

FOR OFFICIAL USE ONLY

JPRS L/9833

8 July 1981

USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

(FOUO 8/81)



FOREIGN BROADCAST INFORMATION SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

COPYRIGHT LAWS AND REGULATIONS GOVERNING OWNERSHIP OF MATERIALS REPRODUCED HEREIN REQUIRE THAT DISSEMINATION OF THIS PUBLICATION BE RESTRICTED FOR OFFICIAL USE ONLY.

FOR OFFICIAL USE ONLY

JPRS L/9833

8 July 1981

USSR REPORT
LIFE SCIENCES
BIOMEDICAL AND BEHAVIORAL SCIENCES
(FOUO 8/81)

CONTENTS

BIOCHEMISTRY

Entomopathogenic Viruses..... 1

BIOTECHNOLOGY

Tissue Culturing Methods in Plant Physiology and Biochemistry..... 10

Salt-Water Fish Signaling and Behavior..... 13

Methods of Mathematical Biology. Book 1: General Methods for
Analysis of Biological Systems..... 17

Activity of a Photosynthesizing Culture of Microalgae..... 23

MEDICINE

Aviation Medicine..... 30

Physiology of Blood--Physiology of Erythropoiesis, in 'TEXTBOOK
OF PHYSIOLOGY' Series..... 35

Peripheral 'Hearts' in Man..... 39

Medical and Physiological Cybernetics..... 42

Man and Biologically Active Substances..... 47

Mediator Mechanisms of Regulation of Respiration and Correction
Thereof in the Presence of Extreme States..... 50

Clinical Research Links Emotional Stress, Cardiovascular Disease.. 54

- a -

[III - USSR - 21a S&T FOUO]

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

RADIATION BIOLOGY

Elimination of the Consequences of Radioactive Contamination.....	58
Metabolic Products in the Presence of Radiation Lesions.....	63
Mutagenesis Induced by Physical Factors.....	65

- b -

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

BIOCHEMISTRY

UDC: 632.937.1.16+632.953

ENTOMOPATHOGENIC VIRUSES

Novosibirsk ENTOMOPATOGENNYYE VIRUSY in Russian 1976 (signed to press 20 Jan 76)
pp 2-14, 285-286

[Annotation, introduction and table of contents from book "Entomopathogenic Viruses", by Neonila Nikolayevna Vorob'yeva, Biological Institute, Siberian Department of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 1650 copies, 288 pages]

[Text] This monograph submits data gathered and studied over the last two decades, which deal with morphology, structure of virions of insect viruses, biochemical composition, classification, distribution and role in nature. Special attention is given to questions of viral infection, its manifestation at different stages of insect development, routes of viral transmission in sites of reproduction of the host insect, conditions of onset of spontaneous and artificial epizootic outbreaks, and the role of viruses in biological control of insect population. (The results of production experiments on the use of viruses in a biological method of control of the fox-colored sawfly [Neodiprion sertifer (Geoff.)], cabbage moth [Mamestra brassicae (L.)] and cabbage white butterflies [Pieridae family] merit attention.)

This book is intended for virologists, entomologists, students on biological faculties and institutes, workers in agriculture and forestry.

Introduction

In the last two decades, applications have been found for entomopathogenic viruses in the control of harmful insects in many countries. The very first attempts at using viruses in a biological method of controlling agricultural and forestry pests showed them to be promising and superior to chemical agents. The action of viruses is specific, and it is directed toward specific species of host insects and closely related species, inducing epizootic diseases among them that result in mass scale death. They are harmless to the surrounding flora and fauna, and thus do not disrupt the biocenotic associations formed in nature. Entomopathogenic viruses are not pathogenic for man and farm animals or fowl. Inherited resistance does not develop in insects sensitive to a virus.

There are many reports on devastating epizootic outbreaks among populations of insects referable to the orders Lepidoptera and Hymenoptera, to which belong most species of harmful insects (Morozova, 1966; Shekhrina, 1966; Guliy, 1967; Sirko, 1968; Zarin', 1968; Dikasova, 1969; Shvedchikova et al., 1969; Shamonin, Ponomarenko, 1971; Nurlybayeva, 1973; Vorob'yeva, Baranovskiy et al., 1974; Steinhau, 1950, 1952; Lotmar, 1941; Bird, 1954, 1955; Franz, 1955; Tanada, 1961; Hall,

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

1957; Elmore, 1961; Adams et al., 1966; Akutsu, 1967; Doane, 1967; Smith, 1967; Weiser, 1966).

In the literature, it is indicated that epizootics of viral nature with high mortality, which occur among harmful insects, arrest mass reproduction thereof and lead to prolonged depression of the species (Orlovskaya, 1962, 1963, 1968; Guliy, 1966, 1967; Dikasova, 1969; Vorob'yeva, 1974; Steinhaus, 1949, 1963; Bergold, 1953, 1958; Bird, 1964). There are known instances of introduction of pathogenic viruses into insect populations, and these viruses became members of the biocenosis, retarding reproduction of the insects for a long time (Orlovskaya, 1963; Vorob'yeva, Zhimerikin, 1974; Bird, 1955).

Insect viruses are widespread, and viral diseases that occur among populations of different harmful insects when there is a burst of mass reproduction were found to be one of the important factors regulating the number of harmful insects in nature (Pospelov, 1940; Orlovskaya, 1960, 1968; Poltev, 1963; Balch, Bird, 1944; Bird, 1954; Steinhaus, 1954; Bergold, 1958). Consequently, taking into consideration the forecast for reproduction of harmful insects, one can introduce at a specific time large doses of virus into a population and induce an epizootic resulting in mass scale insect death.

Viruses began to be used for the control of harmful insects in the Soviet Union, Canada, the United States, Yugoslavia, Czechoslovakia and other countries by means of inducing artificial epizootics. However, production tests with viruses for the control of agricultural and forestry insect pests were not always successful. In some cases, introduction of the virus results in epizootics with high mortality and in others, the same virus introduced into a population of the same insect species turned out to be minimally effective or ineffective. This is attributable, first of all, to inadequate knowledge of the biological properties of entomopathogenic viruses, which is so needed for comparative studies of viruses isolated from different insect species, or even the same species but different populations. The type of nucleic acid and morphological structure of the virion have been identified for only a few insect viruses.

In essence, entomopathogenic viruses resemble known viruses that strike at vertebrate animals; but many of them are capable of forming unique crystalline elements, which are called inclusion bodies, and which differ in shape and size in different viruses, that are found in the cells and tissues of insects infected with virus. The inclusion bodies may be in the form of polyhedrons and granules, and for this reason the insect diseases are called polyhedrosis and granulosis, respectively. However, there are also viruses that are pathogenic for insects that do not form inclusion bodies in cells. For this reason, all insect viruses are usually divided into two main groups: viruses that form inclusion bodies--polyhedrons or granules--in the cells of infected animals (inclusion viruses) and viruses that do not form such inclusions (noninclusion viruses).

There are more than 250 known viruses isolated from 175 arthropod species. They include 170 species of viruses of nuclear polyhedrosis, 30 of cytoplasmic polyhedrosis, 35 of granulosis and the rest are viruses that do not form inclusion bodies (Hughes, 1957; Martignoni, Langstrom, 1960; Weiser, 1966). The largest number of viruses has been isolated from insects of the orders Lepidoptera, Hymenoptera and Coleoptera. Viruses have also been found in Hemiptera and

FOR OFFICIAL USE ONLY

Orthoptera. The uneven distribution of viruses, as determined from isolation thereof, does not reflect the real situation. There are many more viruses in existence than have been described, and they can strike any species, but Lepidoptera and Hymenoptera are of greater interest to researchers, since the pests of trees and farm crops are largely represented by these orders. There is regular appearance of reports in the literature about detection of new viral diseases among the pests of different crops and useful wild plants; however, there is still too little or no information about isolation of viruses from harmful insect species that are important to farming.

The prevalence of viruses of polyhedrosis and granulosis among those isolated is apparently attributable to the ease of identifying them because of the presence of inclusion bodies. It is considerably more difficult to detect viruses that do not form inclusion bodies and to isolate them from insect tissues; numerous successive passages through healthy insects are required, and this is limited by the short larval stage, which is the most sensitive to viruses (Grace, 1968; Havashi, Bird, 1968; Mivajima et al., 1967, 1968).

Detection and isolation of entomopathogenic viruses are also difficult because viral infections occur in insects chiefly in a latent form, without marked symptoms of disease. Research has established that viruses present in insects in a latent form are capable of advancing from one stage of development to another, higher stage, as well as transovarially from one generation to another, thereby persisting in a population for many generations without causing acute infection (Pokhil et al., 1936; Yermakova, Tarasevich, 1968; Vorob'yeva, Nurliybayeva, 1974; Bird, 1961a; Bullock et al., 1969).

The virus could be activated under the influence of endogenous or exogenous factors, change from a latent state to infective virus resulting in outbreaks of acute infection among insects with marked symptoms (David, 1966, 1969a; Ignoffo, 1965; Jaques, 1962, 1964).

The numerous routes of viral transmission, which have been demonstrated in sites of insect reproduction, cause the spread of acute infection in a population, striking a large number of insects and causing a spontaneous epizootic. While it is relatively easy to detect and isolate the virus from insect tissues in the case of acute infections, this is very difficult with latent infection, especially since the form of existence of the virus in a latent state is not yet known.

Up to now, differentiation of entomopathogenic viruses is made on the basis of presence or absence of inclusion bodies, their morphology and localization in insect cells, without consideration of the morphological structure and physico-chemical features of virions. The absence of descriptions of virions prevents detection and selection of strains for use in biological control of harmful insects, studies of viruses in nature, their role in pathology of man and animals, and systematization thereof. Insufficient knowledge about the biological properties of insect viruses prevents solving problems that are important to substantiation of the desirability of using viruses in the biological method of controlling harmful insects.

Some researchers consider virulence of the pathogen to be the main cause of viral epizootics and high insect mortality, whereas others relate it to the physiological condition of the pest, its sensitivity to the virus and population density

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

(Kelsey, 1957, 1958; Rivers, 1958; Gershenson, 1958, 1960; Ossowski, 1960; Ito et al., 1960; David, 1964, 1965; Gilmore, Munger, 1965; Ignoffo, 1966; Chauthani et al., 1968, 1971; Cunningham, 1970; Martignoni, Schmidt, 1961).

There is also disagreement as to virulence of the viruses. Some researchers believe that the virulence of a virus isolated from one species of insects is manifested to the same degree when it infects insects in different populations of this species. Others, on the contrary, maintain that there is variability of virulence, depending on the population. Thus, Bird and Burke (1961) report that different populations of sawflies in the field differ in resistance to nuclear polyhedrosis virus. David et al. (1965) isolated a strain of nuclear polyhedrosis virus from a resistant population of *Pieris brassicae* L.; Aruga et al. (1963) isolated such a strain from a resistant population of silkworms [*Bombyx mori* L.]. In 1958, Ossowski (1958) isolated a strain of nuclear polyhedrosis virus from the *Kotochalia junodi* (Heye) bagworm in remote populations, which was more virulent than a local strain; Thompson (1968) isolated one from the *Cadra cautella* almond moth.

Smirnoff (1961, 1962) reported isolating virus from the *Neodiprion swainell* sawfly, which was virulent for many populations after passages through sawflies gathered from many regions of Canada.

The lack of systems that permit studies outside the host is hampering studies of biology of insect viruses. For a long time, persistent efforts to obtain cell cultures of insect tissues were in vain. In recent years, some researchers have made some advances (Grace, 1969; Wyatt, 1956; Vago, 1967). V. D. Miloserdova (1966) did much work on the use of cell cultures to study Nucleopolyhedrosis virus of *Bombyx mori*. She observed in vitro reproduction of nuclear polyhedrosis virus of the silkworm and formation of polyhedrons in cells in cell cultures taken from the ovaries of *Bombyx mori* (Miloserdova, 1966; Miloserdova et al., 1971).

Mitsuhashi (1967) obtained reproduction of Iridovirus Chilo in cell cultures from leafhopper tissues; Bellett and Mercer (1954, 1965) obtained Iridovirus sericesthis reproduction in a cell culture from tissues of *Antheraea eucalypti* Scott, and nuclear polyhedrosis virus was reproduced in sawfly hemocytes (Mosolov et al., 1967; Sohi, Cunningham, 1972).

The Japanese researchers, Himeno et al. (1967) obtained polyhedron formation in cell cultures from tissues of the silkworm by introducing DNA of nuclear polyhedrosis virus of *Bombyx mori*.

Many published works deal with the correlations that occur between different viral species when they are found together. In practice, infestation of plants by several insect species has been repeatedly encountered. If these insects are infected with viruses, there could be an exchange of viruses if there is close enough contact, use of the same feed contaminated with insect excrements. Some researchers have reported synergism of viruses in insects in such cases (Tanada, 1959-1961; Dikasova, 1969; Paillot, 1936); others, on the contrary, refer to interference between viruses (Bird, 1959). It is important to settle this question for use of complex viral preparations containing 2-3 viruses in the biological method.

It is impossible to propose with certainty the use of a virus isolated in one region against the same host insect in another region because of the lack of sufficient data about the sensitivity to the same virus of pest populations

FOR OFFICIAL USE ONLY

in different ecological conditions, and about the degree of virulence of different viral strains for the same insect population.

Bergold (1963) believes that entomopathogenic viruses can be used in any ecological situations: with or without an identical virus in the insect population. But, in the former instance, efficacy is achieved only if a large enough amount of the virus is introduced into the population, in the form of overall treatment. In the latter case, introduction can be limited to local treatment.

The experience of Soviet and foreign researchers indicates that insect viruses can be used in the control of insects that are farm and forest pests, but one must take into consideration and adhere to many virological, entomological and ecological factors that affect the outbreak and course of artificial epizootics, and the efficacy of viral agents.

The best use of entomopathogenic viruses in the control of farm and forestry insect pests can be achieved through the joint collaboration of researchers in many countries of the world.

The virological method of controlling harmful insects will make it necessary to solve many problems, which are the concern of many countries, rather than only one. The main question that will have to be answered in the next few years is whether insect viruses are safe to man, farm animals and surrounding fauna. Introduction of large amounts of a viral agent over the circumscribed site of reproduction of a harmful insect, accumulation of enormous amounts of the virus in soil during an epizootic, absence of a host insect or drastic decline of population thereof cannot fail to have an effect on the virus and local fauna. A virus, as a live agent and strict intracellular parasite, must enter into specific biocenotic relations with local fauna to remain viable under conditions that are new to it. While circulating among members of a biocenosis and in the course of adaptation to new hosts, a virus may acquire new properties, such as pathogenicity for new species of insects and mammals, including man.

