0089 RADIOIMMUNOASSAY OF NEUROENDOCRINE CHANGES FOLLOWING MICROWAVE EXPOSURE. Vetter, R. J. (Purdue Univ., Sch. Pharmacy, Executive Building, Lafayette, IN 47907).

The feasibility of using radioimmunoassay to monitor changes in pituitary and thyroid hormone levels in the serum of animals exposed to various levels of nonionizing radiation will be determined. Rats will be exposed to 2450 MHz microwave radiation 8 hr/day for 21 consecutive days. Before exposure and at 7, 14, and 21 days of exposure and at 7 days following exposure, some rats will be sacrificed, and the levels of T3, T4, and thyroid-stimulating hormone in the serum will be determined by radioimmunoassay techniques. (6/76-5/77)

Supporting Agency:Purdue Res. Foundation.

0090 NONINVASIVE ESTIMATION OF TISSUE TEMPERATURE. Diller, K. R.; Eberhart, R. C.; Cogdell, J. R.; Thompson, K. (Univ. Texas, Sch. Engineering, 200 W. 21st St., Austin, TX 78712).

Microwave radiation emission from biologic tissue is detectable at depths up to 1 cm with conventional Dicke-switched superheterodyne radioastronomy radiometers. This allows for the potential detection of tumors, estimation of the severity of burns, and estimation of blood flow, undetectable by conventional infrared thermography. Microwave antennas and receivers, which most efficiently couple with and can be adapted to, biologic tissue will be designed and analyzed. Data on radiation absorption coefficients, their frequency and temperature dependence and tissue specificity, will be determined to assess the effectiveness of this technique. (7/75-6/76)

Supporting Agency:Univ. Texas.

0091 ELECTRICAL & ACOUSTIC PROPERTIES OF BIOLOGIC MATERIAL. Schwan, H. P.; Takashima, S.; Fischler, H.; Schwartz, G. (Univ. Pennsylvania, Sch. Engineering & Applied Science, 4001 Spruce St., Philadelphia, PA 19104).

Research will be conducted on the electrical and acoustic properties of biologic materials and on electrode polarization and forces induced by alternating electrical fields acting on biologic particles. Present and future emphasis will be on: (1) The behavior of electrodes used for impedance measurements and excitation purposes in physiology and cardiology (pacemaker), with particular emphasis on their nonlinear characteristics. (2) Electrical characteristics of macromolecules and water bound to their surface. (3) Electrical characteristics of biologic and artificial cells and membranes as related to their structure and function. (4) Acoustic properties of tissues and biologic macromolecules and the reasons why their specific absorption varies from one type to another. (5) Field induced force effects, particularly alternating field induced forces acting on biologic cells to determine their hazards or potential for new biologic research techniques. (9/76-11/76)

Supporting Agency:HEW, PHS, NIH, Natl. Heart, Lung & Blood Inst.

0092 LABILE METABOLITES, TRANSMITTERS IN THE HEART CYCLE. Stavinoha, W. B.; Medina, M. A.; Modak, A. T.; Jones, D.; Deam, A. P. (Univ. Texas, Sch. Medicine, 7703 Floyd Curl Drive, San Antonio, TX 78284).

Electromagnetic radiation is being used to inactivate the enzymes at specific times during the beat cycle of the spontaneously beating turtle heart. Electrocardiogram and reflectrometry is used to monitor events in the beat. After inactivation of the enzymes, the following compounds from the right and left auricles, ventricular apex, and ventricular base are assayed: acetylcholine, choline, cyclic adenosine monophosphate and guanosine monophosphate, the high energy phosphates, lactate, and pyruvate. (9/76-8/77)

Supporting Agency:HEW, PHS, NIH, Natl. Heart, Lung & Blood Inst.

0093 EFFECT OF PHYSICAL STIMULI ON INSECTS. Earp, U. F.; Perumpral, J. V. (Virginia Polytechnical Inst. & State Univ., Sch. Agriculture & Life Science, Burruss Hall, Blacksburg, VA 24061).

The objective of this project is to determine the response of certain insects of economic importance in Virginia to physical stimuli, especially electromagnetic field energy, and to determine the feasibility of using such stimuli as an attractant or repellent of insects or as a population suppressant. Insect behavior will be studied in magnetic and electrostatic fields in the zero frequency range. Experiments will be conducted to determine the effect of electromagnetic fields in flight chambers for orientation behavior, in homogeneous fields for egg-laying and hatchability, and in CO_2 production monitoring for insect activity. Tests to determine the effect of electrostatic fields on oviposition among cabbage loopers were completed. Field gradients ranging from 100 V/cm to 5000 V/cm were considered. Results show that in higher gradient fields egg production is comparatively lower than normal. These results are useful to evaluate the potential use of electrostatic fields for the control of insects. A manuscript entitled *Low-Intensity Magnetic Field Studies on Cabbage Looper* was completed. The final report on the study is being prepared. (10/76-9/77)

Supporting Agency:Virginia State Government.

0094 HATCHABILITY OF CHICKEN AND TURKEY EGGS. Krueger, W. F. (Texas A & M Univ. System, Agricultural Experiment Station, College Station, TX 77843).

This study will investigate and evaluate incubational and pre-incubational factors influencing hatchability of chicken and turkey eggs under southern climatic conditions. The causes of egg spoilage during incubation will be determined, and methods of preventing this condition will be established. Incubational and pre-incubational factors necessary for optimum embryonic development will be correlated with seasons. The interrelationships between hatchability and other genetic characters of economic importance will be investigated under varying incubational and pre-incubational conditions. Pedigree hatching eggs will be characterized after treatment by various chemical and weight measurements of the shell, albumen, and yolk of eggs 1 wk each mo. Similar eggs from the same pedigreed hens will be incubated usually under three incubation conditions to determine treatment effects. Studies are in progress to determine methods of efficiently preventing spoilage of hatching eggs and of sanitizing hatching eggs prior to and during incubation. Genetic differences in the various egg characteristics must eventually be related to other physiologic characteristics of the bird to avoid genetic antagonisms. Records are being kept on a pedigree basis to study these potential antagonisms. Experiments with laying hens and males exposed to three types of electromagnetic fields for a 20 wk period resulted in significant differences in rate of egg production. There were no significant differences produced in fertility, hatchability, chick quality, or sex ratio. Continuous exposure to microwaves at low power densities and low level magnetic and electric fields did not appear to influence reproductive ability of chickens. (10/76-9/77)

Supporting Agency:Texas State Government.

0095 QUANTIFICATION & MEASUREMENT OF INTERNAL ELECTROMAGNETIC FIELDS INDUCED IN FINITE BIOLOGICAL BODIES BY NONUNIFORM ELECTROMAGNETIC FIELDS. Chen, K. (Michigan State Univ., Sch. Engineering, Engineering Building, East Lansing, MI 48824).

See Current Research 0073. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Army.

0096 BIOPSYCHOLOGICAL STUDIES OF MICROWAVE IRRADIATION. Justesen, D. R.; Sheridan, C. L.; Garrison, R. G.; Levinson, D. M. (Univ. Kansas, Sch. Medicine, 39th & Rainbow Blvd., Kansas City, KN 66101).

