, W. and McClelland, R.N.: Intravenous Hyperosmolar Alimentation. Archives of Surgery 100: pp. 393-398; 1970.
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12. Rea, W.J., Wyrick, W.: Necrotizing Fasciitis. Modern Medicine, 39 No. 17: pp. 77-78; August 23, 1971.
13. Ecker, R.R., Mullins, C.B., Grammar, J.C., Rea, W.J., Atkins, J.M.: Control of Intractable Ventricular Tachycardia by Coronary Revascularization. Circulation 44 Vol. 4: pp. 666-670; October, 1971.
14. Rea, W.J., Eberle, J.W., Watson, J.T., Ecker, R.R., Sugg, W.L.: Gas Transfer in a Heparinized Membrane Oxygenator. Surgical Forum Vol. XXII: pp. 188-190; October, 1971.
15. Rea, W.J., Ecker, R.R., Sugg, W.L.: Zinc in Cardiac Surgery. Journal of Surgical Residents 13, No. 3: pp. 164-167; March, 1972.
16. Ecker, R.R., Rea, W.J., Sugg, W.L., Miller, W.W.: Changes in 2, 3-Diphosphoglycerate after Cardiopulmonary Bypass. Annals of Thoracic Surgery 13: pp. 364-370; April, 1972.
17. Rea, W.J., Mills, C., Whitley, D., Eberle, J.W., Sugg, W.L.: Assessment of Long Term Membrane Oxygenation Without Heparin. European Society for Experimental Surgery, Abstracts, p. 288, 7th Congress Amsterdam, The Netherlands, April 11-14, 1972.
18. Schwade, J., Pombo, J., Rea, W.J., Waksman, A., Shapiro, W.: Emergency Diagnosis and Attempted Therapy in Post-Infarction Interventricular Septal Rupture. Texas Medicine Vol. 68: pp. 74-78; May. 1972.
19. Rea, W.J., Gallivan, G.J., Ecker, R.R., Sugg, W.L.: Traumatic Esophageal Perforation. Annals of Thoracic Surgery 14: pp. 671-677; December, 1972.
20. Rea, W.J., Eberle, J.W., Ecker, R.R., Watson, J., Sugg, W.L.: Long-Term Membrane Oxygenation in Respiratory Failure. Annals of Thoracic Surgery, 1972.

William J. Rea, M.D.

21. Rea, W.J.: Hyperalimentation in Chest Surgery. In Intravenous Hyperalimentation. Philadelphia, Lea & Febiger, Chapter 15, pp. 177-184; 1972.
22. Rea, W.J., Whitley, D., Eberle, J.W.: Long-Term Membrane Oxygenation Without Systemic Heparinization. Society of Artificial Internal Organs, 1972.
23. Whitley, D.E., Meals, C.R., Eberle, J.W., Manton, J.R., Somerville, P., Rea, W.J.: 24-Hour Membrane Oxygenation Without Systemic Heparin. Surgical Forum ACS, 1972.
24. Rea, W.J.: Myocardial Revascularization. Proceedings of John Peter Smith Hospital, Tarrant County Hospital District, Spring, 1972. Vol. 3: pp. 52-53.
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LECTURES

Environmental Protection Agency Science Advisory Board.
Society for Clinic Ecology.
Royal Society of Medicine in London, McCarrison Society.
Charing Cross Medical School, London, England.
University of Southampton, Southampton, England.
Postgraduate Seminar in England.
Society for Clinical Ecology, Royal College of Physicians,
London, England.
Wyoming Postgraduate Course in Allergy and Immunology.
University of Texas Postgraduate Course in Allergy and
Immunology.
University of Miami Postgraduate Course in Allergy and
Immunology.
World Food Symposium, Mexico City, Mexico.
American College of Allergy.
American College of Preventive Medicine.
Tennessee State Medical Society.
World Food Symposium, Boston, Massachusetts.
Nine Wells Medical School, Dundee, Scotland.
University of Berlin.
British Society of Clinical Ecology.
Royal Australian College of Surgeons.
Straub Clinic, Honolulu, Hawaii.
London Neurological Institute, Middlesex Medical School.
First World Conference on Indoor Air Pollution, Harvard.
Indoor Air Pollution, University of Calgary School of
Architecture, Calgary, Canada.
University of Texas, School of Architecture.

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American Lung Association.
Pan American Allergy Society.

The World Conference I, II, III, IV, and V on Man and His Environment
in Health and Disease.

The American Academy of Otolaryngic Allergy.

The University of Guangzhou, Guangzhou, China.

The Capital University Medical School, Beijing, China.

The 4th Military Medical School, Xian, China.

The University of Nanjing Medical School, Nanjing, China.

Wuxi Medical School, Wuxi, China.

Hang Chou Medical Society, Hang Chou, China.

Postgraduate courses for the Academy of Otolaryngic Allergy of
10 years.

The postgraduate advanced seminars for the American Academy of
Environmental Medicine for 15 years.

Postgraduate courses on chemical sensitivity for four years.

Human Ecology Action League, Washington, D.C.

German Conference on Environmental Medicine, Black Forest,
Germany

Environmental Health Association, Prince Edward Island, Canada.

World Research Foundation Conference, Los Angeles, California.

Kitasato University, Dept. of Ophthalmology, Tokyo, Japan.

Second Japanese Conference in Neurophthalmology, Matsuyama, Japan.

Environmental Medicine Foundation, Philadelphia, PA.

Emerging Challenges in Occupational and Environmental Health.

Annual New England Occupational Medical Association Conference With the
Harvard School of Public Health.

Pan American Allergy Society Postgraduate courses for physicians, San
Antonio, Texas

Pan American Allergy Society Seminar, San Antonio, Texas

The University of Rome, Rome, Italy.

The University of Puerto Rico, Mayaguez, Puerto Rico.

The British Society of Clinical Ecology, Torquay, England.

St. Hughes College, Oxford, England, McCarrison Society.

European Community Research Center, ISPRA, Luguano, Italy.

Clinical Ecology Seminar, Eubia, Greece.

National Association for the Advancement of Science.

University of Wuhan, Wuhan, China.

Peking Union Medical School, Peking, China.

Third Military Medical School, Chong Ching, China.

American College of Nutrition.

The Ontario Postgraduate Course in Environmental Medicine,
Toronto, Canada.

The Halifax Nova Scotia Environmental Health Association.

The Minneapolis Environmental Health Association.

The California Medical Association Scientific Advising Committee.