It is imperative to trace the fate of a virus, its biological properties, nature of relations with other members of the biocenosis--vertebrates and invertebrates--at the site of reproduction of the host insect over a period of several years following an artificial epizootic, and only if these problems are resolved can viruses be used extensively in biological control of harmful insects.

Work was done for several years at the Biological Institute, Siberian Department of the USSR Academy of Sciences, to work out the theoretical bases for practical use of entomopathogenic viruses for biological control of the most dangerous pests of trees and agricultural crops in Siberia.

This work was pursued in several directions: study of viral infections in insects, detection of epizootic outbreaks, patterns of course thereof, effect on population size, study of biological properties of isolated viruses, selection of the most virulent strains for experimental studies of viral infections and reproduction of artificial epizootics at the sites of insect reproduction.

Demonstration of viral infections, patterns of onset and course of epizootic outbreaks among insect species was necessary because of the economic importance and mass reproduction of a pest insect species during the period these studies were conducted.

FOR OFFICIAL USE ONLY

Prior to our work in Siberia, insects had not been submitted to virological examination. V. I. Poltev and V. P. Luk'yanchikov (1961) were the first to isolate granulosis virus--Granulosis virus *Dendrolimus sibiricus*--from caterpillars of the Siberian silkworm, *Dendrolimus sibiricus* (Tschtw.), during an epizootic outbreak of granulosis in a population of this pest in Tuva.

In Tomskaya Oblast, at the sites of mass reproduction of sawflies--*Neodiprion sertifer* Geoffr. fox-colored sawfly, *Diprion similis* Hart (Tenthredinidae family) black-yellow pine sawfly and *Cladius viminalis* Fall. (Tenthredinidae) poplar sawfly--V. V. Guliy (1967) isolated nuclear polyhedrosis virus during epizootics with mass insect mortality, from caterpillar-like larvae of all 3 of these sawflies.

In Amurskaya Oblast, in sites of mass reproduction of the *Ocneria dispar* L. gipsy moth, when an epizootic was on the decline, the virus of nuclear polyhedrosis, Nucleopolyhedrosis virus *Ocneria dispar* was isolated and, in addition, the Altayskiy strain from healthy caterpillars collected at a State forestry station in Altay, in the absence of cases of polyhydrosis, and the Samarkand strain was isolated from gipsy moth caterpillars, gathered in Samarkandskaya Oblast, which had become sick spontaneously in the laboratory (Larionov, 1971).

Nuclear polyhydrosis virus of the coniferous vaporer moth, N. virus *Dasychiria abietis*, was isolated from caterpillars that died during an epizootic that broke out at the site of mass reproduction in pine stands in Buryatia. At the time of the inspection, the population of coniferous vaporer moths had been entirely destroyed. Mortality rate of caterpillars constituted up to 95% (Zhimerikin, 1969).

Spontaneous epizootics of nuclear polyhedrosis are extremely rare among *Mamestra brassicae* L. cabbage moths, and there is no information about it for either European USSR or Siberia. In 1966, an epizootic was discovered among caterpillars of this pest at a time of a large population thereof in State farms of Novosibirskaya Oblast (25 caterpillars per head of cabbage). Nucleopolyhedrosis virus of *Mamestra brassicae* was isolated from dead and sick caterpillars. The insect death rate on the fields constituted up to 75% (Sirko, 1966).

R. N. Nurlybayeva (1973) isolated nuclear polyhedrosis virus from cabbage moth caterpillars on vegetable fields of State farms in Kazakhstan. Concurrently, granulosis virus of *P. brassicae*, *G. v. P. rapae* were isolated from *Pieris brassicae* and *P. rapae* white butterfly caterpillars on the same fields.

V. I. Baranovskiy (1971) isolated Granulosis virus *Apamea anceps* from *Apamea anceps* Schiff, rustic moth caterpillars collected from fields in Novosibirskaya Oblast.

All of the isolated strains of insect viruses were found to be highly virulent.

In view of the differences in ecological conditions, under which the gipsy moths, sawflies, cabbage moths, white butterflies live, it was logical to assume that there were distinctions and differences in ecological properties of viruses that induced disease in pests of one species inhabiting different geographic zones. To test this hypothesis, comparative studies were made of properties of viruses

FOR OFFICIAL USE ONLY

isolated from populations in Siberia and other geographic zones. For these studies, viruses were received from other laboratories or isolated by the researchers at the sites of reproduction of the studied insect species in different parts of the Soviet Union.

The relationship between viruses isolated from different insect populations was determined by serological reactions and the method of fluorescent antibodies.

Much work was done for the study of resistance of polyhedrons and granules to physical and chemical environmental factors, and to stays in soil. Studies were conducted for determination of the conditions required to induce artificial epizootics, obtain maximum incidence of disease among insects and mass scale deaths within a short period of time (selection of the most virulent strains, doses of agents and age of larvae), under laboratory conditions and at sites of reproduction of the fox-colored sawfly and cabbage moth.

Studies were made of routes of horizontal and vertical spread of the virus during epizootics that occurred spontaneously or were artificially induced. Transphase and transovarian transmission of nuclear polyhedrosis and granulosis viruses by infected insects was demonstrated in the field and experiments (Vorob'yeva, Zhimerikin, 1974; Vorob'yeva, Nurlybayeva, 1974).

Several field tests were conducted on ground and aerial treatment of sites of mass reproduction of the fox-colored sawfly with a viral agent prepared in the laboratory. These tests turned out to be very effective: the epizootics that occurred on tree stands treated with viral agent caused death of 92-100% of the sawfly caterpillar-like larvae. Epizootiological observations conducted for the next 4 years after an artificial epizootic at the site revealed that the sawfly population had been reduced to a minimum, and the few caterpillar-like larvae that developed in the second, third and fourth generations were infected, which delayed an increase in population size (Guliy, Zhimerikin, 1971; Vorob'yeva et al., 1974).

Field experiments at the Aksay State Farm in Kaskelenskiy Rayon of Kazakhstan (experimental base of the Kazakh Institute for the Protection of Plants) revealed that it is possible to induce an artificial epizootic among cabbage moth and white butterfly caterpillars, provided a large dose of virulent virus is introduced into the insect population and that there are caterpillars of a younger age. The production [field] experiment demonstrated that it is possible to produce an artificial epizootic outbreak simultaneously among cabbage moths, cabbage and rape white butterflies using an agent that contains two viruses, polyhedrosis and granulosis (Vorob'yeva, Nurlybayeva, 1974).

In many laboratories of the world, studies are in progress of acute and latent viral infections among insects, pathomorphology and correlation between virus and host, properties of isolated viruses, resistance to physicochemical environmental factors, preservation of virus in nature, the role of soil containing virus in occurrence of epizootics at sites of reproduction of the host insect. The results of these studies have been published in various journals. A vast literature has been accumulated dealing with the role of viruses in biological control of insects in the field and possibility of controlling the size of insect populations with the use of viruses.

FOR OFFICIAL USE ONLY

There are very few summaries of the existing literature in the form of monographs or textbooks, and none at all in the Soviet literature.

The monographs by Steinhaus ("Pathology of Insects" (1950, 1952, 1963), Weister's "Diseases of Insects" (1966) and Smith's "Insect Viruses" (1967) do not include the bibliography of recent years, which sheds light on many aspects of pathogenesis and pathomorphology of viral infections, epizootiological observations made at the sites of reproduction of insects following spontaneous and artificial epizootics.

It is not deemed possible to submit in a single monograph a summary of the Soviet and foreign literature dealing with entomopathogenic viruses, use thereof in biological control of pest insects, and our own research conducted with colleagues. We are giving here only the sources that shed light on issues that are needed for theoretical validation of the use of insect viruses to control harmful insects.

Entomopathogenic viruses constitute a large group. Most of them are distinctive and known only to occur in insects--polyhedrosis, granulosis and iridosis viruses. Viruses are also encountered that resemble smallpox virus of man and animals and the virus of vesicular stomatitis (Sigma virus). If only for this reason, it is not deemed feasible to place entomopathogenic viruses into a group that is separate from animal and plant viruses. In this monograph, we offer the current version of classification of insect viruses and principles used to integrate them in a general system of classification of viruses.

Contents	Page
Introduction	3
Classification of insect viruses	14
Chapter 1. Morphology of Entomopathogenic Viruses	25
Rod-shaped viruses	26
Nuclear polyhedrosis viruses	26
Granulosis viruses	40
Spherical viruses	55
Complex viruses	66
Chapter 2. Chemistry of Insect Viruses	71
Protein composition of viruses	71
Nucleic acids of insect viruses	73
Chapter 3. Physiological Characteristics of Entomopathogenic Viruses	86
Early stage of virus-cell interaction	88
Adsorption of virus on cell surface	89
Penetration of virus into cell	92
Intracellular viral reproduction	94
Formation of mature virions and inclusion bodies	95
Species-specificity of entomopathogenic viruses	103
Relationships between viruses established by serological reactions	107
Reactions of entomopathogenic viruses to physical and chemical environmental factors	114
Effects of temperature	115
Effects of storage conditions	116
Effects of sun and ultraviolet rays	118
Effects of chemical factors	120

FOR OFFICIAL USE ONLY

Chapter 4. Viral Infections in Insects	125
Nuclear polyhedrosis	127
Insect granulosis	145
Cytoplasmic polyhedrosis	154
Viral diseases occurring without formation of inclusion bodies	156
Sensitivity to viruses of insects of the same species in different populations	158
Latent viral infections in insects	163
Insect tumors	176
Chapter 5. Spontaneous and Artificial Epizootics Caused by Entomopathogenic Viruses	180
Spontaneous viral epizootics	180
Routes of viral transmission	185
Intestinal and contact routes of dissemination of insect viruses	186
Role of parasites, predators and schizophages in viral transmission	189
Role of warm-blooded animals in viral transmission	191
Chapter 6. Use of Entomopathogenic Viruses to Control Pests in Agriculture and Forestry	196
Virological method of controlling insect pests	196
Use of Nucleopolyhedrosis virus Neodiprion sertifer Geoffr. virus for control of fox-colored sawfly	202
Use of polyhedrosis and granulosis viruses to control cabbage and rape white butterflies	224
Conclusion	235
Bibliography	247

COPYRIGHT: Izdatel'stvo "Nauka", 1976

10,657
CSO: 1840/169

FOR OFFICIAL USE ONLY

BIOTECHNOLOGY

UDC: 581.1:576.3

TISSUE CULTURING METHODS IN PLANT PHYSIOLOGY AND BIOCHEMISTRY

Kiev METODY KUL'TURY TKANEY V FIZIOLOGII I BIOKHIMII RASTENIY in Russian 1980
(signed to press 2 Jun 80) pp 2, 486-488

[Annotation and table of contents from book "Tissue Culturing Methods in Plant Physiology and Biochemistry", by Fedor Leont'yevich Kalinin, Veresa Vasil'yevna Sarnatskaya and Valentina Yevgen'yevna Polishchuk,, Institute of Plant Physiology, Ukrainian Academy of Sciences, Izdatel'stvo "Naukova dumka", 1000 copies, 488 pages]

[Text] This monograph deals with questions of using methods for culturing cells, tissues and organs in studies of physiology and biochemistry of normal and pathological growth, differentiation and dedifferentiation of plants under ordinary and extreme conditions. The latest methodological recommendations on in vitro cultivation are summarized.

There is a discussion of requirements concerning physical factors and laboratory facilities for culturing cells, tissues and organs, methods of isolating, treating, transplanting them and other aspects of the techniques for in vitro cultivation.

It is intended for physiologists, biochemists, geneticists, cytologists and all those who are concerned with current problems of biology.

There are 67 illustrations and 11 tables; bibliography furnished on pp 407-485.

Contents	Page
Introduction	3
Chapter 1. History of Cultivation of Plant Cells, Tissues, Organs. Problems and Prospects in This Field	15
Part 1. Principles and Methods of Cultivating Isolated Cells, Tissues and Organs of Plants	53
Chapter 2. Material and Methodological Bases of Organizing Work in a Laboratory for Cultivating Cells, Tissues and Organs	55
Laboratory room and equipment	55
Dishes, instruments and materials	58
Maintaining sterile conditions	62
Principles and theoretical bases for preparing nutrient media	77
Constituents of the most widely used nutrient media	95
Part 2. Use of Methods for Cultivating Cells, Tissues and Organs to Solve Theoretical and Applied Problems	131

FOR OFFICIAL USE ONLY

Chapter 3. Cell and Tissue Cultures	133
Cultures of explants of roots and tubers, and stem pith	133
Cultures of tree shoot tissues	136
Cultures of callus tissues	140
Cultures of cell suspensions	145
Unicellular cloning and applications thereof	177
Breeding unicellular clones	189
Cultures of protoplasts, somatic hybridization and gene engineering	191
Chapter 4. Cultures of Isolated Organs and Embryos	207
Roots	207
Leaves	218
Flowers	226
Gynaecium [or ovary] and fruit	227
Pollen and anthers	237
Embryos	243
Meristems	246
Chapter 5. Cytological and Cytogenetic Studies of Cell and Tissue Cultures	251
Chapter 6. In Vitro Cell Differentiation	265
Histogenesis	265
Morphogenesis	271
Chapter 7. Use of Tissue Culture Method in the Study of Neoplastic Transformation	277
Chapter 8. Metabolism of Cells and Tissues With Normal and Neoplastic Type of Growth in Vitro	291
Metabolism of nucleic acids	291
Metabolism of proteins	298
Cell energy	310
Growth regulators	316
Lipids	322
Chapter 9. Study of Secondary Metabolic Substances by the Method of Cell and Tissue Culture	327
Alkaloids	327
Tannins	336
Flavones, flavonols, phenolic acids	338
Coumarins	343
Anthocyanins	345
Lignin	349
Essential oils	349
Resins	353
Rubber	353
Carotenoids	354
Steroids	355
Glycosides	359
Anthraquinones	362
Antibacterial and antiviral compounds	362
Chapter 10. Effects of Extreme Conditions on Isolated Cells and Tissues	366
Extreme temperatures	366
Elevated salt concentration	379
Ionizing radiation	383
Chapter 11. Use of Tissue Culture Method in Phytopathology	387
Viral reproduction in cell and tissue cultures	388
Interaction between mycoplasma and plant tissue	392
Joint cultures of fungi and plant tissues	393
Joint cultures of mycorrhizal fungi and isolated roots	397

FOR OFFICIAL USE ONLY

Tissue cultures in the study of nematod biology	397
Conclusion	400
Bibliography	407

COPYRIGHT: Izdatel'stvo "Naukova dumka", 1980

10,657
CSO: 1840/999

FOR OFFICIAL USE ONLY

UDC: 591.51:597(26)

SALT-WATER FISH SIGNALING AND BEHAVIOR

Leningrad SIGNALIZATSIYA I POVEDENIYE MORSKIKH RYB in Russian 1980 (signed to press 27 Jun 80) pp 2, 154-156

[Annotation and abstracts from book "Salt-Water Fish Signaling and Behavior", edited by A. I. Karamyan, corresponding member of the USSR Academy of Sciences, Murmansk Institute of Marine Biology, Order of Lenin Kola Affiliate imeni S. M. Kirov of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 900 copies, 156 pages]

[Text] This book contains the results of experimental research on reception and behavior of salt-water fish. There are descriptions of reactions of Salmonidae (salmon, humpback salmon) to weak electric fields, and relationship of these reactions to ambient conditions (temperature, density and others). Electrophysiological methods were used to study mechanisms of the ray's electroreceptor system. Data are submitted on biology and feeding behavior of a little known ray species of the Barents Sea, the Raja radiata. A link was demonstrated between feeding behavior of salt-water fish and functional activity of the digestive tract; distinctions were found in gastric and intestinal peristalsis. There is discussion of chemical signaling in fish behavior. Methods and results of electrophysiological studies of the cod's gustatory analyzer are described.

