

BIOEFFECTS

NEWSLETTER

NO. 5, APR. 1978

Distributed by The Physiology Program, Office of Naval Research, Arlington, VA 22217
Written and Edited by T. C. Rozzell, Project Officer, Electromagnetic Field Effects

DR. CURTIS C. JOHNSON
(1932 - 1978)

The bioelectromagnetics research community and the many friends of Curt Johnson were deeply saddened to learn of his death on 25 March 1978. Curt had been severely ill for about two months.

Born in Long Beach, California on November 7, 1932, he received the BS and MS degrees in Electrical Engineering from CalTech in 1954 and 1955 respectively, and the Ph.D. degree in Electrical Engineering from Stanford University in 1958. He first joined the faculty of the University of Utah as an Assistant Professor in 1961. In 1967, he joined the Bioengineering Center at the University of Washington and was involved in research and development of biomedical instrumentation and biological microwave effects. In 1972 he returned to the University of Utah as Professor of Biophysics and Bioengineering and Director of the Institute for Biomedical Engineering. He was appointed Chairman of the New Department of Bioengineering in 1974.

Dr. Johnson was a prolific writer. He published two textbooks in electromagnetic theory and contributed to three other books in bioengineering. He published more than 65 journal articles and made more than 70 presentations at technical meetings. He holds seven patents and filled several editorial positions for technical and scientific publications.

I first became acquainted with Curt as a contractor for the Office of Naval Research. Shortly after I came to ONR in 1971, we collaborated in the invention of the liquid crystal/optic fiber temperature probe, and he (along with Jim Lords and Carl Durney) and I hold a patent on that device. A brilliant researcher, Dr. Johnson was internationally recognized for his work in bioengineering, and in particular, for his work in bioinstrumentation and the biological effects of microwaves.

I am certain that everyone who knew Curt joins me in expressing to his widow, Wilma, and his four children our deep sense of sorrow and our great feeling of loss. We are all much better individuals because he walked among us and so unselfishly shared with us a part of his life.

In order that future students will continue to benefit from the research program that Curt developed, a Memorial Fellowship Fund has been established at the University of Utah. Checks may be made to the University of Utah-Dept. of Bioengineering and sent in care of the University of Utah Development Office, 306 Park Building, Salt Lake City, UT 84112.

This is an informal newsletter compiled as a service to the scientific community interested in bioelectromagnetic interactions. The views expressed are those of the writer and are not to be construed as the official policy of the Department of Defense or the Department of the Navy.

SYMPOSIUM - The 1978 Symposium on Electromagnetic Fields in Biological Systems, to be held in Ottawa in late June (see list of meetings) is largely the brainchild of Curt Johnson. I first learned of his illness when he resigned as Chairman of the Technical Program Committee and John Osepchuk, the General Chairman, asked me to take over the job. More than 80 papers were received and the Committee has put together what I think is a superb program. Advance programs have been mailed out. If you did not receive one, let me know right away. There will be no concurrent sessions and no formal evening sessions. Of course, there will be three other Symposia being held simultaneously, but the subject matter is so different that there should be a minimum of conflict. Ottawa is very beautiful in June-so plan to be there.

NEW BOOKS/PAPERS/REPORTS

Abstracts are given where it is felt that the reader needs to know more than is revealed by the title. An asterisk (*) following an author's name indicates affiliation with the Office of Naval Research EMF Program. PLEASE! DO NOT WRITE TO ME FOR COPIES OF THIS MATERIAL. I HAVE ENOUGH TROUBLE GETTING ONE COPY. WRITE TO THE AUTHOR OR TO THE PUBLISHER OR COGNIZANT DEPOSITORY.

"Electrical Properties of Biological Polymers, Water and Membranes", Annals of New York Academy of Sciences, Vol. 303, 1978. S. Takashima* and H. M. Fishman, Editors. Available from the Academy @ \$35.00.

