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N O N I O N I Z I N G R A D I A T I O N

Anotated Bibliography

Editors

Hana Pafková, Karel Marha

Prague 1975

The publication is the result of a mutual cooperation between the Institute of Hygiene and Epidemiology and the Central Institute for Industrial Medicine of the GDR, Berlin. It was stimulated by the increasing interest in non - ionizing radiation. The publication includes papers from 1970 - 1971 and is divided according to larger thematic groups.

The text has not been linguistically revised and corrected.

The Editors

C O N T E N T S

1 9 7 0

M I C R O W A V E S

(1) B a i l l i e, H. D.

THERMAL AND NON-THERMAL CATARACTOGENESIS BY MICROWAVES.

Non-ioniz. Radiat., 1, 4, 1970, 159 - 163

Dogs were first anaesthetized in the usual way and mydriasis produced (5% atropine and 2% cocaine solution). Microwaves (12.4 cm, effective density 5 W/cm^2) were used to irradiate their eyes, hypothermia was produced by immersion of their bodies into icy water, reheating by water with a temperature of 40°C. A single application of microwaves (45 and 55 secs.) on the eye with normal body temperature caused visible corneal lesions within 14 days of observation. After 65 seconds irradiation slight opacity of the eye was observed on the seventh day.

(2) B a i l l i e, H. D., H e a t o n, A. G., P a l, D. K.

DISSIPATION OF MICROWAVES AS HEAT IN THE EYE.

Non-ionizing Radiation, 1, 4, 1970, 164 - 168

Description of examinations of dogs and agar eye models for elaborating the temperature distribution in the eye by converting microwave energy. The temperature behaviour ascertained by testing models was graphically plotted to predict the lens temperature after exposition. The deviations of the predi - ctionable from the experimentally measured temperatures were analyzed by help of waveguides at isolated lenses and liquid. There it turned out, that fallacious inferences are possible, if the mechanisms of the origin of microwave cataracts shall be explained by reason of temperature measurements in the eye but not in the lens. The results furthermore show, that the eye does not possess regular dielectric properties and that the intraocular temperature decrease shall be taken into consideration when estimating the temperature after exposition.

3 B a s h a r i n o v, A. E., G u r v i c h, A. S.

INVESTIGATIONS OF MICROWAVE RADIATION OF THE EARTHS SURFACE AND ATMOSPHERE ON "COSMOS-243".

Vestnik Akademii Nauk SSSR, 10, 1970, 37

4 B i l b r o u g t, J.

FOOD STERILIZATION BY MICROWAVE RADIATION.

Non-ioniz.Radiat., 1, 2, 1970, 70 - 72

Normal methods of sterilization are briefly compared with the effect of microwave processing whose main objective is to kill mold spores on the inside of wrapping materials. A number of design features of suitable equipment are described with particular reference to prevention of stray radiation.

5 B o i s i o, R. G., B a r t h a k u r, N., S p o o n e r, J.

MICROWAVE PROTECTION OF A FIELD CROP AGAINST COLD.

J. Microwave Power., 5, 1, 1970, 47 - 52

An open field aplication of radiant microwave energy against frost damage of a corn crop is described. A sectoral horn antenna was used to radiate 2,4 kW at a frequency of 2,45 GHz.

6 B o o t h, L. F.

REVIEW OF MICROWAVE SAFETY.

Naval Research Laboratory Mene. Rept. 2178, 1970

(7) B o w m a n, R. R.

QUANTIFYING HAZARDOUS ELECTROMAGNETIC MICROWAVE FIELDS: PRACTICAL CONSIDERATIONS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 204 - 209

This paper is concerned mainly with the problem of making easy, resonably accurate survey measurements of hazardous EM fields.

(8) C a r p e n t e r, R. L.

EXPERIMENTAL MICROWAVE CATARACT: A REVIEW.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 76 - 81

This paper is a rewiev of literature about the problem of microwave cataract.

9. C h e r n y s h o v a, M.A.

THE ROLE OF THE NERVOUS SYSTEM AND ENDOCRINE GLANDS IN CONNECTION WITH THE EFFECT OF MICROWAVES ON CARBOHYDRATE METABOLISM.

Tr.Celinogr.selskokhoz.inst., 8, 9, 1970, 169 - 172

Changes in carbohydrate metabolism were studied in rabbits (blood sugar and glycogen in the liver). Following the application of hormonal preparations and some drugs rabbits were irradiated by microwaves (frequency 2,307 mHz, wave length 12,5 cm). Trial results showed that 10 minutes exposure to microwaves (intensity 75 W/cm^2) produced statistically significant increase in blood sugar and reduction in hepatic glycogen (with the participation of hormonal preparations). Microwave effects with drug participation are diverse.

10 C i p r a, J.S., B o w e r s, J.A.

FLAVOR OF MICROWAVE AND CONVENTIONALLY RE - HEATED TURKEY.

Poultry Sci., 49, 5, 1970, 1375

Flavor aroma, and juiciness of precooked frozen turkey reheated in microwave and conventional gas ovens were evaluated by an experienced taste panel. Percentage ether extract, TBA numbers, and percentage moisture were determined. Conventionally-reheated turkey had a greater percentage moisture (P bellow 0,01) and higher juiciness scores meat reheated by microwaves. Percentage ether extract was similar for the two methods of reheating.

11 C l e a r y, F.S.

BIOLOGICAL EFFECTS OF MICROWAVE AND RADIOFREQUENCY RADIATION.

Critical Reviews in Environmental Control (CRC), 1, 2, 1970, 257 - 307

Critical review. In the opinion of the reviewer, the present "state of the art" of the biological effects of microwave and rf is one of incomplete and inadequate knowledge based on the presently available information. In spite of this, resonable control measures have been developed in USA and elsewhere to effectively limit the hazards associated with occupational exposure to these radiations. The proliferation of sources of radiation in these frequency bands dictates a need for a more complete understanding of its biological effects, particularly due to the presence of sources such as the microwave oven in the home.

(12) Cleary, S. F.

CONSIDERATIONS IN THE EVALUATION OF THE BIOLOGICAL EFFECTS OF EXPOSURE TO MICROWAVE RADIATION.

Amer.Ind.Hyg.Assoc.J., 31, 1, 1970, 52 - 59

Review. The increasing use of microwave and UHF radiation in industry and in the home suggests the need for a re-evaluation of the vailable information concerning a biol.effects of such exposures. A review of the thermal and nonthermal effects of microwave and UHF exposure on organisms, organs, cells bacteria and biological molecules is presented, as wel as the exposure limites based on such data. The area of greatest uncertainty is the effects of nonthermal exposure on the CNS. Suggestion are made for additional research on the effects of nonthermal exposure at various le - vels of biological system.

(13) Cleary, S. F.

BIOLOGICAL EFFECTS AND HEALTH IMPLICATIONS OF MICROWAVE RADIATION.

Bureau of Radiological Health, Rockville, Md
cit.: U.S.Gov.Res.Dev.Rep., 70, 21, 1970, 51, PB-193 898

This symposium was held to provide an indication of the present state of knowledge in the area of microwave health effects. The Proceedings are a complitation of the 31 technical papers presented, the deliberations that followed each one, and the two panel discusions that concluded the meeting.

14 Cohen, B. H., Lilienfeld, A. M.

THE EPIDEMIOLOGICAL STUDY OF MONGOLISM IN BALTIMORE.

Annals of the N.Y. Academy of Science, 171, 2, 1970, 320 - 327

The epidemiological study of mongolism in Baltimore was initiated pri - marily to determine whether there was a relationship between parental exposure to ionizing radiation and the occurence of mongolism among offs- pring. Occupational histories were reviewed: 7.9% of the mothers of mon - gols, but only 3.3% of the control, mothers had worked in a professional or technical capacity in medical fields ($P \leq .05$). Eight mongol mothers, in contrast to three control mothers, gave histories of definite x-ray and/or fluoroscopic exposures in all types of occupations prior to the conception of the index child.No differences were found in the occupations of the fa- thers of the mongols and the controls, except for a higher frequency of mili- tary service for the fathers of mongol children-63.1%, as compared with 56.6% for control fathers. In addition a history of radar exposure was obtained from the fathers, which indicated that 8.7% of the fathers of the children with mongolism and 3.5% of the control fathers had had contact with radar, both in and outside of the armed forces-a difference which is of borderline statistical significance ($P \leq .02$).

15 Copeland, E. S., Michelson, S. M.

EFFECT OF SELECTIVE TUMOR HEATING ON THE LOCALISATION OF 131 J FIBRINOGEN IN THE WALKER CARCINOMA 256 - II - HEATING WITH MICROWAVES.

Acta radiol., 9, 4, 1970, 323

16 Crapuchettes, P. W.

MICROWAVE LEAKAGE INSTRUMENTATION.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 210 - 216

They are described measurements of leakage hazard of microwave ovens.

17 Dietrich, W. C., Huxsoll, C.C., Guadagni, D.G.

COMPARISON OF MICROWAVE, CONVENTIONAL AND COMBINATION BLANCHING OF BRUSSELS SPROUTS IN FROZEN STORAGE.

Food Technol, 24, 5, 1970, 105 - 109

When brussels on a 1.5 ft wide moving belt were heated by microwave energy from 1 to 6 min, they retained residual peroxidase enzyme in the outer leaves and lost considerable moisture. Brussels sprouts that were blanched by a combination blanch of microwave energy and a steam or water blanch to effectively inactivate peroxidase were as flavor stable at -20°, C°, and 20°F and had as good or better chlorophyll and ascorbis acid retention as conventionally processed samples. Variability of heating among sprouts was a factor that lengthened time for an adequate blanch and increased color deterioration. Again results indicated that water caused less chlorophyll conversion to accomplish an adequate blanch than steam.

18 Dietrich, W.C., Huxsol, C.C., Wagner, J.R., Guadagni, D.G.

COMPARISON OF MICROWAVE WITH STEAM OR WATER BLANCHING OF CORN- ON-THE-COB: II PEROXIDASE INACTIVATION AND FLAVOR RETENTION.

Food Technol, 24, 3, 1970, 87 - 90

Various degrees of peroxidase enzyme inactivation resulted from heating corn-on the-cob. 2 to 6 min exposure gave nearly complete inactivation and caused considerable dehydration. Peroxidase tests on kernel, germ and base of kernel area showed a variation in activity from end to middle of the ear

for underblanched samples. Samples steam-blanched for 8 and 12 min had residual peroxidase in the base of kernel and core areas. Sensory panel results on samples stored at -20°, 0° and 20°F indicated better flavor retention in the 4 min microwave and 12 min steamblanched samples. A combination water and microwave blanch gave good peroxidase inactivation without noticeable dehydration but without flavor improvement over steam or microwave blanching.

(19) D i a c h e n k o, N.A.

CHANGES IN THYROID FUNCTION WITH CHRONIC EXPOSURE TO MICROWAVE RADIATION.

Gig.tr.prof.zabol., 14, 7, 1970, 51 - 52

Iodine-131 studies of 38 males subject to chronic microwave radiation exposure revealed increased rates of I uptake by the thyroid in 18 cases during the 1 st 2 hr, in 13 cases during the 1 st 4 hr, and in 7 cases over a 24-hr period. These changes are probably secondary effects resulting from radiation induced distrubances of the sympathetic nervous system in the vicinity of the hypothalamic region.

(20) D i a c h e n k o, N.A.

THE EFFECT OF ULTRA HIGH FREQUENCY ELECTROMAGNETIC RADIATION ON THE FUNCTIONAL STATUS OF THE MYOCARDIUM.

VLIIANIE SVCH ELEKTROMAGNITNOGO IZLUCHENIIA NA FUNKCIONALNOE SOSTOIANIE MIOKARDA.

Voenno-meditsinskii zhurnal, 2, 1970, 35

A series of 62 persons was studied (aged 20 - 39 years) who had been working for periods ranging from 2 - 15 years under conditions of microwave irradiation. The duration of radiation exposure did not exceed three and a half hours per day and the effective density of the UHF field was in some cases higher than the standard. The functional status of the myocardium was studied by the method of phase structure analysis of cardiac systole. Results obtained in persons working under conditions of systematic exposure to an UHF field are consistent with the view that, in a majority of cases, changes in phase activity of the heart may be connected with the effect of nervous impulses on the cardiovascular system. In a number of cases results pointed to dystrophic lesions of the heart muscle.

(21) D o c h k i n, I.I.

INFLUENCE OF A MICROWAVE FIELD ON THE HEMATOPOIETIC SYSTEM.

Voenno-meditsinskii zhurnal, (Abstr. A 71-20539), 1970, 42 - 3

(22) D o d g e, CH.H.

CLINICAL AND HYGIENIC ASPECTS OF EXPOSURE TO ELECTROMAGNETIC FIELDS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 140 - 149

Author gives us a review of the Soviet and Eastern European literature about clinical manifestations of exposure to rf fields.

(23) D o r d e v i c, Z.

INTENSITY OF MICROWAVE RADIATION IN RADAR UNITS AND CHANGES IN THE BLOOD COUNT OF RADAR OPERATORS.

Vojnosanit.Pregl., 27, 11, 1970, 538 - 541

The results are presented of measurement of the intensity of radar radiation in radar stations, as well as of medical examinations in a group of radar operators. Measurement of radar at the work places of radar crew showed that there are no real possibilities of the operators being irradiated under normal circumstances of operation. The result of blood counts point to an increased lymphocytosis in radar operators, white the other findings are within normal limits. The opinion is expressed that inadequate proof exists to attribute this lymphocytosis to microwave radiation, taking into account the conditions of exposure in the microwave field.

(24) D o u r y, P., B o i s s e l i e r, P, B e r n a r d, J.

PATHOLOGICAL EFFECTS OF ELECTROMAGNETIC HIGH FREQUENCY RAYS OF RADAR DEVICES ON THE HUMAN BEING: A CASE STUDY.

EFFECTS PATHOLOGIQUES SUR L'HOMME DES RAYONNEMENTS ELECTROMAGNETIQUES U.H.F. DES AERIENS RADARS-A PROPOS D'UNE OBSERVATION.

Sem. hop. 46, 42, 1970, 2681 - 2683

The clinical observation of a case of an extraordinary long exposition [illegible] rays of a very high frequency, emitted by two types of radar devices for aeronautics (search radar and monitoring radar), showed an extensive change of the general status. There disturbances in connection with an intensive vegetative dystonia, a hypercoagulability syndrome with multiple venous thrombosis as well as endocrine disturbances were found. After concluding the exposition the disturbances progressively abated. The importance of medical supervision of the staff and of safety measures (safety clothes and goggles, absorbing protective screens and bottoms, marking of exposed areas) is discussed.

(25) E d w a r d s, V.

MICROWAVE DOSIMETRY USING A RESONANT CAVITY.

BRH/DBE Radiation Bio-Effects, Summary Rept. Jan.-Dec.1970, 221

In the microwave cavity irradiation technique discussed, a detailed mathe - matical approach to the problem involved in determining the biological absorption is given.

(26) F r e y, A.H.

EFFECTS OF MICROWAVE AND RADIO FREQUENCY ENERGY ON THE CENTRAL NERVOUS SYSTEM.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 134 - 139

Review. Author briefly refers some of the history of research in the area biological effects of microwave on the CNS and the experimentation in this area that be has carried out.

(27) G a z i v o d a, N.

COMPARATIVE ELECTROENCEPHALOGRAPHIE AND CLINICAL NEUROLOGICAL EXAMINATIONS IN RADAR OPERATORS.

Vojnosanit. Pregl., 27, 11, 1970, 542 - 545

EEG examinations were performed on 90 operators of various ages under conditions of the electromagnetic field. The precentage of subjective disturbances in these operators taken together with the low voltage, the EEG electrical activity without correlation with other parameters-neurologic findings age -should not be connected with radiation of this kind. According to the pre - sent findings there is no reason to attribute the findings to the chronic effect of high electromagnetic oscillations on the CNS. It is conducted that there is no serious hazard of radiation if norms and regulations at work strictly followed with proper application of adequate protective measures.

28 G i l b e r t, H.

A STUDY OF MICROWAVE RADIATION LEAKAGE FROM MICROWAVE OVENS.

Amer. Industr. Hyg.Ass.J., 31, 6, 1970, 772 - 78

The increase in the use of microwave ovens for cooking foods results in a

considerable reduction in cooking time over conventional ovens. A study was made of 187 commercial use ovens to determine the extent of leakage of microwave radiation. Twenty percent leaked 10 or more mW/cm^2 at the perimeter of the closed oven door. There is concern about this leakage, particulary because of the increased use of these ovens in the home. There is a need for an improved door desing to minimize leakage. Improved safety interlocks are needed also in some models to assure cut off of microwave radiation while the door is being opened.

(29) G l o t o v a, A.V., S a d c h i k o v a, M.N.