This book is of interest to marine biologists, ichthyologists, physiologists and specialists in evolutionary biology.

UDC: 061.62:591.1

TWENTIETH ANNIVERSARY OF THE LABORATORY OF PHYSIOLOGY, MURMANSK INSTITUTE OF MARINE BIOLOGY, USSR ACADEMY OF SCIENCES (IN LIEU OF A FOREWORD)

[Abstract of article by A. D. Chinarina]

[Text] Main stages of development of the Laboratory of Physiology and scientific directions of work over a 20-year period (1958-1978) are outlined. Establishment of the Laboratory of Physiology in Dal'niye Zelentsy coincided with the conversion of the Murmansk Biological Station into the present institute. The comparative evolutionary approach is emphasized in solving problems of marine physiology.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

UDC: 597.553.2:537.212

ELECTRICAL SENSITIVITY OF SALMONIDAE

[Abstract of article by V. M. Muraveyko]

[Text] Studies were made of electrosensitivity of Salmonidae by the electrophysiological and conditioned reflex methods. The threshold electrosensitivity (about $1 \cdot 10^{-8}$ A/mm²) is not indicative of functional electroreception in these fish. Galvanic reaction tests demonstrated a correlation between threshold of primary reaction and fish size, position in relation to lines of flow, specific resistance and temperature of water. The obtained data indicate that the forced movement of fish toward the anode is based on the Verigo phenomenon of cathodic depression. There are 6 illustrations; bibliography lists 25 items.

UDC: 597.35/57

BIOLOGY OF THE RAJA RADIATA (DONOVAN) RAY

[Abstract of article by A. D. Chinarina and N. V. Troshicheva]

[Text] Biological analysis was made of the Raja radiata rays of the Barents Sea. There was demonstration of proportion of sexes, size and weight composition, state of gonads, index of the liver and index of the brain. Data are submitted on nutrition of rays. There are 2 illustrations, 10 tables; bibliography lists 26 items.

UDC: 612.812

PERCEPTION OF MAGNETIC FIELDS BY THE RAY'S LORENZINI AMPULLA

[Abstract of article by G. R. Broun and V. M. Muraveyko]

[Text] Studies were made of reactions of the ray's Lorenzini ampullar electroreceptors to electric fields induced by movement of water in a magnetic field, fish movement in relation to static water in a magnetic field and variations of intensity of the geomagnetic field. Direct neurophysiological experiments showed that perception of the geomagnetic field and its variations by the ray's electroreceptors is possible. The question of perception of magnetic stimuli by the electroreceptor system of Chondrostei is discussed on the basis of extensive experimental material. There are 17 illustrations, 1 table; bibliography lists 18 items.

UDC: 597.35:591.53:578.083

FOOD AND FEEDING BEHAVIOR OF THE RAJA RADIATA (DONOVAN) RAY UNDER EXPERIMENTAL CONDITIONS

[Abstract of article by A. D. Chinarina and N. V. Troshicheva]

[Text] Data are submitted from observations and experiments on nutrition and feeding behavior of the Raja radiata starry ray of the Barents Sea in a tank. This is the first attempt at keeping R. radiata in captivity for a long time. Feed selectivity was observed in the ray. Its favorite food is live fish, and

FOR OFFICIAL USE ONLY

it refuses to eat scallops. The amount of feed consumed by the ray depends on many factors--size of the animal, quality of feed, temperature of water, individual distinctions, etc. Elimination of visual reception does not affect the feeding behavior of these animals. The hypothesis is expounded that triggering of food-searching reactions is a function of olfaction. There are 2 tables; bibliography lists 23 items.

UDC: 612.327

MOTOR AND BIOELECTRICAL ACTIVITY OF THE GADUS MORHUA (L.) COD STOMACH

[Abstract of article by I. A. Shparkovskiy]

[Text] Chronic experiments were conducted to study motor and bioelectrical activity of the cod stomach. The background distinctions of peristalsis and electric activity of smooth gastric muscles were established. Elements of periodic function of the empty stomach were demonstrated, which are manifested differently in the cardiac and pyloric parts of the stomach. In satiated fish, there was a reduction of amplitude of oscillation of gastric muscle potentials, without appreciable change in frequency. Stimulation of external chemical receptors with food extracts inhibited peristalsis. Bilateral vagotomy elicited brief (3-6 days) impairment of motor and bioelectrical activity of the stomach. It is assumed that, along with autonomic peripheral neuromuscular mechanisms, there are central mechanisms involved in regulating functional activity of the stomach. There are 5 illustrations; bibliography lists 46 items.

UDC: 591.185.3+591.58

CHEMICAL SIGNALING AND BEHAVIOR OF FISH

[Abstract of article by I. A. Shparkovskiy]

[Text] This survey deals with the role of chemoreception in the behavior of fresh-water, migratory and salt-water fish. There is a description of morphology of olfactory, gustatory and general chemical analyzers in fish referable to different ecological conditions. Data are submitted from electrophysiological and other studies related to testing of the effects of natural and synthetic chemical reagents on functional activity of chemical analyzer systems (salt, acid, carbohydrate, alcohol, fragrant substances, peptides, amino acids and others). Questions related to the significance of chemoreception in different forms of fish behavior are discussed (during migration, homing, spawning, feeding, group and defense behavior, and interspecies relations). Bibliography lists 226 items.

UDC: 597.56+578.083

METHODS OF STUDYING NONOLFACTORY CHEMORECEPTION IN SALT-WATER FISH

[Abstract of article by I. D. Pavlov]

[Text] A bench is proposed, which is made of materials (plexiglas, polyvinyl chloride plastic), which are chemically resistant to salt water and are designed for electrophysiological studies of salt- and fresh-water fish. Illustrations and a description of operation of the device are furnished. A method was developed for local stimulation of chemoreceptors of the intact abdominal fin of the cod

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

in an experimental tank with water. A device is described for controlling the temperature and dosage of chemical stimuli. There are 4 illustrations; bibliography lists 68 items.

UDC: 597.56:591.18.3

EVOKED ACTIVITY OF THE COD'S MEDULLA OBLONGATA NEURONS BY STIMULATION OF CHEMORECEPTORS

[Abstract of article by I. D. Pavlov]

[Text] The electrophysiological method was used to demonstrate that stimulation of the cod's chemoreceptors with very salty water, distilled water, mild solutions of citric and hydrochloric acids intensifies impulse activity of neurons in the lateral segment of the vagal part of the medulla. Groups of neurons were demonstrated that react selectively to the stimuli used. It was shown that there is prevalence of "salt" neurons over "acid" ones. There are 2 illustrations; bibliography lists 35 items.

COPYRIGHT: Izdatel'stvo "Nauka", 1980

10,657
CSO: 1840/174

FOR OFFICIAL USE ONLY

UDC: 588.4+577.1+001.5(07)

METHODS OF MATHEMATICAL BIOLOGY. BOOK 1: GENERAL METHODS FOR ANALYSIS OF BIOLOGICAL SYSTEMS

Kiev METODY MATEMATICHESKOY BIOLOGII. KNIGA 1: OBSHCHIYE METODY ANALIZA BIOLOGICHESKIKH SISTEM in Russian, 1980 pp 4-12

[Annotation, foreword by editor-in-chief, introduction and table of contents from book "Methods of Mathematical Biology. Book 1: General Methods for Analysis of Biological Systems" edited by Academician V. M. Glushkov, Izdatel'stvo "Vishcha shkola", 240 pages]

[Text] This is a systematization of analysis of biological systems, methods of experimental and theoretical studies thereof. The principles of function of biological systems expounded by mathematicians and cyberneticists are discussed. In presenting the methods for experimental studies of biological systems, attention was focused mainly on the methods used to synthesize mathematical models; in the discussion of methods of theoretical research on biological systems it was focused on the method of mathematical modeling and applied significance of mathematical models of biological systems.

This book is an educational aid for the courses on "Biological Cybernetics," "Bionics," "Medical Cybernetics," "Mathematical Modeling of Biological Systems" and "Biophysics" for students at universities, medical and pedagogic institutes and institutes of physical culture; it may be useful to scientists concerned with problems of mathematical biology.

There are 89 illustrations and 4 tables; bibliography lists 116 items.

Foreword by Editor-in-Chief [V. M. Glushkov]

Biological systems have such a wide assortment of properties, distinctive combinations thereof, while the function of biological systems is governed by so many different principles that virtually all mathematical methods are used to study them, and the present stage of development of biological and medical sciences is characterized by increasing use of mathematics. In the last 20 years, much material has been accumulated on mathematical models of different biological systems; we have become aware of the need to compare the mathematical methods used to the complexity of the biosystems studied and to the applied problems that are being solved on the basis of mathematical models of biosystems.

Thus, it can be considered that, at the present time, a new scientific direction, a new scientific discipline is being formed--mathematical biology. This is also indicated by the fact that the Academic Press (New York, London) published the

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

"Fundamentals of Mathematical Biology" in three volumes, in 1972. The editor of this publication and one of its main authors, R. Rosen, states in his foreword that "mathematical biology is a subject which is in the process of active development" and that the "relevant [meaningful] text of mathematical biology must contain a sense of overt incompleteness of this branch of research, in addition to the specific results." Aside from the obvious postulation of the infinite nature of the scientific search for "absolute truth," this statement also reflects the objective situation that has developed at the present time with the use of mathematical methods for analysis of biological systems. For example, there are numerous mathematical models of the heart or neuron. However, by far not every author discusses the range of application of his model, which properties this model reflects and which ones it does not, which applied problems the model makes it possible to resolve. Such a situation is typical of any branch of biology and medicine. For this reason, it is difficult to state at the present time that a specific model best reflects the circumscribed aggregate of properties of a biosystem under study or that it makes it possible to adequately solve a certain applied problem. This is why the "Fundamentals of Mathematical Biology" represent nothing more than collections of articles brilliantly written by a group of well-known specialists in mathematical investigation of various biosystems. Each of the authors, develops in his field, be it kinetics of enzymes or quantum genetics, his own mathematical models.

The situation that has developed today in mathematical biology determined the route that would be best to follow--the route of systematization of various mathematical methods that have found applications in studies of various biological systems and solving various applied problems. This was also aided by the following two circumstances. In 1974, the "Encyclopedia of Cybernetics" in two volumes was published, with the active involvement of the Institute of Cybernetics, Ukrainian Academy of Sciences, and it contains articles on biological and medical cybernetics. In spite of the fact that many of them are comprehensive, they are essentially informative. But for such a developing branch as mathematical biology, there has long been a need for a guide of mathematical methods. The few monographs published in the Soviet Union and abroad do not meet this need. Thus, the need to publish the "Methods of Mathematical Biology" series is obvious; in our opinion, it should combine the best qualities of a scientific reference book and make use, as much as possible, of information given in it for theoretical research and solving applied problems, an encyclopedia in breadth of coverage, and an educational aid in intelligibility of presentation.

The second circumstance that compelled us to undertake the writing and publication of the "methods" is as follows. We are still far from a real, well-established textbook theory of biological systems, whereas it is imperative to resolve even now the applied problems related to medicine. This is why the Institute of Cybernetics, Ukrainian Academy of Sciences, is already taking vigorous steps to create a bank of biological and medical data. A bank with such data is the first and necessary prerequisite for creating a medical information system. At the same time, a data bank is a mandatory prerequisite for creating automated control systems in public health. We believe that the next mandatory condition for synthesis of such automated control systems is to create a bank of mathematical methods. It is expressly here that we view the applied value of the "Methods of Mathematical Biology." Let us also note that the complexity of problems of mathematical biology is no lower than most technological ones, and for this reason this work also furnishes a systematic presentation of mathematical methods and examples of their use for engineering [technological] applications.

FOR OFFICIAL USE ONLY

This work, which was performed at the initiative of the Institute of Cybernetics, Ukrainian Academy of Sciences, is the collective labor of prominent specialists of the Soviet Union in the area of biological and medical cybernetics.

Introduction

Biological investigations constitute one-third of current scientific research. Accordingly, more than one-third of the scientists of the world are engaged in analysis of biological systems and solving applied problems of biology and medicine. Such distribution of scientific research is attributable to the complexity of biological systems, biological and medical problems, as well as the vital need to solve these problems for mankind. In recent times, the results of biological studies are becoming more and more often the basis for solving problems in traditionally technical scientific directions: automation, development of computer technology, design of intelligent robots.

Solving these problems implies integration of experimental and theoretical studies of biological and medical systems, as well as increasingly broader use in such studies of mathematical methods. Mathematics is a universal language for describing any process or phenomenon. Because of their abstract nature, the same mathematical methods are found to be suitable for studying processes differing in physico-chemistry.