"Dielectric Behaviour of Biological Molecules in Solution", by E. H. Grant*, R. J. Sheppard and G. P. South, Oxford University Press, Walton Street, Oxford, OX2 6DP, UK. Cost is 11 pounds sterling. There are 244 pages, 84 text figures and the book provides valuable information on how to study the properties of biological molecules through the use of dielectric theory, the measurement of permittivity and other electromagnetic parameters. This is a book that should find wide use in medicine as well as in biological research.

The World Health Organization - Regional Office for Europe has been working for several years now on a *Manual on Health Aspects of Exposure to Non-Ionizing Radiation*. This is under the able direction of Dr. M. Suess. Two chapters of the Manual are now complete and can be ordered, separate and apart from the complete Manual, from The Regional Office for Europe, World Health Organization, Copenhagen, Denmark. The two chapters which are now available are:

Microwave and Radiofrequency Radiation
by S. M. Michaelson

Optical Radiation with Particular Reference to Lasers
by L. Goldman, S. M. Michaelson, R. J. Rockwell, D. H. Sliney, B. M. Tengroth, and M. L. Wolbarsht

"An Investigation of Broadcast Radiation Intensities at Mt. Wilson, California", EPA Technical Note, ORP/EAD-77-2, by Richard A. Tell and Patrick J. O'Brien, U.S. Environmental Protection Agency, Off. of Radiation Programs, P.O. Box 15027, Las Vegas, NV 89114.

"RF Dielectric Properties Measurement System: HUMAN AND ANIMAL DATA", NOISH Research Report No. 77-176, by J. Toler and J. Seals, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, GA 30332. For copies try, DHEW, PHS, CDC, Nat. Inst. for OCC. Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226.

Zatz, M. and Weinstock, M., "Electric Field Stimulation Releases Norepinephrine and Cyclic GMP from the Rat Pineal Gland", Life Sciences, 22, 767(1978).

Adey, W. R*, "Models of Membranes of Cerebral Cells as Substrates for Information Storage", BioSystems, 8, 163(1977). A paper dedicated to the memory of Lars Onsager, it gets into several aspects of the EM field/brain interaction problem.

Lin, James C.*, "Further Studies on the Microwave Auditory Effect", IEEE Trans. MTT, Vol. MTT-25, No. 11, 938(1977)

Lin, J. C.* Guy, A. W.* and Caldwell, L. R., "Thermographic and Behavioral Studies of Rats in the Near Field of 918-MHz Radiations", IEEE Trans. MTT, Vol. MTT-25, No. 10, 833(1977)

Grundler, W., Keilmann, F., and Frohlich, H., "Resonant Growth Rate Response of Yeast Cells Irradiated by Weak Microwaves", Physics Letters, 62A, No. 6, 463(1977)

Yeast cultures were exposed to weak (1.1 to 2.7 mW/cm²) microwave fields. The growth rate of the yeast was found to be increased or decreased depending on the frequency in the range of 41.5 - 42.0 GHz. The resonance bandwidths were of the order of 0.01 GHz. Temperature effects were pretty well excluded due to careful control. These findings pretty much substantiate what Frohlich and others have been saying for some time now, viz., that coherent molecular oscillations can occur that activate or inhibit metabolic processes. (TCR).

Dickson, J. A. and Shah, S. A., "Technology for the Hyperthermic Treatment of Large Solid Tumors at 50^o C.", Clin. Oncol., 3(3), 301(1977)

Hand, J. W., "Microwave Heating Patterns in Simple Tissue Models", Phys. Med. Biol., 22(5), 981(1977)

Schwan, H. P.* and Foster, K. R.*, "Microwave Dielectric Properties of Tissue: Some Comments on the Rotational Mobility of Tissue Water", Biophys. J., 17(2), 193(1977)

Bigu-del-Blanco, J. and Romero-Sierra, C., "The Design of a Monopole Radiator to Investigate the Effect of Microwave Radiation in Biological Systems", J. Bioeng., 1(3), 181(1977)