CHARACTERISTICS IN THE DEVELOPMENT AND CLINICAL COURSE OF CARDIOVASCULAR CHANGES OCCURING DUE TO CHRONIC EXPOSURE TO THE EFFECT OF SUPER-HIGH FREQUENCY ELECTROMAGNETIC FIELDS.

OSOBENNOSTI ROZVITIIA I KLINICHESKOGO TECHENIIA IZMENENII SERDECHNO - SOSUDISTOI SISTEMY PRI CHRONICHESKOM VOZDEISTVII ELEKTROMAGNITNYCH POLEI SVERCHVYSOKICH CHASTOT.

Gig. Tr. Prof.Zabol., 14, 7, 1970, 24 - 28

Clinical ECG studies of 105 patients who suffer from the effects of a chronic exposure to cm range radio-waves, are reported. Some patients demonstrated asthenic manifestations with sinus bradycardia and arterial hypertension, running in a compensated fashion while the others showed an early vegetative-vascular dysfunction, not infrequently with signs of hypothalamic insufficiency, hypertensive and angiospatic reactions leading to the derangement of regional circulation (cerebral and coronary) and decrease of the work capacity of such patients.

30 G o r d o n, Z.V.

BIOLOGICAL EFFECT OF MICROWAVES IN OCCUPATIONAL HYGIENE.

Israel program for scientific translations for the national aeronautics and space administration. The National Science Foundation, Washington, D.C., USA, 1970

(31) G r i g o r i a n, D.G., K s e n o f o n t o v a, N.I.

THE EFFECT OF MICROWAVES ON HEPATIC AND BLOOD PLASMA PROTEINS OF THE NORMAL ANIMAL AND DURING VARIOUS PERIODS OF EXPERIMENTAL ATHEROSCLEROSIS EVOLUTION.

VLIIANIE MIKROVOLN NA BELOK PECHENI I SYVOROTKI KROVI KROLIKOV V NORME I V RAZNYE SROKI RAZVITIIA EKSPERIMENTALNOGO ATEROSKLEROZA.

Tr. CNII kurotrol. i fizioterapii, 15, 1970, 142 - 148

Feeding of rabbits with cholesterol for 30 days and exposure to microwaves

(effective density 0.045 W/cm^2) of the liver region of healthy animals increased the level of albumin and alpha-globulin in the blood plasma and at the same time, reduced the gamma-globulin level.

(32) Hamid, M.A., Boulanger, R.J., Hodgson, G.C., Kondra, P.A., Smith, K., Bragg, D.B.

THE EFFECT OF MICROWAVE RADIATION ON THE GROWTH AND REPRODUCTION OF CHICKENS.

J. Microwave Power, 4, 4, 1970, 253,- 256

Preliminary results of an experiment designed to study the behavior of chickens continously exposed to microwave radiation show no adverse effect on the laying rate, feed efficiency, weight of peak production, albumen quality, shell thickness, fertility, hatchability, water consumption, and mortality. Under the experimental conditions described, continuous microwave radiation may have some beneficial effects on chickens.

(33) Healer, J.

REVIEW OF STUDIES OF PEOPLE OCCUPATIONALLY EXPOSED TO RADIO-FREQUENCY RADIATIONS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 90 - 97

They are presented informations about the problem of occupationel expesition to rf radiation from the coming Soiviet union and Eastern European countries.

(34) Healer, J., Smiley, R.

CITATION INDEX FOR FOREIGN LANGUAGE REPORTS ON BIOLOGICAL EFFECTS OF RADIOFREQUENCY ELECTROMAGNETIC FIELDS.

Cit.in U.S.Gov.Res.Dev.Rep., 70, 14, 1970, 56, AD-706 236

A citation index is presented for foreign language documents selected from an extensive literature collection in the subject field of biological effects of radio-frequency electromagnetic field, with emphasis on the microwave range. Also included a list of references cited in each document used as basis for the citation index.

(35) Henny, G.C., Tansy, M., Kall, A.R., Watts, H.M., Campellone, F.

STUDIES OF BIOLOGICAL HAZARDS FROM HIGH POWER HF BAND TRANSMITTERS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept.Health, Education and Welfare, Public Health Service, 1970, 66 - 69

The effect of frequency of irradiation (for a constant radiation dosage) on biological parameters of the rats was determined. The adult male albino Wistar rats was used. Several experimental variables were studied in the 6 MHz and 14 MHz regions. The effects were observed in thin tissue section slides of myocardium, lung, liver, stomach, pancreas, kidney, testis and spleen. The field intensities used were one or more orders of magnitude higher than those corresponding to the far field microwave safety limit of 10 mW/cm^2. The patological damage appeared to be on the order of 50 percent greater at 14 MHz than at 6 MHz.

36 Huxsoll, C.C., Dietrich, W.C., Morgan, A.I.

COMPARISON OF MICROWAVE WITH STEAM OR WATER BLANCHING OF CORN- ON-THE- COB: I CHARACTERISTICS OF EQUIPMENT AND HEAT PENETRATION.

Food Technol, 24, 3, 1970, 84 - 87

Corn- on- the- cob was microwave blanched in a 25 kW continuous microwave tunnel, water blanched in a steam jacketed kettle and steam blanched in a conventional steam blancher. Combinations of water blanching followed by microwave blanching were also examined. The characteristics of heat pene - tration for each blanching treatment were determined, and qualitative enzyme activity tests were made for each blanching procedure. Complete inactivation of the peroxidase enzyme required approximately 6 min in microwave and 20 min in steam or water. A 4 min water blanch followed by a 2 min microwave blanch also resulted in complete inactivation.

(37) Illinger, K.H.

MOLECULAR MECHANISM FOR MICROWAVE ABSORPTION IN BIOLOGICAL SYSTEMS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept.of Health, Education and Welfare, Public Health Service, 1970, 112 - 115

Mechanisms of interaction of biological systems with radiation are explained in terms of quantum-mechanical models.

(38) J o l y, R., S e r v a n t i e, B.

EMISSION RADAR AND SAFETY.

EMISSION RADAR ET SECURITÉ.

Travail humain, 33, 2, 1970, 311 - 314

After a short reference to the fundamentals, components and efficiency of a radar device the hazards are discussed. That can occur in connection with the transmitting system, above all the thermal hazards that particulary effect the hollow organs, testicles and eyes. Safety standards of the French army. Safety measures: Marking the dangerous areas by colour coding, barriers etc.; wearing wire clothes, especially the maintenance staff; medical supervision, above all opthalmological and hematological examinations. The authors emphasize, that not the radar staff, working in the direct neighbourhood of the electronic equipment, is most endangered and that the radar hazards are of latent nature.

(39) J o n e s, D.E., L e a c h, W.M., M i l l s, W.A., M o o r e, R.T., S h o r e, M.L.

EFFECTS OF 2450 MHz MICROWAVES ON PROTEIN SYNTHESIS AND ON CHROMOSOMES IN CHINESE HAMSTERS.

Ioniz. Radiat., 1, 3, 1970, 125 - 130

Male Chinese hamsters were investigated to determine the effects of whole body microwave irradiation on the in vivo incorporation of 14 C-labeled phenylalanine into liver and testis protein, and the chromosomes of mitotic bone marrow cells. Incorporation of labeled amino acid into protein was decreased in both liver and testis. Chromosome stickness phenomena were increased. Chromatid aberrations were not seen in the 1 st division following microwave exposure.

(40) J u s t e s e n, D.R., K i n g, N.W.

BEHAVIORAL EFFECTS OF LOW LEVEL MICROWAVE IRRADIATION IN THE CLOSED SPACE SITUATION.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept.of Health, Education and Welfare, Public Health Service, 1970, 154 - 179

The "closed-space" irradiation concept as a biological and psychological research tool is considered in this paper. The advantages and disadvantages of "open-space" and "closed-space" irradiation techniques are described. Authors discuss problems and approaches regarding quantitative characteri -

sation of EM energy and problems of empirically inter-relating field - density and calorimetric dosimetries.

(41) Kaderavek, F.

THERMOREGULATORY EVENTS ASSOCIATED WITH MICROWAVE APPLICATION.

TERMOREGULAČNÍ DĚJE PŘI APLIKACI MIKROVLN.

Fysiatr. a reumatol. věstn., 48, 3, 1970, 112 - 120

Study animals were exposed for a period of 30 minutes to the action of microwaves (2450 MHz). The internal and skin temperature was recorded afterwards. The highest absolute rise in temperature was observed in the regions directly exposed to wave action. The highest relative rise in temparature was registered on the limbs. The volume of utilized energy produced by the microwave generator amounts to 42 - 50%.

(42) Kamat, G.P., Janes, D.E.

STUDIES ON THE EFFECT OF 2450 MHz MICROWAVES ON HUMAN IMMUNOGLOBULIN G.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 104 - 111

The human imunoglobulin IgG was used. Two IgG samples were irradiated ared with microwace oven (2450 MHz) and their elution profiles on Sepharose 4B columns compared with those of unirradiated IgG and with IgG which had been heated in a water bath at 50°C for 30 min. The results indicate that there is no qualitative diference between the effects observed when IgG is heated either with microwaves or with a water bath.

(43) Kholodnyi, A.I., Stravinskaia, P.T., Chesnokov, V.I.

CHANGE IN VIABILITY OF BLOOD ERYTHROCYTES IRRADIATED WITH ULTRAHIGH FREQUENCY ELECTROMAGNETIC WAVES.

Probl. Gematol. Pereliv. Krovi, 15, 7, 1970, 39 - 41

The peripheral blood of 3 test dogs was irradiated while in extracorporeal circulation with ultrahigh frequency electromagnetic waves (12,5 cm, power density = 50 mV/cm^2) for 11/2 hr. A test for acid stability and measurement of the life-span of erythrocytes labeled with Cr^{51} were conducted according to accepted methods. The results, when compared with values for

a control group of 4 dogs, indicate that the direct action of such an electromagnetic field lowers the viability of erytrocytes.

(44) K i e r e b i n s k i, C.

A HISTOLOGICAL COMPARISON OF THE STRUCTURAL CHANGES IN MEAT TISSUE FOLLOWING HEATING WITH MICROWAVES (2450 MHz) AND HEATING WITH THE TRADITIONAL METHOD.

Med. Vet., 24, 1, 1970, 26 - 28

Structural changes in meat tissue-beaf longissimus dorsi muscle-subjected to heating with microwaves (2450 MHz) for 1 to 4 min. were evident upon histological examination. The morphological changes included corrugation and contraction of the sarcoplasma, formation of free spaces between the sarcoplasma and sarcolemma, and partial disappearance of the sarcolemma. The granular sarcoplasm then filled the spaces. In the samples examined following heating for 4 min. the internal temperature of the meat reached 100°C and simultaneously an intense release of steam from the product was observed. Similar changes were observed in the structure of meat heated in boiling water (traditional method) for 35 min.

45 K i n g, G.R.

EFFECT OF MICROWAVE OVEN ON IMPLANTED CARDIAC PACEMAKER.

J.Amer.Med.Ass. 212, 1970, 1213

(46) K o l d a e v, V.M.

THE INFLUENCE OF ULTRA-HIGH FREQUENCY ELECTROMAGNETIC FIELD ON RATS IN THE ATMOSPHERE WITH ALTERED OXYGEN CONCENTRATION AND AFTER THE INTRODUCTION OF CHEMICAL SUBSTANCES.

VLIJANIE SVERCHVYSOKOCHASTOTNOGO ELEKTROMAGNITNOGO POLIA NA KRYS PRI IZMENENII INTENSIVNOSTI OKISLITELNYCH PROCESSOV V ORGANIZME.

Bull.Exp.Biol.Med., 11, 1970, 69

The resistance of rats to the effect of ultra-high frequency elmag. field with a wave length of 12,6 cm and intensity of 150 mW/cm^2 in a gaseous mixture enriched with oxygen increases, whereas in oxygen-poor gaseous mixture and after the administration of AET and cystamine decreases. The markedness of these effects depends on the degree and direction of the redox potential of tissue (muscles).

(47) Korbel, S.F.

BEHAVIORAL EFFECTS OF LOW INTENSITY UHF RADIATION.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Department of Health, Education and Welfare, Public Health Service, 1970, 180 - 184

1. At some low intensity power levels, rats exposed to continuous ascending and descending sweeps of frequencies from 300 - 900 MHz showed the folloving behavioral changes as compared to control Ss: (a) consistent, long-term hypoactivity which may be preceded by a short term period of hyperactivity, (b) greater emotionality, (c) longer latency of recovery from electrocon - vulsive shock. (d) longer time to learn to swim in water maze, and(e) a dif - ferential stress reaction as determined by weight of adrenal glands.
2. Within the band of frequencies investigated (320 - 900 MHz), frequencies toward the low end of this band (320 - 450 MHz) have a greater effect in producing hypoactivity than those at the higher end (770 - 900 MHz).
3. At the low power level of 0.50 mW/cm^2 applied for 40 days, UHF appears to be related to hypoactivity, but has essentially no significant effect on emotionality, learning, or stress.
4. Results suggest that some time is required for UHF to have a consistent effect on behavior.

(48) Kulachenko, S.P.

A STUDY OF REGULATION MECHANISMS OF BLOOD PLASMA PROTEIN CONTENTS IN RABBITS EXPOSED TO MICROWAVES AND DRUGS.

IZUCHENIE MECHANIZMOV REGULIACII BELKOVOGO SOSTAVA SYVOROTKI KROVI KRO - LIKOV PRI VOZDEISTVII MIKROVOLN I FARMAKOLOGICHESKICH VESHCHESTV.

Tr. Celinogr. selskokhoz. inst., 8, 9, 1970, 172 - 177

Total protein contents as well as blood plasma protein fractions were stu - died following exposure to microwaves and drugs, as well as the action me - chanism. Field intensity amounted to 75 W/cm^2, duration of exposure to 10 min. Changes were found in the protein pattern of the blood plasma fol - lowing the application of drugs (aminazin, ephedrine, atropine, strychnine), as well as following exposure to microwaves. These changes allow the assump- tion that the nervous system and endocrine glans play an important part in the action mechanism of microwaves.

(49) Kurtshaliya, V.A., Golovnya, R.L.

EFFECT OF SUPER-HIGH FREQUENCY ELECTROMAGNETIC FIELD (SHF EF) OF DECIMETER RANGE ON THE COURSE OF ACUTE ASEPTIC INFLAMMATION OF THE GENITALS.

VLIYANIE SVERKHVYSOKOCH.STOTNOGO ELEKTROMAGNITNOGO (SVCH EM) POLIA DETSIM.E - TROVOGO DIAPAZONA NA TECHENIE OSTROGO ASEPTICHESKOGO VOSPALITEL'NOGO PROTSESSA POLOVYKH ORG.NOV.

Soobshch.Akad.Nauk Gruz.SSR, 58, 1, 1970, 225 - 228

Experimental data on the effect of SHF EF on the course of an acute inflammatory process of the genitals are discussed. These data show the powerful anti-inflammatory action of these waves and the advisability of their use in the acute stages of the disease.

(50) Auzman, E., Bretz, K.

EFFECT OF MICROWAVE FIELDS ON BIOLOGICAL STRUCTURES.

Hungarian Academy of Sciences and Scientific Society for Telecommunication, Coloquium on Microwave Communication, 4th, Budapest, Hungary, April 21-24, 1970, Proceedings. Vol.4, Ed.G.Bognár, Budapest, Academiai Kiado. 1970

Use of the Mössbauer effect to study submolecular changes induced in blood specimens of various animals by microwave irradiation. The Mössbauer spectrum of the oxyhaemoglobin in blood exposed to a microwave field shows a decrease in the isomer shift and a increase in quarrupole splitting. The implications of these changes are assessed, and it is concluded that the convalence of oxyhemoglobin increases in blood exposed to the action of microwave fields.

(51) Laroche, M.P., Zaret, M.M., Brown, A.F.

AN OPERATIONAL SAFETY PROGRAM FOR OPHTHALMIC HAZARDS OF MICROWAVE.

Arch. Environm. Health., 20, 3, 1970, 350 - 355

Cases reported demonstrate the latency and slow evolution of microwave cataractogenesis in man. Some safety operating instructions are recomended for the employees working with or in vicinity of systems capable of producing hazardous levels of microwave radiation.

(52) Laskey, J.

LETHAL DOSE OF 2450 MHz MICROWAVE IRRADIATION AT VARIOUS POWER DENSITIES IN THE SPRAGUE-DAWLEY RAT (A PRELIMINARY REPORT).

BRH/DBE 70-7 Radiat. Bio-Effects, Summary Rept.Jan.-Dec.,1970, 167

Time - to death in rats exposed to microwaves at various power densities was measured.

(53) L a s k e y, J., D a w e s, D., H o w e s, M.

