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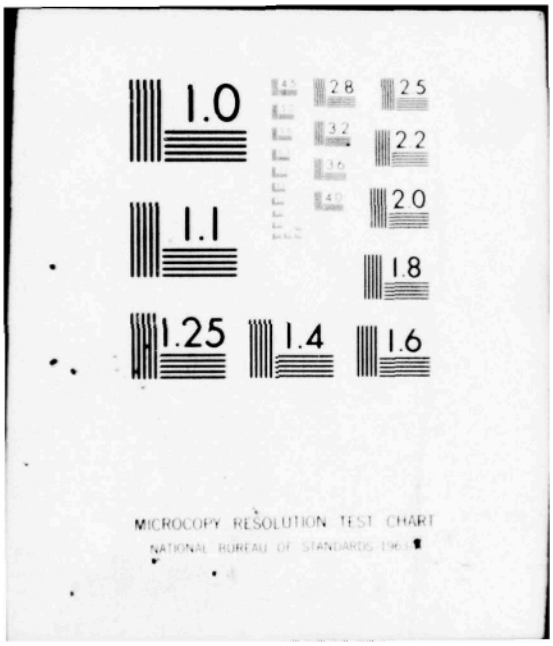
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13. ABSTRACT

Biological Effects of Electromagnetic Radiation serves as a vehicle through which current documentation of research highlights on the biological effects and health implications of non-ionizing electromagnetic radiation (microwave and radiofrequency radiation) are compiled, condensed and disseminated on a regular basis. Biological Effects of Electromagnetic Radiation is intended to be a highly useful current awareness tool for scientists engaged in research or related activities. The great number of diversity of relevant publications make imperative the availability of this service to persons whose work requires that they keep abreast of current developments in the field.

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BIOLOGICAL EFFECTS OF ELECTROMAGNETIC RADIATION

A Digest of Current Literature and a Forum of Communication

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Biological Effects Electromagnetic Radiation II(1), March 1975

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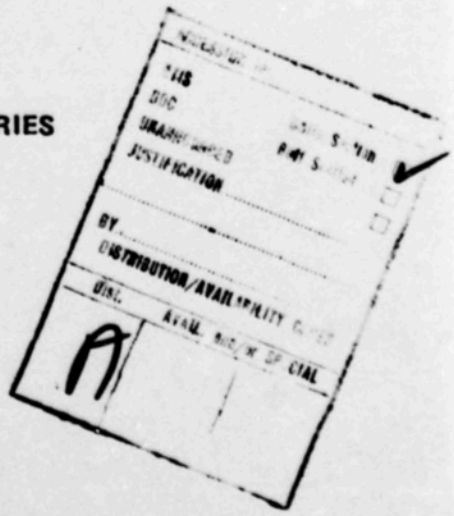
Literature Selected and Abstracted
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Biomedical Section

Bruce H. Kleinstein, Ph.D., Technical Editor



PREFACE

Biological Effects of Electromagnetic Radiation is a publication researched and prepared by the Franklin Institute Research Laboratories, Science Information Services Department, under a grant from the U. S. Army Research Office. The grant is co-sponsored by the Bureau of Radiological Health, Food and Drug Administration; Office of Naval Research; U. S. Navy Bureau of Medicine and Surgery; U. S. Air Force School of Aerospace Medicine; and the Walter Reed Army Institute of Research. The U. S. Environmental Protection Agency is cooperating in this project.

Biological Effects of Electromagnetic Radiation serves as a vehicle through which current documentation of research highlights on the biological effects and health implications of nonionizing electromagnetic radiation (microwave and radiofrequency radiation) are compiled, condensed and disseminated on a regular basis. *Biological Effects of Electromagnetic Radiation* is intended to be a highly useful current awareness tool for scientists engaged in research or related activities. The great number and diversity of relevant publications make imperative the availability of this service to persons whose work requires that they keep abreast of current developments in the field.

Biological Effects of Electromagnetic Radiation is published quarterly. Volume I, 1974, consists of three issues, which cover the scientific literature published from July 1973 through December 1974. The first several issues also cover past work of importance. The quarterly issues of Volume II, and future volumes, will include materials received during the preceding three months. Each issue will include news items and announcements, a listing of meetings and conferences, abstracts of current literature, and a directory of current research. Articles carried over because of space limitations and materials for which full text is not available will be included as citations. When available, a special report section, technical note, book review, or topical retrospective literature survey will be included.

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ABBREVIATIONS AND ACRONYMS

(used in this issue)

- A -

A - ampere (also amp)
ac - alternating current
AMP - adenosine monophosphate
ANSI - American National Standards Institute
ATP - adenosine triphosphate

- B -

BRH - Bureau of Radiological Health
BSI - British Standards Institute

- C -

c - cyclic
C - Centigrade
CL - Current Literature
cm - centimeter
CNS - central nervous system
cps - cycles per second
CR - Current Research
CW - continuous wave

- D -

dB - decibel
dc - direct current
DNA - deoxyribonucleic acid
DOD - Department of Defense

- E -

ECG - electrocardiogram
EEG - electroencephalogram
E-field - electric field strength (V/m)
EHF - extremely high frequency
ELF - extremely low frequency
EM - electromagnetic
EMC - electromagnetic compatibility
EMF - electromagnetic field
EMI - electromagnetic interference
EMP - electromagnetic pulse
EMR - electromagnetic radiation
EPA - Environmental Protection Agency
ES - electrostatic
ESF - electrostatic field