The Province of Ontario Advisory Committee, The Effects of

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Environmental Chemicals on Humans.
Southwestern Psychological Association, Austin, Texas.
German Conference, Clinical Ecology, Emstal, Germany.
Roger Wyburn-Mason & Jack M. Blount Foundation for the Eradication
of Rheumatoid Disease, Inc., Los Angeles, California.
International Polio Conference, Warm Springs, Georgia.
Natural Food Associates, Hot Springs, Arkansas.
Dalhousie University Medical School, Halifax, Nova Scotia.
Environmental Health Association, Halifax, Nova Scotia.
Texas County Medical Society, Waco, Texas.
Northeast Community Hospital, Bedford, Texas.
North Texas State University, Denton, Texas.
Sixth Annual Veterans Conference, Claremore, Oklahoma, May, 1987.
Ashrae Conference, Washington, D.C., May, 1987.
G.I.N.I.'s Fourth International Polio and Independent Living
Conference, St. Louis, Missouri, June, 1987.
The 11th International Congress of Biometeorology, West
Lafayette, Indiana, September, 1987.
American Academy of Otolaryngic Allergy, Chicago, Illinois,
September, 1987.
The 25th Japanese Congress on Neuro-ophthalmology, Japan, October,
1987.
Ninth Annual New England Occupational Health Conference, Boston,
Massachusetts, December, 1987.
American Academy of Environmental Medicine, 12th Instructional
Course, Denver, Colorado, December, 1987.
1988 Allergy: In-Vitro, Orlando, Florida, February, 1988.
Sixth Annual International Symposium on Man and His Environment in
Health and Disease, February 1988.
Pan American Allergy Society, San Antonio, Texas, March, 1988.
Australian Society for Environmental Medicine, Melbourne, Australia,
March, 1988.
Australia's Association of Chemical Victory, March, 1988.
Tasmanian Medical Society, Tasmania, Australia, March, 1988.
Health By Choice, Atlanta, Georgia, April, 1988.
The Canadian Society for Clinical Ecology and Environmental
Medicine, April, 1988.
T.V. Ontario, Ontario, Canada, May, 1988.
V.O.T.E. Environmental Awareness Symposium, Oklahoma City,
Oklahoma, June, 1988.
Rocky Mountain Environmental Health Association, Denver,
Colorado, August, 1988.
American Academy of Otolaryngic Allergy, Washington, D.C.,
September, 1988.
4th International Symposium for Environmental Medicine, Emstal,
Germany, October, 1988.
T.V. Ontario, Ontario, Canada, October, 1988.
American Academy of Environmental Medicine, 22nd Scientific Session,

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Incline Village, Nevada, October, 1988.
Asahikawa Medical University, Asahikawa, Japan, November, 1988.
Kitasato University, Tokyo, Japan, November, 1988.
American Academy of Environmental Medicine, 13th Instructional Course, Part III, Cleveland, Ohio, December, 1988.
Allergy In-Vitro Update, Phoenix, Arizona, December, 1988.
T.V. Ontario, Ontario, Canada, February, 1989.
University of Toronto, Toronto, Canada, February, 1989.
Seventh Annual Symposium on Man and His Environment in Health and Disease, Dallas, Texas, February, 1989.
Pan American Allergy Society, San Antonio, Texas, March, 1989.
Clinical Ecology Study Group, Ft. Worth, Texas, April, 1989.
Ft. Worth Club, Ft. Worth, Texas, April, 1989.
American College of Advancement in Medicine, Dallas, Texas, May, 1989.
Natural Food Associates, Atlanta, Texas, June, 1989.
Environment Week, Moncton, New Brunswick, Canada, June, 1989.
American Academy of Environmental Medicine, Denver, Colorado, July, 1989.
U.S. House of Representatives Committee on Science, Space, and Technology, Washington, D.C., July, 1989. Testified.
American Academy of Otolaryngic Allergy, New Orleans, Louisiana, September, 1989.
British Society for Nutritional Medicine, London, England, September, 1989.
National Society for Research into Allergy, Enfield, England, September, 1989.
American Academy of Otolaryngic Allergy, New Orleans, Louisiana, September, 1989.
American Academy of Environmental Medicine, Atlanta, Georgia, October, 1989.
Second National Conference on Pesticides and Human Health, Cirencester, England, October, 1989.
American Academy of Otolaryngic Allergy, Corpus Christi, Texas, November, 1989.
Eighth Annual International Symposium on Man and His Environment in Health and Disease, Dallas, Texas, February, 1990.
Pan American Allergy Society, San Antonio, Texas, March, 1990.
The Environmental Medicine Foundation, London, England, April, 1990.
British Society for Allergy and Environmental Medicine, Buxton, Derbyshire, England, July 1990.
American Academy of Environmental Medicine, Fifteenth Instructional Course, Minneapolis, Minnesota, July, 1990.
American Academy of Otolaryngic Allergy Annual Meeting, San Diego, California, September, 1990.
American Society of Otolaryngic Allergy Technicians, San Diego, California, September, 1990.
Workshop to Review Congressional Office of Technology Assessment's

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Document on Identifying and Controlling Immunotoxic Substances, September, 1990.
Building Pathology 90, Surrey, England, September, 1990.
Pesticides Conference, Breakspear Hospital, Hertfordshire, England, September, 1990.
Fifth International Symposium on Environmental Medicine, Emstal, Germany, September, 1990.
The American Academy of Environmental Medicine 25th Annual Meeting, Coeur d'Alene, Idaho, October, 1990.
Oklahoma College of Occupational Medicine 15th Annual Fall Educational Meeting, Edmond, Oklahoma, November, 1990.
American Academy of Otolaryngic Allergy, Newport Beach, California, February, 1991.
Ninth Annual International Symposium on Man and His Environment in Health and Disease, Dallas, Texas, February, 1991.
Pan American Allergy Society, San Antonio, Texas, March, 1991.
National Academy of Sciences, Irvine, California, March, 1991.
Pesticide Exposure Group of Sufferers, Cambridge, England, April, 1991.
Allergy, Nutrition and Health Preservation, Orlando, Florida, April, 1991.
American College of Occupational Medicine, San Francisco, California, April, 1991.
First International Symposium on "Prophylactic Role of Clean Environment in Health Preservation", Cracow, Poland, June 1991.
First Annual Conference of the International Society for the Study of Subtle Energies and Energy Medicine, Golden, Colorado, June 1991.
American Academy of Environmental Medicine, Sixteenth Instructional Course, Shamburg, Illinois, July 1991.
St. John's Regional Medical Center, Joplin, Missouri, August 1991.
The 21st Century Medicine Conference, Czechoslovakia, August 1991.
American Academy of Otolaryngic Allergy, Kansas City, Missouri, September 1991.
American Academy of Environmental Medicine, Jacksonville, Florida, October 1991.
American College of Occupational Medicine, St. Louis, Missouri, October 1991.
American Academy of Otolaryngic Allergy, Orlando, Florida, November 1991.
Tenth Annual International Symposium on Man and His Environment in Health and Disease, Dallas, Texas, February 1992.
Pan American Allergy Society, Houston, Texas, March 1992.
The University of Oklahoma Health Sciences Center, College of Public Health, Oklahoma City, Oklahoma, April 1992.
Klaire Europe Nutrition '92 Seminar, Amsterdam, May 1992.
American College of Advancement in Medicine, Dallas, Texas, May 1992.
Allergy Problems in Buildings, London, England, June 1992.

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American Academy of Otolaryngic Allergy, Washington, D.C.,
September 1992.

Fourth Annual James R. Miller Conference on Brain Function and
Learning, University of North Texas, September 1992.

Seventh Symposium fur Umweltmedizin, Emstal, Germany, September, 1992.
American Academy of Environmental Medicine, Lincolnshire, Illinois,
October 1992.

American Academy of Otolaryngic Allergy, Las Vegas, Nevada, October
1992.

Oklahoma College of Occupational and Environmental Medicine, Fall
Occupational Health Conference, Norman, Oklahoma, November 1992.

Tenth Annual International Symposium on Man and His Environment in
Health and Disease, Dallas, Texas, February 1993.