PROGRESS REPORT ON 2450 MHz IRRADIATION OF PREGNANT RATS AND THE EFFECT ON THE FETUS.

BRH/DBE 70-7 Radiation Bio-Effects, Summary Rept. Jan.-Dec.1970, 167 - 173

The effect of 2450 MHz microwave irradiation delivered to pregnant rats on the unborn pups is tested. Pregnant animals were exposed during the preimplantation stage, day 2 or day 2 and day 5, the postimplantation stage, day 8; or in the posorganogenesis stage, day 13 of gestation. Each exposition was 8 - 13 min. There was found : a significant increase in the number of resorptions in the dams exposed on day 8 of gestation, a significant decrease in the weight of fetuses from dams exposed on day 8 and day 13 of gestation, a 20% reduction of brain cell-free incorporation of ^{14}C phenylalanine into protein from fetuses exposed on day 8 and day 13 of gestation. No significant patological changes was found.

(54) L a t e u r, J., L e h m a n n, J.F., S t o n e b r i d g e, J.B., W a r r e n, C.G., G u y, A.W.

MUSCLE HEATING IN HUMAN SUBJECTS WITH 915 MHz.

Arch.Phys.Med.Rehabil., 51, 3, 1970, 147 - 151

Microwave diathermy, using a 915 MHz direct contact applicator with circulating, was applied to the anterior thighs of 2 groups of volunteers, 1 with - 1 cm subcutaneous fat, the other with - 2 cm fat. Temperatures in the tissues were monitored continually, throughout the experiments. Physiologically efective temperature increases were produced, at various times during the 20 min application, to an average depth of 2.5 cm in thinner and of 2.1 cm fatter subject. The cooling permits vigorous muscle heating without exceeding tolerance levels in the subcutaneous fat. The increased blood flow in superficial layers of muscle also contributes to uniform muscle heating, since by cooling the superficial layers the temperatures in deeper layers of muscle are permitted to rise with continued application of energy.

55 M a f r i c i, D., B e r n s t e i n, S.V., M i l l e r, C.E.

NASSAU COUNTY MICROWAVE OVEN STUDY, JUNE 1969 - MARCH 1970.

Radiol.Hlth Data Rep., 11, 12, 1970, 667 - 670

The radiological health section of the Nassau County Department of Health conducted a survey of microwave ovens located in Nassau County, New York. A total of 166 ovens were surveyed between June 1969 and March 1970. It was found that 23 of the 166 ovens (14%) exceeded the industry's standard of 10 mW/cm^2 during normal operation. When the door was in the process of being opened, 69 of the 166 ovens (42%) exceeded the standard. The owners

and the manufactures of the ovens were notified of the results of the survey, and recommendations were made for correction of deficiencies.

56 M a koč, Z. and coll.

THE EFFECT OF COFFEINE ON THE RESISTANCE OF RATS AGAINST HYPERTHERMIA INDUCED BY MICROWAVE RADIATION.

VLIV KOFEINU NA REZISTENCI KRYS VŮČI HYPERTERMII VYVOLANÉ MIKROVLNNÝM ZÁŘENÍM.

Vojenské zdravotnické listy, 5, 1970, 186 - 190

A study was made on the effect of coffeine administered per os on the resistence of rats against hyperthermia produced by microwave radiation of relatively high intensity (H = 120 mW/cm^2 and lambda = 3.1 cm). Coffeine failed to influence the temperature which was lethal for the animals, but shortened the period for which the animals tolerated hyperthermia. It seems that the cause for the reduced resistance of rats is the action of coffeine on the central nervous system and raised metabolic activity and oxygen consumption.

57 M a r h a, K.

MAXIMUM ADMISSIBLE VALUES OF HF AND UHF ELECTROMAGNETIC RADIATION AT WORK PLACES IN CZECHOSLOVAKIA.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. Health, Education and Welfare, Public Health Service, 1970, 188 - 196

Research in Eastern Europe on biological effects of microwaves is briefly reviewed and a basic viewpoint involving nonthermal and cummulative effects is presented. Safety standards expressed in terms of dose or irradiation are described based on this viewpoint. It is suggested that differences between these standards and those in the West may become smaller with further study and closer collaboration between researches in this field.

58 Mcc A f e e, R.D.

THE NEURAL AND HORMONAL RESPONSE TO MICROWAVE STIMULATION OF PERIPHERAL NERVES.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 150 - 153

A 12.2 cm Rathem Microtherm apparatus and a surplus aircraft 3 cm radar were used in this study. The output at the 3 cm radar waveguide was about 200 mW at 1000 cps. Areas well supplied with afferent cutaneous nerves, such the lower limbs or face, of a decerebrated cat were irradiated. When the subcutaneous temperature reached 45° ± 2°C a powerful nociceptive reflex was produced. The blood pressure increased 50 to 60 mm Hg and the respirations became hyperpneic folowing a period of apnea. The crossed extension reflex was observed when the feet of the animal were irradiated. No changes were observed when the subdermal region was injected with xylocaine, or were sectioned. Cardiac arrhythmias have been observed as a result of microwave irradiation of anesthetized animals and have been attributed to the nonthermal microwave effect. Author found that analeptic effect of microwave radiation (known fenomen) can be duplicated by irradiating regions other than the head. The noural and hormonal interactions, which may be occuring as a result of peripheral nerve stimulation by thermal heating or heat from microwave irradiation are also described.

(59) McGregor, R.J.

A DIRECT MECHANIZM FOR THE INFLUENCE OF MICROWAVE RADIATION ON NEUROELECTRIC POTENTIALS.

The Rand Corporation, Santa Monica, Calif., USA, 1970, Rept. no. P-4398

The paper explores the idea that electrical component of applied microwave radiation might induce transmembrane potentials in nerve cells and thereby disturb nervous functions and behavior. The paper estimates the transmmembrane currents and potentials induced in nerve cells by applied electrical fields and currents. Estimates are made for steady and for oscillating stimulation. The primary conclusion is that intracranial electrical fields associated with low intensity microwave irradiation may induce transmembrane potentials of tenths of millivolts (or more) and that therefore such externally applied field may disturb normal nervous function through this mechanism. The paper also presents an analysis which indicates that the induced transmembrane potential should exhibit maximum in the microwave range of electromagnetic radiation.

(60) McGregor, R.J.

A BRIEF SURVEY OF LITERATURE RELATING TO THE INFLUENCE OF LOW INTENSITY MICROWAVES ON NERVOUS FUNCTION.

The Rand Corporation, Santa Monica, Calif., USA, 1970, AD-712 694 in US.Gov.Res.Dev.Rep., 70, 23, 1970, 56

A review is provided of behavioral, neuroelectric, and morphological effects resulting from exposure to low intensity microwave radiation

(61) M i c h a e l s o n, S.M.

BIOLOGICAL EFFECTS OF MICROWAVE EXPOSURE.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 35 - 58

The paper is divided as follows.
I. Thermal effect. A. Biophysical Principles. B. Biomedical Principles.
II. Critique of Biomedical Investigations into the Biological Effects of Microwaves.
A. Experimental Design. B. Effect on the Lens of the Eye. C. Effect on the Testes. D. Embryonic Development. E. Alteration in Electrophoretic, Immunologic and Enzymatic Activity of Proteins. F. Decreased Incorporation of Labeled Amino Acid Into Liver and Testes. G. Genetic Effects. H. Pearl - Chain Formation. I. Soviet Investigations. J. Central Nervous System Effects. K. Cardiovascular Effects. L. Ionizing Radiation. M. Perspective. N. Prospects.

(62) M i c h a e l s o n, S.M.

PATHOPHYSIOLOGICAL ASPECT OF MICROWAVE IRRADIATION: I. THERMAL EFFECTS.

Non - Ioniz. Radiat., 1, 4, 1970, 169 - 176

Laboratory experience concerning the effects of radiation within the range of frequencies from 500 MHz - 10 GHz (60 - 3 cm wavelength) is summarized.

(63) M i k o l a j c z y k, H.

NUMBER OF MITOSES IN CORNEAL EPITHELIUM OF EXPERIMENTAL ANIMALS EXPOSED TO MICROWAVES. Medycyna pracy, 1, 1970, 15 - 22

The number of mitoses was counted per 100 high power fields in the corneal epithelium of rats, cocks and rabbits exposed to microwaves at 8.00 - 9.00 a.m. (morning groups) or at 5.00 - 6.00 p.m. (evening groups). Conditions of exposure: 2860 MHz; 120 mW/cm^2; 6 x 10 min. in daily intervals. In corneal epitholium of rats and cocks the irradiation reduced significantly the number of mitoses in comparison to that in control animals. This decrease was greater by 11.3 per cent in morning group of rats and by some 6 per cent in evening group of cocks. The number of mitoses in corneal epitholium of irradiated rabbits increased significantly in the morning group and decreased significantly in the evening group in comparison to that in the control animals. It was suggested that intra and inter-species differences in the frequency of mitoses in the corneal epitholium under the influence of microwaves could be due to variation in sensitivity of this epitholium in relation to circadian rhytm of mitotic cell division.

The author emphasized the possibility of taking into consideration the circadian rhytm of physiological functions in establishing the permissible microwaves power. Careful inspection of the cornea during opthalmologic investigation of persons exposed professionaly to electromagnetic radiation seems to be highly recomended.

(64) Mills, L.F.

BIOLOGICAL EFFECT OF DIATHERMY.

BRH/DBE 70-7, Radiation Bio-Effects, Summary Report, 1970, 50- 52

The purpose of this project is to determine the biological effects associated with the therapeutic application of heat by means of microwave diathermy. The need for this information is based on the widespread use of diathermy in medical and dental practice and the probable association between microwave radiation and cataract formation. By determining the frequency of cataracts or other lens opacity in a treated population, this study evaluates the biologic effects associated with acute exposure and repeated exposure to therapeutic microwave diathermy.

(65) Mills, L.F., Segal, P.

RADIATION INCIDENTS REGISTRY REPORT 1970.

BRH/DBE 70-6, Dec. 1970, 55, U.S.Dept.Health,Education, Welfare

There are reported incidents and potential incidents, resulting from exposure to ionizing and nonionizing radiation (electromagnetic radiation - microwaves, laser).

(66) Miro, L., Deltour, G., Pfister, A., Kaiser, R.

DIFFICULTIES IN LIMITING DANGER ZONES FOR PERSONNEL AROUND RADAR ANTENNAS.

DIFFICULTES A CIRCONSCRIRE LES ZONES DANGEREUSES POUR LE PERSONNEL AUTOUR DES AERIENS RADARS.

Rev.Méd.Aérounaut.Spatiale, 9, 1970, 7 - 8

Discussion of the dangerous effects of radar beams on personnel, and of means of protecting them. Various syndromes caused by radar beams are enumerated, some of which are irreversible. The U.S. has established certain exposure time limits and intensities of radiation beyond which individuals must not be subjected. The USSR imposes much more stringent limits. It is suggested that dangerous areas should be demarcated by beacons, and

all persons authorized to enter them should be fully instructed. The case is complicated by the possible conjuction of beams when two or more radars are operating together in the same area.

67 M o o r e, R.L.

A COMPARISON OF MICROWAVE DETECTION INSTRUMENTS.

BRH/DEP 70-7, Bureau of Radiological Health, Public Health Service, Rockville, Maryland 20852, USA, April 1970, 17

Various types of devices for detecting and measuring the energy density of microwaves, emitted by electronical devices, were tested and evaluated by help of criteria: Accuracy, response, reliability, simplicity of measurement, heat resistance, life of battery and costs. It turned out, that all devices have their advantages and disadvantages.

68 M u m f o r d, W.W.

HEAT STRESS DUE TO R.F. RADIATION.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 21 - 34

There are results of a brief study undertaken to evaluate in a quantitative way the heat stress due to microwave radiation. There is established a reduction factor for the Radiation Protection Guide (RPG) number under adverse thermal environmental conditions.

69 P e p e r s a c k, J.P.

A NEW INDUSTRIAL DANGER: CENTIMETER WAVES.

Brux Med., 50, 1970, 243 - 247

The paper summarizes well known facts, does not contribute any new experiments and findings, no literary references. The author in his brief introduction states the limits of frequency and wave length of centimeter waves and refers to their exploitation. Physio-pathological aspects of the problem are dealt with next. A general review is given on the thermal and non-thermal effect, stress is laid to ocular and testicular damage. A description is presented of subjective and objective symptoms in persons. The American standard for maximal permissible radiation values is given. In conclusion the preventive measures for avoiding a pathological effect of centimeter waves is discussed i.e. adaptation of work places, screening of appropriate parts of equipment and individual protection.

70 Petrov, I.P.

THE EFFECT OF UHF FIELDS ON THE HUMAN AND ANIMAL ORGANISM.

VLIIANIE SVČ-IZLUCHENII NA ORGANIZM CHELOVEKA I ZHIVOTNYCH.

L. Medicina, 1970, 230

This book consists of an introduction and three parts. The introduction deals with biophysical foundations of the UHF field effect on the organism. The I. and II. parts present experimental facts about the effect of microwaves of high and low intensities on the bodies of animals. The III. part is devoted to the effect of microwave of low intenisities on the human body.

71 Piontkovskaii, I.A., Kruglikov, R.I., Efremova, T.A.

EMBRYOLOGIC AND GENETIC EFFECTS OF ELECTROMAGNETIC OSCILLATIONS OF ULTRA- HIGH FREQUENCY (MICROWAVE).

Patol. Fiziol. Eksp. Ter., 14, 2, 1970, 33 - 38

Female rats with 1 to 20-day gestation period were subjected to irradiation with microwaves intensity 10 and 50-55 mW/cm^2, for 20 and 15 min. after irradiation with microwaves, 50-55 mW/cm^2 for 15 min, male rats were coupled with nonirradiated female animals. The progeny of irradiated animals displayed reduced viability maldevelopment and anomalies, as well as changes in the rate of postnatal development. There were also various disturbances of the higher nervous activity. Under definite conditions microwaves proved to produce both genetic and embryologic effects.

72 Powell, C.H., Vosel, E.Rose

HEALTH SURVEILLANCE OF MICROWAVE HAZARDS.

Amer.Ind. Hyg. Ass. J., 31, 1, 1970, 358 - 367

Various local, state and federal health programs and survey techniques and instrumentation are reviewed. Standardization of survey techniques is suggested, and recommendations are presented regarding future activities in establishments where persons may be potentially exposed to microwaves from ovens and other commercial and industrial sources of energy.

(73) P o z o s, R.S., R i c h a r d s o n, A.W., K a p l a n, H.M.

NONUNIFORM BIOPHYSICAL HEATING WITH MICROWAVES.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S. Dept. of Health, Education and Welfare, Public Health Service, 1970, 70 - 75

The question, that the position of the animal relative to the microwave di - rector alters the biological respons, is studied. The paper is centered in determining exactly the microwave pattern. A gel composed of cornstarch and water was found most effective in mapping a microwave field. Two different types of containers for temperature distribution measurements are compare. In animal studies rats were selectively irradiated (2450 MHz). The same hot spots were obtained in both the gel and the irradiated rat. Finally, rat models made of cornstarch were contructed, irradiated and monitored their temperatures. The results on fantoms in every case agreed with the data from live animal studies.

74 R a f a i l a, E., L a n c r a n j a n, I., P r e d a, N., P o p e s c o, H., R o v e n t a, A., T e c o u l e s c o, D.

RECHERCHES CONCERNANT LES MODIFICATIONS DE L'ORGANISME CHEZ LES TRAVAIL LEURS OCCUPÈS AUX INSTALLATIONS DE RADAR.

Ergonomics and Physical Environmental Factors. Occupational Safety and Health Series 21 Geneva: International Labour Office., 1970, 427 S. (175 - 177)

75 R e h n b e r g, G.I., M o g h i s s i, A.A., P e p p e r, E.W.

EFFECTS OF MICROWAVES ON OPTICAL ACTIVITY.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 101 - 103

The initial phase of this study was to determine if microwave irradiation would in fact produce a change in the optical activity of a compounds. A number of a optically active compounds have been evaluated. It was found that the optical rotation of sucrose in mixture of Triton N-101[2] and water could be altered. Also, the optical activity of sucrose in a mixture of glycerin and polyvinylpyrrolidone could be altered. In both cases the optical activity of sucrose was reduced in proportion to the amount of mi - crowave radiation. The effect of heat was compared to that of microwave exposure on each mixture and experimental data are presented. All micro - wave exposures were done with a microwave owen with a frequency of 2450 MHz ± 50 MHz. The magnetron was pulsed at 60 Hz with pulse duration on the order of 5 msec.

76 R e n z, A.

APPLICATIONS OF LASER BEAMS IN ENGINEERING: SAFETY MEASURES AND GUARDS.