- F -

f - frequency
FDA - Food and Drug Administration
FM - frequency modulation

- G -

g - gram
GHz - gigahertz
GMP - guanosine monophosphate

- H -

HEW, DHEW - Dept. of Health, Education and Welfare
HF - high frequency
HFC - high frequency current
H-field - magnetic field
hr - hour
Hz - hertz

- I -

IEEE - Institute of Electronic and Electrical Engineers
IMPI - International Microwave Power Institute
i.p. - intraperitoneal
ISM - assigned industrial, scientific and medical frequencies
i.v. - intravenous

- J -

J - joule
JPRS - Joint Publication Research Service

- K -

kg - kilogram
kHz - kilohertz
km - kilometer
kV - kilovolt
kW - kilowatt

- L -

l - liter
LF - low frequency

- M -

m - meter
mA - milliampere
mc - megacycle
mEq - milliequivalent
MF - medium frequency
mg - milligram
mho - unit of measurement of conductivity
MHz - megahertz
MIC - microwave integrated circuit
min - minute
ml - milliliter
mm - millimeter
mmho - millimho
mon - month
mW - milliwatt
Mw - megawatt
MW - microwave
mV - millivolt

- N -

NBS - National Bureau of Standards
NIH - National Institutes of Health
NIR - nonionizing radiation
nm - nanometer
NMR - nuclear magnetic resonance
nsec - nanosecond
NSF - National Science Foundation
NIOSH - National Institute for Occupational Health and Safety
NTIS - National Technical Information Service

- O -

ONR - Office of Naval Research

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ABBREVIATIONS AND ACRONYMS (continued)

- P -

P - pulsed
PFD - power flux density
PHA - phytohemogglutinin
PHS - Public Health Service

- R -

r - Roentgen
rad - radiation absorbed dose
RBC - red blood cell
RF - radiofrequency
RMF - rotating magnetic field
RNA - ribonucleic acid
rpm - revolutions per minute

- S -

s.c. - subcutaneous
sec - second
SHF - super high frequency

- U -

U - units
UHF - ultra high frequency
USAFSAM - U.S. Air Force School of Aviation Medicine
USDA - U.S. Dep. of Agriculture
UV - ultraviolet

- V -

V - volt
VA - Veterans Administration
VLF - very low frequency

- W -

W - watt
Wb - unit of measurement of magnetic flux
WBC - white blood cell
WG - waveguide
WHO - World Health Organization
wt - weight
wk - week

Symbols

ε - dielectric constant
λ - wavelength
μ - micro
σ - specific conductance
Ω - ohm

Biological Effects Electromagnetic Radiation II(1), March 1975

NEWS ITEMS

INTERNATIONAL SYMPOSIUM ON BIOLOGIC EFFECTS, WARSAW, POLAND, 1973

Abstracts of the Proceedings of the International Symposium on Biologic Effects and Health Hazards of Microwave Radiation, which was held in Warsaw, Poland, October 15-18, 1973, are included in the Current Literature section of this issue of *Biological Effects of Electromagnetic Radiation Digest* (CL 0404 through CL 0450). The proceedings were published last year by Polish Medical Publishers, and the full-text articles from the book have been used for the abstracts presented here. Dr. Sol M. Michaelson's contribution "Thermal Effects of Single and Repeated Exposures to Microwaves--A Review," was included in Volume I, issue 2, of the *Digest*, as CL 0087, and is not repeated. Dr. Michaelson's evaluation of the symposium has been included instead, and appears as CL 0451.

EMC SYMPOSIUM, MONTREUX, 1975

The EMC Symposium being held in Montreux, Switzerland, May 20-22, 1975, is considered to be the "first" of its kind in Europe. The aim of the event is to promote interdisciplinary contacts and exchange of information on problems which may be described as "protection of the EM environment." The conference will treat problems of the interaction of EM energy with electronic and biological systems, the immunity of electronic systems to interference, as well as their compatibility with the EM environment.

The Symposium is held under the auspices of the Director-General of the Swiss PTT. Cosponsors are the URSI, IEEE, SAE, CISPR, the Association of Polish Electrical Engineers, and the Convention of the Societies of Electrical Engineers of Western Europe. The keynote address, opening day, May 20, by Professor R. M. Showers, University of Pennsylvania, is entitled "Electromagnetic Compatibility Comes of Age." The 36 papers presented that day will include those in a session on "EMC and the Hospital." On Thursday, the 22nd, 44 papers will be delivered. Among the sessions is one on the "Biological Aspects of EMC."

The largest number of contributions on all topics comes from the United States, followed by Poland, Germany, Switzerland and England. Papers were also contributed from Japan, Australia, India, USSR, Czechoslovakia, the Scandinavian countries, the Netherlands, Austria, Italy, France, Bulgaria and Canada. The full text of the 118 papers and 15 summaries will be made available in a 550-page report, *Electromagnetic Compatibility 1975*. Papers presented on biological effects of EM radiation will be abstracted in a later issue of the *Digest*.