It would be wrong to believe that mathematics began to be used only in the last 15-20 years for description of the function of biological systems; it had been used already at the early stages of studies of living organisms (suffice it to mention the mathematical study of the circulatory system, which L. Euler conducted as far back as the 18th century).

The use of some mathematical method or other for analysis of biological systems depends on the experimental data that the researcher has and the goals he sets for himself. This, in turn, is related to the level of knowledge gained from studies of biological systems, possibilities and resources for experimental studies of biosystems, knowledge of mathematics and software for problem solving. The mathematical description of biological systems and processes is being refined as the level of biological knowledge increases. This is not a simple process; mathematical description may become more complicated at certain stages of a study, then become simpler.

At the early stages of using mathematical methods for describing biological systems, any mathematical formula acquired the importance of a biological law by virtue of its terseness. At the present time, the situation has changed in the area of application of mathematical methods for analysis of biosystems. When constructing a mathematical description of some specific biosystem, researchers are beginning to realize that they are not covering the entire set of properties of the biosystem and exogenous conditions. For this reason, one no longer refers to mathematical laws, but to mathematical models of biosystems. Each time, the researcher mentions the properties of a biosystem that he is reproducing in the mathematical model, and he delineates the range of problems, for the solution of which the model is intended. This circumstance is related to the fact that we have deeper knowledge about the function of biosystems, greater opportunities for experimental studies thereof and more detailed problems that are formulated in experimental studies.

FOR OFFICIAL USE ONLY

Until recently, progress in biology was linked mainly with the use of the methods of chemistry and physics to analyze biosystems, but the main idea permeating all of the volumes is related to substantiation of the applicability to biology of the principles and laws inherent in physical systems.

In the last 15-20 years, it was determined by development of cybernetics. The very appearance of cybernetics is to be credited to deeper studies of engineering and biological systems from the standpoint of general control processes [34, 49], processes of transformation of information [55], studies of complexity and organization. The inception of cybernetics as a science is linked with the names of many Soviet scientists, among whom A. N. Kolmogorov occupies a special place [73]. We owe the development of cybernetics in the USSR with delineation of different applied directions, to the efforts of A. I. Berg, V. M. Glushkov, N. M. Amosov, A. A. Lyapunov, P. K. Anokhin and V. V. Parin.

Modern biology integrates the information of many scientific disciplines, mainly biophysics, biochemistry and biocybernetics. They make wide use of mathematics, whereas in biocybernetics mathematical modeling is the principal method. Biocybernetics makes it possible to come closer to demonstration of biosystem function on all hierarchic levels: macromolecular, cell organelle, cell, organ, physiological and analyzer systems, internal system and the brain, the integral organism and interaction between the organism and the environment. On the one hand, this is related to its rather general approach directed toward investigation of the patterns of transformation of information, control, complexity and organization of biosystems; on the other hand, it is related to the depth of studies, which is attributable to the feasibility of using the same approach to study different hierarchic levels and interactions between them.

It is opportune to mention here a basically new approach to mathematical biology, which was determined by biocybernetics. It is known that virtually all of the known laws of chemistry and physics are valid for biosystems. The uniqueness of organization and complexity of biosystems lies in the fact that one can find in each biosystem, qualitatively different from others, only its own inherent combination of chemical and physical laws and principles. Unlike biochemistry and biophysics, it is biocybernetics that permits demonstration, to some degree, of the unique mosaic of patterns of the biosystems studied.

The fundamentals of theoretical cybernetics occupy a large place in the "Methods of Mathematical Biology," by virtue of their importance to the study of biological and medical systems. This makes it possible not to place biological material on the procrustean bed of purely physical laws and principles, but to disclose the patterns of biosystem function on the basis of mathematical models of this function.

At the present time, the geographic range of application of mathematical methods of studying biological and medical systems in our country is rather representative. It can be stated that there are a number of schools differing in object of investigation and specifics of application of mathematical methods. Aside from Moscow, Leningrad and Kiev, which play the leading role, schools are developing in Tbilisi, Rostov-na-Donu, Tashkent, Novosibirsk, Kishinev, Vilnius, Riga, Gor'kiy, Kaliningrad and Kaunas. Studies are conducted there in a complex way: biologists and physicians, engineers and mathematicians work together on the same problem.

FOR OFFICIAL USE ONLY

This explains the numerous meaningful achievements of research on biological and medical systems, which have been made in recent times.

Virtually all branches of classical and modern mathematics are used to synthesize mathematical models of biological and medical systems. Let us mention that the mathematical methods are virtually always altered because of the specifics of the objects studied. Expressly this characterizes the first stage of formation of biomathematics.

Concurrently with development of biomathematics, mathematical biology is also being formed. At the present stage of development of research, the large number of mathematical models of biological and medical systems and experience gained in using them to solve applied problems make it possible to systematize and classify the mathematical methods that have found broad use in biology and medicine.

Contents	Page
Foreword by Editor-in-Chief	7
Introduction	9
Chapter 1. A biological System as the Object of Investigation	13
1.1. Concept of biological system. General description	13
Biological systems	13
Open nature of living systems	20
The norm and pathology	25
1.2. Properties of biological systems	26
Complexity and organization	27
Protective properties	31
1.3. Principles involved in function of biological systems	41
Structural functional principles	41
Principles of dynamic function of biosystems	44
The principle of a functional system	49
Principles of self-organization and adequacy	55
Principle of multichannel organization of analyzers	65
Principles of brain function	69
1.4. Classification of biological systems	84
Classification chart	84
Determination of complexity and organization of biosystems	85
Estimation of complexity and organization according to combinations of states	86
Classification of biosystems and adequate mathematical description of biosystems	89
Chapter 2. Methodology of Experimental Studies of Biological Systems	93
2.1. Specifics of an experimental study	93
Scientific approaches	93
Interaction schemes	95
2.2. Objectives of experimental research	97
Main goal	97
Structural and functional study	98
2.3. Experimental methods of research	102
Neuronal level	102
Level of neuronal ensembles	103
Level of neuronal associations	106
Organ level	114
Brain level. Mental activity	117

FOR OFFICIAL USE ONLY

Studies of function of the brain and integral human body under different technical and ergodic systems	119
2.4. Biological modeling. Biological model	127
The integral organism	129
Chapter 3. Methodology of Theoretical Studies of Biological Systems	
3.1. Cybernetics and mathematical biology. Cybernetics	132
Biological cybernetics	134
Physiological cybernetics	137
Medical cybernetics	140
Neurocybernetics	143
Psychological cybernetics	146
Applied biocybernetics	147
3.2. Specifics of a theoretical study. Biomathematics	157
Mathematical biology	159
3.3. Fundamentals of mathematical modeling. Modeling method	160
Stages of modeling	162
Means of modeling	170
3.4. Hierarchy of mathematical models. Breakdown of models according to internal nature	172
Hierarchy of models	173
Modeling with consideration of hierarchy of models	178
Advantages and disadvantages of modeling	179
3.5. Methodology of modeling determined biological systems.	
Mathematical models of static modes	181
Dynamic models with consideration of correlation between internal structures of systems	192
3.6. Methodology of modeling probabilistic biological systems.	
Modeling of static modes	194
Modeling of dynamic modes	196
3.7. Methodology of analysis of properties of biological systems.	
Use of control theory methods	199
Complex use of mathematical analytical methods	209
Complex modeling of man-machine systems	212
3.8. Methodology of using methods of mathematical biology to solve applied problems. The problems. Correlations	214
Diagnostics	216
Prognostics [forecasting]	222
Control	224
Bibliography	233

COPYRIGHT: Izdatel'skoye ob"yedineniye "Vyshcha shkola", 1980

10,657

CSO: 1840/999

FOR OFFICIAL USE ONLY

UDC: 581.132.035:582.26

ACTIVITY OF A PHOTOSYNTHESIZING CULTURE OF MICROALGAE

Novosibirsk ENERGETIKA FOTOSINTEZIRUYUSHCHEY KUL'TURY MIKROVODOROSLEY in Russian 1980 (signed to press 22 Jan 80) pp 2-9, 136

[Annotation, introduction and table of contents from book "Activity of a Photosynthesizing Culture of Microalgae", by Vladimir Nikolayevich Belyanin, Fedor Yakovlevich Sid'ko and Anton Pavlovich Trenkenshu, Institute of Physics imeni L. V. Kirenskiy, Siberian Department of the USSR Academy of Sciences, Izdatel'stvo "Nauka", 1000 copies, 136 pages]

[Text] The authors submit the results of studies of optic, growth and photo-energetic properties of microalgae under conditions of continuous and intermittent illumination of cell suspensions. The studies involved the use of experimental and mathematical modeling of processes of growth and photosynthesis of microalgae under different conditions, with regard to exposure of cultures to light, with consideration of spectral characteristics of the suspensions and radiant flux. Thermophil and mesophil green, blue-green and red algae of different species were used as the objects of the studies. Data are submitted on dependence on light of growth of species that have been little-studied in culture, including marine planktonic algae.

There is discussion of activity ["energy"] of an algal culture serving as the regenerating link in a closed ecological system, which includes man (biological life support system).

This book is intended for biophysicists and physiologists concerned with plants, ecologists and specialists in the field of cultivation of lower phototrophs.

There are 10 tables and 52 illustrations. Bibliography lists 141 items.

Introduction

Algae are predominantly aquatic plants that live in salt and fresh water. It is known that about 71% of the surface of our planet is taken up by different bodies of water, in which the photosynthetic process takes place on an enormous scale thanks to algae, and in some cases this process is highly effective. This is aided by the relative stability of temperature conditions in an aquatic environment and the fact that algae do not expend energy on evaporation of water, they expend relatively little energy on respiration and are widely supplied with nutrients, for example, in the eutrophic regions of oceans, seas and reservoirs, adequacy of radiant energy and rapid renewal of the photosynthesizing system of cells, as

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

well as the flexibility of adaptation inherent in algae. According to the estimates of different researchers, algae (mainly planktonic) form from one-quarter to one-half of all primary organic matter and oxygen in the earth's biosphere.

Algae are a rich source of protein, vitamins, medicinal and other valuable organic and mineral substances used in microbiology and medicine, the paper, perfume, feed and food industries. However, there are no more than several dozen algal species that are being cultivated at the present time, whereas the number of cultivated higher plants is about 6000. This is largely attributable to the significant differences in form (and availability) of products synthesized by higher plants and algae, as well as the distinctions of cultivating algae on a mass scale.

Thus, there are only a few algae, mainly multicellular and colonial, that can be directly extracted from water and used as food or animal feed without any complicated technological processing and transformation of the original biomass. Most algae (87%) are represented by the phytoplankton of the oceans, which is distributed there in a rather "rarefied" state.

A certain level of achievement in the field of physiology and biophysics of these organisms, as well as methods and techniques for photobiological synthesis on the basis of aquatic plants, are needed to produce productive cultures of algae on a large scale. At the present time, the research analogue of such a process is an optically dense continuous culture of microalgae, conducted in bioengineering units under controlled conditions. With its help, methods and equipment are being refined that are related to biosynthesis of phototrophic cells. Development of methods of controlled cultivation of useful species of algae and of effective technological processes to recover from them the most important products constitute a task, the performance of which will provide us with new and large biological sources of organic and mineral substances.

We can single out some sectors of the national economy concerned with the production of green fodder for livestock farming, live feed for marine farming and inland fisheries, where a concrete solution of such a problem will be needed in the very near future. In our country and abroad, there are plans, as well as extensive measures conducted to create large marine farms and organize intensive mariculture. This is related to the gradual general transition from free hunting of marine organisms to regulated catching and harvesting thereof in the oceans and then on to controlled marine farming. The existing marine farms specialize mainly in the production of macrophyte algae (laminaria, undaria, gracilaria and others), but in the future others (unicellular, filamented) for use as adequate feed by some groups of marine organisms, as well as to obtain new foodstuffs and valuable substances.

The use of algae as test objects and experimental biological models in plant physiology, biophysics, biochemistry, genetics, ecology and other branches of science is also increasing and becoming more effective. Algae are a very convenient and sometimes irreplaceable object for the study of evolutionary links in the organic world and mechanisms of energy and mass exchange processes in a freely living cell.

Among the marine unicellular algae--Peridinium--there are fluorescent species, use of which in biophysics offers additional opportunities for the study of

FOR OFFICIAL USE ONLY

the phenomenon of bioluminescence. The distinction of these organisms is that there can be intensive occurrence in them of two opposite processes, photosynthesis (assimilation of light) and luminescence (emission of light).

Relatively recently, viruses were discovered that induce lysis in algae, so that algal cultures become promising for the study of correlations between a virus and free-living plant cell.

The Chlorella is studied extensively and often used in biological experiments; it is one of the best objects for development of methods and technology of intensive cultivation of microalgae for industrial photosynthesis and artificial ecosystems. It can be raised relatively easily; it has highly flexible metabolism and can grow at the maximum possible speed for algae. Controlled chlorella cultures have been used repeatedly in closed ecosystems that include man, and in all cases they demonstrated the required stability and efficiency of biological circulation of matter in such systems. This direction of work with algae is continuing to be developed, and it is on the borderline of the problem of recovering foodstuffs from autotrophic microorganisms.

Studies related to the regenerative functions of algae in artificial ecosystems are also promising with regard to various natural systems, including the biosphere in its phototrophic element and corresponding connections. At the present time, the anthropogenic effect on some parts of the oceans, inland waters and other components of the biosphere is acquiring the significance of a substantial ecological factor. The related chemical, radiation and thermal changes in the atmosphere and hydrosphere play an increased role. The most probable reactions of plants of our planet to such environmental changes are known to a sufficient extent. For example, if carbon dioxide content of the atmosphere is increased and with the possible elevation of temperature ("hothouse effect"), many groups of plants are capable of increasing photosynthesis. But for higher plants that grow on land, there must be concurrent increase in supply of water by virtue of occurrence of a drier climate. Moreover, higher plants generally have lower levels of saturation of photosynthesis with carbon dioxide than algae (other conditions being equal). Consequently, if no additional restrictions appear, phytoplankton would have more intensive photosynthetic activity and development in this case. Also, if we assume that there are in the biosphere some "ecological units" that are the most sensitive to impairment of equilibrium, the phytoplankton of the oceans must be included among them. It is the first to react to substantial thermal and chemical water pollution, increased dumping of industrial gases (carbon dioxide and others) into the atmosphere, since it has a high growth potential and is capable of making efficient use for its development of colossal amounts of energy (about $3.6 \cdot 10^{20}$ kcal/year) in the form photosynthetically active solar radiation.