ANWENDUNG DER LASERSTRAHLEN IN DER TECHNIK, SCHUTZMASSNAHMEN UND SCHUTZ-VORRICHTUNGEN.

Arbeitsschutz, 1970, 116

The author, technical supervisor of the occupational co-operative for precision mechanics and electrical engineering, begins with asking, which radiation intensity is expected to be dangerous to the human eye. Obligatory threshold values are not existing by now. Only American recommended values, that can be found in a tabular summary, are available. Laser safety goggles offer the best eye protection. Of much interest will be the state - ment, that all known accidents could have been prevented by using safety goggles. Then the author discusses other safety measures. They include the arrangement of special laser areas, that shall be marked by warning boards. Warning lights are going on during laser operation. Wearing safety goggles should be a duty; their filters are to be selected with consideration to special aspects. The complete enclosure of the beam is the best protection.

77 R o s e, V.E., P o w e l l, C.H., L a N i e r, M.E., S w a n s o n, J.R.

A REVIEW OF UNITED STATES MICROWAVE EXPOSURE CRITERIA.

Ergonomics and Physical Environmental Factors. Occupational Safety and Health Series 21 Geneva: International Labour Office, 1970, 427 S. (186 - 191)

78 R o t h m e i e r, R.

EFFECT OF MICROWAVE RADIATION OF FROG SCIATIC NERVE.

Atl. Natur, 25, 1, 1970, 57 - 69

79 R u s c h, D.

MECHANISM OF SHORT WAVES AND MICROWAVES.

WIRKUNGSWEISE VON KURZ- UND MIKROWELLEN.

Dtsch. med. Wschr., 95, 45, 1970, 2307 - 2308

80 S c h w a n, H.P.

INTERACTION OF MICROWAVE AND RADIOFREQUENCY RADIATION WITH BIOLOGICAL SYSTEMS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 13 - 20

The author refers these problems: Dielectric properties of tissues observed at microwave frequencies. Depth of penetration. Relative absorption cross section of man. Non-thermal effects. Field evoked force effects. Excitation of biological membranes. Macromolecular resonance. Standards of safe exposure.

81 S e o, S.T., C h a m b e r s, D.L., K o m u r a, M., L e e, C.Y.L.

MORTALITY OF MANGO WEEVILS IN MANGOES-M TREATED BY DIELECTRIC HEATING.

J. Econ. Entomol., 63, 6, 1970, 1977 - 1978

Authors determine whether dielectric heating with microwaves would give sufficient kill of the mango weevils in fruits. For the test individual infested fruit was placed in the center of the oven of the Amana RR-2 Radarange about 25 mm above the bottom. The frequency and power rating of the radiation were 2450 MHz and about 700 W. Each fruit was either irradiated contiunously for 25-60 sec or was irradiated in 4-10 increments of 10-15 sec; the interval beetwen the increaments was 3-4 sec. During the total of 40-150 sec of the interrupted treatment, the fruit was rotated about 360°. The mortality of adults pupae and larvae of the mango wevil in fruit was evaluated immediatelly and at 48 hour posttreatment. Continuous treatment with microwaves of stationary fruit for 45 sec or more cooked the rind and pupae about 90% of the fruits. If 10 to 15 sec treatments were repeated 4-8 times while the fruit was rotated about 360°, cooked pupae was found only in small areas next the stone and below the neck and the ventral shoulder. 50, 95 and 99% of the weevils died at mean internal temperatures in the stone of 51 ± 4°, 66 ± 16° and 74 ± 24°C.

82 S h a s k a n, E.G.

MICROWAVE IRRADIATION AND HEATING EFFECTS ON METABOLISM OF RAT BRAIN SEROTONIN.

Pharmacologist, 12, 2, 1970, 205

Male Wistar rats (150-250 g) were irradiated in lucite cubicles with a signal of 30 GHz (10 cm) cw. Power levels were set either at 40 mW/cm^2 for 1hr (acute, high level) or at 10 mW/cm^2 for 8 hrs par day for 7 days (chronic, low level). Other rats were placed in identical cubicles but out of the radiation field or in a room maintained at 35° to assuess possible thermal

effect. Turnower of forebrain 5 -HT was estimated from the decline 5 hydroxy-indoleacetic acid (5 -HIAA) after pargyline (75 mg/hg) or its increases after probenecid (200 mg/hg). Acute high level irradiation significantly increased rectal temperature, elevated initial (before drug administration) 5 - HIAA, and accelerated 5-HT turnover. Chronic irradiation or high ambient temperature moderatelly increased rectal temperature and lowered, initial 5-HIAA measured one day after cessation of treatment. Our findings suggest that chronic irradiation with low levels of microwaves may be a significant, and that drowsi - ness and related central effects reported in man may be related to effects on 5-HT metabolism. (Supported by U.S.Army Contract DA DA 17-69-C-9144).

83 S h e r, L.D.

SYMPOSIUM ON BIOLOGICAL EFFECTS AND HEALTH IMPLICATIONS OF MICROWAVE RADIATION.

Medical research engineering, February 1970, 12

A Review.

84 S h i n d r y a e v, A.A.

NOMOGRAM FOR CALCULATING THE POWER FLUX DENSITY IN THE DISTANT ZONE OF A SUPERHIGH - FREQUENCY FIELD.

Gig. Tr. Prof. Zabol., 14, 1, 1970, 56 - 58

A nomogram is proposed with permits simple and rapid calculation of the power flux density of a superhigh-frequency field at various distances from radar devices. This nomogram can be recommended to medical workers check the wor - king conditions of radar personnel as a guide when determining the power flux density in the distant zone of superhigh-frequency field.

85 S h i v e l y, J.N.

A PILOT STUDY OF EFFECTS OF MICROWAVE EXPOSURE ON ONTOGENESIS.

BRH/DBE 70-7 Radiation Bio-Effects, Summary Report, Jan-Dec 1970, 201 - 203

Under the conditions used in this pilot experiment, morphologic changes attributable to microwave exposure were not found.

86 S n y d e r, S.H.

THE EFFECT OF MICROWAVE IRRADIATION ON THE TURNOVER RATE OF SEROTONIN AND NOREPINEPHIRINE IN RAT BRAIN.

U.S.Gov.Res.Dev.Rep., 70, 19, 1970, 56, AD - 710 005

This is a report covering the first year of a research program directed at detecting neurochemical alterations in laboratory animals exposed to microwave irradiation at levels of 10 mW/cm^2. At this low level of irradiation we found that after 7 days exposure for 8 hours per day, there was a marked slowing of serotonin turnover it rat brain. This suggest that microwave irradiation decreased the firing rate of serotonin neurons in the brain. Since these neurons are known to participate in the regulation of sleep and wakefulness as well as body temperature, our findings may account for certain of the behavioral effects produced by microwave exposure.

87 S t a v i n o h a, W.B., P e p e l k o, B., S m i t h, P.W.

MICROWAVE RADIATION TO INACTIVATE CHOLINESTERASE IN THE RAT BRAIN PRIOR TO ANALYSIS FOR ACETYL CHOLINE.

Pharmacologist, 12, 2, 1970, 257

The use of microwave radiation decreases the time required for enzyme inactivation and increases the concentration of acetylcholine measured.

88 S u b b o t a, A.G.

NON-THERMAL EFFECTS OF ELECTROMAGNETIC WAVES ON THE ORGANISM.

NETEPLOVOE DEISTVIE MIKRORADIOVOLN NA ORGANIZM.

Voen. - med. zh., 9, 1970, 39 - 45

In this comprehensive review the author deals with non-thermal effects of microwaves on a variety of physiological functions (effective density 10 mW/cm^2 and lower), as determined in a series of experiments using small laboratory animals. Detailed treatment is given to changes in the state and function of the central nervous system in dogs, studied by the method of conditional reflexes. Mention is made also about some alterations in the human body following UHF irradiation.

89 S w a n s o n, J.R., R o s e, V.E., P o w e l, C.H.

A REVIEW OF INTERNATIONAL MICROWAVE EXPOSURE GUIDES.

Amer. Industr. Hyg. Ass. J., 31, 5, 1970, 623 - 629

The use of higher frequency microwave generating equipment has increased considerably since the development of radar and range finder equipment in the early 1940. Occupational exposure criteria were not officially proposed in the United States until 1958 when a maximum exposure of 10 milliwatts per square centimeter was established for United States Air Force operations. Since then, many organizations have proposed or adopted criteria which have expanded on the concept of a single exposure limit to incorporate other factors involved in a biological response. A review of representative exposure criteria used in the United States is presented along with those adopted in other countries such as England, Russia and Poland and others. Where criteria differ from United States guidelines a short review of the scientific evidence is provided.

90 T a n n e r, J.A., R o m e r o - S i e r r a, C.

BIRD FEATHERS AS SENSORY DETECTORS OF MICROWAVE FIELDS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. Health, Education and Welfare, Public Health Service, 1970, 185 - 187

In experiments a feathers Leghorn hens and defeathered chickens were exposed to the microwave field. The field intensity measured at the tail was 50 mW/cm^2 at a frequency of 9,29 GHz pulsed at 416 pps with a pulse width of 2,35 usec. After a period 10-20 sec the bird with feathers showed mounting signs of distress vented in the form of vocalisation, defecation and the inication of flight. Repeated periods of exposure produced the distress reaction in a shorter time. Little or no reaction was observed in the defeathered birds. These experiments demonstrate that feathers play an important sensory role in enabling a bird to detect a microwave field.

91 T a p e, N.W.

APPLICATION OF MICROWAVE ENERGY IN FOOD MANUFACTURE.

Can.Inst.Food.Technol.J., 3, 2, 1970, 39 - 43

The fast rate of heating obtained from microwave energy has intrigued food scientists for the past 25 years. The application of microwave energy to blanching, cooking, pasteurizing, thawing, drying, etc., has been studied and its advantages and disadvantages discussed. Commercial application in the food industry is recent, however. In 1964, practical continuous microwave ovens with high-powered generating tubes were made available. Plant

installations have been reported for the destruction of mold on bread, baking of crackers, final drying of potato chips, and the pre-cooking of chicken pieces. Several future applications are reviewed. In addition, the microwave tunnel and wave-guide apparatus designed and used by the Food Research Institute, Canada Department of Agriculture, are described and a current study concerning the microwave processing of frankfurters is disscussed. The biological effects of microwave energy are reviewed briefly.

92 T e l l, R.A.

RADIO FREQUENCY AND MICROWAVE ENERGY ABSORPTION IN TISSUE.

ERH/DBE 70-7 Radiation Bio-Effects, Summary Rept., Jan-Dec 1970, 75

This work represents a first approximation to the difficult problem of analytically specifying the heating in an irregularly shaped model.

93 T h o m p s o n, D.R., O r c u t, C.B.,

A MICROWAVE OVEN SURVEY IN MANITOBA.

Can. J. Publ. Health, 61, 6, 1970, 518 - 524

A total of 31 ovens and 1 industrial chip dryper were monitored, both for leakage during operation and for the efficiency of the safety interlock mechanizm. Of the ovens examined only 4 exhibited no leakage. Seven of the 31 radiated energy in excess of the C.S.A. (Canadian Standards Association) recommended maximum of 10 mW/cm^2.

94 T i b b a, C,E.

RADIATION SAFEGUARDS FOR MICROWAVE OVENS.

Non. Ioniz. Radiat., 1, 2, 1970, 73 - 76

The safety and interference aspects of microwave ovens are discused together with the relevant standards. The method of field measurement in the vicinity of an oven and the usher-protection devices icluded in the construction are described.

95 T i k h o n o v, F.D.

FUNCTIONAL DISTURBANCES OF THE GASTROINTESTINAL TRACT IN (HUMAN) SUBJECTS WORKING IN A MICROWAVE FIELD.

Voenno - Meditsinskii Zhurnal, 12, 1970, 44 - 46

The authors studied gastrointestinal conditions in persons who were working for long periods under exposure to UHF fields of low intensity (in the centimeter and decimeter zone). Functional disturbances of the gastrointestinal tract were present in a majority of the workers.

96 U m m e r s e n, C.A., C o g a n, F.C.

EFFECTS OF MICROWAVE RADIATION ON LENS EPITHELIAL CELLS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings. U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 122

In this study microwave radiation was used to determined whether this form of radiation has an effect upon lens epithelium and, if so, whether the effect is similar to that of ionizing radiation on galactose feeding. The right eyes adult white rabbits were exposed to cataractogenic doses of cw radiation at 2,45 GHz, the nonirradiated left eye served as the control. One hour before sacrifice, tritiated thymidine (a radioactive form of the thymine incorporated by cells synthetising DNA in preparation for mitosis and cell division) was injected into the anterior chambers of both eyes. The irradiated lenses showed an initial pronounced suppression of both DNA synthesis and cell division. A precipitous rise in DNA synthesis occuring on the fourth to fifth day after irradiation. This sharp rise in DNA synthesis is similar to that which is observed in galactose fed rats.

97 V i b e, A.G., F a j t e l b e r g - B l a n k, V.R.

THE EFFECT OF MICROWAVES ON THE METABOLISM OF NUCLEIC ACIDS FOLLOWING PRIOR APPLICATION OF HORMONES AND DRUGS.

Tr. Celinogr. Selskokhoz. inst., 8, 9, 1970, 159 - 169

Rabbits were used to study the effect of microwaves on nucleic acid metabolism following the prior application of hormones (ACTH, cortisone, pituitrin) and druggs (strychnine, ephedrine, atropin, aminazin). The nucleic acid content was altered as a result of microwave field exposure. Nucleic acid levels returned to normal, previously raised by drug action. In particular DNA content showed a sharp reduction. RNA likewise returned to a normal level, from the raised content produced by hormone application.

(98) V i b e, A.G., A n l a c h e n k o, S.P.

CHANGES IN AMINO GROUPS CONTENT OF BLOOD SERUM AND LIVER ACCOMPANYING MICROWAVE EFFECT AND ASSOCIATED WITH VARIOUS FUNCTIONAL STATES OF THE NERVOUS SYSTEM AND ENDOCRINE GLANDS.

IZMENENIE SODERZHANIIA AMINOGRUP SYVOROTKI KROVI I PECHENI PRI VOZDEISTVII MIKROVOLN NA FONE RAZLICHNOGO FUNKCIONALNOGO SOSTOIANIIA NERVNOI SISTEMY I ZHELEZ VNUTRENNEJ SEKRECII.

Tr. Celinogr. selskokhoz. in., 8, 9, 1970, 177 - 181

A study was conducted on the amino groups content in the non-protein portion of blood serum and live of rabbits under the action of microwaves. The application of ephedrine, aminazin, strychnine and atropine produced an increase of amino groups content in the blood serum of rabbits. The subsequent exposure to microwave fields induced again reduction of the amino groups content of the blood serum in all instances, changes in either direction were observed in the liver.

(99) V o g e l h u t, P.O.

INTERACTION OF MICROWAVE AND RADIO FREQUENCY RADIATION WITH MOLECULAR SYSTEMS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 98 - 100

Most interaction phenomena are quite well understood in terms of dielectric constants and dispersions. A manifestation of a resonance type phenomenon are changes in the electrophoretic mobility of polystyrene latex spheres after exposure to radiofrequency fields. These resonance type phenomena show some kind of nonthermal interaction between the incident electromagnetic field and the molecular system. Two ways in which thermal energy influences a system of molecules are given in principle: one effect is an increase in the temperature of the system, the other is a change in phase of the system from solid to liquid or liquid to gas.

(100) V o s s, W.A.G.

ADVANCES IN THE USE OF MICROWAVE POWER.

Seminar paper No.008, Bureau of Radiological Health, Public Health Service, Rockville, Maryland, USA 1970, 32

Application as heat sources and in other industries-undesirable microwave radiation. Design of stove dampers and wave absorbers. Discussion of the limit values in the USA and SU.

101 V o s s, W.A.G.

MICROWAVE HAZARD CONTROL IN DESIGN.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 217 - 221

Domestic and industrial microwave heating is considered in terms of the U.S. and Russian safety standards. Typical leakage problems are discussed in re - lation to the leakage trapping and interlock methods available to the desig - ner. It is suggested that some microwave doors now in use are unsafe after a period of time. It is specifically proposed that mesh viewing screens be used at little as possible, and where essential, should be covered by clear plastic or glas. All hazards measurements should be made when systems are operating (loaded) as well as empty. Periodic follow -up inspections are essential in industry. Severe fires can occur in microwave heating equipment which distort metal wave traps and damage protective circuitry. A better de- sign philosophy would ensure that all microwave heating equipment met the Russian safety standard the adoption of which is proposed for this continent, in view of the uncertainty as to the consequences of some of the recently re- ported biological effects.

102 W a c k e r, P.F.

QUANTIFYING HAZARDOUS MICROWAVE FIELDS-ANALYSIS NBS TECHNICAL NOTE 391

Washington/D.C.: National Bureau of Standards, US Department of Commerce., 1970, 19 S.