For further information contact: Mr. T. Dvorak, ETH-HF, Sternwartstrasse 7, 8006 Zurich, Switzerland. Phone (Zurich) 32 62 11, Ext. 2790.

MICROWAVE OVEN LEAKAGE DETECTOR

A device that provides a fast measurement of EM leakage fields from MW ovens is now available from REL Equipment & Components, Croft House, Bancroft, U.K.

Known as Apollo XI, the hand-held RF monitor is designed to indicate the recommended safe limits of RF radiation specified by HEW and BSI. The unit monitors the 2425 to 2475 MHz frequency band. It is calibrated with a direct reading scale from 0 to 10 mW/cm^2, with a cardinal point at 5 mW/cm^2 indicating the exposure and emission standards. Accuracy is said to be ± 1 dB for planewaves of all polarization. A 9 V battery powers the monitor. *Electrical Review*, 196(6):203, 1975.

JOINT RESEARCH EFFORT

Recently, 24 monkey phantoms and one human phantom were transported under the supervision of Dr. Curtis Johnson from the University of Utah, Salt Lake City, to Brooks Air Force Base, Texas. The phantoms will be evaluated in the School of Aerospace Medicine's EM irradiation chambers. The preliminary tests, also in collaboration with Dr. Arthur Guy and associates, University of Washington, were conducted in preparation for more extensive tests during April. *Utah Bioengineering Newsletter*, March-April, 1975.

ITEMS FROM THE COMMERCE BUSINESS DAILY

- COMPARISON OF THEORETICAL AND EXPERIMENTAL ABSORPTION OF RADIOFREQUENCY POWER.

The R&D Contracts Division, Brooks Air Force Base, Texas, has contracted with the University of Utah, Salt Lake City, for the above study. (January 22, 1975)

- ANALYZING AND PREPARING THE AVAILABLE WORLD LITERATURE ON THE BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION.

Negotiations are being conducted between the Contracting Branch, U. S. Army Medical R&D Command, and Mead Technology Laboratories, Dayton, Ohio. (See CR 0103, this issue, for a brief description of the project.) (February 12, 1975)

- MICROWAVE EFFECTS STUDIES.

The Office of Naval Research, Arlington, Virginia, has contracted with the University of Washington, Seattle, for the above study. (March 28, 1975)

- EFFECTS OF HIGH LEVEL EXPOSURE TO MICROWAVE RADIATION.

The Food and Drug Administration proposes to negotiate a contract with the American Health Foundation for the above study. (March 31, 1975)

- STUDY THE BEHAVIORAL EFFECTS OF ANIMALS EXPOSED TO MICROWAVE RADIATION.

The Food and Drug Administration proposes to negotiate a continuation and expansion of ongoing work with

Randomline, Inc., Willow Grove, Pennsylvania. (March 31, 1975)

IMPI REPORTS...

The World Health Organization (WHO) has designated the Bureau of Radiological Health as the WHO Collaborating Center for Standardization of Protection Against Nonionizing Radiation, for the next three years. The Center is to assist WHO in estimating present levels and trends of human exposure from nonionizing radiation; promoting the establishment of instrumentation calibration and reference services in various countries; establishing internationally acceptable nomenclature, definitions, and dosimetry methods; training public health personnel; establishing nonionizing radiation control programs; and stimulating research. It is expected that the Bureau's new assignment will greatly aid in the exchange of scientific information on radiation biology between the United States and other countries.

At a public meeting in December, in Rockville, Maryland, the need for a MW oven standards amendment was debated. It was proposed that the standard be amended to prevent the sale of ovens in which the concealed interlock is clearly visible and readily susceptible to defeat. The amendment also would clarify the test criteria for assuring that the insertion of an object into the oven while the door is closed does not cause microwave leakage in excess of the limit set. The Bureau of Standards will announce its decision soon after the first of the year.

An information exchange program related to the regulation of radiation-producing electronic products was formalized last week between FDA's Bureau of Radiological Health and the Canadian Department of National Health and Welfare's Health Protection Branch. The program will provide a mechanism for communicating information and experience in conducting national compliance programs.

IMPI Newsletter 3(1), 1975

USNC/URSI SERIES ON BIOLOGICAL EFFECTS OF ELECTROMAGNETIC RADIATION ANNOUNCED

The United States National Committee of the International Union of Radio Science (USNC/URSI) has announced that its 1975 meeting, October 20-23, 1975, at the University of Colorado, Boulder, will include the following topics:

General Effects of Electromagnetic Fields
Behavioral, Neural and CNS Effects
Cellular and Biochemical Effects
Quantification and Measurements
Medical and Biological Applications

Sessions will be organized by the Program Committee for the Bio-Effects Series, which includes: A. W. Guy, C. C. Johnson and S. W. Rosenthal. The deadline for abstracts in this Series is July 1. Abstracts and inquiries should be directed to:

Prof. A. W. Guy
Dept. of Rehabilitation Medicine, RJ-30
University Hospital
Seattle, Washington 98105
(206) 543-1071

A call for papers, which includes detailed abstract information, has been mailed. Talks are limited to 20 minutes; abstracts should be 200 to 245 words, submitted with two copies. An abstract form is included in the back of this issue of the *Digest*.

Papers presented in this Series will appear in a special issue of *Radio Science*, early in 1976.