Ho, H. S. and Faden, J., "Experimental and Theoretical Determination of Absorbed Microwave Dose Rate Distributions in Phantom Heads Irradiated by an Aperture Source", Health Phys., 33(1), 13(1977)

Mittler, S., "Failure of Chronic Exposure to Nonthermal FM Radio Waves to Mutate Drosophila", J. Heredity, 68(4), 257(1977)

Barnes, F. S. and Hu, C-L.J., "Model for Some Nonthermal Effects of Radio and Microwave Fields on Biological Membranes", IEEE Trans. Microwave Theor. Techs., 25(9), 742(1977)

Hough, H. L. and Domino, E. F., "Elevation in Rat Brain Histamine Content After Focused Microwave Irradiation", J. Neurochem, 29(2), 199(1977)

Cronin, M. P., "Microwave Thermography", Appl. Radiol., 6(3), 139(1977)

Magin, R. L., Lu, S-T. and Michaelson, S. M.*, "Microwave Heating Effect on the Dog Thyroid Gland", IEEE Trans. Biomed. Eng., 24(6), 522(1977)

Hsieh, S. T., "Biological Effects of X-Band Microwave Irradiations on E. coli.", Ph.D. Dissertation, Tulane University, 1974. (Available from Xerox University Microfilms, Ann Arbor, MI 48106, Order No. 77-19,503)

SOAPBOX - I would like to take this opportunity to briefly discuss a little problem which has been bothering me for some time now; namely the use of the terms "non-ionizing radiation", "electromagnetic radiation", "microwave radiation", "radio-frequency radiation", etc.

Back in 1974, when several of us got together to organize the first Bioeffects Symposium within URSI, I pleaded for (and was successful in) not including the word "radiation" in the title of the symposium. My sensitivity to the word radiation was born out of several contexts. First, I, as may of us in the bioelectromagnetics field, got my start in ionizing radiation. I was aware of the extreme emotionality which surrounds the word "radiation". It conjures up images of Hiroshima and Nagasaki. It has been so much in the news in relation to the effects of X-rays and birth defects. Indeed, with much justification. My feeling was that with the uncertainty which exists concerning the possible effects of electromagnetic fields, it would be better not to confound the problem by having the lay public misconstrue the so-called "non-ionizing" radiation problems with the very obvious problems of ionizing radiation (remember, they don't know the difference). I felt that our research community would be better served if we could use terms like; "electromagnetic fields", "electromagnetic waves", "electromagnetic energy", "microwave fields" or just simply "microwaves", or "radio waves", "radiofrequency waves", etc. In this vain, I would never speak of "irradiated" animals but rather "exposed" animals. I would never title my paper, "Microwave Radiation Effects on.....", but rather, "Microwave Energy Effects on....." or simply, "Microwave Effects on.....".

What I am trying to get across in this rambling discourse is that while we, as scientists in the bioelectromagnetics area know what we mean, the lay public is still confused about ionizing radiation and to use the term "radiation" in our papers and public discussions can do nothing but cause us unnecessary grief. We spend time explaining what we mean which could be more productively spent in carrying out the much needed research. These are only my opinions. I would welcome yours. Either write me (I may not have time to answer) or give me your thoughts at the Ottawa Symposium. By the way, I have taken the liberty, as Chairman of the Technical Program Committee, to edit each of the abstracts for the Ottawa Sym-

posium to conform with the above stated philosophy. However, I did not edit the titles. I did not have that much guts. The title is yours, and I would not change it without your permission. I felt a little different about the body of the abstract. Again, let me know your feelings. I feel I am (or should be) flexible.

ONR CONTRACTOR OFF TO USSR - Dr. K-C. Chen, who has been studying the effects of microwaves on cells in tissue culture, has a paper accepted for presentation at the XIVth International Congress of Genetics which will meet in Moscow 20 August to 1 September.