The familiar power density radiation hazard standards are quite satisfactory for a field consisting of a single infinite traveling plane wave. However, for microwave and lower-frequency fields, hazards occur primarily in near fields which cannot be approximated as the aforementioned plane wave. Further power density can be quite misleading or oven meaningless as a measure of hazard in a near field. Thus, power density in a standing wave can be pre- cisely zero, yet the hazard of such a field can be arbitrarily large. Simi- larly a reactive field may present a considerable hazard, yet have zero time -average power density. The major hazard from microwave and lower frequency radiation is belived to arise from dielectric heating of body tissues, and the heating of an isotropic medium is proportional to the sum of the squares of the absolute values of the electric field components $(E_X)^2 + (E_Y)^2 + (E_Z)^2$. Hence, electric field energy density is proposed for a radiation hazard stan- dard. Analytical limitations of various types of probes are considered and the advantages of a spherically-symmetric probe of lossy dielectric are dis- cussed. For a rather generalspherically-symmetric probe in an arbitrary field both exact and approximate treatments are given for the calibration constant with full correction for the perturbation of the field by the probe. Condi- tions for a constant factor are also given.

103 W a c k e r, P.F.

QUANTIFYING HAZARDOUS MICROWAVE FIELDS: ANALYSIS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 197 - 203

The existing standards for microwave radiation hazards are based upon far - field concepts which may have little or even no validity in near fields. Analytical aspects of near field measurements are discused in general and design of a possible probe described in detail. So that near-field dosimetry experiments are meaningful and reproducible, great care must be used in field measurements and describing conditions which determine the field in the sub - ject.

104 W e b b, S.J.

MICROWAVE ABSORPTION BY NORMAL AND TUMOR CELLS.

Phys. Med. Biol., 15, 4, 1970, 758

The 64 - 76 GHz microwave spectra of cells from active tumours and normal tissue, as cell lines in tissue culture transformed with tumour viruses have been determined. The cells were placed on the mica windows of a specially designed microwave component and attenuation at various frequencies measured. Each cell type was found to have a characteristics spectrum. Only small differencies were found between the attenuation spectra of normal and tumour cells of the same cells type, but the absorption of 66 and 71 GHz by tumour cells was much stronger than that by normal cells. One frequency, 75 GHz, was absorbed by tumour cells but not by normal cells. The attenuation appears to be due to absorption via the rotational energy levels of water molecules associated with the P = O groups of RNA and DNA and possibly with hydroxyl and amine groups of these molecules. The observation suggest that the orientation of phosphate groups in normal and tumour cells nucleic acids is different.

105 Wi l l a m s, G.M., C o e r t z, G.E.

MOISTURE AND MICROWAVE EFFECTS ON SELECTED CHARACTERISTICS OF TURKEY PECTORALIS MUSCLES.

Poultry Sci., 49, 5, 1970, 1449 - 1450

The effect of added water and microwave heating on a ground of composite of pectoralis muscles of a turkey was investigated. Prior to heating the samples in a Raytheon Mark IV Radarange (2450 MHz) for 0, 60 and 110 sec., one of three quantities-- 0, 15 and 30 ml.-- of water was mixed thoroughly with each sample. During one cooking period, all treatments for each of eight replications were prepared and expressible moisture, cooking losses and pH were

determined. Spirit-filled thermometers were inserted into the center of the weighed pattied prior to cooking to insure temperature measurement immedia - tely upon removal from the oven. Water content of food was shown to be related to rate of heating by microwave. Analyses of variance were used to determine significant differences and Duncan's multiple range test was used to locate differences attributable to added moisture and/or heating time. Correlation coefficients were calculated to represent interrela-tionships among characte-ristics.

106 Y a g i, K.

LOCAL APLASTIC BONE MARROW CHANGES INDUCED BY MICROWAVE IRRADIATION IN RABBITS; ESPECIALLY HISTOLOGICAL AND HISTOCHEMICAL STUDIES.

Nippon Acta Radiol. (Jap.), 30, 1970, 184 - 204

The left femur of the rabbits were exposed to 12 cm microwaves for 30 minu-tes, five times a day for seven consecutive days, and resulting injuries of the bone marrow were studied hematologically and histochemically. From these studies, it is proved that if the sinocapillaries are injured once by micro-waves irradiation and inflammation with exudative change occurs in the bone marrow, the parenchymal cells are destroyed and become extinct by exudation, and complete aplastic bone marrow developes. It suggests strongly that human aplastic anemia may be also caused by chronic inflammation or disorders of sinocapillaries in the bone marrow.

107 Y a o, K.T.S., J i l e s, M.M.

EFFECTS OF 2450 MHz MICROWAVE RADIATION ON CULTIVATED RAT KANGAROO CELLS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 123 - 133

Cultivated rat kangaroo choroid and bone marrow cells were irradiated with 2450 MHz microwaves at power densities of 0,2;1,0 and 5,0 W/cm^2 to study microwave radiation effects on cell proliferation and chromosome aberations. At power density of 0,2 W/cm^2, a 10 min. exposure increased cell proliferati-on, but a 30 min. exposure reduced cell proliferation. Cellular proliferation was reduced greatly at a power density of 1 W/cm^2 for exposures of 20 min. or longer. Microwave radiation at a power density of 5 W/cm^2 severaly reduced cell proliferation and at the same time induced chromosome aberrations.

108 Y a t t e a u, R.F.

RADAR-INDUCED FAILURE OF A DEMAND PACEMAKER.

New England J. Med., 383, 26, 1970, 1447 - 1448

Pacemakers have been subject to interference from a variety of sources. In the case reported, in this article, pacemaker failure arose from com - mercial radar.

109 Z a r e t, M.M., K a p l a n, I.T., K a y, A.M.

CLINICAL MICROWAVE CATARACTS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 82 - 84

The criteria for establishing the diagnosis of microwave cataracts are presented. Also a typical retrospective environmental exposure history are detailed.

110 ...

DEVELOPMENT OF LIQUID CRYSTAL MICROWAVE POWER DENSITY METER.

Report BRH-DEP 70-8, Bendix Research Laboratories and Bureau of Radiological Health, Rockville, Maryland 20852, USA,Mai 1970, 24 S.

Description of design, performance and working characteristics of an improved measuring device for microwave energy density with an input unit consisting of a Mylar-membrane with coatings of a conditionally conductive alloy and a liquid crystal coat. The uptaken microwave energy is changed into heat by the metallic coating and there the temperature of the membrane is directly proportional to the field intensity (in mW/cm^2).

111 ...

LEAKAGE VARIATIONS FROM MICROWAVE OVENS.

Bureau of Radiological Health, Rockville, Md.Div. of Electronic Products., BRH/DEP - 70 - 11, Jun 1970, 33

Some microwave radiation leakage is generaly associated with the operation of microwave ovens. This leakage usually occurs around the door seals and varies with the type, size and placement of food or other loads within the oven cavity. This report describes field and laboratory studies that where performed to determined the most important variables and their effect on microwave oven radiation leakage levels. Additional field observations of

ovens in use should be conducted to more clearly define the correlation between food types, sizes and placement and door closing and opening procedures.

112

HEALTH HAZARDS OF MICROWAVE OVENS.

Publ. Health Rep., 85, 1, 1970, 425

Some microwave cooking ovens now used in homes and commercial establishment leak radiation which can present a health hazard to users. Radiation levels in excess of the industry's voluntary standard of 10 milliwats per square cm were detected in 51 of the 155 microwave ovens tested in a survey conducted by the Bureau of Radiological Health of DHEW's Consumer Protection and environmental Health Service in cooperation with health agencies in the states of New York, Massachusets, Mississipi, and New Jersey. There have been no reports of injuries from the owens, however. Representatives from the microwave ovens industries, Federal and State governement and consumers representatives met in Washington, D.C., on January 12, 1970, to discuse proposals for remedial action. A comittee was appointed to write a protocol to conduct a national survey of all microwave cooking ovens in use. Microwave ovens cook foods much faster than any other ovens, often in seconds. As many as 100,000 of the ovens are in use in the United States-about 40 000 of them in homes and 60 000 in hospitals, restaurants, and other establishments. Until ovens now in use are checked and deficiencies corrected, users should follow these precautions: a) stay at least an arms length away from the front of oven while it is on, b) switch the oven off befor opening the door, and c) do not allow children to use the viewport to watch the food cooking.

RADIO FREQUENCIES

113 Barnes, E.C.

THE SPECTRUMS IN INDUSTRIAL HYGIENE.

Amer. Ind. Hyg. Assoc. J., 31, 3, 1970, 265 - 276

The author compares the present maximal permissible values for the entire frequency zone of electromagnetic waves (from gamma radiation up to radio waves), by computing equivalents energy in kilowatt hours. He suggests the introduction of a uniform designation for the entire zone e.g. "reem" (radiant energy equivalent man). He draws attention to the need for research into the possible genetic effects of electromagnetic fields and proposes tests of the techniques used routinely for ionizing radiation.

114 Barci, R., Gray, I.

TEMPERATURE CHANGE AS THE CAUSE OF RADIO FREQUENCY RADIATION EFFECT ON CHLORELLA PYRENOIDOSA.

Physiol. Chem.Phys., 2, 3, 1970, 263 - 273

Chlorella pyrenoidosa cells were exposed to 14 MHz radio frequency fields at 4 power levels, milliwats, 75, 200, 1200 watts. There was no alteration in cell growth at the low power level. At 75 watts there was no change in growth after exposure up to 8 hr, the temperature of these samples rose to 28°C. At 200 watts, temperature rose to 45°C. When the temperature rose above 32°C, a reversible inhibition of growth occured. At 1200 watts, the absorption of rf radiation caused an icrease in temperature to above 53°C, related to the composition of the medium, size of culture and volume at this power level a 6-min exposure arrests growth. At 53°C cell growth stoped. Similar results were obtained with temperature alone. The effects of rf radiation could be the result of temperature increased resulting from the absorption of energy.

115 Caarson, R.W., Innis, W.E.

ELECTRICAL IMPEDANCE OF THE HUMAN BODY FOR HF (2 - 30 MHz) BAND, (INITIAL RESULTS).

Naval Weapons Lab. (Dahlgren, Va.),Tech.Rept., TR-2481, 1970

116 D i e t z e l, F., K e r n, W.

ABORTION FOLLOWING ULTRA-SHORT-WAVE HYPERTHERMIA. ANIMAL EXPERIMENTS.

FEHLGEBURT NACH KURZWELLENBEHANDLUNG-TIEREXPERIMENTELLE UNTERSUCHUNGEN.

Arch.Gynäk., 209, 3, 1970, 237 - 255

In previous experiments we were able to show that intensive ultrashort-wave hyperthermia during pregnancy might produce malformation. However, there were no exact data on the abortion ratio. Therefore, experiments were carried out on 749 pregnant rats at different days of gestation. Hyperthermia up to 42.7 celsius was applied by use of the Siemens Minoda electromagnetic field electrode to the lower abdomen. Then 7800 embryos graviditatis, the ratio of intrauterine deaths could be estimated. Ultra-short-wave hyperthermia prior to implantation of germs proved to be dangerous for most of them; diathermy in the later stages of pregnancy also was fatal for some of the fetuses because of stagnation of heat. Thus it seems inadvisable to apply stronger ultra-short-wave hyperthermia to the female pelvis during pregnancy.

117 D i v a c h e n k o, N.A.

MODIFICATIONS OF THYROID FUNCTION DURING CHRONIC EXPOSITION UNDER THE INFLUENCE OF ULTRA-HIGH FREQUENCY FIELDS.

Gig. Tr. prof. zabol., 7, 1970, 51 - 52

118 D o o l e y, E.S., G i l l e n w a t e r, J.Y., F r o h l i c h, E.D.

ALTERED RENOPRESSOR RESPONSE PATTERN TO ENDOTOXIN RADIATED WITH RADIO-FREQUENCY ENERGY.

U.S.Gov.Res.Dev.Rep., 70, 22, 1970, 46, AF-411 221

Injected S.Typhosa endotoxin produces a characteristic diphasic pressor response in the renal vascular bed. There is an immediate transient mild rise in pressure followed by a more intense and prolonged rise which subsequently returns toward or to the pre-injection level. Radiating S.typhosa endotoxin at 10,40 Mc/sec modified the above pressor response pattern. The first pressor response was enhanced and the second remained permanently sustained, i.e., there was no return toward the preinjection pressure level. Radiating endotoxin at 13,34 Mc/sec enhanced the first pressor response-pattern.

119 Dumanski, Iu.D., Serdiuk, A.M., Los, I.P.

HYGIENIC EVALUATION OF THE BIOLOGICAL EFFECT OF ELECTROMAGNETIC FIELDS OF SHORT AND ULTRASHORT WAVE ZONES IN RESIDENTIAL DISTRICTS.

GIGIENICHESKAIA OCENKA BIOLOGICHESKOGO DEISTVIIA ELEKTROMAGNITNYCH POLEI KOROTKOVOLNOGO I ULTRAKOROTKOVOLNOVOGO DIAPAZONOV V NASSELENNYCH MESTACH.

Gigiena naselen.mest.Resp.Mezhved.sb., 9, 1970, 176 - 181

In regions harbouring shortwave radio transmitters and television centres electromagnetic fields are created which might exert a harmful effect on the population. Systematic exposure to fields of low intensity cause disturbances in the function of the central nervous, cardio-vascular and endocrine systems and also alterations in the morphologic composition of the blood. In areas of residential districts maximal admissible values of electromagnetic field intensity are recommended, in the short wave zone of 0,2 - 0,4 V/m, in the ultrashort wave zone of 0,2 V/m.

120 Dumanski, Iu.D., Tomashevskaia, L.A.

THE EFFECT OF RADIO FREQUENCY ELECTROMAGNETIC FIELDS ON RIBONUCLEIC AND DESOXYRIBONUCLEIC ACID CONTENTS OF VARIOUS ORGANS.

VLIIANIE ELEKTROMAGNITNOGO POLIA RADIOCHASTOT NA KOLICHESTVENNOE SODERZHANIE V ORGANACH RNK I DNK.

Gigiena naselen.mest.Resp.mezhved.sb., 9, 1970, 181 - 183

A study was conducted on the effect of electromagnetic fields of radio frequencies on animals. An electromagnetic field in the short wave zone with a voltage of 50 V/m increases the contents of RNA and DNA in the liver, spleen and brain. Field voltage of the order of 0,4 V/m has no effect. Changes in the contents of RNA and DNA were induced mainly in the spleen.

121 Ermakov, E.V., Muruskov, B.F.

THE PATHOGENESIS OF NEUROENDOCRINE DISTURBANCE IN PROTRACTED EFFECT OF ELECTROMAGNETIC ULTRAHIGH FREQUENCY FIELD.

Sovetskaia med., 9, 1970, 138

122 E r s h o v a, L.A.

DISTURBANCES OF SOME FUNCTIONS OF THE CENTRAL NERVOUS SYSTEM OF RABBITS EXPOSED TO THE EFFECTS OF A SHORT WAVE ZONE ELECTROMAGNETIC FIELD.

NARUSHENIE NEKOTORYCH FUNKCII CENTRALNOI SISTEMY KROLIKOV PODVERGAIU - SHCHIKHSIA DEISTVIIU ELEKTROMAGNITNOGO POLIA KOROTKICH VOLN.

Gigiena naselen.mest.Resp.mezhved.sb., 9, 1970, 186 - 189

The effect of an electromagnetic field of short wave zone and low intensity on the bioelectric activity of the cerebral cortex in rabbits was studied. Following protracted exposure (two months) slow biopotentials predominated in the EEG pointing to gradual depression of the hemisphere cortex. EEG tracings returned to normal within two months after the termination of irradiation.

123 F r e y, A.H.

CARDIAC AND NEURAL EFFECTS OF MODULATED RF ENERGY.

Proc.23 rd Annu.Conf.Eng.Med. and Biol., Washington, D.C., 1970, vol. 12, New York, N.Y., 1970, 175

124 G e l f o n, J.A., R o s e n b e r g, P.A., F e d o r o v a, V.J.

THE EFFECT OF ULTRAHIGH FREQUENCY IRRADIATION ON SILICOSIS.

Gig. Truda Prof.Zabolev. USSR, 14, 6, 1970, 43

125 G o r d o n, Z.V.

NEW FACTS AND PROJECTS REGARDING HYGIENIC AND EXPERIMENTAL STUDIES ABOUT THE EFFECT OF RADIO FREQUENCY ELECTROMAGNETIC FIELDS.

NOVYE DANNYE I ZADACHI V GIGIENICHESKOM I EKSPERIMENTALNOM ISSLEDOVANII DEISTVIIA ELEKTROMAGNITNYCH POLEI RADIOCHASTOT.