Thus, if we were to remove the presently existing limits for biogenous elements, including carbon, phytoplankton could grow at almost an 8 times faster rate, as compared to the average rate inherent in modern conditions. For this reason, phytoplankton could potentially provide to a significant degree for the regenerative function of plants on earth, but then its species-related structure would undergo some substantial changes, which harbors some danger related to dominance of only a few species, and those with low trophic value.

Under the conditions existing at the present time, we know of the so-called "phytoplankton paradox," which consists of the fact that marine phytoplankton

FOR OFFICIAL USE ONLY

has retained an enormous diversity of species and forms in an environment where the small number of main growth factors should, it would appear, have led to preservation of only a few species. The answer to this question is important both to predicting the consequences of intensified growth of phytoplankton in nature and to find means of controlling its photosynthetic activity and species structure.

Blue-green algae (Cyanophyta), which consist of about 2500 species, hold a special place among phototrophs. This algae are distributed everywhere. They are encountered on the surface of snow and ice, in stagnant waters and swift rivers, on damp cliffs, on the surface of the ground, in hot springs and in the cold Arctic lakes. They can also be found in the most diverse places in symbiosis with other organisms. Some species are well-adapted for growth in the presence of high levels of radiation and high concentrations of different salts, including sulfur-containing mineral compounds. There are known cases of growth of these algae in an atmosphere of carbon dioxide alone and at high pressure. These and other properties of blue-green algae are of considerable scientific interest. By using them in research, one can determine the ecological boundaries, within which the organic world is preserved and develops within the region of its phototrophic mode of existence. And, although such boundaries are being determined on the basis of the properties of terrestrial microorganisms, this also gives us greater certainty of discovering extraterrestrial life on planets where the gas, temperature, water, radiant and other conditions do not preclude the growth and photosynthesis of unicellular organisms similar to blue-green algae. It is known that blue-green algae are among the most ancient and relatively simply organized of all existing chlorophyll-containing organisms. They do not have a distinctly formed organoids. The chlorophyll is not concentrated in chloroplasts, as in other plants; rather, it is distributed (relatively uniformly) over the cytoplasm in the form of fine grains. In addition to chlorophyll and carotenoids, blue-green algae have additional pigments--phycocyanin and phycoerythrin (biliproteins)--from the mixture of which with chlorophyll results the typical blue-green color of the algae. However, it could change from bright blue-green, yellowish to red, depending on conditions of growth and development. The cells are usually covered with a sticky, gel-like external membrane. On the whole, blue-green algae occur in a wide diversity of external appearance within the unicellular and filamented forms, but the structure of their cells changes to a lesser extent than in other types of algae.

As shown by the experience of some ethnic groups on earth, some species of blue-green algae (from the genera Nostoc and Spirulina) can be used as food. However, it is not clear about the amounts of such algae that can be included in man's steady diet. Most likely, they can be used as vitamin, therapeutic and other food supplements, rather than as the basis of the diet. It is known, for example, that Spirulina is rich in vitamins A, B₁, B₂, B₁₂ and C. Therapeutic properties have also been demonstrated in some species of blue-green algae, including those developing in hot springs. Blue-green algae play a large part also in forming therapeutic mud.

Some species of blue-green algae, which are capable of fixing molecular nitrogen, are actively involved in increasing the fertility of soil in flooded land, as well as nitrogen enrichment of reservoirs, which enhances their overall biological productivity.

At the same time, some species of blue-green algae have toxic properties, thereby lowering the quality of available sources of clean water. During the period of

FOR OFFICIAL USE ONLY

their mass scale development, blue-green algae create considerable difficulties in water purification. Knowledge of the causes and conditions of mass scale development of blue-green algae in certain reservoirs ("coloration" of water) is gaining ever increasing practical importance. The fact that there is some correlation between this phenomenon and eutrophication of water prompted some researchers to use saprogenic ["saprobnnye"?] species of algae as a sensitive biological indicator of polluted bodies of water.

Blue-green algae are the only organisms capable of photosynthesis and discharge of oxygen at high temperatures. The cells of all other photosynthesizing organisms do not usually grow at temperatures above 46°C. Field and laboratory studies have shown that the maximum temperature for growth of blue-green algae is 73°C, although we only know of one species thus far that grows at this temperature. In neutral and alkaline hot springs, blue-green algae prevail at temperatures of up to 40°C. Thermophil and high-temperature algae grow profusely in the hot springs of the Caucasus, Kamchatka, Iceland, New Zealand and North America.

It was found that the maximum temperature for growth of thermophil bacteria is close to 95.5°C, although they may remain viable at 105°C. If we also consider the fact that structural and certain functional features of blue-green algae are similar to those of bacteria, we can assume that there are natural hot springs, in which algae develop at temperatures above 73°C. Perhaps these will be exclusively relict forms. In the last decades, hydrobionts of thermal springs have been studied intensively and extensively. Among them, a significant diversity of species of bacteria and blue-green algae have been found; however, the maximum temperature for photosynthesis has not been determined. Nor is there a developed theory to explain the growth and development of primitive organisms at very high temperatures, on the basis of which one could make a quantitative estimate of the maximum temperature for photosynthesis.

Blue-green algae have drawn our attention in connection with work on problems of stability and energy efficiency of algal cultures as an object of controlled biosynthesis. We have already noted that there are inherently greater restrictions for other types of algae than for representatives of blue-green algae with respect to resistance to different factors and range of optimum effects thereof. On the whole, the amplitude of ecological adaptation is much wider for them than other groups of lower phototrophs. Moreover, under conditions of intensive and prolonged cultivation thereof in biotechnological complexes, in which cells could be exposed to extreme physicochemical factors, their genetic resistance and wide biochemical diversity are very important. By using blue-green algae in controlled biosynthesis, one can widen significantly the range of functional activity and stability of cultures.

Studies were conducted mainly with thermophilic, high-temperature forms of blue-green algae, which made it possible to raise the temperature drastically while cultivating cells, up to the maximum levels that have been found for photosynthesizing organisms in nature. For one of the high-temperature strains of blue-green algae which we cultivated, the optimum temperature for growth was 54±58°C and the maximum was about 65°C.

Special cultivator units were designed and assembled to study the patterns of growth, photosynthesis and production properties of microalgae as related to

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

cultivation parameters. By using these units one can regulate and stabilize at a specified level the main exogenous factors and main parameters of the algal culture: irradiation of the cell suspension, with regard to both intensity and spectral composition, temperature of the suspension, concentration of CO₂ in the gas flux, composition and concentration of elements in the nutrient medium, optical density of the suspension, pH and others.

A most important aspect of research on algal photobiosynthesis is to study its kinetics in stationary and transient states as related to intensity, spectral composition and frequency of interruption of light. Some of the patterns of growth and photosynthesis of cell, demonstrated in the experiments, ensue from the shape of the light curves obtained for a specific growth rate, productivity (biomass), assimilation characteristics of chlorophyll and efficiency of assimilation of absorbed radiant energy. On this route, one can find the conditions for reaching maximum energetic efficiency of biosynthesis of algae in culture and high functional stability of the process of photosynthesis, which provides for synthesis by means of light, the organic products needed by the cell for energy and regulatory purposes. The solution of these problems will ultimately result in the high energy efficiency of algal production in all of the practical and research applications where intensive cultivation of algae is required.

Successful work on the theoretical bases and most important applications (regeneration of environment and production of valuable substances) of controlled cultivation of various species of algae and communities thereof will enable us, in the future, to acquire a strong resource for organic and mineral products, to augment drastically the biological productivity of bodies of water and obtain a significant national economic effect, and it will concurrently give researchers an effective experimental model of photobiosynthesis with inexhaustible possibilities.

Contents	Page
Introduction	3
Chapter 1. Cultivation of Microalgae Under Continuous Illumination.	
Experimental Results	10
1.1. Methods, experimental equipment	10
1.2. Lighting conditions and absorption of photosynthetically active radiation in suspensions of unicellular algae	18
1.3. Photosynthetic growth of thermophil green and blue-green algae in suspensions with low optical density. Dependence on light	27
1.4. Growth and productivity of mesophil green and red algae under different illumination conditions	32
1.5. Productivity and energy efficiency of optically dense culture of microalgae with constant levels of illumination	38
Chapter 2. Parametric Equation of Light-Dependent Growth. Estimates	
2.1. Models, equations of photosynthesis and growth	48
2.2. Construction of parametric equation, determination of coefficients	49
2.3. Quantitative description of dynamics of algal growth in the accumulative process	56
2.4. Estimation of photoenergetic parameters of optically dense cultures in flowing medium	62
Chapter 3. Cultivation of Microalgae Under Intermittent Light.	
Experimental Results	64
3.1. Light curves for growth of green and blue-green algae as related to frequency of interruption of full flux	64

FOR OFFICIAL USE ONLY

3.2. Growth patterns as related to changes in duration of dark intervals in intermittent flow	74
3.3. Experimental verification of lighting conditions for algae in optically dense culture	84
Chapter 4. Culture of Microalgae as the Regenerating Element in a Biological Life Support System for Man	93
4.1. Preliminary remarks	93
4.2. Base data on energy and mass metabolism of the human body	96
4.3. Corresponding mass metabolism characteristics of culture of microalgae	110
4.4. Photoenergetic parameters of algal culture in the system	118
Conclusion	124
Bibliography	126

COPYRIGHT: Izdatel'stvo "Nauka", 1980.

10,657
CSO: 1840/999

FOR OFFICIAL USE ONLY

MEDICINE

AVIATION MEDICINE

Moscow AVIATIONNAYA MEDITSINA in Russian 1980 (signed to press 5 Nov 79)
pp 2-4, 247

[Annotation, foreword and table of contents from book "Aviation Medicine", edited by Prof A. N. Babiyuchuk, doctor of medical sciences, Izdatel'stvo DOSAAF SSSR, 17,000 copies, 247 pages, illustrated]

[Text] This book deals with problems of aviation medicine as they relate to the distinctions of medical support of flights aboard flying vehicles of the civil aviation and DOSAAF [All-Union Voluntary Society for Assistance to the Army, Air Force and Navy of the USSR]. There is discussion of measures for providing optimum working conditions for flight crews, and a set of measures is presented that provides for a high level of health of flight personnel, psychophysiological capacities, as well as discussion of some other priority problems of medical support of flight safety.

Foreword

As a result of scientific and technological progress in the field of aviation engineering, the civil aviation fleet of aircraft is being constantly enlarged with Tu-134, Tu-154, Il-62, Il-76, Tu-144, Il-86 and other liners, which transport passengers and cargo on a mass scale, as well as the Mi-6, Mi-8, Mi-10 and Ka-26 helicopters, which are used extensively in different sectors of the national economy. Aviation techniques are being refined in flying schools of the civil aviation and DOSAAF air clubs.

Modern aircraft and helicopters are complex flying vehicles, which are equipped with the latest automatic and semiautomatic equipment, but, as before, man plays the leading role in the "man-machine" system.

Control of a modern aircraft is viewed as a complex system, which includes a human operator, on the one hand, and control equipment, on the other, which are interconnected.

A high degree of reliability and efficiency in operation of this system can be achieved only if the specifications of machine elements that directly interact with the operator conform with his physical and psychological capacities, and if the flight factors will not have an adverse effect on him that would lower his fitness for work.

FOR OFFICIAL USE ONLY

For this reason, medical support of flight safety in the civil aviation and DOSAAF is organized in two directions.

The first direction refers to providing optimum working conditions for flight crews in the broad sense.

These measures are implemented directly in the design and equipment of cabins, in accordance with special medical and engineering requirements, and they include optimum lay-out and equipment of work places for the crew, units that provide the necessary microclimate, protection against pollution of the cabin air environment by toxic chemicals, protection against noise and vibration, adherence to standards for cabin illumination, etc.

The second direction of medical support of flight safety refers to a set of measures, whose main object is the operator, to provide for a high level of health of flight personnel, psychophysiological and psychological capacities, guaranteeing a high degree of reliability of the human element in the system of aircraft or helicopter control.

The medical measures in this direction include screening of candidates for civil aviation flying schools and DOSAAF air clubs, with respect to health status, observation of their health status during training and flying; evaluation of the candidates' personality traits is given a certain role.

An important place is assigned to questions of developing work, rest and eating schedules, as well as observation of physical conditioning of flight and engineering-technical personnel and other special aviation medicine problems.

Medical analysis of the causes and conditions related to flight incidents and erroneous action by flight personnel constitutes a special branch of support of flight safety, for the purpose of preparing medical recommendations to prevent them.

The most pressing problems of medical support of flight safety in the civil and DOSAAF aviation are discussed in relevant chapters.

This book is intended for aviation physicians and other aviation specialists; its purpose was to try to systematize problems of aviation medicine as they relate to the distinctions of medical support of flight safety in flying vehicles of the civil aviation and DOSAAF.