MEETINGS AND CONFERENCES

****** 46TH ANNUAL SCIENTIFIC MEETING, AEROSPACE MEDICAL ASSOCIATION**

Date: April 28 - May 1, 1975
Place: San Francisco, California
Sponsor: Aerospace Medical Association
Requests for Information: Dr. M. H. Goodwin, Exec. Vice President, Aerospace Medical Association, Washington National Airport, Washington, D. C. 20001

Selected Bibliography of Papers to be Presented:

MEDICAL SURVEY OF PERSONNEL OCCUPATIONALLY EXPOSED TO NONIONIZING ELECTROMAGNETIC RADIATION. W. C. Milrow (Naval Surf. Weapons Cent., Dahlgren, Va.)

****** 1975 INTERNATIONAL MICROWAVE SYMPOSIUM**

Date: May 12-14, 1975
Place: Palo Alto, California
Sponsor: San Francisco Chapter MTT-S
Requests for Information: 1975 IEEE G-MTT International Microwave Symposium, Rickeys Hyatt House, 4219 El Camino Real, Palo Alto, California 94306, (415) 493-8000

Selected Bibliography of Papers to be Presented:

RESONANT ELECTROMAGNETIC POWER DEPOSITION IN MAN AND ANIMALS. O. P. Gandhi (Electr. Eng. Dep., Univ. Utah, Salt Lake City).

NONINVASIVE MICROWAVE MEASUREMENT OF RESPIRATION. J. C. Lin (Electr. Eng. Dep., Wayne Univ., Detroit, Mich.).

COMPLEX PERMITTIVITY AND PENETRATION DEPTH OF CERTAIN BIOLOGICAL TISSUE BETWEEN 40 AND 90 GHz J. Edrich (Univ. Denver, Colo.) and P. C. Hardee.

DIELECTRIC MEASUREMENTS FOR THE DESIGN OF A PHANTOM EYE. M. R. Foster (Mass. Inst. Tech., Cambridge) and W. B. Westphal.

EFFECT OF MICROWAVE FIELDS ON RABBIT VAGUS NERVES AND SUPERIOR CERVICAL GANGLIA. C. K. Chou (Univ. Washington, Seattle) and A. W. Guy.

MICROWAVE IRRADIATION DESIGN USING DIELECTRIC LENSES. H. S. Ho (HEW, Rockville, Md.), G. J. Hagan, and M. R. Foster.

A NONPERTURBING LIQUID CRYSTAL FIBEROPTIC MICROWAVE POWER PROBE. O. P. Gandhi (Electr. Eng. Dep., Univ. Utah, Salt Lake City) and T. C. Rozzell.

FIBEROPTIC MICROPROBES FOR MICROWAVE ELECTROMAGNETIC FIELDS MEASUREMENT. A. Deficis (Lab. du D.E.R.M.O., O.N.E.R.A.-C.E.R.T., Toulouse, France).

****** SYMPOSIUM & TECHNICAL EXHIBITION ON ELECTROMAGNETIC COMPATIBILITY**

Date: May 20-22, 1975
Place: Montreux, Switzerland
Cosponsors: International Union of Radio Science, Prof. Group on EMC of the Inst. of Electrical and Electronic Engineers, Comm. AE-4 on EMC of the Soc. of Automotive Engineers.
Requests for Information: T. Dvorak, Secretary General, ETH-HF, 7 Sternwartstrasse, 8006 Zurich, Switzerland.

Selected Bibliography of Papers to be Presented:

SOME EMC PROBLEMS IN HOSPITALS. A. Kirkeby (Birch & Krogboe, Virum, Denmark).

ELECTROMAGNETIC ENVIRONMENTS IN MAJOR MEDICAL FACILITIES. J. C. Toler (Georgia Inst. Tech., Atlanta, Ga.).

A COST EFFECTIVE METHOD FOR ASSESSING ELECTROMAGNETIC PERFORMANCE OF DEMAND PACEMAKERS. J. J. Crenca (Atlantic Res. Corp., Alexandria, Va.).

ENERGY DENSITY: A PROPOSED PARAMETER FOR ASSESSING ELECTROMAGNETIC PERFORMANCE OF DEMAND PACEMAKERS. J. C. Toler (Georgia Inst. Tech., Atlanta, Ga.).

ELECTROMAGNETIC ENVIRONMENT TO PACEMAKERS IN TERMS OF MODULATION FREQUENCY AND FIELD STRENGTH. R. Schlentz (Medtronics Corp., Minneapolis, Minn.).

QUANTIFICATION OF HAZARDOUS RF FIELDS. H. Korniewicz (Centralny Instytut Ochrony Pracy, Warsaw, Poland,.

MICROWAVE POLLUTION OF THE ENVIRONMENT AND THE ECOLOGICAL PROBLEM. J. Bigu del Blanco (Queen's Univ., Kingston, Canada) and C. Romero-Sierra.

MICROWAVE POWER DENSITY MEASUREMENT IN THE PRESENCE OF BIOLOGICAL SPECIMENS. J. Bigu del Blanco (Queen's Univ., Kingston, Canada) and J. A. Tanner.

EFFECTS OF PULSE MODULATED MICROWAVE ENERGY ON ISOLATED FROG HEART. R. Chapman (Univ. Illinois, Urbana) and C. Cain.