Gigiena Truda i Profzabolev., 14, 4, 1970, 32 - 34

The paper provided accurate information on basic methodologic approaches towards solving the problem of maximal admissible irradiation values, as accepted in the USSR and USA.

126 G r i f f i n, J.L.

ORIENTATION OF HUMAN AND AVIAN ERYTHROCYTES IN RADIOFREQUENCY FIELDS.

Exp. Cell Res., 61, 1, 1970, 113 - 120

Human and chicken erythrocytes suspended in isotonic glucose or mixed isotonic glucose and saline orient when subjected to impressed radio-frequency fields. Erythrocyte orientation may be either across the field or with the field. The direction of orientation can be predicted from knowledge of the frequency of the impressed field and the conductivity of the suspending medium. The relationship between orientation and frequency can be changed by alterning the osmotic environment. The type of chamber and the techniques used seem to offer both practical and theoretical (analytical) advantages over earlier procedures. While this paper deals with normal erythrocytes, the procedures could be applied to other systems.

127 H e n n y, G.C., T a n s y, M., K a l l, A.R., W a t t s, H.M. C a m p e l l o n e, F.

STUDIES OF BIOLOGICAL HAZARDS FROM HIGH POWER HF BAND TRANSMITTERS.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 66 - 69

The adult male albino Wistar rats was used as the test animals. For irradiation was used the HF transmitter, operating in the frequency range of 3 to 30 MHz with good frequency stability. Several experimental variables were studied in the 6 MHz and 14 MHz regions. The objective was to determine the effect of frequency of irradiation on biological parameters of the rats, for a constant radiation dosage.The effects were observed in thin tissue section slides of myocardium, lung, liver, stomach, small and large bowel, pancreas, kidney, testis and spleen. The E and H fields were used separately. From tissue slides the pathological damage appeared to be on the order of 50% greather at 14 MHz than at 6 MHz. The E field seemed to produce about 3 times the damage produced by the H field for the same dosage. One of the most sensitive indications of damage was the lowering of the white cells count, very soon after irradiation. For the type of animals tested, the following order-of-magnitude levels of E and H fields were established as threshold levels of tolerability:
Mag. field = 1 to 10 A/m for exposures not exceeding 0,1 hour
El. field = 400 to 4000 V/m exposures not exceeding 0,1 hour

128 H o l m, D.A., S c h n e i d e r, L.K.

THE EFFECTS OF NON-THERMAL RADIO FREQUENCY RADIATION ON HUMAN LYMPHOCYTES IN VITRO.

VLIIANIE ATERMICHESKOGO RADIOCHASTOTNOGO IZLUCHENIIA NA LIMFOCITY CHELOVEKA IN VITRO.

Experientia, 26, 9, 1970, 992 - 994

The effect was studied of an electromagnetic field with a 27.120 MHz ± 1 kHz frequency and an effective density of 10 W/cm2on a culture of lymphocytes from the peripheral blood of 18 males and females with a normal karyotype. An hour prior to the commencement of irradiation colchicin (0,1 gamma/ml) and thymidin - H^3 1.0 gamma curie/ml) were added to the culture. In the cell culture which was irradiated for 72 hours the number of chromosomal aberrations was seven times in excess as compared with control cultures. Indicators of DNA synthesis, growth and cell mitoses, however, remained unchanged. The temperature of the trial cultures differed from that of the control cultures by less than $1^{o}C$.

129 K n a p i k - F i a l k o w s k a, D., M a c i e j e w i c z - M a k o w i e c k a, R.

SELECTED OBSERVATIONS ON THE HEARNING AND EQUILIBRIUM ORGAN IN HUMANS WHEN EXPOSED TO THE ACTION OF A HIGH FREQUENCY ELECTROMAGNETIC FIELD.

Pamiet Zjazdu Otolaryngol. Pol. Katowicach 1968., 1970, 181

130 K u l i k o v s k a i a, E.L.

PROTECTION FROM THE EFFECT OF RADIO WAVES (IN SHIP - YARDS).

ZASHCHITA OTDEISTVIIA RADIOVOLN (NA PRIMERACH SUDOSTROITELNOI PROMYSHLENNOSTI).

Izdatelstvo "Sudostroenie", Leningrad, 1970

The book presents methods for the determination of the intensity of radio -frequency radiation, results of working conditions studies and the character of exposure for personnel operating high frequency and ultra high frequency apparatus. Recommendations were made concerning methods of protection for ship-yard workers, radiotechnicians working on ship and for the operation of radio centre shore installations. The book was written for engineers and an - cillary technical personnel of research institutes, ship-building firms, merchant fleet and sea transport staff, as well as for safety technicians. It can be used for teaching high school and technical college students including technological universities.

131 L a m b e r t s, K., L æ p p i n, J.

HIGH FREQUENCY MEASUREMENT TECHNOLOGY.

V.D. I - Z., 112, 5, 1970, 310 - 312

132 L a z a r o v i c h, V.G.

THE EFFECT OF ELECTROMAGNETIC FIELDS OF ULTRA HIGH FREQUENCY ON IRON AND COPPER CONTENT IN THE BLOOD AND ORGANS OF ALBINO RATS AND ON SOME METALLOPROTEINS (RUSSIAN).

Biull.Eksper. Biol. Med., 70, 10, 1970, 44 - 46

In experiments on 55 albino rats the prolonged effect of ultra high frequency electromagnetic fields (an intensity of 160 mV/cm^2 10 min for 28 days) was shown to cause considerable changes in the content and redistribution of iron and copper on the blood and organs, as well as changes in the metalloproteins (ceruloplasmin and transferrin).

133 M e z e r o v a, V., S y n e k, V.

EVALUTION OF IMPORTANT FACTORS INFLUENCING EEG FINDING IN PERSONS WITH LONGTERM PROFESSIONAL EXPOSURE TO ELECTROMAGNETIC RADIATION OF METER WAVE LENGTH RANGE.

Pracovní lékařství, 22, 1, 1970, 1 - 5

Studied were EEG findings in group of 80 persons working in longterm exposure (13,4 years average) to electromagnetic field of meter wave length range (mean intensity 53 V/m). The results were compared with findings of the corresponding group of control persons. In both groups only individuals were classified with which neither case history nor present health state contained factors which could influence EEG finding significantly. By comparison of the results of EEG examination in both groups, there were determined practically identical distributions of normal, limit and abnormal records and equal incidence of records tending to prove infraclinical decrease of vigility. Correlation of professional data with the type of EEG finding, carried out by computer, disclosed no relation of length of professional exposure and intensity of electromagnetic field to resulting of EEG examination.

134 M e z e r o v a, V., S y n e k, V., V o l a v k a, J.

THE EFFECT OF ELECTROMAGNETIC RADIATION OF METER WAVE LENGTH RANGE UPON EEG FREQUENCY SPECTRUM OF EXPOSED PERSONS.

VLIV ELEKTROMAGNETICKÉHO ZÁŘENÍ ŘÁDU METROVÝCH VLN NA FREKVENČNÍ SPEKTRUM EEG EXPONOVANÝCH OSOB.

Pracovní lékařství, 22, 1, 1970, 5 - 7

In a group of 80 persons working in longterm professional exposure to meter wave length, EEG automatic frequency analysis was carried out and results compared by computer with data of 80 control persons. In respect of questions which the authors studied, the following was determined: 1. length of work exposure, intensity of electromagnetic field and frequency range of radiation sources do not bear any significant effect upon results of automatic frequency analysis EEG in exposed persons;
2. various types of EEG records disclose no significant differences between exposed and control group;
3. visual description of EEG correlates with results of frequency analysis in normal, limit and abnormal EEG findings.

135 N e l s o n, S.O., N u t i l e, G.E., S t e t s o n, L.E.

EFFECTS OF RADIOFREQUENCY ELECTRICAL TREATMENT ON GERMINATION OF VEGETABLE SEEDS.

J. Amer. Soc. Hort. Sci., 95, 3, 1970, 359 - 366

Seed lots of several vegetables, were exposed to 40 MHz radiofrequency (RF) electric fields and tested to determine the influence of the electrical treatment on germination performance. Germination was significantly increased by RF treatment through reduction of hard-seed content. The influences of seed moisture content, seed size, and characteristics of the RF electric field were also considered. Improved responses are attributed to thermal stresses developed in seed during RF treatment, but further research is recommended to explain the responsible mechanisms.

136 M u s i l, J.

THE VALUES OF FIELD INTENSITY IN THE SURROUNDING OF HIGH-FREQUENCY INDUSTRIAL GENERATORS.

HODNOTY INTENSITY POLE V OKOLÍ VYSOKOFREKVENČNÍCH PRUMYSLOVÝCH GENERÁTORU.

Československá hygiena, 15, 9/10, 1970, 315 - 320

The possible industrial applications of electromagnetic energy in connection with the changes of maximum admissible irradiation by electromagnetic waves in cases of industrial use of h.f.radiation is described. The results of field intensity measurements in different distance and altitudes from generators and applied devices in more than 40 sorts of industrial applications of h.f.radiation are presented. The measurements were carried out by the working group

of VÚ ZEZ Prague in 1964 - 69. The review of the results obtained is suplemented by description of the measuring group activity as well as by notes concerning the faults that were found and possibilities of different devices adaption. From the results obtained follow that in most cases the working conditions could be put into proper relation with hygienic requirements.

137 N i k i t i n a, V.N.

ABOUT THE EFFECT OF ULTRA HIGH FREQUENCY ELECTROMAGNETIC FIELDS OF LOW INTENSITY ON THE PERIPHERAL BLOOD CIRCULATION.

O VLIIANII ELEKTROMAGNITNOGO POLIA UVCH MALOI INTENSIVNOSTI NA SOSTOIANIE PERIFERICHESKOGO KROVOOBRASHCHENIIA.

Nauchn.sessija,posviashch.itogam raboty Leningr.int.gigieny truda i prof.zabolev. za 1968-1969 g., 1970. Tezisy dokl.,1970, 120 - 122

138 P a v l o v a, I.V., D r o g i c h i n a, E.A., S a d c h i k o v a, M.N., G e l f o n, I.A.

THE ROLE OF SOME BIOCHEMICAL DISTURBANCES IN THE PATHOGENESIS OF RADIOWAVE DISEASE.

Gig. tr. prof. zabol., 14, 3, 1970, 20 - 23

Reproduction of the results of an analysis of the behaviour of biochemical quantities in 70 persons with several forms of chronic microwave disease. The most significant modifications could be stated in the blood sugar level after adequate functional charge and in the 24-hours-dynamics of the catecholamines (adrenaline and noradrenaline). The modifications observed reflects a disturbance of the control mechanisms for adrenal systems activity, that also includes functional modifications of hypothalamus-hypophysis-suprarenal-gland-system. These observations corroborate the results of former clinical and physiological studies about the development of an insufficiency of the hypothalamus.

139 P r o p e r z i o, W.S.

AN INEXPENSIVE RF SHIELD FOR USE WITH (ionizing) RADIATION SURVEY INSTRUMENTS.

Health Physics, 19, 3, 1970, 442

Description of a bag, made of silver plated nylon ~~network~~ fabric, that can be pulled over the devices that shall be protected against radio frequency interferences during surveying of (ionizing) radiation fields. The ~~network~~ fabric allows a satisfying readability of the display scales and in addition to that it is flexible enough to allow an easy service. The bag has only a little influence on the response sensitivity of the devices.

140 R o g e r s, S.J.

RADIO FREQUENCY RADIATION HAZARDS TO PERSONAL AT FREQUENCIES BELOW 30 MHz.

Biological Effects and Health Implications of Microwave Radiation. Symposium Proceedings.U.S.Dept. of Health, Education and Welfare, Public Health Service, 1970, 222 - 232

The author studies these problems: The Nature of the Near-Field Environment. R.F.Radiation Hazards. A Safety Criterion for Frequencies Below 30 MHz. Behavior of Human Tissue to R.F. Radiation. Plane-Wave Analysis for Semi -Ifinite Layer of Dielectric. Plane-Wave Analysis for a Sphere of Dielectric. Capacitor Field Analysis for a Layer of Dielectric. Experimental Work.
(a) Capacitor Field
(b) Testes in Near-Field of Whip Aerial
(c) Test at S-Band Frequencies

141 R o g e r s, S.J., K i n g, R.S.

RADIO HAZARDS IN THE M.F./H.F. BAND.

Non - ionizing Radiation, 1, 4, 1970, 178 - 189

A short review of the regulations poverning safe exposure limits at micro-wave frequencies is given, showing the extrapolation for use at frequencies in the m.f./h.f. bands. The nature of the near field of a radiating aerial is discussed. Absorption at h.f. of the human body is analysed, and experi-mental work on simulated body tissues described. It is concluded that an electric field strength of 1,000 V/m is considered to be the safe limit for continuous daily exposure to m.f./h.f. radiation.

142 R o g u s s k i i, S.S., U l i c k i i, L.A., B a r c e v i c h, B.N., I l i n, A.V., K r i v e n k o, V.N.

DYNAMIC STUDIES RESULTS IN PERSONS WORKING IN THE ZONE OF ULTRA HIGH FREQUENCY FIELD ACTION.

REZULTATY DINAMICHESKOGO NABLIUDENIIA ZA LICAMI RABOTAIUSHCHIMI V ZONE DEISTVIIA SVCH POLIA.

Voenno-medicin. zh., 6, 1970, 39

The study was conducted in over 100 persons aged 19 - 22 years who were working in a zone UHF field action. The authors studied the latency period of locomotor reactions, mental concentration, content of K, Na, Ca, total protein and cholinesterase in the blood, performed a complete blood analy - sis and complex clinical examination. Metabolic changes were non-specific and could have been due to other unfavourable factors. A shortening of the

latenty period of locomotor reaction was observed, some changes of the subjective general condition and autonomic nervous system disturbances. Lability of the pulse rate with a tendency to bradycardia was described, frequent complaints of pains in the heart region and cephal gia. Sinus bradycardia with arythmia was found in one third of the series. No other electrocardiographic lesions were observed.

143 S c h m i d t, P.

THE EFFECTS OF RADIO-FREQUENCY ENERGY ON CORYNEBACTERIUM DIPTHERIA AND CLOSTRIDIUM WELCHII TOXINS.

Army Medical Research Lab., Fort Knox, ay. cit.: U.S.Gov.Res. Dev. Rep., 70, 22, 1970, 50, AD-443 816

Cl. Welchii and C. . Diptheriae toxins were exposed to continuous microwave irradiation at 158 megacycles per second. No effect was noted on clostridium toxin. The toxicity of C. diptheriae toxin was slightly reduced while antigenicity was not affected. The assay procedures are discused and their efficacy questioned.

144 S k a r i k h i n a, L.A.

ULTRAHIGH FREQUENCY PULSE THERAPY AND NEW EFFECTIVE METHOD OF TREATMENT.

Biomed. Eng., 4, 1970, 212

145 W e n n e r s t r a n d, J., S a r b y, B.

HISTOLOGIC AND VOLUMETRIC INVESTIGATION OF BIPOLAR STEREOTAXIC RADIOFREQUENCY HEAT LESIONS.

Acta Chir. Scand., 136, 6, 1970, 453 - 460

A volumetric and histological examination is carried out on temperature controlled bipolar heat lesions in the brains of cats. The investigation shows correlation between the temperature and the size of lesion. A temperature of 60°C was the most suitable electrode temperature for producing a predi - ctable confluent and bloodless lesion.

146 Z u f a r o v, K.A., S h n e i v a i s, V.B.

THE EFFECT OF ELECTROMAGNETIC FIELD ON MITOCHONDRIAS OF THE WHITE RATS LIVER.

REAKCIIA MITOKHONDRII PECHENI BELYKH KRYS NA VLIIANIE ELEKTROMAGNITNOGO POLIIA.

Citologiia, 12, 2, 1970, 146

The ultrastructure of mitochondria was studied following the influence of electromag. field of 1625 MHz frequency. The initial changes on mitochondria involving their swelling could be traced during the treatment. Later part of the mitochondria underwent a lysis. In addition, some gigant mitochondria appeared. Three days after treatment, mitochondria appeared having myelin-like cristae as well as those transformed into myelin figures.

147 ...

THE EFFECT OF UHF RADIATION ON THE ORGANISM OF HUMAN AND ANIMALS.

VLIIANIE SVC-IZLUCENII NA ORGANIZM CELOVEKA I ZIVOTNYKH.

Leningrad: Izd. Modicina, 1970, 229

148 ...

INSTRUCTIONS FOR THE APPLICATION OF HIGH-FREQUENCY ELECTRICAL HEATING EQUIPMENT.

PŘEDPISY PRO PRUMYSLOVÁ VYSOKOFREKVENČNÍ ELEKTROTEPELNÁ ZAŘÍZENÍ.