	Contents	Page
Foreword		3
Chapter 1.	Development of Aviation Medicine in the USSR (Prof A. N. Babiychuk, doctor of medical sciences)	5
Chapter 2.	Medical Aspects of Work and Rest Schedules for Flight Personnel (V. F. Onishchenko, F. V. Babchinskiy, candidates of medical science)	21
Chapter 3.	Physiological and Hygienic Characteristics of Cabins and Passenger Sections ["Lounges"] (G. A. Demidov, candidate of medical sciences)	41
	The pilot's work place	42

FOR OFFICIAL USE ONLY

Cabin microclimate in commercial [passenger] aircraft	45
Barometric pressure	45
Air temperature in pressurized cabins	49
Relative air humidity in pressurized cabins	50
Atmospheric ozone	52
Chapter 4. Role of Vision in Flight Work (I. D. Semikopnyy, candidate of medical sciences)	54
Visual acuity and correction in flight work	55
Correction of vision	57
Night flying vision of flight personnel	58
Spatial orientation in flight	61
Importance of color vision in flight	64
Study of pilot's visual functions in the spacecraft cabin	65
Study of visual perception of instruments	66
Chapter 5. Effects of Altitude Factors on the Body and Physiological- Hygienic Distinctions of Exposure to Rarefied Atmosphere (Prof Ye. M. Peshkov, doctor of medical sciences)	68
Main altitude factors characterizing high-altitude flights, and their biological significance	68
Change in barometric pressure and its effect on the body	69
Causes and conditions for onset of changes in barometric pressure	69
Effect on the body of expansion of gases in airways	71
Changes in the body during emission of gases dissolved in blood and tissues	73
Vapor production in liquid and semiliquid media of the body	74
Role of partial pressure in supplying tissues with oxygen at high altitudes	76
Distinctions of breathing with atmospheric air at high altitude	76
Distinctions of breathing with a mixture of air and oxygen	82
Distinctions of breathing with pure oxygen (with the exception of pumping air under mask)	83
Distinctions of breathing with hyperbaric oxygen	87
Distinctions of breathing with hyperbaric oxygen and use of compensation (counterpressure)	93
Chapter 6. Accelerations in Flight and Their Effects on Man (I. A. Tsvetkov, doctor of medical sciences)	96
Physical characteristics of accelerations and conditions under which they appear	96
Accelerations during take-off and landing of an aircraft	103
Accelerations in flight	114
Chapter 7. Aviation Noise and Its Effect on the Body (V. M. Kozin, candidate of medical sciences)	122
Sources of noise and their characteristics	123
Effect of noise on the body	126
Methods for lowering noise and protection against sonic factors	129
Chapter 8. Vibration (Yu. N. Kamenskiy, candidate of medical sciences)	133
Sources. Physical characteristics	133
Effect of vibrations on man	134
Symptoms of vibration sickness	137
Prevention of vibration sickness	142
Chapter 9. Chief Principles of Expert Medical Certification of Flight Personnel in the Civil Aviation (B. L. Gel'man, candidate of medical sciences)	146

FOR OFFICIAL USE ONLY

Medical supervision in the period between certifications	147
Annual certification of flight personnel by medical flight commission	148
Preflight medical supervision	150
Medical monitoring during flights	151
Chapter 10. Medical Support of Flights in Aviation Schools (Prof A. N. Babiychuk, doctor of medical sciences, A. G. Gridchin, M. A. Palamarchuk)	153
Distinction between visual flights and instrument flights	154
Introductory, training, test and solo flights	156
Instrument flight	156
Chapter 11. Medical Support of Parachute Jumps (I. A. Tsvetkov, doctor of medical sciences)	164
The parachute as a system for descending from a high altitude, and classification of parachute jumps	164
Effect on man of parachute jumps	170
Medical support of parachute jumps, and prevention of traumatism	172
Emergency abandonment of aircraft with high performance characteristics	175
G forces occurring with forced abandonment of an aircraft, and their effect on the body	177
Prevention of traumatism related to ejection	180
Chapter 12. Medical Support of Aviation Sportsmen in the USSR DOSAAF (Prof A. N. Babiychuk, doctor of medical sciences, M. A. Palamarchuk)	184
Chapter 13. Search and Rescue of Flight Crews and Passengers (Prof A. N. Babiychuk, doctor of medical sciences)	188
Chapter 14. Problems of Aviation Toxicology (T. A. Drobyshevskaya, candidate of medical sciences)	196
Severity and nature of effects of toxic chemicals	197
Deleterious chemicals in the air of crew's cabin and passenger sections, and monitoring of condition of air environment	200
Atmospheric ozone	203
Cosmic radiation background	204
Aviation fuel, lubricants and products of oxidative breakdown, Preventive measures related to servicing and overhaul of aviation equipment	206
Aviation fuel. Kerosene. Gasoline	206
Chronic poisoning; effect on the skin; first aid	207
Prevention of poisoning	208
Lubricants	208
A. Mineral oil	209
B. Synthetic lubricants	209
Preventive measures	210
Polymers used in aircraft cabins	217
Toxic chemicals in atmospheric air of airports, and monitoring of the state thereof	218
Chapter 15. Medical Support of Airborne Chemical Work [crop dusting] (L. D. Derevyanko, candidate of medical sciences)	222
Chapter 16. Physiological-Hygienic Principles for Protection of Crews (and Passengers) Against Shortage of Oxygen in the Air (Prof Ye. M. Peshkov, doctor of medical sciences)	229
Chief principles of group protection against low barometric pressure and oxygen shortage in air	229

FOR OFFICIAL USE ONLY

Chief principles for individual protection against low partial oxygen pressure	230
Chief principles and distinctions of physiological-hygienic specifications for oxygen gear and amount of oxygen for flight crew	231
Chief principles and distinctions in setting physiological-hygienic requirements for oxygen gear and amount of oxygen for passengers and stewards	241
Bibliography	245

COPYRIGHT: Izdatel'stvo DOSAAF SSSR, 1980

10,657
CSO: 1840/999

FOR OFFICIAL USE ONLY

UDC: 612.119+612.41

PHYSIOLOGY OF BLOOD--PHYSIOLOGY OF ERYTHROPOIESIS, IN 'TEXTBOOK OF PHYSIOLOGY' SERIES

Leningrad FIZIOLOGIYA SISTEMY KROVI--FIZIOLOGIYA ERITROPOEZA. SERIYA NO 5: "RUKOVODSTVO PO FIZIOLOGII" in Russian 1979 (signed to press 9 Oct 79) pp 2-4, 359-360

[Annotation, foreword (by V. N. Chernigovskiy) and table of contents from book "Physiology of Blood--Physiology of Erythropoiesis, in 'Textbook of Physiology' Series", edited by I. Ya. Ashkinazi et al., Department of Physiology, USSR Academy of Sciences, Izdatel'stvo "Nauka", 3200 copies, 360 pages]

[Text] This book deals with current aspects of physiology of erythropoiesis. Data are submitted on innervation and blood supply of bone marrow, original studies of hemopoietic stem cells and their microenvironment, morphology of erythroid cells of bone marrow. There is a detailed analysis of the role of erythropoietin in regulation of erythropoiesis in normal and pathological conditions, mechanisms of its action and significance of inhibitors of erythropoiesis. Methods for purifying erythropoietin are described. Data are given on biochemistry of erythrocytes, ontogenetic changes in properties of hemoglobin and erythrocytes, physiological mechanisms of hemolysis. Sufficient attention is given to the role of iron and deficiency thereof in production of hemoglobin and erythrocytes, and effect of the spleen on erythropoiesis. Questions of mathematical modeling of erythron are discussed. There are 7 tables, 45 illustrations; bibliography lists 1353 items.

Foreword

This volume is a supplement to the volume of "Physiology of Blood" published in 1968.

In the 10 years that have passed since the first manual was published there has been significant revision of theses, the fundamental role of which in regulation of erythropoiesis had been generally recognized up to that time. This applies, first of all, to the teaching on cellular bases of hemopoiesis. We can state with certainty that new cloning methods of experimental analysis have triumphed; they altered fundamentally the methodological approach to studies of cytological bases of erythropoiesis and radically altered the conception about the hemopoietic stem cell.

The present stage of research on mechanisms of regulation of erythropoiesis is characterized by the use of the latest methods of morphological and functional investigations. Along with classical cytomorphological analysis of blood and

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

hemopoietic organs, they include cytochemical methods of studying metabolism, electron microscopy, radioisotope methods of studying cytokinetics and metabolism, as well as biochemical methods. Use of the new methods deepened significantly our knowledge about molecular and subcellular mechanisms of regulation of erythropoiesis. However, a complex research program should be considered the most promising; it permits development of a conception of the principles of correlation between processes that are formed on different levels--molecular, subcellular, cellular, tissular, systemic--and thus form a judgment about the distinctions of processes involved in regulating erythropoiesis in the body.

Having defined this as the most promising task in the study of physiology of erythropoiesis, we tried to lay the foundation for performing it, submitting chapters in this volume that deal with the role of erythropoietin in regulation of erythropoiesis and that shed light, in particular, on molecular and genetic aspects of the action of erythropoietin, as well as submicroscopic organization of erythroid cells and changes therein under the influence of the hormone.

Significant attention is given to analysis of the mechanisms of renal and extra-renal synthesis of erythropoietin, its chemistry and methods of purification. There is a separate chapter dealing with current conceptions of properties of the hemopoietic stem cell, regulation of its proliferation and differentiation, and formation of erythroid precursor cells.

For the first time, data are concentrated in this manual on blood supply and innervation of the hemopoietic organ, i.e., bone marrow. Comprehensive data are submitted on the role of iron as a factor that limits erythropoiesis, the role of the spleen in physiological destruction of erythrocytes, biochemistry of mature erythrocytes and their role in oxygen transport. There is comprehensive discussion of different aspects of the problem of erythrocyte destruction under physiological conditions. The correlations between processes of breakdown and formation of erythrocytes are analyzed from new vantage points. Presentation of current conceptions of the bases for mathematical modeling of erythron is the logical conclusion of the data published in this volume.

This manual on "Physiology of Erythropoiesis" offered to the reader is based not only on analysis of the extensive literature of recent years, but the results of many years of research by the authors, which renders this work particularly valuable.

Contents	Page
Foreword (V. N. Chernigovskiy)	3
Chapter 1. Blood Supply and Innervation of Bone Marrow (A. V. Petrov, V. G. Sveshnikov)	5
Blood supply to bone marrow	5
Innervation of bone marrow	18
Bibliography	34
Chapter 2. Ultrastructure of Erythron (E. N. Barkova, A. V. Petrov)	41
General description of ultrastructural organization of erythroid cells	41
Submicroscopic organization of hypothetical hemopoietic stem cells	49
Submicroscopic organization of erythroid cells	51
Migration of erythroid cells into the blood stream	57

FOR OFFICIAL USE ONLY

Iron metabolism in erythroid cells	58
Effect of erythropoietin on ultrastructure of erythroid cells	61
Phagocytosis of erythrocytes	62
Ultrastructure of erythroid cells in the presence of hypoxia and hyperoxia	63
Bibliography	67
Chapter 3. The Hemopoietic Stem Cell, Its Differentiation in the Erythroid Direction, Hemopoietic Microenvironment (I. L. Chertkov, A. Ya. Fridenshteyn)	72
Properties of hemopoietic stem cell	74
Hemopoietic microenvironment	75
Erythroid precursor cells	79
Regulation of proliferation and differentiation of hemopoietic stem cells	86
Bibliography	94
Chapter 4. Role of Erythropoietin in Regulation of Erythropoiesis (E. P. Barkova)	97
Molecular and genetic aspects of action of erythropoietin	97
Effect of erythropoietin on activity of delta-aminolevulinic acid synthetase	100
Erythropoietin and cyclic adenosine-3,5-monophosphate	102
Effect of erythropoietin on erythron kinetics	103
Role of erythropoietin in regulation of energy metabolism of erythroid cells and bone marrow	106
Bibliography	112
Chapter 5. Erythropoietin-Forming Function of the Kidneys (O. I. Moiseyeva)	118
The kidneys and erythropoietin	118
Erythropoietin and renal erythropoietic factor--erythrogenin	124
Involvement of different segments of the nephron in erythropoietin production	132
Renal inhibitor of erythropoietin	136
Extrarenal erythropoietin production	138
Regulation of erythropoietin production	143
Bibliography	
Chapter 6. Effect of Inhibitor of Erythropoiesis on Erythron (O. I. Moiseyeva)	159
Erythropoiesis and inhibitor of erythropoiesis	160
Site of production and chemistry of inhibitor of erythropoiesis	162
Mechanism of action of inhibitor of erythropoiesis	165
Bibliography	169
Chapter 7. Iron and Erythropoiesis (V. N. Petrov)	172
Shortage of iron as an erythropoiesis-limiting factor	173
Delayed release of iron from the reticuloendothelial system, and erythropoiesis	193
Bibliography	202
Chapter 8. Biochemistry of Erythrocytes (Kh. M. Rubina)	211
Embden-Meyerhof glycolytic pathway of glucose metabolism	213
Control of Embden-Meyerhof glycolytic chain	221
Pentose-phosphate cycle in erythrocytes	224
Role of the glutathione reductase system in erythrocytes	226
Bibliography	232

FOR OFFICIAL USE ONLY

Chapter 9. Gas-Transport Function of Erythrocytes in Ontogenesis (L. I. Irzhak)	233
Oxygen capacity	234
Oxygenation	235
Affinity for oxygen	236
Carbon dioxide transport by erythrocytes	248
Critical periods	249
Bibliography	251
Chapter 10. The Spleen and Erythrocytes (S. V. Kanayev, M. M. Tushinskaya)	256
Bibliography	271
Chapter 11. Destruction of Erythrocytes (I. Ya. Ashkinazi)	274
General description of the process of destruction of erythrocytes	275
Aging of erythrocytes	283
Utilization of hemoglobin (heme) of old erythrocytes	296
Correlations between the process of erythrocyte destruction and erythrocyte production under physiological conditions and in extreme states	308
Bibliography	319
Chapter 12. Analysis of Regulation in the Red Blood System (Modeling Erythron) (I. I. Gitel'zon, K. K. Dzhanseitov)	335
Bibliography	352
Subject Index	355

COPYRIGHT: Izdatel'stvo "Nauka", 1979

10,657

CSO: 1840/999

FOR OFFICIAL USE ONLY

UDC: 612.13.17.213.74.766

PERIPHERAL 'HEARTS' IN MAN

Minsk PERIFERICHESKIYE "SERDTSA" CHELOVEKA in Russian 1980 pp 2-6, 79

[Annotation, foreword by Prof I. K. Shkhvatsabaya, corresponding member of the USSR Academy of Medical Sciences, introduction and table of contents from book "Peripheral 'Hearts' of Man", by N. I. Arinchin, Institute of Physiology, Belorussian Academy of Sciences, Izdatel'stvo "Nauka i tekhnika", 80 pages]

[Text] Scientists have long since been concerned with the question of why there is no duplication for such an extremely important organ as the heart. Why is there only one heart in an organism?

This pamphlet describes helpers of the central heart, which were discovered in man and animals and which are not contained in the cardiovascular system, but within skeletal muscles, and which were named intramuscular peripheral "hearts." The readers will learn about their function, how peripheral "hearts" can be used as the most efficient helpers of the central heart to alleviate its function, enhance its reliability, strengthen health, prolong life and creative fitness for work in man.

This pamphlet is intended for a wide circle of physicians, instructors and VUZ students.

There are 17 illustrations; bibliography lists 24 items.