Pan American Allergy Society, Houston, Texas, March 1993.

Health Built in the Environment, Calgary, Alberta, March 1993.

American College of Occupational and Environmental Medicine,
Atlanta, Georgia, April 1993, **completion of ACOEM Curriculum in
Occupational Medicine.**

American Academy of Environmental Medicine, Schaumburg, Illinois,
April 1993.

Second International Conference on Nanometer Scale Science and
Technology, Moscow, Russia, August 1993.

Diagnosztikus es Terapeutikus Modszerek, Budapest, Hungary, August
1993.

International Congress of Clinical Ecology, Asahikawa, Japan,
September 1993.

13th International Congress of Biometeorology, Calgary, Canada,
September 1993.

VIII Symposium fur Umweltmedizin, Bad Emstal, Germany, September 1993.
American Academy of Otolaryngic Allergy, Minneapolis, Minnesota,
September/October 1993.

American Academy of Environmental Medicine, Reno, Nevada, October 1993.

American Academy of Pain Management, Annual Conference, Knoxville,
Tennessee, October 1993.

American College of Occupational and Environmental Medicine,
Dallas, Texas, October 1993.

American Academy of Otolaryngic Allergy, Key Biscayne, Florida,
November 1993.

Twelfth International Symposium on Man and His Environment in
Health and Disease, Dallas, Texas, February 1994.

Pan American Allergy Society, Houston, Texas, March 1994.

Environmental Allergy Update, University of Osteopathic Medicine
and Health Sciences, Des Moines, Iowa, April 1994.

American Academy of Environmental Medicine, Kansas City, Missouri,
April 1994.

Foundation for the Advancement of Innovative Medicine Education
Fund, Inc., New York, New York, April 1994.

William J. Rea, M.D.

Symposium on Developing a Research Strategy for Investigating Multiple Chemical Sensitivity", California Department of Health Services, Environmental Health Investigations Branch, B Berkeley, California, May 1994.

Primer Simposio Latino Americano De Salud Ambiental, Rosario, Argentina, May 1994.

Fourth International Symposium, Food and Environmental Factors in Human Disease, London, England, June 1994.

Occupational Rhinitis Symposium, York, England, June 1994.

Examining Research Assumptions in Alternative Medical Systems, National Institutes of Health, Bethesda, Maryland, July 1994.

Fourth International Symposium and Workshops on Inner Ear Medicine and Surgery, Snowmass-Aspen, Colorado, July 1994.

Clinical Ecology Study Group, Fort Worth, Texas, August 1994.

American Academy of Otolaryngic Allergy, San Diego, California, September 1994.

Fourth International Scientific Conference, Work With Display Units, Milan, Italy, October 1994.

American Academy of Environmental Medicine Twenty-Ninth, Virginia Beach, Virginia, October 1994.

Rocky Mountain Environmental Health Association, Denver, Colorado, November 1994.

Multiple Chemical Sensitivity, A Seminar for the Naturopathic Academy of Allergy and Environmental Medicine, Bellevue, Washington, November 1994.

American Academy of Otolaryngic Allergy, Phoenix, Arizona, November 1994.

Thirteenth Annual International Symposium on Man and His Environment in Health and Disease, Dallas, Texas, February 1995.

Society for Orthomolecular Medicine America, San Francisco, California, March 1995.

Pan American Allergy Society, San Antonio, Texas, March 1995.

American Academy of Environmental Medicine, Phoenix, Arizona, March 1995.

Earth Week, Experimental Approaches to Chemical Sensitivities, Evanston, Illinois, April 1995.

American Academy of Environmental Medicine, Houston, Texas, May 1995.

2nd Copenhagen Conference on Electromagnetic Hypersensitivity, Copenhagen, Denmark, May 1995.

American Academy of Otolaryngic Allergy, New Orleans, Louisiana, September 1995.

10th International Symposium for Environmental Diseases, Bad Emstal, Germany, September 1995.

American Academy of Environmental Medicine 30th Annual Meeting,

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Tucson, Arizona, September 1995.
Australian Conference of Environmental Medicine, Brisbane, Australia,
November 1995.
Environmental Health and Cardiovascular Disease, Morristown, NJ,
December 1995.
Fourteenth International Symposium, on Man and His Environment in
Health and Disease, Dallas, Texas, February 1996.
American Academy of Environmental Medicine Spring Board Meeting,
Cancun, Mexico, March 1996.
Pan American Allergy Society, Training Course and Seminar, San
Antonio, Texas, March 1996.
American Academy of Environmental Medicine, Part III, Dearborn, MI,
April 1996.
American Academy for Advanced Medicine, Orlando, Florida, May 1996.
4th International Symposium, Nutritional, Orthomolecular and
Minimally Invasive Anterior Surgery of the Lumbar Spine, Memphis,
Tennessee, June 14-15, 1996.
Environmental Modalities in Medical Practice, Salzburg, Austria, July
1996.
Australian Conference of Environmental Medicine, Toxicity '96,
Understanding, assessing and managing diseases caused by exposure to
toxins. Brisbane, Australia, August 31 - Sept 1. 1996.
American Academy of Otolaryngic Allergy, Annual Meeting Scientific
Program. Washington, D.C., September 26-28, 1996.
American Academy of Environmental Medicine, 31st Annual Meeting,
Boston, MA, October 11-15, 1996.
American College for Advancement in Medicine, Palm Springs, California,
October 31 to November 3, 1996.
The American College of Allergy, Asthma & Immunology, Boston, MA,
November 8-13, 1996.
Fifteenth International Symposium, on Man and His Environment In
Health and Disease, Dallas, Texas February 1997.
Pan American Allergy Society, Annual Training Course and Seminar, San
Antonio, TX. March 19-23, 1997.
American Academy of Environmental Medicine, Spring Instructional
Courses, Kansas City, MO. April 17-22, 1997.
Sociedad Mexicana De Alergia en Otorrinolaringología, Guadalajara,
Mexico, January 24, 1998.
American Academy of Environmental Medicine, Instructional Courses,
Potomac, MD. April 2-7, 1998.
American Academy of Otolaryngic Allergy, 57th Annual Meeting, San
Antonio, TX. September 10-12, 1998.
American Academy of Environmental Medicine, 33rd Annual Meeting,
Baltimore, MD. November 6-8, 1998.
Seventeenth Annual International Symposium on Man and His
Environment in Health and Disease, Dallas, TX. June 10-13,
1999.
The Health Impact of Chemical Exposures During the Gulf War: A

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Research Planning Conference, Atlanta, GA. February 28- March 2, 1999.

Pan American Allergy Society, 43rd Annual Training Course and Seminar, San Antonio, TX. March 10-14, 1999.

American Academy of Environmental Medicine, Instructional Courses, St. Charles, IL. March 21-26, 1999.

"A Healthy Home and School for Your Child", Richardson Church of the Nazarene, Richardson, TX. April 20, 1999.

American Academy of Otolaryngic Allergy, New Orleans, LA. September 23-25, 1999.

American Academy of Environmental Medicine, Coeur d'Alene, ID. October 10-12, 1999.

4th International Congress of Bioenergetic Medicine, Orlando, Fl. February 25-27, 2000.

Pan American Allergy Society, San Antonio, TX. March 8-12, 2000.

12th International Symposium, Integrative Medicine, Lisbon, Portugal. Portugal, June 22-25, 2000.