Státní úřad pro normalisaci, Praha, CSN 34 1685, 17.4. 1970

M A G N E T I C F I E L D

149 A c h k a s o v a, Y.N., V l a d i m i r s k i i, B.M.

THE EFFECT OF LOW FREQUENCY MAGNETIC FIELDS ON MICROBIOLOGICAL OBJECTS.

Ref. zh. Biol., 2, 1970, 250 - 252

Nonheritable changes of microbiological objects are described as result of low frequency magnetic field treatment.

150 B a r n o t h y, M.F., B a r n o t h y, J.M.

MAGNETIC FIELDS AND THE NUMBER OF BLOOD PLATELETS.

Nature (Engl.), No. 5238, 1970, 1146 - 1147

Investigations of mice, exposed to strong homogenous magnetic fields have revealed that the number of megakaryocytes decreases in the bone marrow and increases in the spleen of exposed animals. The purpose of the investigation reported here was to find out whether magnetic fields of the same strength would also alter the number of platelets in the circulating blood. Female virgin DBA/J2 strain mice 100 - 120 days old were used. The mice were placed for 20 days in a 9000 oersted homogenous vertical magnetic field, while an equal number of mice were kept in identical "dummy magnets". The mice kept in the magnetic field showed, as early as the third day of their exposure to the field a 25 ± 3% increase in the number of platelets over the value of their controls. From the tenth to last day of their residence in the field, the difference between the magnet and control group vanished. The observed variation in the number of platelets could be interpreted as a reaction of the organism to the stress of the magnetic field.

151 B e i s c h e r, D.E., C o w a r t, G.S.

GROWTH OF STAPHYLOCOCCUS AUREUS IN A NULL MAGNETIC FIELD ENVIRONMENT.

Naval Aerospace Medical Inst. Pensacola Fla Apr 70, 12p Rept. no. NAMI-1105 NA VMED-MR-005.08.01-0031B-1; Contract NASA Order-ER-19841

No significant differences were observed between the growth of S.aureaus in the geomagnetic field and in a mg. field with a field strength reduced by a factor of 1000. Pigmenation, mannitol fermentation, gelatinase activity, coa - gulase production, and catalase activity were also not influenced by the low magnetic field. The results are discused in their relation to previous fin - dings of R.O. Becker, who observed a reduction of growth rate in fields of lower field strength than the geomagnetic field.

152 B o b r o v, A.J., I s q u i t h, I.R.

INFLUENCE OF HIGH INTENSITY MAGNETIC FIELD ON CONTRACTILE VACUOLE ACTIVITY IN PARAMECIUM CAUDATUM.

J. Protozool., 17, 1970, 13

A series of experiments was conducted to observe the effect of a high intensity magnetic field (1750 gauss) on the rate of penetrance of water into Paramecium caudatum. The presence of a positive effect ascertained by measuring the rate of contractile vacuole activity in the organism. Immobilization of paramecias was accomplished a one-hour pre-treatment of the organism in $2,5 \times 10^{-3}$% $NiSO_4$ solution. The experiments were then carried out in this same solution. In order to be able to nickel treated organism, it was necessary to show that nickel would not confound the data relevant to the entrance of water. It was shown that nickel enters the cell at an equal rate in and out of a high intensity field; also nickels possible metabolic activity is not altered by the magnetic field. Statistical analysis of the data indicates that organism subjected to the high intensity field have a lower rate of contractile vacuole pulsation after removal from the field than to the controls. Since other possible variables have been shown to be constant, e.g., contractile vacuole volume, total body volume and metabolic rate, it may therefore be assumed that the change in contractile vacuole rate is proportional to the change in rate of water entrance into the cell as caused by the magnetic field.

153 B o g i n i c h, L.F., V a s i l i e v, N.V., D a r c h u k, V.A., M e l i k, E.V.

COMPLEX REACTION OF LYMPHOID TISSUE TO THE ACTION OF AN ALTERNATING MAGNETIC FIELD.

KOMPLEKSNAIA REAKCIIA LIMFOIDNOI TKANI NA VOZDEISTVIE PEREMENNOGO MAGNITNOGO POLIA.

Patol. Fiziol. Eksp. Ter., 14, 1970, 73 - 74

In experiments on rats placed into conditions of alternating magnetic field for a long time it was shown that there developed in the lymphoid tissue a complex of changes resembling those taking place during the inductive phase of antibody formation.

154 C h a l a z o n i t i s, N., C h a g n e u x, R., A r v a n i - t a k i, A.

ROTATION OF EXTERNAL SEGMENTS OF PHOTO RECEPTORS IN THE CONSTANT MAGNETIC FIELD.

C.R.Hebd.Seances.Acad.Sci.Ser.D.Sci.Nat.(Paris), 271, 1, 1970, 130

Isolated external segments of frog retina photo receptors were suspended in physiologic saline solution and placed in a constant homogenous magnetic field. The segments orientated themselves to lie with their longitudinal axis paralel to the magnetic field forces.

155 C o n l e y, C.C.

A REVIEW OF THE BIOLOGICAL EFFECTS OF VERY LOW MAGNETIC FIELDS.

NASA Tech. Note., 5902, 1970, 1 - 25

156 C o o k, A.M., L o n g, F.M.

MAGNETIC FIELDS ASSOCIATED WITH NERVOUS CONDUCTION.

New York/London: Pergamon Press, 1970, 9 - 13

157 D e g e n, I.L., P o t a s h n i k, V.Ya.

CHANGES OF BLOOD COAGULATION IN A CONSTANT MAGNETIC FIELD.

Vrach. Delo, 7, 1970, 45 - 46

Enhancement of human blood coagulation was observed 3,3 times more frequently than reduction with magnetic field tension of 1500 oersted. No correlation was found between this phenomenom and other factors. Experiments were conti - nued to detect minimum magnitude field tension still able to influence blood coagulation.

158 D e r e v e n k o, A.S., M o l o t k o v s k i, G.K.

THE POSSIBLE EFFECT OF THE EARTH'S MAGNETIC FIELD ON SEXUALIZATION OF ENANTIOMORPHOUS MAIZE PLANTS.

O VOZMOZHNOM VLIIANII MAGNITNOGO POLIA ZEMLI NA SEKSUALIZACIIU ENANTIOMORFNYCH FORM RASTENII KUKURUZY.

Fiziol. Rast., 17, 6, 1970, 1217 - 1222

The experiments were carried out with hybrids and varieties of maize and cucumber. During sowing the root part of the seeds was oriented towards the south north, east or west; nonoriented sowing was used as a control. Such car- dinal orientation of the seeds, and later of the plants, had a considerable

effect on enantiomorphous modifications of double-cross interline maize hybrids, influencing the growth of root system, cropping capacity and air-dry plant mass weight. Orientation of germinating seeds northward and westward caused a shift to the female, and southward and eastward to the male form in maize. The degree of sexualization in the maize plants was determined by a ratio between leaf-stem and root formation capacity, the manifestation of which was connected with the enantiomorphous modification of the caryopsis and its orientation during sowing. The changes in sexualization of the enantiomorphous maize plants are explained by the effect of the earth's magnetic field.

159 D o r o z h k i n a, L.I.

ACTION OF MAGNETIC FIELD ON THE ENERGY METABOLISM OF CILIATES.

Cytologia, 12, 6, 1970, 783 - 786

Effect of a static magnetic field (intensity of 1000 oersted) was studied on the mass culture of Paramecium caudatum. The static magnetic fields is shown to decrease the glycogen content, and to increase the sensitivity to 2,4-dinitrophenol and the amount of lactic acid of the infusoria.

160 D u b r o v, A.P.

EFFECT OF MAGNETIC FIELD ON PHYSIOLOGICAL PROCESSES IN PLANTS.

VLIIANIE GEOMAGNITNOGO POLIA NA FIZIOLOGICHESKIE PROTSESSY U RATSENII.

Fiziol. rast., 17, 4, 1970, 836 - 842

Experimental data provide evidence that geomagnetic fields are of great significance for the functioning of plants. A hypothesis is presented that permeability of biological membranes is controlled by natural magnetic and electrical fields. A comparative analysis of the changes in the diurnal plant rhythm and single elements of the geomagnetic field, made on concrete dates revealed a complete synchronism between them. Seasonal variations of processes in the plant also are shown to be connected with variations of the elements of geomagnetic fields. Direct test should be carried out to necessary evidence.

161 E v t u s h e n k o, G.I., K o l o d u b, F.A., F r e n k e l, S.R.

METABOLIC DISTURBANCES ACCOMPANYING THE EFFECT OF AN IMPULSION MAGNETIC FIELD OF LOW FREQUENCY ON THE ORGANISM.

NARUSHENIE OBMENA VESHCHESTV PRI VOZDEISTVII IMPULSNOGO MAGNITNOGO POLIA NIZKOI CHASTOTY NA ORGANIZM.

Gigiena truda Resp. mezhved. sb., 6, 1970, 70 - 76

Rats were exposed daily for one and a half hours for a period of three months to the effects of an impulsion magnetic field (intensity 300 oersted, duration of impulse 130 /usec, interval between impulses 10 secs.). The following blood assays were made: lactic acid contents, urea, performed NH_3, glucose and "pseudocholinesterase" activity. In brain, liver, heart and muscle tissue assays were done of glycogen, lactic and pyruvic acid, creatininephosphate, performed NH_3, glutamin, DNA and RNA. Marked changes were found in the metabolism of carbohydrates and nitrogen metabolism, as well as in nucleic acids metabolism, increasing in scale with the prolongation of magnetic field exposure periods.

162 F a r k a s, F., R a c o v e a n u, N., G e o r g e s c u, G.

MORPHOLOGIC ALTERATIONS IN THE LYMPHOCYTE NUCLEUS OF PERSONS EXPOSED TO THE ACTION OF ELECTROMAGNETIC FIELDS.

Igiena, 19, 5, 1970, 305 - 310

Two groups of persons exposed to magnetic fields were studied: the 1st group (4 subjects) received a treatment with magnetodiaflux (pulsating magnetic field) and the 2nd (10 subjects) was exposed to a more powerful continuous magnetic field (6-10 x 10^7 Oe). The incidence of binucleate, bilobate and lobate lymphocytes was slightly higher in the 2nd group. The subject exposed to magnetodiaflux exhibited a significant increase in lymphocytes with nuclear alterations, although the exposure to ionizing radiations was very low. The role of the magnetic field in the appearance of lymphocytes with nuclear alterations is not clear.

163 G i b s o n, R.J.

A MONOGRAPH ON MAGNETIC FIELDS FOR LIFE SCIENTISTS, VOLUME 2.

Scientific and Techn.Aerosp. Rep., 8,4, 1970, 731, N70-14963

This report is a general compilation of materials related to magnetobiology. Topics discussed include the dimensions and unit systems of the magnetic quantities, fundamentals of magnetic fields and the design of air core coils for producing magnetic fields, permanent magnet assemblies for producing magnetic fields the earth as a permanent magnet the design of shields to reduce magnetic fields and the measurement of magnetic fields and instrumentation required.

164 Golev, V.P., Chepelenko, G.V.

THE CONDITION OF THE NERVOUS SYSTEM AND CHANGES OF NEUROGLIAL ASSOCIATIONS OF THE RAT PHARYNX DURING APPLICATION OF A CONSTANT MAGNETIC FIELD AND CENTRIFUGAL ACCELERATION.

SOSTOIANIE INNERVACIONNOGO APPARATA I ZMENENIE NEIROGLIALNYAH OTNOSHCHENII PISHCHEVODA KRYS V USLOVIIACH VOZDEISTVIIA POSTOIANNOGO MAGNITNOGO POLIA I RADIALNOGO USKORENIIA.

Morfol. i fiziol. nervn. sistemy., Izhevsk, 1970, 91 - 94

By using various doses of a constant magnetic field in combinations of this field with centrifugal acceleration, the authors produced - in the intramural pharyngeal nervous system-changes ranging from minor neuron involvement to severe damage of the same.

165 Golceva, I.N., Derzhkina, L.I., Sacheva, T.S.

THE BIOLOGIC EFFECT OF A CONSTANT MAGNETIC FIELD.

O BIOLOGICHESKOM VLIIANII POSTOIANNOGO MAGNITNOGO POLIA.

XI.Sezd Vses.fiziol. o-va im. I.P. Pavlova, 1970, T. 2., L. Nauka, 1970, 4 - 5

The application of a constant magnetic field reduced resting potential and altered values of action potential in Nitella flexilis cells. Due to field effect impulse activity of receptor neurons of crayfish was depressed. The protoplasmatic RNA contents in paramecia was altered, aerobic glycolysis in infusoria was enhanced, the reaction of the isolated frog heart to adrenaline and noradrenaline was altered.

166 Hefco, V., Constanta, B., Haba, M.

METABOLIC MODIFICATIONS IN RATS UNDER THE INFLUENCE OF MAGNETIC FIELDS.

Rev.Roum.Biol.Ser.Zool., 14, 3, 1970, 227 - 236

The modifications of lactic acid, pyruvic acid and glycemia are presented under the influence of the magnetic field of different intensity, of different magnetic doses, of the different mode of orientation of animals in relation to the mf lines of force and various intervals from the interruption of the treatment. The conclusion is reached that non-uniform mf produce greater biological effects than the uniform ones. Magnetic fields generated by an alternating and pulsatory current produce greater biological effects than the continuous ones. Within certain mf intensity limits, the organism responds in a constant manner. In the production of biomagnetic effects, besides the physical factor, the biological factor likewise intervenes.

167 I r i a n o v, Iu.M.

THE EVOLUTION OF ULTRASTRUCTURAL NERVOUS TISSUE CHANGES FOLLOWING APPLICATION OF A CONSTANT MAGNETIC FIELD. PROBLEMS CONNECTED WITH THE BIOLOGIC EFFECT MECHANISM OF A CONSTANT MAGNETIC FIELD.

DINAMIKA ULTRASTRUKTURNYKH IZMENENII NERVNOI TKANI POSLE DEISTVIIA POSTOIANNOGO MAGNITNOGO POLIA. K VOPROSU O MEKHANIZME BIOLOGICHESKOKHO DEISTVIIA POSTOIANNOGO MAGNITNOKHO POLIA.

Morfol. i fiziol. nervn. sistemy. Izhevsk, 1970, 87 - 90

Based on experiment, the hypothesis is expressed that the mechanism of the biologic effect of a constant magnetic field consists in changes of physical properties in the lipoprotein membrane structures, inducing impairment of cell vitality. The amount of ribosome is reduced, these get separated from the membranes. This results in a reduced level of protein synthesis. Nucleolar lesions are also induced. Impairment of mitochondrial structures decreases oxidation reactions thus the energetic balance of cells is altered. All the changes listed were, under the experimental set-up used, reversible.

168 K a s p a r e k, C.F., T u r n e r, Ch.E.

ANNOTATED BIBLIOGRAPHY OF REPORTS ISSUED BY THE NAVAL AEROSPACE MEDICAL INSTITUTE, 1 JULY 1969 - 30 JUNE 1970, SUPPLEMENT No. 2.

Naval Aerospace Medical Inst. Pensacola Fla.; (see.: U.S.Gov. Res.Dev. Rep., 70, 20, 1970, 52, AD-710 837)

Contents include: Mechanizm underlying disorientation and other vestibular disturbances in flight; Physiological effects of null magnetic fields; Influence of vibrations of flight vehicles on chromosomes; Physiological effects of high magnetic fields; Individual differences with selected sensory stimully related to orientation and performance in flight; Identification of causes of pilot/vertigo disorientation accidents; Development and improvement in auditory testing methods; Human vestibular function: Motion sickness and other vestibular disturbances in unusual gravitoinertial force environments; Experimental and theoretical studies in radiation hazards on Apollo missions and in supersonic aircraft.

169 K a t e l a, V.M.

THE EFFECT OF A PERMANENT MAGNETIC FIELD ON THE SENSITIVITY OF BACTERIAL POPULATIONS TO ANTIBIOTICS.

Antibiotiki, 15, 5, 1970, 421 - 422

Bouillon cultures of strains of white nonpathogenic Staphylococcus, yellow Sarcina, Staphylococcus aureus 209P, Escherichia coli AB 247 and P678 and

Salmonella Breslau strain Lt_2 were put in a constant magnetic field at am intensity of 2500 oersted for up to 30 days. In addition the sensitivity for penicillin, streptomycin, levomycetin (chloramphenicol), tetracycline, erythromycin and neomycin of E. coli taken from white mice and rats and S.Breslau and golden Staphylococcus taken from the organs of dead mice was studied after the animals were put in a magnetic field of 1400-2500 oersteds. The sensitivity of white Staphylococcus to antibiotics did not change with uninterrupted cultivation for 30 days. With 12 passages in the magnetic field there was a significant increase in sensitivity to erythromycin. A correlation between the presence of "warty" growth and sensitivity to antibiotics was found in 246 substrains of yellow Sarcina. In the magnetic field Sarcina had heightened sensitivity in the summer, but in winter its resistance compared to the control, increased. Resistance to streptomycin and levomycin appeared in E.coli taken from "magnetized" animals starting on the 15-16 day in the magnetic field. A greater length of time did not increase resistance. E.coli bouillon culture in the magnetic field did not differ the control in sensitivity. Analogous results were observed with S.Breslau and golden Staphylococcus.