Dose-determinant exposures of pregnant mice and rats to 2450 MHz and 915 MHz microwaves will be performed in studies of lethal-dosing, teratology, longevity, and maze-learning. Related studies will: (1) evaluate the role of endogenous (psychogenic) heating in mammals as induced by handling and restraint in lethality of dosing; (2) examine growth and ultrastructure of a thermophilic organism that exhibits retarded growth and hyperplasia of the plasma membrane under microwave radiation; (3) record the ethogram of an avian species previously incubated in a microwave field; (4) determine the utility of evoked thermal responses as indicators of perception of microwave energy; and (5) obtain evidence of the use of hypothermal agents in mammals to determine the biodosimeter of absorbed electromagnetic energy. The multimode cavity will be used for exposing organisms to microwaves and the effects of continuous wave versus pulsed radiations of the same average density will be compared. (9/76-8/77)

Supporting Agency:HEW, PHS, FDA.

0097 ACCELERATION OF FRACTURE HEALING BY ELECTRICAL FIELDS. Brighton, C. T.; Friedenberg, Z. B.; Black, J.; Korostoff, E.; Heppenstall, R. B. (Univ. Pennsylvania, Sch. Medicine, 36th & Hamilton Walk, Philadelphia, PA 19104).

This research will continue the investigation of the effects of an applied electrical current and/or field on the acceleration of fracture healing in laboratory animals. The research will determine the comparative effectiveness of direct constant and pulsed current, alternating current, electrostatic fields, and magnetically induced electrical fields in producing osteogenesis and in accelerating fracture healing in laboratory animals. In addition, the site and mechanism of action of electrical stimulation on medullary canal cells and on fracture callus cells will be determined. The methodology will include point-counting analysis of histologic sections for new bone formation produced in an intact medullary canal around a cathode in response to various parameters of current, voltage, electrostatic, and electromagnetic fields; mechanical testing for maximum resistance to bending of healing fractures in laboratory animals; point-counting analysis of electron micrographs of fracture callus cells to quantitate changes in cytoplasmic components; electron microscopy combined with histochemical analysis of fracture callus cells to detect changes in cell membrane surface charges; and determination of changes in tissue pO_2, O_2, and pCO_2 consumption using a tissue tonometer system. (9/76-8/77)

Supporting Agency:HEW, PHS, NIH, NIAMDD.

0098 NAVY ENVIRONMENT: QUANTITATION OF MICROWAVE RADIATION EFFECTS ON THE HEAD AND EYES OF RABBITS, PRIMATES AND MAN. Kramar, P. O.; Emery, A. (Univ. Washington, Sch. Medicine, 500 17th Ave., Seattle, WA 98122).

Exposure to microwave radiation can cause the production of opacity and damage in the eye. The exact conditions under which these effects occur are yet to be established; consequently, there is a great deal of controversy concerning the safe level of human exposure to microwave radiation. The increased use of high power microwave equipment by the Navy and other armed services, as well as the

general population, demands well-planned and expertly executed theoretic and experimental investigations. Rabbits will be exposed to 300 mW/cm^2 incident power (2450 MHz) level for subthreshold time periods but with the interval between exposures varying by 1 to 5 days. These tests should help to determine: (1) the period of time needed between exposures that will "protect" the lens from permanent damage, and (2) whether repeated subthreshold exposures alter the temperature regulating mechanisms of the eye. Rabbits will also be exposed to lower power levels, using a slot irradiator, to determine the lowest threshold level for the formation of cataracts. The slot threshold for the monkey will also be determined. An investigation of the effects of long-term, low level chronic irradiation on rabbits has been initiated and will be continued for at least another year. Electronmicroscopic studies and fluorescein angiography will be used to help determine the mechanism of cataract formation. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0099 THE EFFECTS OF LOW POWER DENSITY ELECTROMAGNETIC ENERGY ON BIOLOGICAL SYSTEMS. Flanigan, W. F.; Ridgway, S. H. (U.S. Navy, Biosystems Research Dept., San Diego, CA 92132).

The electrophysiology (i.e., brain wave activity and heart rate) and behavior of reptiles exposed to low power density ($\leq$ 10 mW/cm^2) electromagnetic radiation will be studied at 960 and 2450 MHz. Turtles, land tortoises, the North American box turtle, the North American painted turtle, and the Southern California desert tortoise will be used. Electroencephalograms and electrocardiograms will be recorded from semichronically implanted animals. Averaged cortical evoked potentials will also be recorded using a computer of averaged transients. Animals will be unanesthetized but fully restrained during exposure and recordings. Baseline recordings prior to field exposure will be compared with those obtained when an animal is exposed to electromagnetic radiation. The cumulative effects of recurring field exposure will also be investigated. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0100 RADIOFREQUENCY RADIATION EFFECTS ON BIOCHEMICAL SYSTEMS IN THE CENTRAL NERVOUS SYSTEM. Merritt, J. H.; Frazer, J. W. (U.S. Air Force, Sch. Aerospace Medicine, Brooks Air Force Base, San Antonio, TX 78235).

The Department of Defense Triservice Electromagnetic Radiation (EMR) Bioeffects Research Program describes the central nervous system (CNS) as the "singularly most important area where there is evidence that EMR interacts with biological systems." The objective of this effort is to quantitate the radiofrequency (RF) EMR effects on biochemical events subserving nerve transmission in the CNS. The information obtained will be applied to establish more appropriate safety standards for personnel working in close proximity to Air Force RF emitters. The effects of RF radiation on the CNS, specifically on a specialized function of the neuron, namely synaptic transmission, will be studied: brain cells are connected, directly or indirectly, by chemical switching systems (synaptic transmission). This effort will attempt to quantify changes produced by RF energy in these chemical systems, determine thresholds for frequency and power density, and interpret these changes in terms of the expected effect on man in Air Force operational environments. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0101 RADIOFREQUENCY RADIATION INTERFERENCE (RFI) OF MEDICAL PROSTHETIC DEVICES. Mitchell, J. C.; Hardy, K. A. (U.S. Air Force, Sch. Aerospace Medicine, Brooks Air Force Base, San Antonio, TX 78235).

A biomedical data base on the interaction of Air Force radiofrequency (RF) radiation emitters and medical prosthetic devices will be established. The data will be applied to operational situations in accordance with Air Force regulation (AFR) 161-42. The effort will include a state-of-the-art technology watch on cardiac pacemaker interference. Manufacturers' progress in developing pacemakers to operate properly in pulsed RF fields of 200 root-mean-square V/m will be assessed. New state-of-technology pacemakers will be accepted on loan from manufacturers and evaluated under a variety of RF emission sources in the USAFSAM laboratory. Sources will include radiofrequencies between 50-500 MHz. Field tests will also be conducted using a high frequency band transmission system at Ava, NY. Additional field tests will be conducted in support of specific operational problems as provided by AFR 161-42. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0102 VISUAL SYSTEM DISEASES IN AIRCREWMEN. Tredici, T. J.; Burman, M. L. (U.S. Air Force, Sch. Aerospace Medicine, Brooks Air Force Base, San Antonio, TX 78235).