National CPA Health Care Advisors Association, HCAA-Sponsored Health Care Track, Chicago, Illinois, July 19-21, 2000.

Anti-Aging Conference & Exposition, Chicago, Illinois, July 22-23, 2000.

Fifty-Ninth Annual Meeting, American Academy of Otolaryngic Allergy, Washington, D.C., September 21-23, 2000.

American Academy of Environmental Medicine, Hilton Head, SC, September 27-30, 2000.

Seminars on Scientific Aspects of Fluoridation, San Antonio, TX, October 14, 2000.

Endometriosis Association 20th Anniversary Conference, Milwaukee, WI, October 21, 2000.

American College for Advancement in Medicine, Advanced Anti-Aging Workshop, Salt Lake City, UT, October 25-26, 2000.

American Academy of Otolaryngic Allergy, Austin, TX, November 30 - December 3, 2000.

International Symposium on Current Status of Indoor Air Pollution by Organic Compounds and Countermeasures for Healthy Housing, Tokyo Japan, January 13, 2001.

La Sociedad Mexicana de Alergia en Otorrinolaringología, Guadalajara, Mexico, February 1-3, 2001.

Pan American Allergy Society, San Antonio, Texas, March 7-11, 2001.

American Academy of Environmental Medicine, Colorado Springs, Colorado, March 29-31, 2001.

19th International Symposium on Man & His Environment in Health & Disease, Dallas, Texas, June 7-10, 2001.

American Academy of Otolaryngic Allergy, Denver, Colorado, September 6-8, 2001.

Texas Conference Medical-Dental Outreach Congress, Corpus Christi, Texas, October 4-6, 2001.

New England Conference on Health, Environment, and Medicine,

William J. Rea, M.D.

Farmington, Connecticut, October 13, 2001.
American Academy of Environmental Medicine, Colorado Springs,
Colorado, October 18-20, 2001.
Texans for Alternatives to Pesticides, Dallas, Texas, March 5, 2002.
Pan American Allergy Society, San Antonio, Texas, March 14-17, 2002.
Twentieth International Symposium On Man and His Environment in
Health and Disease, Dallas, Texas, June 6-9, 2002.
American Academy of Otolaryngic Allergy, San Diego, CA. September
19-21, 2002.
International Symposium on Indoor Air Quality and Health Hazards,
Tokyo, Japan. January 8-11, 2003.
La Sociedad Mexicana de Alergia en Otorrinolaringología,
Aguascalientes, Mexico. February 26-28, 2003.
Pan American Allergy Society, San Antonio, Texas. 20-23,
2003.
American Academy of Environmental Medicine, Plano, Texas. April 3-7,
2003.
Nutrition for Optimal Health Association, Inc., "Environmental
Aspects of Health and Disease," Chicago, Illinois. May 7, 2003.
5th Congresso Internazionale Teorico Pratico di Nutrizione
Olistica, Rome, Italy. May 23-25, 2003.
21st International Symposium on Man and His Environment in Health and
Disease, Dallas, Texas. June 19-22, 2003.
62nd Annual Meeting, American Academy of Otolaryngic Allergy/Foundation,
Orlando Grand Lakes, Florida. September 18-20, 2003.
Chemical Injury Information Network, Fairfax, Virginia. October 5, 2003.
American Academy of Environmental Medicine, Phoenix, Arizona.
October 30 - November 2, 2003.
La Sociedad Mexicana de Alergia en Otorrinolaringología,
Aguascalientes, Mexico. February 25-28, 2004.
Pan American Allergy Society, San Antonio, Texas. March 11-14, 2004.
American Academy of Environmental Medicine, Overland Park, Kansas,
April 15-19, 2004.
IDEA 2004, Miami, Florida, April 27-29, 2004.
The American Academy of Integrative Medicine, Manhattan, NY, April
30, 2004.
22nd Annual International Symposium on Man and His Environment in
Health and Disease, Dallas, Texas, June 24-27, 2004.
63rd Annual Meeting, American Academy of Otolaryngic Allergy, New
York, NY, September 17-20, 2004
39th Annual Meeting, American Academy of Environmental Medicine,
Hilton Head Island, SC, October 28-31, 2004.
La Sociedad Mexicana De Alergia En Otorrinolaringología A.C.,
Veracruz, Mexico, March 2-5, 2005.
Pan American Allergy Society, Grapevine, TX, March 17-20, 2005.
American Academy of Environmental Medicine, Oakbrook, IL, April
13-18, 2005.
Annual Raymer Family Lecture, Sir Mortimer B. Davis-Jewish General

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Hospital - McGill University, Montreal, Canada, April 28, 2005.
22nd Annual International Symposium on Man and His Environment in
Health and Disease, Dallas, Texas, June 24-27, 2005.
Mountain Valley Spring Company, Hall of Fame, Charleston, SC, October
7-8, 2005.
40th Annual Meeting, American Academy of Environmental Medicine, Tucson,
AZ, October 27-30, 2005.
Congreso Annual Internacional Sociedad Mexicana de Alergia en
Otorrinolaringología, Mazatlan, Mexico, February 15-18, 2006.
Intestinal Health...And Beyond, Dallas, Texas, March 3-5, 2006.
Pan American Allergy Society, Grapevine, Texas, March 9 - 12, 2006.
13th International Symposium on Functional Medicine, Tampa, Florida,
April 19-22, 2006.
American Academy of Environmental Medicine, Kansas City, Kansas, April
27-30, 2006.
American College for Advancement in Medicine, Dallas, Texas, May 5-6,
2006.
Eighth Congress of Olistic Nutrition, Paestum, Italy, May 12-14, 2006.
La Sociedad Mexicana de Alergia en Otorrinolaringología, Saltillo, Coah.
Mexico, August 31 - September 2, 2006.
Defeat Autism Now, Seattle, WA, October 6-8, 2006.
American Academy of Environmental Medicine, St. Louis, Missouri,
February 22-24, 2007.
Pan American Allergy Society, Grapevine, Texas, March 15-18, 2007.
Defeat Autism Now, Alexandria, Virginia, April 19-23, 2007.
25th Annual International Symposium on Man and His Environment in Health
and Disease, Dallas, Texas, June 7-10, 2007.
California Naturopathic Doctors Association, San Diego, California,
October 20 - 21, 2007.
American Academy of Environmental Medicine, Rancho Mirage, California,
October 31 - November 4, 2007.
American Academy of Environmental Medicine, Kansas City, Missouri,
February 28 - March 2, 2008.
Sociedad Mexicana Del Alergia En Otorrinolaringología, A.C., Saltillo,
Coahuila, Mexico, March 5-8, 2008.
II Congreso de Medicina Ambiental, Madrid, Spain, May 30 - June 2,
2008.
26th Annual International Symposium on Man and His Environment in Health
and Disease, Dallas, Texas, June 19-22, 2008.
Curso de Enseñanza en Alergia y Medicina Ambiental, Puebla, Mexico,
September 3 - 6, 2008.
8th National Congress of the Italian Occupational and Environmental
Allergic Dermatology Society (SIDAPA), Florence, Italy, October 23-
25, 2008.
American Academy of Environmental Medicine, Orlando, Florida, October
30 - November 1, 2008.
Pan American Allergy Society, The Woodlands, Texas, March 12-15, 2009.
SOMAO Congress, Xalapa, Ver., Mexico, March 19-21, 2009.