CONGRESSIONAL HEARINGS - Two sub-committees of the House Committee on Science and Technology recently held joint hearings on the Solar Power Satellite (SPS) Research Development and Demonstration Act of 1978. Of interest to the bioelectromagnetics community was that portion of the testimony given by Bill Guy, Dick Phillips and others relating to the biological and ecological implications of the SPS.

POSITIONS AVAILABLE - Not meant to be complete, just what was sent to me recently. The Laboratory of Environmental Biophysics, National Institute of Environmental Health Sciences, is seeking a physiologist for a Non-ionizing Radiation Work Group. This position will involve mechanistic studies on the effect of microwave fields on the CNS, neuroendocrine, hematopoietic, cardiovascular and reproductive systems. The successful candidate will also be expected to coordinate collaborative projects to determine the teratogenic, immunologic and behavioral effects of microwaves. Experience in the biological effects of electromagnetic fields is desirable though not essential.

Salary range is approximately \$21,883 to \$33,825 (GS-12 and GS-13) depending on qualifications. United States citizenship is required.

Send curriculum vitae or Standard Form 171 (Personal Qualifications Statement), bibliography and transcript or listing of college and university courses to:

Dr. Colin F. Chignell, Chief
Laboratory of Environmental Biophysics
National Institute of Environmental Health Sciences
P.O. Box 12233
Research Triangle Park, North Carolina 27709
Telephone: 919/541-3196

The Electrical Engineering Department at the University of Utah is actively seeking outstanding graduate students for TAs and RAs in some or all of the following areas: applied optics, electromagnetic biological effects, instrumentation, systems, signal processing. For information, write to:

Dr. Douglas A. Christensen
Director of Graduate Studies
Department of Electrical Engineering
University of Utah
Salt Lake City, Utah 84112

A position of Research Assistant Professor is open for biomedical and energy applications of microwaves; microwave biological effects, ecological implications of microwave radiation from proposed space power satellites, and microwaves for cancer diagnostic and therapeutic applications. Applicants must have a Ph.D. and 2-3 years of experience in microwave instrumentation. Contact:

Professor Om P. Gandhi
Department of Electrical Engineering
University of Utah
Salt Lake City, Utah 84112

BIOMAGNETICS EFFECTS WORKSHOP - This workshop was recently held at the Lawrence Berkeley Laboratory. Sponsored by the Division of Biology and Medicine, it dealt with many aspects of the effects of magnetic fields on biological systems. For copies of the proceedings, write to Dr. T. Tenforde, Donner Laboratory, University of California, Berkeley, CA 94720.

MEETINGS, SYMPOSIA AND CONFERENCES

7-12 May 1978 — American Industrial Hygiene Conference. Los Angeles, CA. (Biltmore Hotel). Co-sponsored by the American Industrial Hygiene Association and the American Conference of Governmental Industrial Hygienists. Dr. Zory R. Glaser has arranged sessions on Non-Ionizing Radiation.

15-19 May 1978 — International IEEE/AP-S Symposium and USNC/URSI meeting. Jointly on the campus of the University of Maryland, College Park, MD. For more information write:

IEEE
6411 Chillum Place, NW
Washington, DC 20015

22-26 May 1978 — IX-th International Congress of The Societe Francaise de Radioprotection. Chateau de Nainville-les-Roches near Paris (France). Theme of the Congress will be "Risks Associated with the Utilization of Non-ionizing Radiations". For more information write:

M. Regis MARCHAND
DSC-18 Rue Ernest-Cognacq
92300 Levallois-Perret
France

18-23 June 1978 --Annual Meeting of the Health Physics Society. Minneapolis, Minn. HPS is having a poster session on bioeffects of electromagnetic fields at this meeting.