The incidence and significance of ophthalmologic disorders in flying personnel will be determined from the standpoint of retention without compromising flying safety. The means to prevent or correct such disorders, and techniques for early diagnosis or prediction of development of such disorders will be developed. Flying personnel with ophthalmologic problems will receive a comprehensive aeromedical evaluation and a battery of function testing, including manifest and cycloplegic refractions, motility tests, tonometry, tonography, funduscopy and fundus photography. The response to aerospace environmental factors (i.e., acceleration, altitude and electromagnetic radiation) will be studied in special

cases. Longitudinal basic studies will assess the significance of disease in relationship to flying operations and the validity of current aeromedical standards. Fluorescein fundus photography, electroretinography, electrooculography, static perimetry, and biomicroscopy will be utilized in studying the effect of disease and stress on aircrewmen. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0103 CLINICAL ASPECTS OF MICROWAVE EXPOSURE. Michaelson, S. M. (Univ. Rochester, Sch. Medicine & Dentistry, 401 Elmwood Ave., Rochester, NY 14642).

Evaluation of alterations in the functional status of the neuroendocrine system after exposure to microwaves and elucidation of threshold levels, cumulative effects, interaction with other stresses and environmental factor is the objective of this study. Mature rats will be exposed to microwave irradiation in three different regimens: 100 mW/cm^2, 10 mW/cm^2, and 1 mW/cm^2 for 8 wk. Periodically throughout the exposure, body weight and temperature will be taken, and blood drawn. Gross behavioral observations will also be made. Thyroid function will be evaluated using T3 and T4 resin sponge absorption studies. Pituitary function will be determined by a bioassay of thyroid-stimulating hormone. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0104 NAVY ENVIRONMENT: INVESTIGATION OF THE BIOLOGICAL EFFECTS OF PULSED ELECTROMAGNETIC FIELDS GENERATED BY NAVAL OPERATIONS. Cleary, S. F. (Virginia Commonwealth Univ., Sch. Medicine, 1200 East Broad St., Richmond, VA 23298).

See Current Research 0013. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0105 NAVY ENVIRONMENT: EFFECTS OF BIOLOGICAL SYSTEMS DUE TO EXPOSURE TO MICROWAVES. Durney, C. H.; Lords, J. L. (Univ. Utah, Sch. Engineering, 1400 East 2nd St., Salt Lake City, UT 84112).

See Current Research 0011. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0106 NAVY ENVIRONMENT: EFFECTS OF MICROWAVES ON MATURATION IN THE RAT. Michaelson, S. (Univ. Rochester, Sch. Medicine & Dentistry, 401 Elmwood Ave., Rochester, NY 14642).

See Current Research 0050. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0107 MEASUREMENT OF POWER DISTRIBUTION AT RESONANT AND NONRESONANT FREQUENCIES IN EXPERIMENTAL ANIMALS AND MODELS. Guy, A. W.; Lovely, R. H. (Univ. Washington, Sch. Medicine, 500 17th Ave., Seattle, WA 98122).

See Current Research 0046. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force

0108 NAVY ENVIRONMENT: BIOMEDICAL EFFECTS OF RADIO FREQUENCY RADIATION. Lin, J. C.; Kraus, G. E. (Wayne State Univ., Sch. Engineering, 5950 Cass Ave., Detroit, MI 48202).

See Current Research 0059. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Navy.

0109 MICROWAVE IRRADIATION OF BRAIN THROUGH CRANIOPLASTY. Sutton, C. H. (Univ. Miami, Sch. Medicine, 1400 N.W. 10th Ave., Miami, FL 33124).

No descriptive information is available. (1/77-12/77)

Supporting Agency:American Cancer Soc., Inc.

0110 COMPARISON OF THEORETICAL AND EXPERIMENTAL ABSORPTION OF RADIOFREQUENCY POWER. Johnson, C. C.; Durney, C. (Univ. Utah, Sch. Engineering, 1400 East 2nd St., Salt Lake City, UT 84112).

Methodology for quantitating electromagnetic radiation (EMR) energy distribution and measurement will be developed. Methods and data are critically needed to extrapolate (via appropriate scaling factors) animal data to man to establish more realistic personnel safety exposure guidelines for Air Force operations. The specific objectives of this study are (1) to define adequate models, (2) to extend theoretic radiofrequency (RF) power absorption data to assess consequences of human exposure to 10 KHz to 1.5 GHz RF radiation fields, and (3) to develop methods, accounting for size and orientation effects, to extrapolate animal exposures to equivalent human exposures. Twenty phantoms will be constructed to simulate 3.5 kg monkeys. Absorbed power will be calculated utilizing this monkey model for exposures in free space, near field, and on a ground plane. Experiments will be conducted to measure power absorbed in the phantom and in actual monkeys for six exposure orientations. The best model for man, monkey, rat and mouse will be developed and calculations will be performed to determine power density to which these animals should be exposed to produce the same average absorbed power as man when exposed to 10 mW/cm^2 at the same frequency. The exposure frequency for animals subjected to the same power density as man to accomplish equivalent average power absorption will also be calculated. These data will be used to compile a handbook (Researcher's Guide) for use in selecting appropriate exposure parameters (frequency and power

density) for animal studies to simulate bioeffects in man. Power absorption calculations for man and animals will be extended to 1.5 GHz using wave solution, numeric techniques, or other applicable methods. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0111 BIOLOGICAL EFFECTS OF AIR FORCE TRANSMITTER NEAR FIELDS. Stavinoha, W. B.; Medina, M. A. (Univ. Texas, Sch. Medicine, 7703 Floyd Curl Drive, San Antonio, TX 78284).

The independent and synergistic effects of high frequency band (3-30 MHz) magnetic and electric field vectors on a variety of biologic systems will be investigated using the USAFSAM "near-field" radiation simulator. This information is required to establish personnel exposure criteria in close proximity to Air Force high power radiofrequency radiation emitters operating in the frequency range of approximately 3-500 MHz. Various mammalian systems will be exposed in the "near field" simulator and studied to detect any possible alterations in growth and reproduction, central nervous system effects (neurotransmitter turnover, brain nucleotide levels, brain cyclic AMP assay), endocrine status (corticosteroid assays depending on experimental animal, water balance, vanillylmandelic acid, norepinephrine and epinephrine analysis), hematology (primates), and liver and renal function. In selected animals specific examination of the heart will be undertaken. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0112 EFFECTS OF MICROWAVE RADIATION ON THE NERVOUS SYSTEM. Lovely, R. H. (Univ. Washington, Sch. Medicine, 500 17th Ave., Seattle, WA 98122).

The effects of long-term, low intensity microwave exposure on the nervous system, particularly the brain, will be investigated. The effects of microwaves on the brain will be measured and correlated with behavior and biologic functions. (6/76-6/77)

Supporting Agency:HEW, PHS, NIH, Natl. Inst. Environmental Health Science.