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American Academy of Environmental Medicine, Overland Park, Kansas,
April 2-6, 2009.

Autoimmune Disease Symposium, San Francisco, California, April 22-26,
2009.

27th Annual International Symposium on Man and His Environment in Health
and Disease, Dallas, Texas, June 25-28, 2009.

Congresso Internacional Sobre Medicina Ambiental, September 5-7, 2009,
Manaus, Brazil.

Ontario Association of Naturopathic Doctors: Revolutionizing Medicine,
The Connection Between the Environment and Health. November 13-15,
2009, Toronto, Ontario, Canada.

Pan American Allergy Society, The Woodlands, Texas, March 11-14, 2010.

28th Annual International Symposium on Man and His Environment in Health
and Disease, Dallas, Texas, June 3-6, 2010.

American Academy of Environmental Medicine, LaJolla, California,
October 21-23, 2010.

Advanced Clinical Therapies for Women's Health, Dallas, Texas, November
6, 2010.

Pan American Allergy Society, San Antonio, Texas, March 17-20, 2011.

American Academy of Environmental Medicine, Mpls., Minnesota, April 6-
7, 2011.

American College for Advancement in Medicine, Mpls., Minnesota, April
8-10, 2011.

Southwest College of Naturopathic Medicine conference, Tucson, Arizona,
May 21, 2011.

Indoor Air 2011, Austin, Texas, June 5-10, 2011

Fundacion Alborada y Fundacion Vivosano Organizan el Quinto Congreso
Internacional de Medicina Ambiental, Madrid, Spain, June 24-27,
2011.

II Congresso Internacional De Medicina Ambiental, Sao Paulo, Brazil,
November 19-20, 2011.

12th Annual Scientific Session of the International Lyme and Associated
Diseases Society, Toronto, Ontario, Canada, October 28-30, 2011.

Pan American Allergy Society, Plano, Texas, March 22-25, 2012.

American Academy of Environmental Medicine, Lexington, Kentucky, April
4-6, 2012.

Sixth International Congress of Environmental Medicine, Madrid, Spain,
June 18, 2012.

American Academy of Environmental Medicine, Environmental Influence on
the Brain and Nervous System, St. Petersburg, Florida, October 4-
7, 2012.

Healthy Bodies, Healthy Buildings, International Institute for Bau-
biologie & Ecology, Chantilly, Virginia, October 13-14, 2012.

International Lyme and Associated Diseases Society, Boston,
Massachusetts, November 2-4, 2012.

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ABSTRACTS

1. Laseter, J.L., Rea, W.J., Buckley, T.P., DeLeon, B.S., Antoine, S.R.: Occurrence Of Chlorinated Phenoxy Acid Herbicides And Chlorinate Phenols In Environmentally Sensitive Patients. Presented, American Academy of Environmental Medicine. 1985.
2. Laseter, J.L., DeLeon, B.S., Antoine, S.R., Rea, W.J., Alger, C.: Analysis And Distribution Of Selected Volatile Organics In Whole Blood From Environmentally Sensitive Patients. Presented, American Academy of Environmental Medicine. 1985.
3. Jones, F.M., Butler, J.R., Lawlis, G.F., Rea, W.J.: Psychological Intervention Techniques: Part Of The Clinical Ecology Treatment Team Approach. Presented, American Academy of Environmental Medicine. 1986.
4. Sherek-O'Connor, R., Butler, J.R., Rea, W.J., Johnson, A.R.: Total Stress Load Inventory: A Validation Study. Presented, American Academy of Environmental Medicine. 1986.
5. Rea, W.J.: The Role of The Enzyme Detoxification Systems in Chemical Sensitivity.
6. Rea W.J., Ching, P.Y., Johnson, A.R., Butler, J., Laseter, J.: Organic Solvents - A Possible Etiology For Some Patient's Psychoimmunopathology.
7. Rea, W.J., Fenyves, E.J., Johnson, A.R., Smiley, R.E., and Sprague, D.E.: A Double Blind Study of Chemical Sensitivity.
8. Rea, W.J.: Environmental Effects of ENT And Upper Respiratory System.
9. Rea, W.J.: Controlled Environment for Study of Environmental Pollutants in Buildings.
10. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F., and Fenyves, E.J.: Bronchial Lavage as an Adjunct to the Treatment of Acute Recurring Asthma.
11. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F., and Fenyves, E.J.: Chemical Sensitivity as a Result of Overexposure in The Work Place.
12. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de

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- Victoria, A.L., Tucker, W.F., and Fenyves, E.J.: Formaldehyde Sensitivity Following Exposure to Building Material.
13. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F., and Fenyves, E.J.: The Pancreas as a Target Organ in The Chemically Sensitive Individual.
 14. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., Edgar, R.T., Fenyves, E.J., Greenberg, M., and Williams, M.L.: Food Injection Therapy.
 15. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F., and Fenyves, E.J.: Bronchial Lavage as an Adjunct to the Treatment of Acute Recurring Asthma.
 16. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F. and Fenyves, E.J.: Chemical Sensitivity as a Result of Overexposure in the Work Place.
 17. Rea, W.J., Smiley, R.E., Sprague, D.E., Johnson, A.R., de Victoria, A.L., Tucker, W.F. and Fenyves, E.J.: Formaldehyde Sensitivity Following Exposure to Building Material.
 18. Rea, W.J., M.D., F.A.C.S., F.A.C.A.: Which Environmental Substances Can Cause Illness.
 19. Rea, W.J., M.D., F.A.C.S., F.A.C.A.: Immunological and Non-Immunological Mechanisms.
 20. Rea, W.J., M.D., F.A.C.S., F.A.C.A.: Management of Chemical Exposures.
 21. Kuehn, K.A., Johnson, A.R., Rea, W.J.: Sequential Sampling and Identification of Fungal and Pollen Genera Within the Dallas City Area: The Floral Picture?
 22. Kuehn, K.A., Johnson, A.R., Rea, W.J.: Preliminary Observations on the Airborne Mycofloral Component Within the North Dallas metroplex.
 23. Kuehn, K.A., Johnson, A.R., Rea, W.J.: Airborne Algae: Is It Prevalent? Is It Important?
 24. Kuehn, K.A., Johnson, A.R., Rea, W.J.: Airborne Mycota Identified from Domestic Interiors Within Various Regions of Texas.