•••• 10TH ANNUAL MICROWAVE POWER SYMPOSIUM

Date: May 27-30, 1975
Place: University of Waterloo, Waterloo, Ontario, Canada
Sponsor: International Microwave Power Institute
Requests for Information: IMPI, Box 1556, Edmonton, Alberta, Canada

Selected Bibliography of Papers to be Presented:

MICROWAVE HEATING OF MALIGNANT MOUSE TUMORS AND TISSUE EQUIVALENT PHANTOM SYSTEMS. J. E. Robinson (Univ Maryland Sch. Med., Baltimore), D. McCulloch and E. A Edelsack.

ENERGY DEPOSITION IN HOMOGENEOUS AND MULTILAYER TISSUE SPHERES AND EFFECT OF CIRCULATION. H. P. Schwan (Dep. Bioeng., Univ. Pennsylvania, Philadelphia) and H. N. Kritikos.

COLOUR THERMOGRAPHY AND MICROWAVE RADIOMETRY: THEIR APPLICATION TO BIOLOGICAL SYSTEMS UNDER MICROWAVE RADIATION EXPOSURE. J. Bigu del Blanco (Anat. Dep., Queen's Univ. Kingston, Ontario) and C. Romero-Sierra.

MICROWAVES IN TUMOR THERAPY. F. Dietzel (Cent. Radiol., Justus Liebig Univ., Giessen, W. Germany).

ELECTROMAGNETIC THAWING OF FROZEN GRANULOCYTES. C. P. Burns (Georgia Inst. Tech., Atlanta) E. C. Burdette and V. P. Popovic.

FAST FIXATION OF BRAIN IN VIVO BY HIGH INTENSITY MICROWAVE IRRADIATION FOR NEUROCHEMICAL STUDIES. S. H. Butcher (Dep. Pharmacol., Univ. California, Los Angeles), L. L. Butcher, M. S. Harms and D. J. Jenden.

A NEW TECHNIQUE FOR MEASURING POWER DEPOSITION PATTERNS IN PHANTOMS EXPOSED TO EM FIELDS OF ARBITRARY POLARIZATION--EXAMPLE, THE MICROWAVE OVEN. A. W. Guy (Bioelectromagnetics Res. Lab., Univ. Washington Sch. Med., Seattle), M. D. Webb and J. A. McDougall.

BIOLOGICAL ALTERATIONS OBSERVED UNDER MICROWAVE IRRADIATION. A. Deficis (Lab. D.E.R.M.O., O.N.E.R.A.-C.E.R.T., Toulouse, France), J. S. Dumas, S. Laurens.

LOW LEVEL MICROWAVE EFFECTS ON THE TOTAL IRON BINDING CAPACITY OF PREGNANT RATS. W. D. Travers (Dep. Bi nucleonics, Purdue Univ., W. Lafayette, Ind.) and R. J Vetter.

EFFECT OF MICROWAVE FIELDS ON MUSCLE CONTRACTION. C-K. Chou (Bioelectromagnetics Res. Lab., Univ. Washington Sch. Med., Seattle) and A. W. Guy.

CONDITIONED TASTE AVERSIONS IN THE RAT INDUCED BY A SINGLE EXPOSURE TO MICROWAVES. R. H. Lovely (Bioelectromagnetics Res. Lab., Univ. Washington Sch. Med., Seattle) and A. W. Guy.

NEUROENDOCRINE AND CARDIODYNAMIC RESPONSE OF THE DOG SUBJECTED TO CRANIAL EXPOSURE TO 2450 MHz MICROWAVES. S-T. Lu (Univ. Rochester Sch. Med. Dent.), J. Jones, S. Pettit, N. Lebda and S. Michaelson.

THE GENERATION OF ACOUSTIC SIGNALS IN MATERIALS IRRADIATED WITH MICROWAVE PULSES--A THEORETICAL ANALYSIS. D. Borth (Dep. Electr. Eng., Univ. Illinois, Urbana) and C. Cain.

STRIPLINE TECHNIQUES IN THE STUDY OF MICROWAVE BIOLOGICAL EFFECTS ON ISOLATED NEURAL PREPARATIONS. R. L. Seaman (Dep. Biomed. Eng., Duke Univ., Durham, N. C.), H. Wachtel and W. T. Joines.

THE OCULAR LENS AND CATARACT. S. M. Michaelson (Univ. Rochester Sch. Med. Dent., N.Y.) and S. W. Magin.

ELECTRON MICROSCOPIC EVALUATION OF THE LENSES OF RABBITS EXPOSED TO LONGTERM 2450 MHz CONTINUOUS MICROWAVE ENERGY AT 10 MW/CM^2. R. J. Williams (Duke Univ. Eye Cent., Durham, N.C.), A. McKee, E. D. Finch and D. W. Fulk.

A MODEL FOR THERMAL CATARACTOGENESIS. M. R. Foster (Div. Biol. Effects, Bur. Radiol. Hlth, Winchester, Mass.).

BIOLOGICAL EFFECTS OF LOCALLY APPLIED MICROWAVES ON THE THYROID GLAND OF DOGS. R. L. Magin (Univ. Rochester Sch. Med. Dent., N.Y.), S-T. Lu and S. M.. Michaelson.