0113 BEHAVIORAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION ON STORED-PRODUCT INSECTS. Bruce, W. A. (U.S. Dept. Agriculture, Stored Products Insects Research & Development Lab., 3401 Edwin Ave., Savannah, GA 31405).

The electromagnetic frequencies (EF) capable of controlling and/or altering insect behavior will be determined. Working models, based on insect physiology, morphology, and behavior by which economic nonchemical control might be accomplished will be provided. Insects will be exposed to various frequencies and intensities to determine response, thresholds, and probable locations of sensory receptors. Precise receptor location will be accomplished electrophysiologically. Because of the increased power and wavelength penetrability of laser-produced infrared (IR) radiation, IR spectrum studies will utilize frequencies produced by gas lasers; the feasibility of using laser technology and techniques for behavioral work involving insect detection of and attraction/repulsion to these frequencies will be determined. The principle of differential absorption of laser-produced frequencies between commodity and insect will be utilized for possible detection and control of the infestation within the commodity. Electromagnetic radiation has been used to alter the behavior of several species of stored-product insects. UV radiation has been shown to have an extremely damaging effect on *Plodia interpunctella*, *Tyrophagus putrescentiae*, and *Pyemotes ventricosus*; although, each is able to repair the UV damage (photoreactivation) through either a light or dark mechanism. UV radiation has also been used to destroy the biologic activity of the synthetic sex pheromone of *P. interpunctella* and thereby provide a possible new nonchemical method of insect control. IR radiation emitted by a CO_2 gas laser has been used to elicit responses from two species of stored-product insects. The response was observed and quantified by two newly developed techniques. A system utilizing IR CO_2 analysis was developed to detect hidden insect infestations. The method is rapid, nondestructive, and applicable to a wide variety of materials, either packaged or bulk, and can be employed at any point in the marketing channel. (10/76-9/77)

Supporting Agency:U.S. Dept. Agriculture, Agricultural Res. Service, Georgia-South Carolina Area.

0114 IMPACT OF RF BIOEFFECTS ON AF OPERATIONS. Mitchell, J. C.; Hardy, K. A. (U.S. Air Force, Sch. Aerospace Medicine, Brooks Air Force Base, San Antonio, TX 78235).

A radiofrequency radiation (RFR) bioeffects technology data base will be maintained to support environmental impact positions and to establish operational RFR safety criteria for current and future Air Force systems. Specific biologic consequences of human exposure to unique pulsed radiofrequency fields from phased array emitters will be evaluated and compared with the findings of pulsed versus continuous wave radar exposure experiments. Radiofrequency radiation effects data will be compiled, analyzed, and applied to establish systems specific exposure criteria in accordance with Air Force mission requirements and operational situations. Additional research data will be obtained through a multi-agency contract with the Franklin Institute. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0115 BIOLOGICAL EFFECTS OF AF RF TRANSMITTER FIELDS. Frazer, J. W.; Merritt, J. H. (U.S. Air Force, Sch. Aerospace Medicine, Brooks Air Force Base, San Antonio, TX 78235).

The setting of safety standards for Air Force personnel exposed to electromagnetic radiation (EMR) must rest on a foundation of known bioeffects. This effort will investigate radiofrequency (RF) field effects on biophysical model systems. The information gathered will allow the adjustment of exposure criteria for Air Force personnel working in unique RF radiation environments. Field modulation effects, including pulsed fields, on a variety of central nervous system (CNS) ionic and chemical distributions will be examined. The effects of EMR fields on solvent transport processes in tissue and polarization processes in macromolecules will also be investigated. Alterations in the trace metal content in various areas of the rat CNS will be related with frequency, power density, and thermal stress, and these findings will be extrapolated to an expected effect on Air Force personnel operating in EMR environments. (10/76-9/77)

Supporting Agency:U.S. Dep. Def., Air Force.

0116 EFFECTS OF MICROWAVE RADIATION ON THE NERVOUS SYSTEM. Gandhi, O. P. (Univ. Utah, Sch. Engineering, 1400 East 2nd St., Salt Lake City, UT 84112).

The effects of long term, low intensity microwave exposure on the physiologic function of the nervous system, particularly the brain of rodents, will be investigated. Biochemical analyses of the cholinesterase activity of the blood, the sulfhydryl groups in the blood, and ketosteroid in the urine will be performed, and the data will be correlated with nervous system and behavioral measurements. (6/76-6/77)

Supporting Agency:HEW, PHS, NIH, Natl. Inst. Environmental Health Science.

0117 CELLULAR EFFECT OF MICROWAVE RADIATION. Livingston, G. (Univ. Utah, Dept. Bioengineering, Salt Lake City, UT 84112).

The biologic effects of 2450 MHz microwave radiation on cultured Chinese Hamster Ovary (CHO) cells are being investigated. One aspect of the study is the effect of such radiation on the reproductive integrity of the cells following treatment. Measurements of cell survival following hyperthermic exposure to microwave compared with conventional heating in a water bath showed no significant differences in cell survival. Also being studied is the effect of microwave treatment on the frequency of sister chromatid exchange (SCE) in the chromosome complement of CHO cells. SCE frequency has been found to be highly sensitive to various physical and chemical carcinogens. Furthermore, it has been found that conventional hyperthermia (44°C) drives up the frequency of this event significantly. Work is underway to determine whether microwave heating has a comparable effect on SCE production and whether heat combined with x-ray exposure leads to an additive or possibly a synergistic effect on the formation of sister chromatid exchanges.

Supporting Agency:Not Specified

0118 MILLIMETER WAVE SPECTRA OF LIVING TISSUE. Gandi, O.; Johnson, C.: Partlow, L.; Hill, D.; Stensaas, L.; Millhouse, G. (Univ. Utah, Sch. Engineering, 1400 East 2nd St., Salt Lake City, UT 84112).

To determine the microwave spectra over the 8-90 GHz band of normal and malignant cells, the absorption spectra of cells bearing temperature-sensitive viruses and cells with isolated spontaneous transformants and drug-induced transformants will be evaluated. Light and electron microscopy experiments will be performed to study the effects of microwave irradiation on the morphology of several cloned lines and primary cell cultures.

Supporting Agency:NIH

0119 BIOLOGICAL TEMPERATURE SENSOR USING OPTICAL ETALONS. Christensen, D. (Univ. Utah, Salt Lake City, UT 84112).

A fiberoptic temperature probe using a small solid optical cavity (etalon) as the sensor will be developed. Temperature will be determined by measuring the temperature-dependent wavelength shifts in the optical reflectivity nulls from the sensor. Such a probe, being entirely nonmetallic and nonperturbing, would find applications in microwave and radiofrequency biohazard studies, microwave cooking and thawing experiments, and microwave hyperthermia studies.

Supporting Agency:NIH

4800 COMPARISON OF THEORETICAL AND EXPERIMENTAL ABSORPTION OF RADIOFREQUENCY POWER. (Eng.) Allen, S. J.; Durney, C. H.; Johnson, C. C.; Massoudi, H. (Dept. Bioengineering, Univ. Utah, Salt Lake City, UT 84112). 16 pp. 1975. [available through National Technical Information Services, Washington, D.C., Document No. AD A022890].