26-30 June 1978 -- Four Symposia will be held Simultaneously in Ottawa, Ontario.
(1) Conference on Precision Electromagnetic Measurements.
(Government Conference Center, 26-29 June). Contact:

K. Charbonneau, Ex. Sec.
Conference on Precision Electromagnetic
Measurements.
c/o National Res. Council of Canada
Ottawa, Ont., Canada K1A 0R6

(2) IEEE MTT-S International Microwave Symposium. (Chateau
Laurier Hotel, 27-29 June). Contact:

S. J. Kubina
Elec. Eng. Dept.
Concordia University
7141 Sherbrooke St. W.
Montreal, Quebec, Can. H4B 1R6

(3) IMPI Microwave Power Symposium. (Chateau Laurien Hotel,
28-30 June). Contact:

W. Wysouzil
Elec. Eng. Division
National Res. Council of Canada
Ottawa, Ont., Can. K1A 0R8

(4) Symposium on Electromagnetic Fields in Biological Systems.
(Holiday Inn - Centre, 27-30 June). Contact:

M. H. Repachol
Dept. of Nat'l Health & Welfare
Environmental Health Ctr., Rm 233
Tunney's Pasture
Ottawa, Ont., Can. K1A 0L2

This latter symposium is being sponsored by the Microwave Theory
& Techniques Society, IEEE, and IMPI, with the cooperation of
the U.S. National Committee for the International Union of Radio
Science (URSI) and Canadian Commission A of URSI. Preliminary
programs are now out. If you did not receive one, let me know
and I'll send one to you immediately.

1-8 August 1978 -- Open Symposium on Biological Effects of Electromagnetic Waves.
(Helsinki, Finland). This Symposium will be held as part of
the 19th General Assembly of the International Union of Radio
Science (URSI). For information, contact:

S. W. Rosenthal
Polytechnic Institute of New York
Farmingdale, NY 11735

4-7 Sept 1978 -- 8th European Microwave Conference. (Hotel Meridien, PARIS, France). Contact:

Professor E. Constant
8th EuMC Conference Chairman
Centre Hyperfréquences et Semiconducteurs
Université des Sciences et Techniques
BP 36,
59650 Villeneuve d'Ascq, FRANCE

9 Sept 1978 -- Workshop on Diagnosis and Therapy Using Microwaves. (Hotel Meridien, Paris). This workshop will be held immediately after the 8th European Microwave Conference. The aim of this international workshop is to assess the state of medicine and the progress realized in the treatment of cancer. Further information from:

A. Priou
Microwave Department (DERMO)
O.N.E.R.A. - C.E.R.T.
B.P. 40-25
31055 Toulouse Cedex
France

RUMP SESSION IN OTTAWA - Dick Lovely and others are attempting to organize an extemporaneous session at the Ottawa Bioeffects Symposium dealing with the adverse effects of microwaves. Watch for word on this session at the meeting. It will probably be held one evening. A good chance to air your thoughts on this subject. Do rats run away from microwaves, or do they love it????

ZORY'S NINTH SUPPLEMENT - The most comprehensive bibliography in the bioelectromagnetics field is undoubtedly that put together by Dr. Zorach (Zory) Glaser and his cohorts. The ninth supplement should be off the press by now. For a copy, write to Zory at National Institute for Occupational Safety and Health, Priorities & Research Analysis Br., 5600 Fishers La., Park Bldg 3-50, Rockville, MD 20857.

NEW DEVELOPMENTS - There are some new and very exciting things coming about in the bioelectromagnetics research field. These include all research in the frequency range from DC to and including visible light. It includes medical uses of electromagnetic energy as well as research relating to hazards and behavioral changes. It even includes studies of electromagnetic energy emitted by a biological organism. And finally, it includes the use of EM as a research tool to investigate basic biological phenomena. Want to know more? Come to the Ottawa Symposium or write to me this summer. You will be pleasantly surprised.

ONCE AGAIN - Don't forget to send me items which you would like to see included in BN. I can't acknowledge or return things, but I promise to look at and consider everything which I receive.