EFFECTS OF RF FIELDS ON NERVOUS ACTIVITIES. H. Kritikos (Dep. Bioeng., Univ. Pennsylvania, Philadelphia) S. Katashima and H. P. Schwan.

LOW LEVEL MICROWAVE INTERACTION WITH ISOLATED MAMMALIAN HEARTS. R. G. Olsen (Dep. Electr. Eng., Univ. Utah, Salt Lake City), C. H. Durney, J. L. Lords and C. C. Johnson.

LIGHT AND ELECTRON MICROSCOPIC OBSERVATIONS ON HAMSTERS AFTER MICROWAVE IRRADIATION. E. N. Albert (George Washington Univ. Med. Cent., Washington, D.C.).

MICROWAVE SPECIFIC EFFECTS ON BEER YEAST. B. Thourel (O.N.E.R.A.-C.E.R.T., Toulouse, France), A. Priou and C. Auge.

STUDIES ON MICROWAVE LEAKAGE SUPPRESSION OF MAGNETRONS. A. Harada (Hitachi, Ltd., Mobara, Chiba, Japan), I. Ohara, and T. Oguro.

MICROWAVE DOSIMETRY. M. Piotrowski (Mil. Inst. Hyg. Epidemiol., Sawsaw, Poland) and K. Dzieciolowski.

OCULAR EFFECTS OF 35 AND 107 GHZ CW MICROWAVES. L. Birenbaum (Res. Assoc. Polytech. Inst. New York, Brooklyn), I. T. Kaplan, W. Metlay, S. W. Rosenthal, and M. M. Zaret.

**** 1975 JOINT INTERNATIONAL IEEE/AP-S SYMPOSIUM & USNC/URSI MEETING

Date: June 2-4 (IEEE); June 3-5 (URSI), 1975
Place: Urbana-Champaign, Illinois
Sponsors: Institute of Electrical and Electronics Engineers and U.S. National Committee of the International Scientific Radio Union.
Requests for Information: Department of Electrical Engineering, University of Illinois, Urbana, Illinois 61801 (217) 333-1200

Selected Bibliography of Papers to be Presented:

SCATTERING FROM FINITE BIOLOGICAL AND METALLIC CYLINDERS. D. Livesay (Michigan State Univ., East Lansing), B. S. Guru and K. M. Chen.

ELIPTICALLY POLARIZED EM FIELD INDUCED IN A BIOLOGICAL TISSUE BY A PLANE EM WAVE. K. M. Chen (Michigan State Univ., East Lansing) and D. Livesay.

DEVELOPMENT OF ELECTROMAGNETIC MODELING MATERIALS FOR X-BAND DOSIMETRY STUDIES. A. Y. Cheun (Univ. Maryland, College Park), D. W. Koopman, J. D. Saffer and M. L. Swicord.

INVERSE SCATTERING SOLUTIONS BY LEAST SQUARES. H. E. Bussey (NBS, Boulder, Colo.).

A FINITE ELEMENT METHOD FOR CALCULATING ELECTROMAGNETIC FIELDS IN COMPLEX GEOMETRIES. R. B. Kellogg (Univ. Maryland, College Park) and S. Neuder.

HEATING PATTERNS OF ENCLOSED AND DIRECT CONTACT MICROWAVE DIATHERMY APPLICATORS. G. Kantor (Bur. Radiol. Hlth., Rockville, Md.), M. L. Swicord and M. Blair.

INDUCED CURRENTS IN BIOLOGICAL MEDIA WITH IMPLANTED METALLIC CONDUCTORS. D. P. Syquist (Michigan State Univ., East Lansing) and K. M. Chen.

CALIBRATION OF MINIATURE MICROWAVE ELECTRIC FIELD DETECTOR FOR IMPLANTATION MEASUREMENT WITHIN BIOLOGICAL TISSUES. A. Y. Chung (Univ. Maryland, College Park).

MEASURE OF ENZYMATIC ACTIVITY COINCIDENT WITH 2450 MHz MICROWAVE EXPOSURE. T. R. Ward (EPA, Research Triangle Park, N.C.), J. W. Allis and J. A. Elder.

MICROWAVE EFFECTS ON HUMAN TISSUE CULTURE CHROMOSOMES. B. S. Guru (Michigan State Univ., East Lansing), R. Hoopingarner and K. M. Chen.

A NUMERICAL STUDY OF MICROWAVE DOSE DISTRIBUTION IN THE HUMAN HEAD. S. M. Neuder (Bur. Radiol. Hlth., Rockville, Md.) and R. B. Kellogg.

THE MICROWAVE HEARING EFFECT--A THEORETICAL ANALYSIS. C. Cain (Univ. Illinois, Urbana-Champaign) and D. Borth.

ELECTROMAGNETIC TRANSIENT PROPAGATION IN MODELS OF MAN. J. C. Lin (Wayne State Univ., Detroit, Mich.) and C-L Wu.

**** 5TH EUROPEAN MICROWAVE CONFERENCE

Date: September 1-4, 1975
Place: Hamburg, W. Germany
Sponsors: VDE, in cooperation with the Convention of National Societies of Electrical Engineers of Western Europe, IEEE, International Microwave Power Institute, German National Committee of URSI, and Microwave Exhibitions & Publishers, Ltd.
Requests for Information: Dr. H. J. Schmitt, Conference Chairman, Philips Forschungslaboratorium, Vogt Koellnstrasse 30, D2 Hamburg 54, W. Germany.