Power absorption calculations using prolate spheroid models were performed for radiofrequency exposures between 10 and 50 MHz, and these data were compared with experimental data obtained from saline-filled prolate spheroid monkey and human phantoms as well as from live monkeys (rhesus primates). The agreement, generally, between the calculated and measured values for the phantoms was good, with the best agreement occurring at the higher frequencies. The perturbation theory appeared to be valid for describing the power absorbed by prolate spheroid phantoms. A total of 20 live monkeys, however, absorbed significantly more power than the phantoms, and data taken at a frequency of 40 MHz revealed significant differences in absorbed power at a given polarization when the monkeys were rotated about their long axis. This indicated that a spheroid, which is circular in cross section, is not an adequate model for the monkey. Ellipsoid models better approximated power absorption for both monkeys and humans. (2 refs.)

4801 ELECTROPHYSIOLOGICAL EFFECTS OF ELECTROMAGNETIC FIELDS ON ANIMALS. (Eng.) Guy, A. W.; Lin, J. C.; Chou, C. K. *In: Fundamental and Applied Aspects of Nonionizing Radiation.* Michaelson, S. M.; Miller, M. W.; Magin, R.; Carstensen, E. L., eds. (New York: Plenum Press): pp. 167-211; 1974.

In vivo and *in vitro* studies were performed on nervous tissues of cats exposed to microwave radiation to determine thresholds of electrophysiologic phenomena observed in absorbed electromagnetic power levels and possible temperature increases at sites of interaction. The microwave frequencies extended from ultra-high frequency to X band, and the exposure facilities included near zone reflectors, horns and apertures, and waveguide irradiation chambers. It was shown that the conduction and transmission latencies and amplitudes of evoked potentials in both the central nervous system of anesthetized cats, isolated nerves of cats, and ganglia of rabbits were affected by continuous wave (CW) microwaves in a manner very similar to that of localized conduction heat. Temperature rises were always associated with observable changes of the measured characteristics in the nervous tissues exposed to CW irradiation. The threshold of occurrence of latency changes was between 2.5-5.0 W/kg of absorbed power density in the affected tissues, which is about one-quarter to one-half of the normal metabolic rate of brain tissue. This absorbed power corresponds to 5-10 mW/cm^2 and 10-25 mW/cm^2 incident upon a cat head and a human head, respectively. Pulsed microwaves of high peak intensity and low average power induce a hearing phenomenon in man. Electrophysiologic studies on cats indicated that pulsed microwaves interact with mammalian auditory systems in a manner similar to that of conventional acoustic perception. The authors suggest that a possible mechanism of microwave interaction is the acoustic energy release from rapid thermal expansion due to power absorption in the gross structure of the head. (44 refs.)

4802 USE OF MICROWAVE AND LOWER FREQUENCY RF ENERGY FOR IMPROVING ALFALFA SEED GERMINATION. (Eng.) Nelson, S. O. (Univ. of Nebraska, Lincoln, NB 68583). *J. Microwave Power* 11(3): 271-277; 1976.

The use of microwave and radiofrequency energy for increasing the germination of alfalfa seed (*Medicago sativa* L.) by lowering the hard-seed content is reported. Exposure of alfalfa seed to frequencies of 5, 10, 39, and 2450 MHz effectively reduced the hard-seed percentages and provided increased seedling germination; all of these frequencies were equally effective when the resulting seed temperatures were comparable. Germination responses to different field intensities were also similar when the final temperatures were similar. Moisture in the seeds was an important factor, with treatments generally more effective at lower seed moisture contents. Optimum germination response to microwave and radiofrequency radiation depended mainly on the elevation of the seed temperature to the proper level. The optimum temperature for increasing seed germination was about 75°C for seed lots of normal moisture content (about 6-7%). (19 refs.)

4803 BRAIN TEMPERATURE AND ENZYME HISTOCHEMISTRY AFTER HIGH INTENSITY MICROWAVE IRRADIATION. (Eng.) Butcher, L. L. (Dept. Psychology, Univ. California, Los Angeles, CA 90024); Butcher, S. H. *Life Sci.* 19(7): 1079-1088; 1976.

Cerebral temperature measurements and histochemical analyses were performed on the brains of male and female Sprague-Dawley rats following exposure to high intensity microwave irradiation. The brains were subjected to low intensities of microwave radiation of 2.5 kW x 1.0 sec, 5.0 kW x 0.5 sec, or less, and higher intensities of 2.5 kW x 2.0 sec, 5.0 kW x 1.0 sec, or more. It was found that brain temperature increased with increasing intensities of irradiation. Histochemically assessed telencephalic and mesencephalic acetylcholinesterase (AChE) was inactivated for a considerable distance pericentrally by a microwave power level of 5.0 kW applied for 0.5 sec. With these parameters, core brain temperature was 56°C, and neuronal somata in the red nucleus and other neural regions displayed pyknotic nuclei or compacted nucleolei, an inflated appearance, and decreased Nissl staining. AChE was completely inactivated by a 1-sec application of 5.0 kW microwave power. At the same time brain temperature was 78°C, and, as after lower intensities of microwave irradiation, neuronal somata were hypochromic and in-

flated. NADH-diaphorase was found to be less thermolabile than AChE. Because it more rapidly inactivates thermolabile brain enzymes, compared with freezing by immersion and chemical fixation protocols, the use of microwave irradiation of neural tissue is recommended for neurochemical studies. (25 refs.)

4804 NERVOUS SYSTEM CHANGES IN WORKERS OF RADIO-TELEVISION STATIONS EXPOSED TO MICROWAVES. (Pol.) Bielski, J. (Wielkopolski Zespol Specjalisticzny Medycyny Przemyslowej, Instytut Chorob Wewnetrznych AM, 60-852 Poznan, ul. Poznanska 55a, Poland); Pianowska, J.; Sawinska, A.; Gruszka, W. *Pol. Tyg. Lek.* 31(32): 1369-1372; 1976.

A group of 115 people, mean age 40 yr, with a mean length of 10 yr of employment in television and radio, was evaluated for the effect of microwaves on their central nervous system. Among them, 88 worked within the range of tele-radio-communication equipment with a microwave frequency of 3,000-7,000 MHz and a power density below 0.1 W/m^2. Another 27 workers were not directly exposed to the emission of microwaves, and 39 of equal age and tenure, who worked outside of microwave range, served as controls. A complete psychophysical examination established that the complaints of 88.7% of the exposed people were the result of autonomic nervous system dysfunction. However, the same syndromes were also found in 70% of the controls--probably due to the stress-inducing nature of their work. Among the exposed individuals, slight but significant cardiovascular alterations and increased pathologic lenticular eye changes were observed compared to controls. The microwave exposed group showed a higher resistance to stress and reduced sociability. Electroencephalograms in both exposed groups revealed a higher number of flat low-voltage tracings in younger men than in controls. The autonomic nervous system and electroencephalogram changes observed were minor. (9 refs.)