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25. Kuehn, Kevin A., Johnson, Alfred R., Rea, William J.:
Ascomycetes: An Overlooked Aeroallergen.
26. Kuehn, Kevin A., Johnson, Alfred R., Rea, William J.:
Superficial Dermatofungal Infection By Common Edaphic Fungal
Species.
27. Kuehn, Kevin A., Rea, William J., Johnson, Alfred R.:
Sequential Sampling and Identification of Pollen Genera Within
The North Dallas Metroplex: Seasonal Variation Over A Three
Year Period.
28. Chen, B., Price, S.C., Bridges, J.W.: How Environmental
Chemicals May Contribute to "Total Body Load" - A Study of the
Effect of Four Compounds on the Liver-Thyroid Axis.
29. Rea, W.J., Pan, Y., Johnson, A.R., Ross, G. H., Suyama, H.,
Fenyves, E.J.: Progress on Persian Gulf War Illnesses.
30. Rea, W.J., M.D., F.A.C.S., F.A.C.A.: Mitogenic Effects of
Mycotoxins on T₄ Lymphocytes.
31. Baird, N., Deborah, Rea, W.J.: The Temporomandibular
Joint, The Implant Controversy.
32. Nicolson, Garth, L., Hyman, E., Both-Korenyi, A., Lopez,
D.A., Nicolson, N., Rea, W., Urnovitz, H.: Progress on
Persian Gulf War Illnesses - Reality and Hypotheses.
33. Higuchi, H., Miyata, M., Ishikawa, S., Rea, W. J.:
Abnormalities of the Autonomic Nervous System in Chemically
Sensitive Patients with Silicone Breast Implants.
34. Rea, W.J., Pan, Y., Fenyves, E.J., Griffiths, B: The
Clinical Implementations of Autogenous Lymphocytic Factor
in the Chemically Sensitive.
35. Rea, W.J., Griffiths, B.B., Griffiths, B., Pan: The Role of
the Cell Cycle and An Autogenous Lymphocytic Factor In Clinical
Medicine.
36. Mehra P, Rea W, MD, Wolford LM, DDS: Metal Hypersensitivity in
Complex TMJ Patients.

POST GRADUATE TRAINING PROGRAMS

- I. From the Environmental Health Center - Dallas, affiliated with:

William J. Rea, M.D.

- A. The University of Texas at Dallas, Ervin Fenyves, Ph.D.
- B. The North Texas State University, Joel R. Butler, Ph.D.

We have now graduated 10 individuals who received their Ph.D. from research done in collaboration with our Center.

- II. Clinical Training, M.D., D.O. - 9 months to 3 years. Programs - 10 individuals have completed.
- III. Research Fellowships from the Faculty of Medicine; Peking Union Medical School, Peking, China, 3 completed.
- IV. We organized and sponsored The International Symposium on Man and His Environment in Health and Disease from 1982 - 2010.
- V. We have an agreement with the Kitasato Medical School Department of Ophthalmology. Satoshi Ishikawa, M.D. is the Dean of Ophthalmology. We have trained 7 of his faculty in ophthalmology, each who have spent a year with us. We have done numerous research projects and published papers on the research.

Electromagnetic Field Sensitivity

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Yaqin Pan, MD
Dept. of Allergy, Beijing Union Medical College Hospital Beijing, PRC

Ervin J. Yenyves, PhD
Dept. of Physics, University of Texas at Dallas

Iehiko Sujisawa, MD. and Hideo Suyama, MD
Dept. of Ophthalmology, Kitasato University Kitasato, Japan

Nasrola Samadi, PhD
Jacksonville State University, Jacksonville, Florida

Gerald H. Ross, M.D., CCFP
Environmental Health Center, Dallas

Source: This article was first published in 1991 in the *Journal of Bioelectricity*, 10(1&2), 241-256. Figure 1 is not included here, but can be obtained by writing Dr. W. J. Rea at the Environmental Health Center, Dallas, 8345 Walnut Hill Lane, Suite 205, Dallas, TX 75231.

Abstract

A multiphase study was performed to find an effective method to evaluate electromagnetic field (EMF) sensitivity of patients. The first phase developed criteria for controlled testing using an environment low in chemical, particulate, and EMF pollution. Monitoring devices were used in an effort to ensure that extraneous EMF would not interfere with the tests. A second phase involved a single-blind challenge of 100 patients who complained of EMF sensitivity to a series of fields ranging from 0 to 5 MHz in frequency, plus 5 blank challenges. Twenty-five patients were found who were sensitive to the fields, but did not react to the blanks. These were compared in the third phase to 25 healthy naive volunteer controls. None of the volunteers reacted to any challenge, active or blank, but 16 of the EMF-sensitive patients (64%) had positive signs and symptoms scores, plus autonomic nervous system changes. In the fourth phase, the 16 EMF-sensitive patients were rechallenged twice to the frequencies to which they were most sensitive during the previous challenge. The active frequency was found to be positive in 100% of the challenges, while all of the placebo tests were negative. We concluded that this study gives strong evidence that electromagnetic field sensitivity exists, and can be elicited under environmentally controlled conditions.

Introduction

Interaction mechanisms that underlie the health and biological effects of electromagnetic fields (EMF) on humans have been studied by many authors.^{1,2,3,4,5,6} This subject was reviewed recently at the 1990 spring meeting of the American Physical Society.⁷ Choy et al.⁸ investigated individuals with multiple sensitivities who reported reactions to various types of electrical equipment, including power lines, electronic office equipment such as typewriters and computer terminals, video display terminals, household appliances (such as hair dryers), and fluorescent lights.

This paper presents preliminary data on electromagnetic field tests using a square wave generator to evaluate the EMF sensitivity of patients reporting such sensitivities under environmentally controlled and monitored conditions.

Materials and Methods

This study was carried out in four phases.

I. The tests were carried out in an environmentally controlled area with porcelain-on-steel walls to minimize airborne chemical pollution which might interfere with the testing procedure. This type of construction also acted to decrease external electromagnetic fields. Portable EMF monitoring devices were used to find an area that would minimize background EMF which might disturb double-blind challenges and interfere with the testing process. The low-pollution room had a background of 0-100 V/m electric field and 20-200 nT (Tesla) magnetic field. The immediate test site of the patients had unmeasurable electrical fields and magnetic fields in the vicinity of 20 nT.

The major emphasis of this phase of the studies was the evaluation of the effects of the magnetic field generated by a coil fed from a sweep/function generator (Model 3030, B.K. Precision Dynascan Corp.). This equipment allowed us to test square wave frequencies from 0.1 Hz to 5 MHz.

The patients were tested while they were sitting comfortably upright in a chair with the generator on a desk at least 2 m away, with its output connected to a coil 6 cm in diameter and 15 cm tall, made of 35 m of cable and positioned on the floor with its center approximately 0.3 m from the feet of the person tested. The mean values of the alternating magnetic field generated by this arrangement were approximately 2900 nT at floor level, approximately 350 nT at the level of the chair seat and patients' knees, and about 70 nT at hand level. The exposure period lasted approximately 3 minutes per challenge.

Before the EMF challenge, blood pressure, pulse rate, respiratory rate, temperature, sign and symptom scores, and autonomic nervous system functions were tested. The autonomic nervous system function was tested with a binocular iriscorder (Model C2515, Hamamatsu Photonics), which measured pupil area, time at which constriction and dilation occurred, and rate of constriction/dilation.⁹

All patients had been previously evaluated and treated for biological inhalant, food, and chemical sensitivities in order to minimize possible confusion from coexisting problems. The patients were stabilized on a healthy diet in a constant low-pollution environment. In addition, they had their overall body load reduced and stabilized in a controlled environment.

II. This was a single-blind screening of 100 patients who complained of being EMF-sensitive. They were challenged under low-pollution conditions using the sweep/function generator at 0.1, 0.5, 1, 2.5, 5, 10, 20, 40, 50, 60, and 100 Hz; then at 1, 5, 10, 20, 35, 50, 75, and 100 KHz; and finally at 1 and 5 MHz. There were twenty-one active challenges and five blanks (placebos) per person, giving a total of 2600 challenges. When the number and/or intensity of symptoms were 20% over baseline, the result was considered positive, and were recorded as such under the various criteria used. A change in the iriscorder readings more than two standard deviations from baseline was also recorded as a positive result.