170 M i r o, L.

BIOLOGICAL EFFECT OF LOW MAGNETIC FIELD ENVIRONMENTS.

ACTION BIOLOGIQUE DES AMBIANCES A FAIBLE CHAMP MAGNETIC.

Presse therm. et. clim., 107, 1. 1970, 32 - 34

Irradiation by Cosmic rays in the absence of the protective geomagnetic field, and the direct action of the low magnetic field could cause adverse effects. Tests are cited/physiological, visual and psychological/which indicated no differencies between experimental and controle subjects, whether animal, plant or human. Only the critical threshold of fusion was significantly disturbed. In prolonged experiments on mices however, after four months allopecia due to generalised hyperplasia was observed, with premature death of the animals in four month to one year. Consideration of these results leads to the conclusion that additional long term experiments are needed.

171 N a u m e n k o, I.M., S t e p a n o v, A,G., S a b a r n o, R.V.

MAGNETIC FIELDS ULTRAVIOLET RADIATION AND IONISATION OF AIR AS UNFAVOURABLE FACTORS AT SOME KINDS OF ELECTRIC WELDING.

MAGNITNYE POLIA ULTRAFIOLETOVOE IZLUCHENIE I IONIZACIIA VOZDUKHA KAK NEBLAGOPRIIATNYE FAKTORY PRI NEKOTORYKH VIDAKH ELEKTROSVARKI.

Gigiena truda Resp. mezhved. sb., 6, 1970, 66 - 69

The magnetic fields of low frequency (50 cps), ultraviolet radiation and ionisation of air was found to arise at process of electric welding. Those

factors could have an unfavourable effect on welding operators.

172 N e a g a, N., V i o r i c a, A r a b i i

EFFECT OF THE MAGNETIC FIELD ON SERUM TRANSMINASES IN BURSECTOMIZED AND NON-BURSECTOMIZED CHICKENS.

EFFECTUAL CIMPULUI MAFNETIC ASPURA TRANSAMINAZELOR SERICE LA PUII DE GAINA BURSECTOMIZATI SI NEBURSECTOMIZATI.

Inst. Argon. Ion. Ionescu. Brad. Iasi. Lucr. Stiin II Zooteh. Med. Vet., 1970, 221 - 226

Serum transminases were determined in bursectomized and non bursectomized chickens treated with a magnetic field in the 1 st 10 days after hatching. The decrease in glutamic oxalcacetic transaminase (GOT) activity after treatment with a pulsati ng magnetic field of 300 Oe is significant up to 45 days. After this ago differences from controls were not significant. In bursectomized chickens, as well as in bursectomized chickens treated with a magnetic field, GOT activity was lower than in controls. Glutamic pyruvic transaminase (GPT) was not obviously influenced by magnetic field treatment; differences recorded in treated chickens were insignificant. Bursectomy carried out 1 day after hatching as well as bursectomy combined with magnetic field treatment produced a non-significant decrease of GPT activity between 15 and 45 days.

173 P e r s i n g e r, M.A.

OPEN-FIELD BEHAVIOR IN RATS EXPOSED PRENATALLY TO A LOW INTENSITY-LOW FREQUENCY, ROTATING MAGNETIC FIELD.

Dev. Psychobiol., 2, 3, 1970, 168 - 171

Two experiments were conducted to study the behavioral effect of prenatal exposure to a low intensity, ultra-low-frequency magnetic field. In experi - ment albino rats had been exposed continuously during their prenatal development to a 3 - 30 gauss, 0,5 Hz rotating magnetic field (RMF), and controls rats had been exposed prenatally to control conditions. Rats were tested in an field at 21 - 25 days of age. RMF exposed animals traversed significantly fewer squers than their controles in the open field (p below 0,001), but defecated significantly more in that situation (p below 0,001). RMF exposed males also traversed significantly fewer square that the RMF-exposed femals (p below 0,5). Three RMF exposed litters that were nurse by controled mothers did not differ significantly in open field activity from the pcps in the 4 RMF -exposed litters from which they were taken at birth. In experiment 2, in which the experimenters did not know whether the subject was a RMF-exposed rat or control rat, 19 RMF-exposed rats again traversed significantly fewer squars than the 20 control rats (p below 0,1).

174 P e r s i n g e r, M.A., F o s t e r, W.S.

ELF ROTATING MAGNETIC FIELDS: PRENATAL EXPOSURE AND ADULT BEHAVIOR.

Arch.Met.Geoph.Biokl. Ser. B 18, 3-4, 1970, 363 - 369

In three separate experiments, adult male rats that had been exposed conti - nuously during their prenatal development to a 0,5 Hz, 3 to 30 gauss rotating magnetic field (RMF), emitted significantly (p below 0,01) fewer lever presses in a free operant avoidance situation than rats that had been prenatally expo- sed to control conditions. This difference was apparently due, in large part, to the RMF-exposed rats relatively low response rate within response bursts following a shock. However, RMF-exposed rats did not differ significantly from control rats in the number of shocks received.

175 P i r u z i a n, L.A., G l e z e r, V.M., D e m e n t'e v, V.A., L o m o n o s o v, V.A., C h i b r i k i n, V.M.

MECHANISM OF THE BIOLOGICAL ACTION OF CONSTANT MAGNETIC FIELDS.

O MEKHANISME BIOLOGICHESKOGO DEISTVIIA POSTOIANNYKH MAGNITNYKH POLEI.

Akad. Nauk, SSSR, Izvest., Ser.Biol., 1970, 535 - 539

Survey of recent research concerning possible mechanisms of biological action by a constant magnetic field. Magnetic field effects on the electrical pro - perties of axons are analyzed, together with effects involving disturbance of the spatial orientation of biomolecules. Attention is given to mechanisms playing a role in the action of constant magnetic fields on electrolytes and liquids included in the composition of organisms. It is shown that the identi- fication of the primary influence of constant magnetic fields in many observed biological effects requires further experimental and theoretical research.

176 R e n o, V.R.

CONDUCTION VELOCITY IN NERVE EXPOSED TO A HIGH MAGNETIC FIELD.

NASA Order ER-19841, Ref.: Scientific and Technical Aerospace Reports, 8, 5, 1970, 794

Action potentials were recorded at four positions from frog sciatic nerves exposed to a constant magnetic field of 11,6 kilo-oersted. External electro- des arranged in pairs on segments of nerve oriented both parallel and per - pendicular to the field permitted conduction velocity measurements to be expressed as a function of field orientation. An increase in conduction velo- city was observed to be orientation dependent as was a latent period in its appearance. Possible mechanisms of action of the field are discussed in terms of current theories of impulse propagation.

177 R o b e r t s, A.M.

MOTION OF PARAMECIUM IN STATIC ELECTRIC AND MAGNETIC FIELDS.

J.Theor.Biol., 27, 1, 1970, 97 - 106

An elementary quantitative model, based on Jahn's "volume conductor" theory, is described to explain the motion of Paramecium in static fields (galvanotaxis). An expression for the orientation sensitivity to electric fields is derived. The contraction and eventual bursting observed at high field strengths is attributed to the heating effect of the current flowing through the organism.

178 S a c h a v a, T.B., S a m o k h v a l o v a, L.I.

CHANGE IN THE MEMBRANE POTENTIAL OF THE CELLS OF THE ALGA NITELLA FLEXILIS ON EXPOSURE TO A PERMANENT MAGNETIC FIELD.

OB IZMENENII MEMBRANNOGO POTENCIALA KLETOK VODOROSLI NITELLA FLEXILIS PRI DEISTVII POSTOIANNOGO MAGNITNOGO POLIA.

Biophysics, 15, 1, 1970, 89 - 92

The influence of direct magnetic field on the membrane potential of single cells of aquatic alga Nitella flexilis was investigated. It was stated that the decrease of the value of membrane potential takes place in the magnetic field. The dependence of the membrane potencial first, on the intensity of the field and second, on the period of the influence, was noticed.

179 S c h e l k u n o v a, S.A., D e n c h e v, D.D., B a d e n k o, L.A., S e m e n o v, R.Ia.

EFFECT OF MAGNETIC FIELD ON ESCHERICHIA COLI K-12.

VLIIANIE MAGNITNYKH POLEI NA KISHECHNUIU PALOCHKU ESCHERICHIA COLI K-12.

Biophysics, 15, 4, 1970, 665 - 669

The exposition of E.coli culture in a constant magnetic field (H = 500 Oe) and in an impulse magnetic field (H of the impulse = 500 Oe) does not effect the reproduction of E.coli K-12. Homogenous constant field of 3200 Oe after two-hour exposition induces a temporary decrease of cell number in culture capable of forming colonies on a dense nutrition medium. The decrease of oxygen uptake in the presence of glucose is observed in bacteria reproducing in an impulse magnetic field.

180 S o u t h e r n, V.E.

INFLUENCE OF DISTURBANCES IN THE EARTHS MAGNETIC FIELD ON RING-BILLED GULL ORIENTATION.

Amer. Zool., 10, 3, 1970, 292 - 293

Ring-billed Gull (Larcus delawarensis) chicks between the ages of 2 and 20 days were used in 680 orientation-cage trials. All of the experimental birds were taken from a population at Rogers City, Michigan. The apparently innate ability of chicks to select a southeasterly heading, the appropriate bearing for reaching their winter range, was compared when trials were conducted under various intensities of magnetic disturbance (0 to 7 gauss which equals disturbances of 0 to 200 gama). During minor disturbances (0 - 3 gauss) a statistically significant proportion of the experimental birds selected southeasterly headings but during higher intensity storms (4 - 7 gauss) there was a breakdown in such preferences and no statistically significant mean direction was present for the data. Evidence to date suggests that the mode of orientation used by young Ring-billed Gulls for selecting the direction of fall migration is altered by fluctuations in the earth's magnetic field.

181 T a r a k a n o v a, G.A.

EFFECT OF CONSTANT MAGNETIC FIELD ON THE ULTRASTRUCTURE OF BEAN ROOT MITOCHONDRIA.

VLIIANIE POSTOIANNOGO MAGNITNOGO POLIA NA ULTRASTRUKTURU MITOKHONDRII KORENI BOBOV.

Fiziol. Rast., 17, 5, 1970, 970 - 974

The ultrastructure of bean root mitochondria, subjected to the constant magnetic field of 62 and 1200 Oe, was studied by electron microscopy. No significant modification of the mitochondrial ultrastructure was detected as a result of the weak magnetic field (62 Oe). However mitochondria with a denser granulated matrix and numerous closely spaced cristae were common. These changes corresponded to a higher respiration rate of plants subjected to weak magnetic fields. The effect of strong magnetic field (1200 Oe) resulted in greater structural heterogenity of the mitochondria: some mitochondria exhibited pronounced modification. Mitochondria having an elongated "worm-like" form were abundant. Spherical mitochondria with stratificated membranes and a considerably decreased matrix electron density were less numerous. A correlation was established, between the respiration rate and the mitochondrial ultrastructure. Modification of the mitochondrial structure was presumably connected not only with their functional state but also with their develop - mental stage. Magnetically-induced modifications of mitochondrial structures were similar to those induced by other unfavourable factors.

182 T h i e m a n n, W., W a g n e r, E.

THE INFLUENCE OF HOMOGENOUS MAGNETIC FIELDS ON THE GROWTH OF MICROCOCCUS DENITRIFICANS.

DIE WIRKUNG EINES HOMOGENEN MAGNETFELDES AUF DAS WACHSTUM VON MICROCOCCUS DENITRIFICANS.

Z. Naturforsch., 25, 9, 1970, 1021 - 1023

The influence of strong homogenous magnetic fields in the range of 5000 to 8000 Gauss on the growth of Saccharomyces cerevisiae and Micrococcus denitrificans was studies. In the case of yeast growing under nearly anaerobic conditions an inhibition of growth rate was observed in the beginning of incubaton while some hours later the growth accelerated and surpassed the control. M.denitrificans on the other hand grew with the same rate as the controls during the first 2-3 hours of experiment; thereafter the magnetic field resulted in a significant acceleration of growth rate measured by a 5.8 to 13,3% increase of oxygen consumption after 5-6 hours run of experiment. Until now only inhibition of bacterial growths by magnetic fields is reported elsewhere in the literature.

183 U k o l o v a, M.A., K v a k i n a, E.B.

EFFECT OF MAGNETIC FIELD ON TUMOR GROWTH.

O VLIIANII MAGNITNYKH POLEI NA ROST OPUKHOLI.

Vopr. Onkol., 16, 2, 1970, 88 - 91

The effect of weak magnetic field (15 min with induction 500-700 gauss, rotated 2 rpm) was studied on 204 rats in which sarcomas was induced by 3,4 benzpyrine and, their 1 st generation transplants had reached average size. The influence of the magnetic field on the head and the tumor inhibited transplanted tumor growth up to full resolution. In some cases the antineoplastic effect was increased with adrenalin injections. On rats with induced tumors, the magnetic field was used for a day on the head and tumor. One month later the average tumor size was 12 times smaller than in the control group. After that, all tumors except 1 grew intensively. Life span of experimental animals was 39-49 days compared to 25-32 days in the control group. Daily magnetic field exposure only on the head and only on the induced tumor led to inhibited tumor growth. Out of 12 experimental rats, 5 tumors were fully resolved. Under the influence of a magnetic field, induced and transplanted tumor growth can be suppressed up to full resolution.

184 W e b e r, T.R.

TUMOR-INHIBITORY EFFECTS OF NONHOMOGENOUS MAGNETIC FIELDS.

Ohio. State Med. J., 66, 12, 1970, 1191

These experiments have evaluated the tumor inhibitory effects of a nonhomogenous magnetic field, a previously unexplored method of controlling tumor growth. Mammary adenocarcinoma (H2712) mouse tumor cells, prepared by enzymatic digestion of the tumor, were exposed in vitro for 20 minutes to a 38 kilogauss magnetic field, field gradient 12 kilogauss per mm, and immediately injected into adult female C_3H/HeJ mice (one million cells per mouse). Control cells were handled in identical manner but were not exposed to the field. Mean life span of the mice receiving the treated cells was longer than the mean control life span (p below 0,001). The mechanism of tumor inhibition demonstrated in these studies is unknown, but possibilities include enzyme inhibition, alterations in cellular membrane function, and interference with DNA replication.

185 W e b e r, T., C e r i l l i, J.

THE INHIBITION OF TUMOR GROWTH BY NONHOMOGENOUS MAGNETIC FIELDS.

Current Topics in Surgical Research. vol.2., Symposium Academic Press: New York, N.Y., USA, London England, 1970, 267

The nonhomogenous magnetic field has an inhibitory effect on tumor growth. In vivo exposure of tumor nodules and in vitro exposure of tumor cells to the magnetic field prior to injection into C_3H/HeJ mice resulted in slower growing tumors and prolongation of the life spans of the tumorbearing mice. While the exact mechanism of tumor inhibition is unknown, several possibilities are presented, and it is likely that a combination of these is involved. Prospects for human clinical use are briefly discussed.

186 W e h n e r, R., L a b h a r r t, T.

PERCEPTION OF THE GEOMAGNETIC FIELD IN THE FLY DROSOPHILA MELANOGASTER.

Experientia, 26, 7, 1970, 967

The negative geotactical orientation of the Drosophila melanogaster at a 30° inclined plane shows a significant lefthand deviation (5,5°), if the lines of the magnetic field of earth are laterally incident to the move-on direction of the flies. At a horizontal plane the flies prefer the North-South-directions for resting position.

187 Zhokov, V.P., Ideikin, E.I.

RELATIONSHIP BETWEEN ACUTE ATTACKS OF GLAUCOMA AND CHANGES IN THE MAGNETIC FIELD OF THE EARTH.

O SVIAZI OSTRYKH PRISTUPOV GLAUKOMY S KOLEBANIIAMI MAGNITNOGO POLIA ZEMLI.

Vestn. Oftalmol., 5, 1970, 29 - 30

For the 1st time the relation between the incidence of acute attacks of glaucoma (1304 observations) and geomagnetic field fluctuations was studied. There exists a direct dependence between the number of applications for medical help in connection with acute attacks of glaucoma and the planetary index of magnetic perturbation. Moreover, glaucomatous patients showed a statistically significant difference in mean values of the horizontal component of the geomagnetic field in the days with and without acute attacks.