4805 ENERGY ABSORPTION PATTERNS IN CIRCULAR TRIPLE-LAYERED TISSUE CYLINDERS EXPOSED TO PLANE WAVE SOURCES. (Eng.) Ho, H. S. (U.S. Dept. Health, Education, Welfare, Public Health Service, Food and Drug Admin., Bureau Radiological Health, Div. Biological Effects, 5600 Fishers Lane, Rockville, MD 20852). *Health Phys.* 31(2): 97-108; 1976.

The energy absorption patterns in arm and thigh triple-layered phantom tissue circular cylinders were calculated for plane wave sources of 433, 750, 918, and 2450 MHz. The three layers simulated fat, muscle, and bone. At all frequencies for incident E_z polarized (TM) plane waves, the absorption pattern in the thigh model was less intense in the fat region than in the muscle region; the bone region had practically no absorption. At 2450 MHz, the absorption in the muscle attenuated almost exponentially from the fat-muscle interface. The absorption patterns in the thigh model resulting from H_z polarized (TE) plane waves were similar to those of the E_z polarized (TM) case. However, at 433 MHz, there was high intensity in the muscle region at the muscle-bone interface. In the arm model, at all frequencies of incident E_z polarized (TM) plane waves the absorption in the bone region was negligible, while the absorption in the fat region was smaller than that of the muscle region. In the arm model, the H_z polarized (TE) plane wave source resulted in patterns similar to those of the E_z polarized (TM) case. However, the absorption in the muscle region was more intense at the muscle-bone interface than at the fat-muscle interface. It is concluded that since there is a large variation of energy absorption characteristics in tissues, these characteristics should be considered in the design and interpretation of experimental results in relation to health protection. Dosimetry in biologic effects experiments should be quantified in terms of total absorbed energy and the distribution of the absorbed energy in the biologic body. (7 refs.)

4806 HYGIENIC ASSESSMENT OF AN ELECTROMAGNETIC FIELD CREATED BY HIGH-VOLTAGE LINES OF ELECTRO-TRANSMISSION. (Rus.) Dumansky, Y. D. (A. N. Marzeev Kiev Scientific Res. Inst. of General and Communal Hygiene, Kiev, USSR); Popovich, V. M.; Rokhvatilo, E. V. *Gig. Sanit.* (8): 19-23; 1976.

The intensity of electromagnetic fields around high-voltage, 50 Hz, power transmission lines was measured, and the effect of such fields (100-5,000 V/m) on various physiologic parameters was studied in male albino rats in a 4-mo experiment. Power transmission lines with 330-750 kV generated electromagnetic fields with intensities of 1,500-7,500 V/m at 10 m distance, and of 100-350 V/m at 50 m distance. Excitation, unusual motor activity alternating with inhibition, and hyperemia of the mucosa of the nose and eye were observed in rats exposed to 5,000 V/m. In the groups exposed to 1,000-5,000 V/m the following effects were observed: reduction of the blood cholinesterase activity by 34.3-37.8%, reduction of the sulfhydryl group level by 12.4-16.6%, significant increase in the urinary 17-ketosteroid level, and reduction of the fixation and elimination of radioactive iodine in the thyroid gland. In addition, significant hyperglycemia, significant increase in the residual nitrogen and urea levels in the blood, reduction of the oxidative phosphorylation in the brain and liver cell mitochondria, and increased serum lactate and succinate dehydrogenase activities were observed. Dystrophy of tissues and vascular changes were found at the end of the experiment in the brain, myocardium, liver, kidneys, adrenals, and thyroid gland. These changes were proportional to the field intensity to which the animals had been exposed. The results suggest that electromagnetic field around high voltage power transmission lines pose a potential health hazard to adjacent populated areas. (5 refs.)

4807 THE EFFECT OF A STATIC ELECTRIC FIELD ON THE BODY OF MAN AND ANIMALS. (Rus.) Skorobogatova, A. M. (Leningrad Inst. Hygiene and Medicine, Leningrad, USSR); Tarasova, G. M.; Soloviev, A. V.; Plotnikov, V. G.; Plotnikova, L. B.; Yakovleva, M. N. *Gig. Sanit.* (6): 20-24; 1976.

The effect of static electric fields on textile mill workers was studied, and related experiments were carried out on rabbits. Potentials of 2,800-25,000 V/cm were measured in a textile mill at air humidities of 35-55%. The static field potential decreased with increasing humidity. The incidences of hypertension and vegetative dysfunction were 7.6 and 35.8%, respectively, versus 1.4% and 5.7% in the control group. Static electric field reduced the skin resistance and increased the perspiration. In rabbits exposed to static electric field (1,000 V/cm) for 2 hr, dilatation of the cutaneous vessels on the back and ears, increased skin temperature, pronounced bradycardia (25% reduction of the heart rate), and absence of reflex reaction of the heart to the skin irritation were observed. The findings indicate that the interference of static electric field with the regulation of the cardiovascular system is primarily due to activation of the sympathetic nervous system. (3 refs.)

4808 ACTIVITY DYNAMICS OF LACTIC DEHYDROGENASE IN THE SKELETAL AND HEART MUSCLE AFTER A SINGLE EXPOSURE TO AN ALTERNATING CURRENT MAGNETIC FIELD. (Rus.) Udintsev, N. A. (Tomsk Medical Inst., Tomsk, USSR); Kanskaya, N. V.; Schepetilnikova, A. I.; Ordina, O. M.; Pichurina, R. A. *Biull. Eksp. Biol. Med.* 81(6): 670-672; 1976.

The activity, isoenzyme pattern, and intracellular distribution of lactate dehydrogenase (LDH) in the skeletal muscles and myocardium of male rats were studied 1 hr to 28 days after a single 24-hr exposure to an alternating current magnetic field (200 Oe, 50 Hz). The LDH activity in the skeletal muscle showed an increase from 489±24 to 612±27 mmol/min/g of tissue 1 hr after exposure; it remained at that level for 2 days and reached the control level after 28 days. Two days after exposure the percentage of H type LDH in the cytoplasm was 38.3% versus 66.4% in the control, and that of M type was 61.7% versus 33.6% in the control. These values returned to near normal in 7 days. Five iosenzymes were found in the mitochondria; the percentage of LDH_5 was 32.6% on the second day after exposure versus 51.7% in the control. The changes in the ratios of the other isoenzymes were less marked. Histologic examinations performed within 24 hr after exposure revealed dilation of the capillaries, venules, and lymph vessels; perivascular edema; edema of the tissues; and vacuolization of the cytoplasm. The muscular tissue was nearly normal 28 days after exposure. The LDH activity of the myocardium increased during the first 2 days after exposure, and it normalized in 7 days. One hr after exposure type H accounted for 40.7% of the total activity in the cytoplasm, versus 76.4% in the control. Three isoenzymes were found in the mitochondria; $LDH_{1,2}$ showed a tendency to decrease 2 days after exposure. Marked dilation of the vessels, acidophilia of the cardiomyocytes, attraction of the nuclei to the sarcolemma, loss of the regular shape of the nucleus, and isolated focal subendocardial destruction were observed within 48 hr. These changes disappeared in 28 days. The findings indicate the activation of the glycolytic processes as a consequence of tissue hypoxia, which may be due to pronounced edema caused by disturbances in the blood and lymph circulation. (12 refs.)