III. Twenty-five patients who were found to be positive in phase II challenges and who had no more than one placebo reaction were then selected for a third phase of the study. In addition, 25 healthy naive volunteers were challenged. Double-blind EMF challenges and placebos using the aforementioned parameters were performed. There were 1300 total challenges, of which 1050 were active and 250 were blanks. The tests averaged 21 active frequencies and 5 blanks per subject.

IV. Sixteen patients who reacted in phase III were then rechallenged on two separate occasions in a double-blind manner, using only the frequencies to which they had responded most strongly. For each subject, the frequency of maximum sensitivity was inserted randomly into a series of 5 placebo challenges. Thus, there were a total of 32 active challenges and 160 blanks.

Results

Phase I. The EMF measurements were quite reproducible. We found that the lights and air handling equipment had to be off during the tests because of their electromagnetic field output. Baseline studies on patients were completed without remarkable result.

Phase II. Of the total of 100 patients tested in the single-blind study, 50 reacted to several of the placebos in addition to the active challenges, and were excluded from further study. Twenty-five subjects who did not react to any active challenges were also excluded. A final 25 subjects who did react to active challenges, but not to blanks, were selected for the third phase of the study (Table 1).

Phase III. The 25 subjects selected from phase II were rechallenged, and 16 (64%) reacted positively to the active challenges. The total number of positive reactions to the 336 active challenges in the 16 patients was 179 (53%), as compared to 6 positive reactions out of 60 blanks (7.5%). There were no reactions to any challenge, active or placebo, in the volunteer group of naive subjects (Table 2).

When evaluating frequency response, 75% of the 16 patients reacted to 1 Hz, 75% to 2.5 Hz, 69% to 5 Hz, 69% to 10 Hz, 69% to 20 Hz, and 69% to 10 KHz (Table 3). No patient reacted to all 21 of the active frequencies in the challenges. The average was 11 reactive frequencies per patient, with a range of 1 to 19 positive responses.

The principal signs and symptoms produced were neurological (tingling, sleepiness, headache, dizziness, unconsciousness), musculoskeletal (pain, tightness, spasm, fibrillation), cardiovascular (palpitation, flushing, tachycardia, edema), oral/respiratory (pressure in ears, tooth pains, tightness in chest, dyspnea), gastrointestinal (nausea, belching), ocular (burning), and dermal (itching, burning, pricking pain) (Table 4). Most reactions were neurological.

Phase IV. In the 16 patients again rechallenged in a double-blind manner, using only the single frequency to which they were most sensitive, all reported reactions to the active frequencies when challenged. None reacted to the placebos (Table 5). Signs and symptoms in all 16 patients were positive as was the autonomic nervous system dysfunction, as measured by the iriscorder (Table 6, Figure 1). Examples of changes were a 20% decrease in pulmonary function and a 40% increase in heart rate. In the 16 patients with positive reactions to EMF challenges, two had delayed reactions; gradually became depressed and finally became unconscious. Eventually, they awoke without treatment. Symptoms lasted from 5 hours to 3 days.

Discussion

Since it has been found that electromagnetic fields can affect health, researchers have investigated these phenomena *in vivo* and *in vitro*, in animals^{10,11,12} and humans.^{1,2,3,4,5,6,7} No individual had been specifically challenged in an attempt to reproduce acute symptoms until Smith and Monro⁵ followed by Choy, Monro, and Smith,⁸ who used a series of oscillators of varying frequency to trigger symptoms in electrically sensitive patients. We modified this procedure by developing controlled environmental area, where baselines were constantly monitored for particulates, pollutants, and extraneous fields. Here, controlled EMF output was applied so that data would be more reproducible.

Several factors have led us to believe that we have reproducible results. Meticulous construction of environmental rooms made a great difference in the reproducibility of test results. Prior to the use of such facilities and careful monitoring, a variety of factors, such as diet, exposure to chemicals, EMF, or dust gave rise to symptoms which would have been mistaken for placebo reactions. Such effects were minimized here, as evidenced by the small number of placebo reactions. A few patients reacted to the fields generated by the monitoring devices (Irisorder, EKG, and computers) and had to be dropped from the study as too fragile for accurate analysis. Some patients reacted to the fields generated by the fluorescent lights, and others did not present the same signs and symptoms at each challenge, even though the reactions were significant when contrasted with the blank responses. The Irisorder data were objective, however, and were always reproducible (Figure 1).

We also noted that patients sometimes had delayed or prolonged responses. Therefore, care had to be taken to be certain that the patient had returned to baseline before the next challenge. This carry-over was first noted when evaluating responses to placebo challenges. Such a

response could usually be explained and eliminated by use of longer intervals between challenges.

In this study, of the 100 patients who expressed suspicion of EMF sensitivity, 75 actually responded to fields, whereas none of the controls did. Of the 75, 25 had no reactions to blanks, whereas 50 did, and thus were discarded from the study; even though we felt that some of the reactions to blanks might be evidence of delayed reaction to previous frequencies, or prolonged response to the previous positive challenge, as well as true placebo reactions.

We learned that challenge with 21 frequencies was impossible on many sensitive patients. They were often unwell for several hours or days, which confused the data from repeat challenges on subsequent days. Hence, we selected the one frequency of maximum sensitivity for repeat challenges in the phase IV studies.

When one compares the various groups to controls, it is clear that there is a group of patients who have unstable response systems which appear different from those of the individuals who acted as controls. These studies show that EMF sensitivity could be elicited under environmentally controlled conditions. As a result of the weak field levels and short exposure time, the responses were mild except in two patients whose symptoms were so severe (e.g., drop attack, severe itching) that they received intravenous vitamin C, magnesium, and oxygen as a result of the prolonged and delayed reactions.

Signs and symptoms appeared similar to those seen in food or chemically sensitive patients at the Environmental Health Center-Dallas, and included neurological, musculoskeletal, cardiovascular, respiratory, gastrointestinal, dermal, and ocular changes. The neurological symptoms were most common. Similar responses have been recorded by others in the literature.^{5,6,7,6,13,14} In 1972, after the Soviets reported that electrical utility workers were suffering from listlessness, fatigue, and nausea, Subrahmaniam and coworkers¹³ investigated and reported decisive changes in cardiac function and bioamine levels when pulses of 0.01 and 0.1 Hz were used. They found significant changes in the hypothalamus in response to the EMF fields.

In these studies, the preponderance of reactions occurred at one to 10 Hz, which accords well with their observations. However, many reactions also occurred at 50 and 60 Hz, as well as some up to 5 MHz. We conclude that in any given individual susceptibility may develop to any frequency and produce reactions.

Static magnetic fields are known to cause increased blood pressure on some individuals.¹⁴ Choy and coworkers⁸ found that EMF reactions in EMF sensitive patients were not limited to the nervous system, but occurred in the same systems as in these studies, which basically corroborate theirs, though neurological symptoms predominated in our experiments.