Foreword

The heart, circulation and cardiovascular diseases constitute the range of issues that are the most frequent subject of numerous popular science publications, which differ in depth and significance, that have appeared in the last decades in the medical literature. The interest in these matters is understandable, in view of the wide incidence of cardiovascular diseases, which have the sad prerogative of being number one among medical and public health problems, because of their consequences to human health and extent of social and economic detriment to the state.

Therefore, it is understandable that the appearance of publications on this subject could be of interest only if they shed light on new aspects of the problem and advance ideas that can or could be subsequently used to solve practical health care problems.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

In this respect, the pamphlet by N. I. Arinchin, who is known in our country through his work in the field of physiology and pathophysiology of circulation, should attract much interest on the part of readers, including physicians and specialist-cardiologists.

It is interesting, first of all, because the pamphlet is based on ideas that are harmonious with the conception of "peripheral heart" advanced by the Russian scientist, Academician M. V. Yanovskiy, at the start of this century. Up to a certain time, the term, "peripheral heart," was virtually unused in the medical literature or modern physiology, and it was merely mentioned in a historical sense. This occurred because of the extremely contradictory views on this problem, which resulted because of the lack of sufficient scientific facts and use of imperfect methods for studying the circulatory system.

This gap, which was regrettable in our opinion, was filled by a series of numerous scientific studies conducted by N. I. Arinchin and his colleagues. Thanks to them, the question of "peripheral heart" not only inspired interest again, but acquired a new meaning, with emphasis on its practical implications for problems of treatment, rehabilitation and prevention of cardiovascular diseases.

In this relatively small brochure, the author succeeded in submitting, in an attractive and, at the same time, meaningful form, scientific facts with diverse significance and ensuing basic theses referable to different aspects of the problem of "peripheral heart." All of these aspects are essentially listed in the table of contents, which lends clarity to description of the problem, which is sometimes debatable, complex and insufficiently investigated.

In view of the fact that this publication deals with a new problem, there is also inevitable appearance of new terms, for example, "peripheral hearts," "totally isolated intramuscular peripheral heart," "self-sufficient organ" (to which the author refers skeletal muscles), etc., which could prompt discussions among specialists, as well as some doubt as to the validity of using them.

Apart from terminological questions, let us mention the great interest and validation of the author's attempts to use the conception of "peripheral heart" to gain understanding and for future work on purely practical clinical problems. They include, specifically, the effect of an ancillary conditioning regimen on cardiac function and the question of correlation between motor activity and cardiac function in general, the effect of gravity factors on the heart, significance of ancillary [helping] circulatory factors to rehabilitation of patients with cardiovascular diseases, etc.

I am convinced that this pamphlet will be found interesting to readers, and this not because it has a title that is intriguing at first glance, but because it contains new material and theses that broaden our conceptions about the functional patterns of the circulatory system, knowledge about which is important to our understanding of practical problems of preserving health and treating cardiovascular diseases.

Introduction

Reliability of the human body is created by extremely diverse means, including back-up [duplication], i.e., the presence of pairs of organs (vision, hearing,

FOR OFFICIAL USE ONLY

olfaction, secretion [or excretion], etc.) and their interchangeability. For this reason there was no explanation for the fact that our heart had no back-up or helpers, since the search for a "peripheral heart" was unsuccessful.

However, it was found that the heart, which had been considered heretofore to be solitary, has numerous helpers in the form of intramuscular peripheral "hearts." They are still little-known and none of us makes sufficient use of them in our everyday life to relieve the work of our heart. Probably herein lies one of the many reasons why the heart, this sensitive organ that responds to all experiences, the "motor of life," which performs colossal work, becomes diseased, even in young people, leading to premature disability and a high death rate, generating one of the most important problems in the life of modern society.

In this popular pamphlet, an attempt was made to report on the discovery of intramuscular peripheral "hearts," the characteristics of their function, as well as their role in enhancing the reliability of the entire cardiovascular system, prolonging longevity and active creative fitness for work of man.

This pamphlet also deals with potential possibilities of using knowledge about the function of intramuscular peripheral "hearts" in medicine, physical culture and sports, in space biology and in man's everyday life.

Contents	Page
Foreword	3
Introduction	6
Circulation According to W. Harvey	7
Ancillary Circulatory Factors	13
Skeletal Muscle--an Independent Pump	23
Mysteries of skeletal muscles	23
Discovery of pumping capacity of skeletal muscles	26
Discovery of suction capacity of skeletal muscles	31
Same direction of discharge [pumping] and suction function of skeletal muscles	32
Entirely isolated intramuscular peripheral 'heart'	33
Micropump Mechanism of Intramuscular Peripheral 'Heart'	35
How Does the Intramuscular Peripheral 'Heart' Function?	40
Intramuscular pumps during man's rhythmic movement	41
Intramuscular pumps during static tension	42
Pumping property during extension of skeletal muscles	43
Intramuscular pumps in massage of muscles	45
Intramuscular pumps with skeletal muscles at rest	45
Classification of Muscular Pumps	48
Integral System of Circulation	51
Ancillary Training Regimen for Man's Cardiac Function	53
Why is Exercise Beneficial for the Heart?	55
Movement Is Life	58
It Is Not the Legs, but the Heart That Reaches the Finish Line	61
Movement and Space	64
Man's Peripheral 'Hearts' and Medicine	67
Man's Future	72
Conclusion	75
Recommended Reading	78

COPYRIGHT; Izdatel'stvo "Nauka i tekhnika", 1980.

10,657

CSO: 1840 /999

41

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

UDC: 51.62

MEDICAL AND PHYSIOLOGICAL CYBERNETICS

Kiev MEDITSINSKAYA I FIZIOLOGICHESKAYA KIBERNETIKA in Russian 1980 (signed to press 8 Jul 80) pp 2, 93, 95-98

[Annotation, abstracts and table of contents from book "Medical and Physiological Cybernetics", edited by N. M. Amosov, academician of the Ukrainian Academy of Sciences, Scientific Council for the Problem of "Cybernetics," Order of Lenin Institute of Cybernetics, published by the Institute of Cybernetics, 450 copies, 98 pages]

[Text] This book deals with problems of automation of medical examinations, creation of formalized case histories, software for processing of results of instrumental studies. Articles are submitted on physiological cybernetics, which are related to studies of circulatory, heat regulating and tissular respiratory systems. This collection contains several works dealing with experimental studies of control processes in the circulatory system during conditioning for physical and emotional loads.

This collection is intended for scientists, engineers, mathematicians, physicians, as well as undergraduate and graduate students concerned with problems of medical and physiological cybernetics.

UDC: 615.847/088.5/

SOME OF THE MEANS OF CONTROLLING PANCREATIC SECRETION

[Abstract of article by L. S. Aleyev, M. I. Vovk, N. P. Tsaplina]

[Text] A description is given of approaches to control of exocrine function of the pancreas on the basis of electrostimulation. An algorithm is given for activation and depression of pancreatic secretion with normal function thereof. There is substantiation of the possibility of control of exocrine function of this gland by the stomach and duodenum by means of complex electrostimulation of these organs. There is 1 illustration; bibliography lists 7 items.

FOR OFFICIAL USE ONLY

UDC: 615,847/088,8/

SIGNIFICANCE OF AUTOMATIC DETERMINATION OF EXCITATION THRESHOLD TO THE DESIGN OF BIOELECTROSTIMULATORS WITH SELF-ADJUSTMENT ELEMENTS

[Abstract of article by V. N. Gorbanev]

[Text] The importance of determining the threshold of muscular excitation is demonstrated, with reference to equipment for bioelectric control. A method is described for automatic determination of excitation threshold of a stimulated muscle and execution thereof is demonstrated. There are 2 illustrations; bibliography lists 5 items.

UDC: 612.8

SOME CHANGES IN MULTICELLULAR ACTIVITY AS A RESULT OF FORMING AN ARTIFICIAL STABLE FUNCTIONAL CONNECTION

[Abstract of article by P. V. Bundzen and Ye. S. Perkova]

[Text] This article deals with the study of some patterns of change in neuronal activity of different regions of the brain during electrical stimulation of several structures of the human brain. Analysis of multicellular activity is made by forming matrices of an artificial, stable, functional connection. There are 3 illustrations; bibliography lists 4 items.

UDC: 612.13

EFFECT OF EPINEPHRINE, EXERCISE AND EMOTIONAL EXCITEMENT ON THE CIRCULATORY SYSTEM

[Abstract of article by L. D. Palets and T. Ye. Kochetenko]

[Text] It is demonstrated that systemic circulatory reactions maintain the initial arterial pressure level after infusion of epinephrine. With exercise and emotional loads, there is moderate elevation of arterial pressure and increase in heart rate, more significant in the latter case, in spite of the baroreflex influences. There is 1 table; bibliography lists 9 items.

UDC: 612.13

EFFECT OF CHANGE IN TOTAL BLOOD VOLUME AND ORTHOSTATIC TESTS ON HEMODYNAMICS

[Abstract of article by O. I. Lissova]

[Text] A comparative analysis is made of orthostatic and antiorthostatic factors with moderate changes in total blood volume. It was demonstrated that there are similarities and differences in both effects on hemodynamic parameters and regulatory reactions. There are 2 tables; bibliography lists 9 items.

FOR OFFICIAL USE ONLY

UDC: 57:53+612.13

MODELS OF HEMODYNAMIC REACTIONS TO FACTORS CAUSING REDISTRIBUTION OF BLOOD

[Abstract of article by R. D. Grigoryan and B. L. Palets]

[Text] This work deals with mathematical modeling of circulatory regulation with change in spatial position of the body and creation of subatmospheric pressure in the lower half of the body [LBNP]. A comparison of these factors demonstrates similarities and differences, and their possible diagnostic value. There are 3 illustrations; bibliography lists 13 items.

UDC: 57:53+612.13

ANALYSIS OF REGULATORY PROCESSES IN THE SYSTEM OF THERMAL HOMEOSTASIS

[Abstract of article by I. I. Yermakova]

[Text] The author submits the results of modeling two hypotheses concerning regulation of the system of thermal homeostasis. The role of central and peripheral circuits is demonstrated in the process of regulating "nuclear" temperature. There are 3 illustrations; bibliography lists 12 items.

UDC: 681.3.01:621.372.5

FORECASTING ACCELERATION PROCESSES

[Abstract of article by P. V. Vasilik]

[Text] Analysis was made of the changes in body length of draftees over the last 100 years. Typical changes were distinguished for periods of about 20 years each, which are close to a logistic curve. These changes are attributable to the 22-year cycle of solar activity (mediated by changes in geomagnetic activity) and growth (by the logistic law) of force of artificial electromagnetic fields in the last 50 years. Typical elements were isolated in the 100-year changes in length of the human body, and they were used as the basis for forecasting future changes in height. There is 1 illustration; bibliography lists 8 items.

UDC: 612.014

SOFTWARE AND ALGORITHMS FOR AUTOMATED PROCESSING OF ORTHOGONAL ELECTROCARDIOGRAMS

[Abstract of article by T. A. Volkonskaya and E. M. Maslova]

[Text] This article deals with problems related to automated processing of electric signals of the heart. The structure of the software is described. A block diagram of software [programs] and algorithms is submitted. Bibliography lists 4 items.

FOR OFFICIAL USE ONLY

UDC: 612.8

DEVELOPMENT OF IMPLANTED METAL-CONTAINING POLYMER ELECTRODES FOR ELECTROSTIMULATION OF LIVING TISSUES

[Abstract of article by L. S. Aleyev, L. I. Bakhteyeva and Sh. Yu. Yakupov]

[Text] This article deals with problems of development and choice of implanted electrodes for electric stimulation of living tissues. The authors describe a biomedical electrode they developed, which is based on metal-containing polymer, and furnish its main physical and technical specifications. Bibliography lists 1 item.

AUTOREGRESSION MODELS OF DYNAMICS OF HEART RATE

[Abstract of article by A. A. Popov and S. M. Makeyev]

[Text] This work deals with the physiological aspects of using autoregression models to describe time series of the cardiac cycle, for the purpose of analyzing processes of regulation of cardiac rhythm. Formulas are offered for determination of parameters of first and second order autoregression models, which makes this work particularly useful to medical specialists who do not have a good mathematical background. There is 1 illustration; bibliography lists 6 items.

UDC: 61.62-50.61

ALGORITHMS FOR DIAGNOSING PERIODONTOSIS

[Abstract of article by B. V. Antonishin]

[Text] A description is given of the process of diagnosing periodontosis in a patient, and the main elements of the diagnosis are characterized. A system is offered for diagnosing periodontosis with the use of mathematical logic. There are 2 illustrations; bibliography lists 4 items.

Contents	Page
Some of the Means of Controlling Pancreatic Secretion (L. S. Aleyev, M. I. Vovk, N. P. Tsaplina)	3
Significance of Automatic Determination of Excitation Threshold in the Design of Bioelectrostimulators With Self-Adjustment Elements (V. N. Gorbanev)	10
Some Changes in Multicellular Activity as a Result of Forming an Artificial Stable Functional Connection (P. V. Bundzen, Ye. S. Perkova)	16
Effect of Epinephrine, Exercise and Emotional Excitement on the Circulatory System (L. D. Palets, T. Ye. Kochetenko)	25
Effect of Change in Total Blood Volume and Orthostatic Tests on Hemodynamics (O. I. Lissova)	30
Models of Hemodynamic Reactions to Factors Causing Redistribution of Blood (R. D. Grigoryan, B. L. Palets)	37

FOR OFFICIAL USE ONLY

Analysis of Regulatory Processes in the System of Thermal Homeostasis (I. I. Yermakova)	48
Forecasting Acceleration Processes (P. V. Vasilik)	60
Software and Algorithms for Automated Processing of Orthogonal Electrocardiograms (T. A. Volkonskaya, E. M. Maslova)	69
Development of Implanted Metal-Containing Polymer Electrodes for Electrostimulation of Living Tissues (L. S. Aleyev, L. I. Bakhteyeva, Sh. Yu. Yakupov)	76
Autoregression Models of Dynamics of Heart Rate (A. A. Popov, S. M. Makeyev)	80
Algorithms for Diagnosing Periodontosis (B. V. Antonishin)	87

COPYRIGHT: Institut kibernetiki, 1980.

10,657
CSO: 1840/999

FOR OFFICIAL USE ONLY

MAN AND BIOLOGICALLY ACTIVE SUBSTANCES

Moscow CHELOVEK I BIOLOGICHESKI AKTIVNYYE VESHCHESTVA in Russian 1980 (signed to press 4 Aug 80) pp 2-5, ...