4809 THE DEVELOPMENT OF HYPERTHERMIA MICROWAVE GENERATORS AND THERMOMETRY (MEETING ABSTRACT). (Eng.) Sandhu, T. S. (Roswell Park Memorial Inst., Buffalo, NY 14263); Kowal, H.; Johnson, R. J. *Int. J. Radiat. Oncol. Biol. Phys.* (Suppl. 1): 100; 1976.

To study the normal tissue and tumor response of superficial human tumors, regional hyperthermia and thermometry were developed. Initial animal and clinical studies were performed with a 2450 MHz microwave source using the intermediate field of a corner reflector type C applicator and foil collimation for localization. Thermometry showed that the tumor at 1 cm depth could be heated to 41-42°C with an exposed skin temperature of 41-42°C. A 915 MHz microwave generator that theoretically could almost triple the energy penetration was designed and built using a direct contact applicator separated from the skin by liquid dielectric in a bag. The liquid dielectric was circulated through a heat transfer unit to keep the skin at constant temperature. The steady flow rate and the temperature of incoming and outgoing liquid through the bag were recorded to measure the energy lost to the liquid. A thermometric device was developed using intratumor 30 gauge thermocouples, surface thermistors, and surface liquid crystal fibro optic units. It can be used to monitor the operating temperature and regulate the microwave output. (No refs.)

4810 PATHOGENESIS AND AGGRAVATION OF OCCUPATIONAL DISEASES CAUSED BY RAYS OF DIFFERENT WAVELENGTHS. (Ger.) Nikolowski, J. (Universitaets-Hautklinik, 74 Tuebingen, Liebermeisterstr. 25, W. Germany); Schuele, D. *Berufsdermatosen* 23(2): 55-61; 1975.

The effects of occupational exposure to ionizing and nonionizing radiation are reviewed. Exposure to high frequency and ultrahigh frequency radiation induces first- and second-degree burns, but there have been no cases reported of delayed effects on the skin from these sources. Cataracts may develop in persons exposed to infrared radiation. A case is cited in which first- and second-degree skin burns of the face and neck occurred in an engineer who had been exposed to an electromagnetic field. The field emanated from a generator operating at 500-2,000 kW (corresponding to 50,000 kW in the bundled beam) at 5-26 MHz and extending 500-2,000 m from the generator. (10 refs.)

4811 CIRCADIAN ACTIVITY RHYTHM INFLUENCED BY NEAR ZERO MAGNETIC FIELD. (Eng.) Bliss, V. L. (Dept. of Zoology, Univ. of Rhode Island, Kingston, RI 02881); Heppner, F. H. *Nature* 261(5559): 411-412; 1976.

The effect of a near zero magnetic field on the circadian rhythm of house sparrows (*Passer domesticus*) was investigated. Both experimental and control birds were maintained in a light-darkness 8:16-hr cycle and in the earth's normal magnetic field for the first 2 wk of the experiment. During the next 2 wk, all birds were maintained in the light-darkness 8:16 cycle, but the experimental birds were exposed to 8 hr of near 0 G magnetic field and 16 hr of the earth's magnetic field, with the 8 hr of near 0 G magnetic field synchronized with the 8 hr of light. For the last 4 wk, all birds were maintained in darkness, with the controls kept in the earth's magnetic field and the experimental birds kept in the near 0 G magnetic field. During the final 4 wk, the period length of most of the control birds became longer, and the onset of activity began later and later each day. This resulted in a large amount of activity from 1800-2400 hr. The activity period of the experimental birds lengthened in most cases, and this lengthening was due to the activity beginning earlier and ending later than it had while the light cycle was in operation. The experimental birds had a period length of 24 hr; however, the relative amplitude of the 24-hr period was less marked than in the light-darkness 8:16 cycle. The activity between 1800 and 2400 hr was significantly greater for the controls than for the experimental birds during the 4-wk total darkness period. The results indicate that circadian activity of the house sparrow may be entrained by a cycle of change in the intensity of the vertical component of the earth's magnetic field. (19 refs.)

4812 SUDDEN, UNEXPECTED DEATH OF INFANTS AND ELECTROMAGNETIC FIELDS. (Ger.) Eckert, E. E. (14 Green Briar Lane, Newtown, CT 06470). *Med. Klin.* 71(37): 1500-1505; 1976.

On-site investigations of 200 cases of crib death in Philadelphia, Pa., and 294 cases in Hamburg, West Germany, were conducted to assess the possible causal relationship between crib death and electromagnetic fields. The investigations in Philadelphia revealed a high incidence of crib death in buildings near electric railroad and subway lines, high-voltage power transmission lines, water mains magnetized by power supply lines, transmitting antennae, airports, and churches with lightning rods. The survey conducted in Hamburg revealed that the incidence of crib death was highest in temporary accomodations built near railroad and subway lines, and high-voltage transmission lines, especially when combined with high groundwater level. The risk of crib death was higher in cellars and first-floor apartments than in higher floors. The findings indicate a possible causal relationship between crib death and abnormal electromagnetic fields and stray currents in the ground. The findings warrant on-site measurements and animal experiments on the effect of such fields and stray currents on animals. It is hypothesized that magnetic and/or electric fields provoke irreversible changes in the regulatory system of infants who are sensitive to such fields or have been sensitized by the fields. Since this effect is potentiated by the hypofunction of the organs during sleep, this hypothesis would account for the tendency of crib death to occur during sleep. (13 refs.)

4813 EFFECT OF CONSTANT MAGNETIC FIELDS ON MACROMOLECULES. (Rus.) Miroshnichenko, F. D. (Zaporozhye State Pedagogical Inst., Zaporozhye, USSR); Stadnik, A. D. *Biofizika* 21(1): 178-179; 1976.

The effect of constant magnetic field on macromolecules of polymethylmethacrylate was studied. Disks, measuring 2 mm in thickness and 20 mm in diameter, were heated to 100°C and simultaneously exposed to a constant magnetic field with intensities ranging from 16×10^{-3} to 128×10^{-3} amp/m for 60 min. The exposure to the constant magnetic field led to the development of a peculiar electretic state with a surface charge density in the order of magnitude of 10^{-10} Coul/cm^2, depending on the field intensity. The appearance of the surface charges was due to the orientation of the magnetically anisotropic macromolecules and of their segments. The exposure caused a field intensity-dependent decrease in the magnetic susceptibility of the material probably due to the orientation in the magnetic field, which was accompanied by an increase in the polarization paramagnetism. It is concluded that the effects observed may explain some peculiarities of the mechanism of the effect of magnetic fields on biologic objects. (3 refs.)

4814 DEVELOPMENT OF RETICULOCYTOSIS IN THE PERIPHERAL BLOOD DURING AN EXPOSURE TO A CONSTANT MAGNETIC FIELD. (Rus.) Borodkina, A. G. (No affiliation given). *Kosm. Biol. Aviakosm. Med.* 10(1): 66-70; 1976.