Selected Bibliography of Papers to be Presented:

MICROWAVE BIOEFFECTS: CURRENT STATUS AND CONCEPTS. P. Czerski (Dep. Hum. Genet., Natl. Res. Inst. Mother Child, Wawsaw, Poland) and S. Szmigielski.

MICROWAVE ABSORPTION OF LIVING HUMAN SKIN BETWEEN 8 AND 96 GHz. J. Edrich (Univ. Denver, Colo.).

THE IMPORTANCE OF BOUND WATER STUDIES IN THE DETERMINATION OF ENERGY ABSORPTION BY BIOLOGICAL TISSUE. E. H. Grant (Queen Elizabeth College, London, U.K.), R. J. Sheppard and G. P. South.

A SYSTEM FOR QUANTITATIVE CHRONIC EXPOSURE OF A POPULATION OF RODENTS TO UHF FIELDS. A. W. Guy (Univ. Washington Sch. Med., Seattle) and R. H. Lovely.

MEASUREMENT OF TEMPERATURE AND MICROWAVE POWER USING LIQUID CRYSTAL/OPTIC FIBER PROBES. T. C. Rozzell (ONR, Arlington, Va.).

A POCKET-SIZED MONITOR OF DANGEROUS MICROWAVE POWER LEVELS. R. Agarwal (Univ. Newcastle-upon-Tyne, U.K.), S. Hannah, H. Hartnagel and J. T. Kennair.

USE OF DIELECTRIC MICROPROBES FOR ELECTROMAGNETIC FIELDS MEASUREMENT. A. Deficis (O.N.E.R.A.-C.E.R.T., Toulouse, France).

**** 1975 USNC/URSI-IEEE MEETING

Date: October 20-23, 1975
Place: Boulder, Colorado
Sponsor: U.S. National Committee of the International Union of Radio Science (USNC/URSI).
Requests for Information: Prof. A. W. Guy, Dept. of Rehabilitation Medicine, RJ-30, Univ. Hosp., Seattle, Washington 98105.

BOOK NOTES

Biological Effects Electromagnetic Radiation II(1), March 1975

ULTRAHIGH FREQUENCY RADIATION AND HEALTH SAFETY

by

B. A. MININ

The main principles of protecting personnel from occupational exposure to EM radiation in the UHF range are presented in this book, which is designed for use by engineers, technicians, hygienists and safety engineering experts. The information is intended for use in making calculations and measurements of antenna fields and internal radiation emission of operating communication, broadcasting, radar, and radionavigational facilities. Research data on the biological effects of UHF radiowaves are cited. The theoretical and practical aspects of radiation standards are reviewed and UHF and x-ray radiation protection measures are outlined. A 200-item bibliography of international publications is included.

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Conclusion

Bibliography

Subject Index

Sovetskoie Radiao Publishers: Moskow, 1974, 352p. In Russian.

ELF AND VLF ELECTROMAGNETIC FIELD EFFECTS

Edited by Michael A. Persinger
Laurentian University, Ontario

Offering exciting new research on EM signals whose frequencies overlap with time-varying processes in living organisms, this book presents data indicating significant effects of ELF fields on human and other life form activities. It distinguishes between the detection and effect of ELF signals, and examines the physical parameters of ELF-VLF EM fields and their penetrability, shielding properties, and behavioral and biological effects. This volume will be of interest to biophysicists, biochemists, environmental scientists, public health workers, and others concerned with exposure to EM radiation.

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M. A. Persinger, INTRODUCTION

H. L. König, ELF AND VLF SIGNAL PROPERTIES: PHYSICAL CHARACTERISTICS

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H. L. König, BEHAVIORAL CHANGES IN HUMAN SUBJECTS ASSOCIATED WITH ELF ELECTRIC FIELDS

R. Weber, ELF-EFFECTS ON HUMAN CIRCADIAN RHYTHMS

J. de Lorge and M. J. Marr, *OPERANT METHODS ASSESSING* THE EFFECTS OF ELF ELECTROMAGNETIC FIELDS

M. A. Persinger, *et al.*, BEHAVIORAL, PHYSIOLOGICAL AND HISTOLOGICAL CHANGES IN RATS EXPOSED DURING VARIOUS DEVELOPMENTAL STAGES TO ELF MAGNETIC FIELDS

G. Altmann, OXYGEN AND BIOCHEMICAL CHANGES FOLLOWING ELF EXPOSURE

F. E. Cole and E. R. Graf, PRECAMBRIAN ELF AND ABIOGENESIS

M. A. Persinger, ELF ELECTRIC AND MAGNETIC FIELD EFFECTS: THE PATTERNS AND PROBLEMS

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Plenum Publishing Corporation: New York. 1974, 316p

0325 BIOMEDICAL ASPECTS OF NONIONIZING RADIATION. *(E.)* Milroy, W. C. (Naval Weapons Lab., Dahlgren, Va.). *Proc. Symp. Biomed. Aspects Nonionizing Radiat.*, July 1973. Naval Weapons Lab. Rep. TR-3110, NTIS: AD-780 222, March 1974, 75p.