Over the past 30 years, numerous investigations with animals and a few epidemiological studies of human populations have been devoted to assessing the relationship of microwave exposure to cataract development. The severity and speed of formation depends not only on intensity, but also on wavelength and duration of exposure.¹⁶⁻²¹ McCally et al.²² reported damage to corneal epithelium in *Cynomolgus* monkeys after 2.45 GHz irradiation for several hours at only 20-30 mW/cm² (CW) or even 10-15 mW/cm² with pulsed fields. Therefore, the results of Paz²³ strongly suggests that the potential for eye injury exists in surgery where EMF fields are present.

In our experience, the patients' clinical responses could not always be reproduced completely, but the objective Iriscorder, EKG, and respirometer could be. However, the responses were definitely different from controls or placebo challenges. In our experience over the years, we have found partial reproduction of symptoms on repeat challenge to be as significant as total reproduction. Therefore, significant differences from controls in objective measurements were deemed valid.

There are several explanations for lack of exact reproducibility. These are the following: (a) the patients' total body loads were different at different exposure periods. For example, some patients may only respond to EMF when in a reactive hypersensitive state;^{5,8} (b) tissue resistance could influence the effect of the EMF. Zimmerman²⁴ reported that electrical resistance of skin decreased with increasing temperature and increased with progressive drying, as might be expected; (c) injections of antigen neutralizing substances prior to test may have reduced the response to EMF. One patient with asthma was sensitive to high voltage power lines as well as low voltage house wiring. He experienced muscle spasms in head, neck, arms, and legs. This patient was also sensitive to dust, weeds, dust mites, and some foods. He reacted in our tests to 2.5 and 60 Hz and to 5 and 50 KHZ with tightness in the chest. He then received an antigen shot to neutralize his hypersensitivity reactions. Five months later, he was unreactive to EMF; (d) weather changes might affect the results, since we know that the weather can influence the propagation of EMF, as may alterations in the geomagnetic fields. Since humidity, pollution, temperature, etc. can affect resistance and total body load, weather should perhaps affect the results. Adverse weather (inversions, for example) may increase pollution load, while good weather lessens it. There is some evidence of resonance between geomagnetic fields and an applied ac magnetic field,²⁵ which implies that the results may depend in part at least upon the strength and orientation of the geomagnetic field in the test area; and (e) different wave forms might cause different responses. In these experiments, we used only square wave inputs to the coils. Consequently, we do not know whether other wave forms (sine, sawtooth, triangular, etc.) might induce different types or intensities of reactions.

Thus far, definitive information has not been sufficient to identify a plausible mechanism for EMF interactions with biological tissue. Interactions appear to take place at the cell surface, perhaps acting on receptor sites and altering ion and molecular transport across the membranes.²⁵ Further work remains to be done in the field.

It is clear that EMF sensitivity is a real phenomenon in some environmentally sensitive patients, because some had consistent reactions while none of the controls did. This study must be considered as only preliminary, but the evidence clearly points to sensitivity in some people.

In conclusion, it is evident that EMF testing is at a rudimentary stage; but clearly EMF sensitivity exists and can be elicited under environmentally controlled conditions. Further studies are needed to investigate the effects of EMF fields on human health.

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Table 1

Phase II — Single-blind Challenge of 100 Patients				
No. of Patients	No. of Active Challenges	No. of Blank Challenges	Positive Reactions to Active Challenges	Positive Reactions to Blanks
50	1050	250	750	150
25	525	125	0	0
25	525	125	325	0

Table 2 Phase III — 25 Patients Previously Positive Rechallenged and 25 Controls Tested Double-Blind				
No. of Persons	No. of Active Challenges	No. of Blank Challenges	Positive Reactions to Challenges	Positive Reactions to Blanks
16 patients (out of 25 reacting positively)	336	80	179	6
25 controls (none of them reacting positively)	525	125	0	0

Table 3 Percentage of 16 Patients with Positive Reaction to Different Frequencies				

Frequency (Hz)	Patients with Positive Reaction (%)	Frequency (Hz)	Patients with Positive Reaction (%)
0.1	31	1K	56
0.5	44	5K	38
1.0	75	10K	69
2.5	75	20K	56
5.0	69	35K	31
10.0	69	50K	50
20.0	69	75K	50
40.0	50	100K	38
50.0	50	1M	50
60.0	63	5M	31
100.0	56		

Table 4
Comparison of Symptoms and Signs Induced by Frequencies

Hz	# Patients w/pos reaction	Neurological		Musculoskeletal		Cardiovascular		Respiratory		Gastrointestinal		Eyes		Skin	
		# of Pts	%	# of Pts	%	# of Pts	%	# of Pts	%	# of Pts	%	# of Pts	%	# of Pts	%
0.1	5	3	60	0	0	0	0	0	0	1	20	0	0	0	0
0.5	7	4	57	0	0	0	0	0	0	0	0	0	0	0	0
1	12	4	33	3	25	0	0	1	8	1	8	0	0	0	0

2.5	12	5	42	2	17	0	0	1	8	1	8	0	0	0	0
5	11	5	46	0	0	1	9	2	18	1	9	0	0	0	0
10	11	7	64	1	9	0	0	2	18	0	0	0	0	0	0
20	11	4	36	0	0	1	9	1	9	1	9	0	0	0	0
40	8	4	50	0	0	0	0	2	25	0	0	0	0	1	13
50	8	5	63	0	0	2	25	1	13	0	0	0	0	0	0
60	10	5	50	0	0	1	10	3	30	0	0	0	0	0	0
100	9	4	44	0	0	1	11	2	22	1	11	0	0	0	0
1K	9	6	67	0	0	1	11	0	0	0	0	1	11	0	0
5K	6	2	33	1	17	0	0	1	17	0	0	0	0	0	0
10K	11	4	36	1	9	0	0	0	0	0	0	0	0	0	0
20K	9	5	56	0	0	2	22	0	0	0	0	0	0	1	11
35K	5	2	40	0	0	0	0	1	20	0	0	0	0	1	20
50K	8	2	25	0	0	1	13	2	25	0	0	0	0	1	13
75K	8	1	13	0	0	1	13	3	38	0	0	1	13	0	0
100K	6	2	33	2	33	0	0	2	33	0	0	0	0	0	0
	8	4	50	1		0	0	0	0	0	0	0	0	0	0

1M					13										
5M	5	2	40	1	20	0	0	0	0	0	0	0	0	0	0

Table 5
Phase IV—Sixteen Patients Rechallenged to One Active Frequency on Two Separate Episodes and in Addition to Five Blank Challenges on Each Episode—Double-blind

First Episode of Challenge				
No. of Patients	Total No. of Frequencies	Total No. of Blanks	No. of Patients Reacting to Active Challenge	No. of Patients Reacting to Blanks
16	16	80	16	0
Second Episode of Challenge				
No. of Patients	Total No. of Frequencies	Total No. of Blanks	No. of Patients Reacting to Active Challenge	No. of Patients Reacting to Blanks
16	16	80	16	0

Table 6
Parameters of 25 Normal Controls' Pupillary Light Reflex—Irisorder—EHC-Dallas
(Right and Left Eyes Combined)

Parameter	$\bar{x} \pm$ SD	% Variation

Al	5.70	=	3.58	10.0
Cr	0.46	=	0.048	10.4
T2	190.74	=	18.36	9.6
VC	49.67	=	5.86	11.8
AC	503.20	=	75.80	15.1
T5	1520.04	=	286.86	18.7
VD	13.65	=	2.44	17.9