The effect of constant magnetic fields on the reticulocyte count of the peripheral blood was studied in CBA mice. Exposure to a 1,000 Oe magnetic field for 1-3 hr or 1-15 days, or exposure to 4,500-5,000 Oe for 7.5 hr caused no changes in the erythrocyte count or in the hemoglobin level, but it increased the reticulocyte count. During the 15-day exposure to 1,000 Oe, the reticulocyte count peaked 2-3 days after the beginning of the exposure, reaching 246% of the control level, and dropped to 145% of the control value on day 5 and to the control value on day 15. Two days after the 15-day exposure the reticulocyte count rebounded to 235%—higher than the control group count on day 6. It is concluded that the hypoxia caused by the magnetic field leads to stimulation of the erythrocyte system and can be accompanied by the development of reticulocytosis, which is regarded as a typical manifestation of the reaction of the blood to constant magnetic field. (10 refs.)

4815 THE EFFECT OF SOME ANALEPTICS ON THE OUTCOME OF AN ACUTE MICROWAVE LESION IN MICE. (Rus.) Koldaev, V. M. (Vladivostok Medical Inst., Vladivostok, USSR). *Farmakol. Toksikol.* 39(5): 543-544; 1976.

The effect of analeptic agents on the survival time of microwave-irradiated mice was studied. Immediately after irradiation (62±5 mW/cm^2, wavelength 12.5 cm, duration 14-16 min), male albino mice were administered the following analeptics: strychnine nitrate, nicotinic acid diethylamide (Cordiamin, nikethamide), cytitone, camphor, caffeine sodium benzoate, corazol (pentylenetetrazole), and lobeline hydrochloride. The ratio of the survivals after irradiation + analeptic treatment to survival after irradiation alone was 1.48 for strychnine nitrate, 1.43 for nikethamide, 1.26 for cytitone, 1.16 for camphor, 1.16 for caffeine sodium benzoate, 1.07 for pentylenetetrazole, and 1.06 for lobeline hydrochloride. The optimal doses were determined to be 1 mg/kg for strychnine nitrate, 50 mg/kg for nikethamide, 5 mg/kg for cytitone, 200 mg/kg for camphor, 10 mg/kg for caffeine sodium benzoate, 20 mg/kg for pentylenetetrazole, and 50 mg/kg for lobeline hydrochloride. As the optimal dose of strychnine nitrate is close to its toxic dose, nikethamide is of the greatest therapeutic value among the substances tested. The findings indicate the favorable effect of the stimulation of the vital centers of the medulla oblongata on the outcome of acute exposure to microwaves. (4 refs.)

4816 THE CHANGES OF THE EVOKED CEREBRAL POTENTIALS DURING EXPOSURE TO A CONSTANT MAGNETIC FIELD. (Rus.) Klimovskaya, L. D. (No affiliation given); Smirnova, N. P. *Biull. Eksp. Biol. Med.* 82(8): 906-910; 1976.

The effect of a constant magnetic field (CMF; 500-4,000 Oe, 10-20 min) on the cerebrocortical and cerebellocortical potentials evoked by stimulation of the sciatic nerve was studied in Nembutal anesthetized albino rats. Exposure to the CMF caused increases in the latency period (12.5-16.5 msec in the cerebral cortex versus an initial value of 15 msec; 15.5-17 msec versus an initial value of 15.5 msec in the cerebellar cortex), in the first phase of the primary responses (164.7-197.4 μV versus an initial level of 155.9 μV in the cerebral cortex; 123.6-171.6 μV versus 123.4 μV in the cerebellar cortex), in the duration of the first phase of the primary response (from 22 msec to 19-23 msec in the cerebral cortex; from 26.5 msec to 22-26 msec in the cerebellar cortex), and the appearance of additional phases (1.9-4.9 phases versus 2.0 before exposure in the cerebral cortex, and 1.3-5.3 versus 1.5 in the cerebellar cortex). The maximal amplitude was 262.9-364.9 μV in the cerebral cortex versus an initial amplitude of 239.8 μV, and 138.7-336.8 μV versus an initial value of 144.6 μV in the cerebellar cortex. The effect of the CMF enhanced with increasing intensity between 400 and 5,000 Oe. (17 refs.)

4817 INHIBITING ACTION OF ELECTRIC FIELD ON *ESCHERICHIA COLI*. (Rus.) Sadovnichy, B. E. (Mordvin State Univ., USSR); Prytkova, T. N.; Sidorova, V. I. *Mikrobiologiia* 44(5): 948-949; 1975.

The effect of a stationary electric field with 300 V potential on the growth of *Escherichia coli* suspended in sterilized distilled water was studied. The exposure time to the electric field was 30 or 60 min. The effect of the exposure was determined by comparing the number of colonies after incubation for 24 hr at 24-25°C to a control. The experiments demonstrated a highly significant inhibition of the growth of *E. coli* by the stationary field. The inhibition intensified as the length of the exposure increased. (4 refs.)

4818 TREATMENT OF DISEASES OF LIMB STUMPS WITH ALTERNATING CURRENT MAGNETIC FIELD. (Rus.) Kucherenko, A. E. (Dept. Orthopedics, Traumatology and Field Surgery, N. I. Pirogov Vinnitsa Medical Inst., Vinnitsa, USSR); Shevchuk, V. I. *Klin. Khir.* (7): 47-49; 1976.

The effects of treatment with variable magnetic field (200-400 Oe) were studied in ninety 48- to 75-yr-old invalids with painful neuroma and edema of the limb stump and with phantom limb pain. Limb amputation had been performed 29-32 yr earlier. The limb stump was placed between the poles of the electromagnet. The therapy course consisted of 4-40 daily 15-min-sessions with an average of 18.2 sessions. Alleviation of edema, inflammation, and pain; normalization of sleep; improvement of the general well-being; and an increase in the surface temperature of the stump by 3.5-5°C were observed after the therapy. Increased bioelectric activity of the muscles of the stump was noted. Complete cure was achieved in 80 patients, considerable improvement in 6, and improvement in 4. Twenty-eight patients were able to resume the use of their prostheses. The findings indicate the therapeutic value of variable magnetic field in the treatment of diseases of limb stumps. (9 refs.)

4819 EFFECT OF ELECTROMAGNETIC FIELDS ON AIR IONIZATION. (Rus.) Miroshnichenko, L. I. (No affiliation given). *Vestn. Akad. Nauk. SSSR* (6): 105-106; 1976.

Highlights of a conference on "Physico-mathematical and Biological Problems of the Effect of Electromagnetic Fields and of Air Ionization" (Yalta, USSR, Nov. 25-28, 1975) are presented. Natural and artificial electromagnetic fields have been recognized as an important ecological factor. Electromagnetic fields have a differentiated effect on human organs; however, they have a direct effect on the nervous system. The ability of the human body to adapt itself to electromagnetic fields is limited in healthy subjects and impaired under pathologic conditions. The mode of action of electromagnetic fields on the body is unknown. The imposition of standards on artificial electromagnetic fields is suggested. (No refs.)