The proceedings of a one-day Symposium on Biomedical Aspects of Nonionizing Radiation held on July 10, 1973, at the Naval Weapons Laboratory, Dahlgren, Virginia, in conjunction with the opening and dedication of the new Biomedical Research Laboratory, are presented in this report. It includes six invited papers presented at the Symposium by leading authorities in the fields of bio-engineering, comparative biology, human exposure factors, high power pulses, and EMP bioeffects; and an overview of the Naval Weapons Laboratory efforts so far in their study of the possible biological effects and health hazards of EM radiation. (See CL 0326 through CL 0331, and CL 0170, Volume I, No. 2, for abstracts of these presentations.) (No references)

0326 WHERE ARE WE AND WHERE ARE WE GOING? *(E.)* Tyler, P. E. (Naval Weapons Lab., Dahlgren, Va.). *Biomedical Aspects of Nonionizing Radiation*, Naval Weapons Lab. Rep. TR-3110, NTIS: AD-780 222, March 1974, pp. 1-4.

A major portion of the scientific community has shunned the area of nonionizing radiation, primarily because of the lack of a unifying theory which could explain the reported biological effects of electromagnetic radiation. This attitude is changing with the greater willingness of medicine to accept empiral facts without absolute knowledge of the mechanisms of action. Questions in the area of biological effects of nonionizing radiation will eventually be answered through a multidisciplinary approach involving both medica and engineering experts. With its truly interdisciplinary team, the Naval Weapons Laboratory has the opportunity to explore solutions to three major problems in nonionizing radiation: the frequency dependence problem, the effects of long-term exposure to relatively low levels, and the problems of pulsed *verews* continuous radiations. (No references)

0327 SOME GUIDELINES FOR THE DEVELOPMENT OF EM RADIATION STANDARDS. *(E.)* Schwan, H. P. (Moore Sch. Electr. Eng., Univ. Pennsylvania, Philadelphia). *Biomedical Aspects of Nonionizing Radiation*, Naval Weapons Lab. Rep. TR-3110, NTIS: AD-780 222, March 1974, pp. 5-8.

Biophysical studies undertaken with Naval support indicate no direct (nonthermal) effect of microwaves on biosystems at the molecular and cellular level. However, field forces may become significant at the macroscopic level and could be responsible for the phenomenon of "hearing" pulsed waves. Bioengineering research has shown that: (a) penetration of microwaves in body tissues is highly frequency sensitive and decreases from about 1 in. at RF frequencies to less than 1 mm above 10 GHz; (b) man absorbs the incident energy; and (c) for an exposure not in excess of 10 mW/cm^2 external flux, cerebral circulation effectively eliminates the danger of excessive temperature elevation. No detrimental effects have been reported for therapeutic partial body irradiation at 1000 mW/cm^2. Above 100 mW/cm^2 deleterious effects have been observed in animal whole body exposures. Between 1-100 mW/cm^2 a variety of subtle and not necessarily detrimental effects take place, including the threshold of thermal perception and the "RF hearing" phenomena. The U.S. standard of 10 mW/cm^2 corresponds to a current density inside body tissue of 3 $milliamp/cm^2$. The threshold current density is not strongly frequency dependent and could be used as a yardstick for the development of subsidiary standards. Such standards might include exposure to very low frequency and static electrical fields, contact of one part of the body with a high potential (e.g., high voltage line workers), MW, and low frequency and RF standards in terms of magnetic and electrical field parameters. (No references)

0328 COMPARATIVE BIOLOGY IN ASSESSMENT OF ELECTROMAGNETIC BIOEFFECTS. *(E.)* Michaelson, S. M. (Dep. Radiat. Biol. Biophys., Univ. Rochester, N.Y.). *Biomedical Aspects of Nonionizing Radiation*, Naval Weapons Lab. Rep. TR-3110, NTIS: AD-780 222, March 1974, pp. 17-26.

The problem of animal selection for experiments on electromagnetic bioeffects is discussed. Extrapolation of animal data on hot spots to man is complicated by the fact that various animal species differ in brain size and in distribution of brain circulation relative to the circle of Willis. To interpret rabbit experiments related to cataractogenesis, it is important that thermal gradients in the rabbit eye be taken into consideration. The biologist must remember that animal species also differ in eye volume, dimensions, and location of the eye in the head. Thus, the scope of cataractogenesis research must be expanded to include species other than the rabbit. In the major area of thermal conversion, the inherent thermal regulatory capacity of the animal must be considered: the rat and the rabbit are poor thermal regulators, whereas the dog is a very good and man a very efficient thermal regulator. One of the constant factors among species is the relationship of body surface area. Basal metabolic rate or heat production is definitely related to body weight or surface area, in a linear relationship among various species. This relationship may permit the development of interspecies comparisons and extrapolation factors for man. (No references)

0329 HIGH POWER PULSE TRANSMITTERS. *(E.)* Rose, M. F. (Naval Weapons Lab., Dahlgren, Va.). *Biomedical Aspects of Nonionizing Radiation*, Naval Weapons Lab. Rep. TR-3110, NTIS: AD-780 222, March 1974, pp. 38-49.

Two classes of experimental short pulse, high power, discrete frequency transmitters are described which