[Annotation, foreword and table of contents from book "Man and Biologically Active Substances", by Izrail' Itskovich Brekhman, second edition, revised, in the series "Man and the Environment", USSR Academy of Sciences, Izdatel'stvo "Nauka", 200,000 copies, 119 pages]

[Text] This book discusses biologically active substances of natural origin, which enhance man's resistance to diseases and adaptability to different living conditions. The effects of tonic (fortifying) substances from plants--eleutero-coccus, lemon tree, aralia, ginseng and many others-- are described. Analysis is made of the effects of such biologically active substances as vitamin C, pantocrin [hormone derived from reindeer horns], tea, coffee, etc. In the author's opinion, use of these substances is one of the ways of strengthening health.

Foreword

Biologically active substances are often equated with drugs. But drugs are merely a special instance of biologically active substances. Considerably larger amounts of such substances are contained in foods. They include chemical stimulants (tea, coffee), toxic (fungi), narcotic (poppy) substances, as well as those with a therapeutic and preventive action (carrots, cabbage, rhubarb, prunes and others). The average amount of drugs taken by one man over his entire lifetime would fit in his two palms. Immeasurably large amounts of biologically active substances are ingested with foods consumed over a lifetime--meat, fish, vegetables, fruit, as well as tea, wine, beer and other beverages. While a man consumes an average of 1 kg solids (without water) with foodstuffs per day, in 70 years the amount ingested would constitute more than 25 tons. This includes many thousands of biologically active substances, which is immeasurably more than the dozens or hundreds of chemicals ingested in the form of medication.

In spite of the abundant intake of biologically active substances with food, which have enormous significance to human health, they have been studied relatively little. Science has concentrated mainly on the therapeutic effects of drugs and some of the harmful ingredients in food.

Primitive man, in his search for food, tried all of the plants, all of the animals, birds, fish and many other sources of food that he could reach. He discovered that, in addition to satiety, many of the items he consumed had some sort of

FOR OFFICIAL USE ONLY

additional effect on him. Some plants induce perspiration and others, itching over the entire body. Some make one happier, while others cause discomfort. Many plants and animals are poisonous, even lethal. Thus, mankind accumulated experience, which then was transformed into the science of drugs, i.e., pharmacology. At first, people did not know very much about diseases, of which there are now known to be thousands, but they were well aware of the fact that one "potion" made a person feel good, another--poorly, one was beneficial and another harmful.

Pharmacology has grown to be mainly pharmacotherapy, i.e., the science dealing with treatment of diseases. But, when man is not sick, when he is in good health, he does not restrict himself in the choice of food, he smokes, drinks alcoholic beverages, uses sauces, spices, vegetables, fruit, etc. A flow of substances is ingested. As stated by the great dialectician of ancient Greece, Heraclitus, our bodies are like streams and matter is renewed in them like water in a current. These substances determine the condition, health and life of an organism.

Is there a science that deals with this problem as a whole? The science of nutrition deals in essence with hygiene of nutrition and alimentary sanitation. The range of biologically active substances that it studies is limited to vitamins, trace elements and a very small assortment of substances. Intake of all sorts of alcoholic and nonalcoholic beverages, to which increasingly diversified complexes of biologically active substances are added, did not become the subject of research. Smoking tobacco and chewing betel are left beyond the field of vision of science. Spices, sauces, berries, fruit, honey, various beverages made at home and many other products have not yet become the subjects of serious pharmacological studies. Any new synthetic drug is studied for a long time and comprehensively. Yet honey, for example, which people have been consuming for several thousand years, has not been studied seriously.

It should be noted that drugs too vary. Some have distinct and potent action, and they are used to treat the sick and save the dying. But there are also drugs whose action develops gradually, over weeks and months. They are beneficial, since they strengthen health, make the body more resistant to all sorts of difficulties and diseases. Such drugs are closer to beneficial food than medicinal substances. They include ginseng, eleuterococcus and plants with similar action, horns of the young axis and other deer species, the horns of the Saiga tatarica L. and certain aquatic invertebrates, which had been the objects of pharmacological studies of this author for 30 years.

Thus, the life of a healthy man involves the constant effects of many biologically active substances, which determine his condition, resistance to diseases, work capacity and creativity. This area has been studied very inadequately. This book does not presume to fill the gap in any significant way. It has a more modest purpose, that of pointing to a very important field, in which research has yet to be conducted.

	Page
	48
Contents	
Foreword	3
Chapter 1. Life and Health	6
What is life?	9
Health	20
Third state	24
Biologically active substances	31
Structural information	

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

Pharmacology of health (pharmacohygiene)	39
Chapter 2. Biologically Active Substances in Man's Life	47
Prophylaxis	47
Professional activities	58
Birth rate	63
Healthy old age	66
Preservation of health under difficult and extreme conditions	73
Control of excesses	80
Chapter 3. Biologically Active Substances--Pharmacohygienic Agents	86
Healthy food	86
Drugs for those in good health	98
Chapter 4. A Look Into the Future	102
Pharmacology	102
Scientific Prognosis	108
Conclusion	113
Bibliography	117

COPYRIGHT: Izdatel'stvo "Nauka", 1980

10,657

CSO: 1840/999

FOR OFFICIAL USE ONLY

UDC: 616.014.4-063

MEDIATOR MECHANISMS OF REGULATION OF RESPIRATION AND CORRECTION THEREOF IN THE PRESENCE OF EXTREME STATES

Leningrad MEDIATORNIYYE MEKHANIZMY REGULYATSII DYKHANIYA I IKH KORREKTSIYA PRI EKSTREMAL'NYKH SOSTOYANIYAKH in Russian 1979 (signed to press 7 Sep 79) pp 2-5, 200

[Annotation, introduction and table of contents from book "Mediatory Mechanisms of Regulation of Respiration and Correction Thereof in the Presence of Extreme States", by German Yakovlevich Bazarevich, Uzbek Yakubovich Bogdanovich and Irina Nikolayevna Volkova, Izdatel'stvo "Meditsina", 5000 copies, 200 pages, illustrated]

[Text] This book describes comprehensively the mediator mechanisms of regulation of respiration under normal conditions, in the presence of traumatic shock, acute and massive loss of blood, brain trauma, combined trauma to the skull and skeletomuscular system, acute pancreatitis and peritonitis. It was proven that activation of the adrenergic system induces faster breathing and inhibition induces slower breathing. There is a description of phasic changes in mediator activity at different stages of formation of pathological sets of symptoms in the presence of extreme states and with artificially induced surplus or shortage of adrenergic, cholinergic and serotonergic complexes. The pathogenesis of "lung shock" is identified in the light of pathophysiological and pathomorphological parallels. A method was developed for experimental therapy of respiratory disturbances in the presence of the extreme states studied, as related to the stage of the process, by means of using pharmacological agents that affect mediator metabolism. It was learned that normalization of respiration in extreme situations increases drastically the survival of experimental animals. On the basis of their studies, the authors propose and have made clinical use of methods of normalizing respiration in the presence of traumatic shock, massive hemorrhage, cerebral trauma, combined trauma to the skull and skeletomuscular system, acute pancreatitis and peritonitis, which are based on the use of tried and true neurotropic agents--cholinesterase, serotonin, cholinomimetics combined with hydrocortisone.

This book is intended for pathophysiologicals, resuscitation specialists, traumatologists and surgeons.

This publication contains 39 figures and 21 tables; bibliography lists 368 items.

Introduction

At the present time, there is a distinct conception of morphology and physiology of respiratory organs, starting with the nasal passage and ending with the cells of the

FOR OFFICIAL USE ONLY

alveolar epithelium. The conception of airways as passive air ducts has been entirely rejected; the role of bronchopulmonary muscles has been proven in formation and correction of physiological and pathological atelectases; the teaching on lung surfactant as the most important factor in the function of pulmonary alveoli and all of the parenchyma of the organ as a whole is undergoing a "rebirth."

In essence, the current conception of regulation of respiration has also been formed. The conception of the respiratory center, formulated by N. A. Mislavskiy (1885) was developed in the studies of numerous authors, in particular by the school of M. V. Sergiyevskiy (1950-1975). It was proven that the respiratory center has automatism, which is related to its distinctive metabolism and is maintained by afferent impulsion and influences from the higher branches of the brain.

Communication between the respiratory center and effector organs--the lungs--is provided through the system of the trigeminal, phrenic and vagus nerves and adjacent sympathetic trunk. Receptors of the alveolar parenchyma, which "function to expand and collapse," are of special importance.

The system of the vagus plays the leading role in neuroreflex regulation of respiration. At the same time, diencephalic and cortical structures, which refine and complicate regulation of respiration under the continuously changing environmental conditions, are rather important in man.

Studies were also made of the second route of regulating respiration, the humoral one. It was demonstrated that blood CO₂ tension affects both the chemoreceptors of vascular reflexogenic zones and chemoreceptive corpuscles right near the respiratory center. The significance of changes in blood pH to regulation of respiration is discussed.

The significance of neuromediators to maintenance of adequate respiratory function has been studied considerably less. The most comprehensive studies of the effects of the adrenergic mediator on respiration, which were conducted in the laboratory of M. V. Sergiyevskiy (1975), demonstrated that, depending on the mode and site of administration, catecholamines act as stimulators or inhibitors of pulmonary ventilation.

Numerous experiments dealing with the effects of a mediator such as acetylcholine revealed that when it acts on central nervous structures there is most often a two-phase effect on the respiratory system: first depression of respiratory function and then stimulation. With peripheral action of acetylcholine, there is usually intensification of respiration.

In the last few years, serotonin has inspired the close scrutiny of clinicians and theoreticians; not infrequently it is called a "neurohormone" because of its affinity with elements of the nervous system. Studies of its effects on respiration led authors to contradictory results. Data were obtained indicative of both activation and depression of external and tissular respiration under the influence of this mediator. Thus, T. P. Il'ichenko (1970) discovered a two-phase reaction to serotonin--depression of respiration followed by intensification.

Thus, it may be considered that the most important problem--definition of the place and significance of mediator systems in regulation of respiration--has only been solved thus far in the first approximation, and that it is waiting for further development.

FOR OFFICIAL USE ONLY

Until recently, not enough attention had been given to respiratory function under extreme conditions, i.e., in expressly the situation where the main systems of life support of the body and, ultimately, the body's ability to continue to exist are put to the test of enduring "wear and tear." These considerations prompted us to conduct systematic experimental and clinical studies of respiration under normal and pathological conditions, taking into consideration the role of adrenergic, cholinergic and serotonergic mechanisms of regulation thereof.

Having established the general patterns of respiratory disorders as related to changes in mediator activity, we undertook the study of activity of mediator systems in the presence of extreme states--acute hemorrhage, traumatic and hemorrhagic shock, cerebral trauma and combined trauma to the skull and skeletomuscular system, extensive peritonitis and acute pancreatitis. For better verification of the results we obtained, we conducted additional studies with artificial activation or inhibition of a given mediator system. Of course, the most interesting phase of the study was the attempt to treat respiratory disorders in the presence of the above-mentioned extreme states (both experimentally and under clinical conditions) by normalizing the levels of the appropriate mediators in the body.

It must be stipulated that the authors by no means consider respiratory disturbances to be the sole or prime factor in the pathogenesis of shock, skull trauma, combination thereof with injury to the skeletomuscular system, let alone acute inflammatory diseases of the abdominal cavity. However, it is unquestionable that there are respiratory disturbances with these extreme states, and they aggravate the clinical signs; for this reason, normalization of such an important function cannot fail to affect the function of other vital systems. In addition, the breadth of physiological effects of mediators suggests that there are numerous points of their application and universality of influence on all elements involved in maintaining homeostasis. Indeed, there was reliable increase in survival rate of experimental animals when breathing was "controlled" through mediator mechanisms in all series of experiments. Clinical trials of some of the methods developed experimentally for normalizing mediator activity and respiratory function also yielded encouraging results.

The investigations that served as the basis of this monograph are the collective labor that was described in numerous publications and competent works. We consider it our pleasant duty to express our sincere appreciation to our students and colleagues: M. A. Aydarov, M. Kh. Sadekov, L. V. Makarova, A. K. Kolesnikov, V. Yu. Tereshchenko, G. V. Maslen, Yu. A. Ukhanova, S. G. Grigorenko, A. M. Devyatayev, A. L. Kirillov, V. Ye. Krylov, B. P. Natsvlshvili, I. G. Abuzyarov, A. G. Samoylov, L. V. Lazareva and others who participated in working on the problem in question.

The experimental studies were conducted in the department of normal physiology of the Kazan' State "Order of Red Banner of Labor" Medical Institute imeni S. V. Kurashov (department head--Prof I. N. Volkova, Honored Scientist of the Tatar SSR) and in the laboratory of pathophysiology (headed by G. Ya. Bazarevich, doctor of medical sciences) of the Kazan' Scientific Research Institute of Traumatology and Orthopedics (Prof U. Ya. Bogdanovich--director). Clinical observations and tests were conducted at the Kazan' Municipal Oncological Dispensary (I. B. Nagimov--chief physician) and in the department of resuscitation of the Kazan' Scientific Research Institute of Traumatology and Orthopedics (A. O. Likhtenshteyn, doctor of medical sciences, head of the clinical department).

FOR OFFICIAL USE ONLY

In the opinion of the authors, the involvement of representatives of different medical specialties--a physiologist, pathophysiological, traumatologist, surgeon and resuscitation specialist--in working on the problem should have provided a harmonious blend of in-depth theoretical research with practical orientation.

This book is the logical continuation of the traditional scientific research conducted in the department of physiology of the Kazan' Medical Institute dealing with the study of physiology of respiration, which originated with the classical experiments of N. A. Mislavskiy, and determination of the physiological role of mediators, which is linked with the names of A. F. Samoylov and A. V. Kibyakov. The material in this monograph also reflects the main scientific topics of the Kazan' Scientific Research Institute of Traumatology and Orthopedics, whose staff has been studying the body's reactions to trauma for the last few years.

Just how successful this book is, is up to the reader. The authors would be grateful for any advice and comments.

Contents	Page
Introduction	3
Chapter 1. The Role of Neuromediators in Regulation of Respiration	6
Significance of cholinergic system to function of the respiratory system	6
Catecholamines and respiratory function	34
The role of serotonin in regulating respiration	46
Chapter 2. Neuromediators and Respiratory Function in the Presence of Hemorrhage and Shock	58
Chapter 3. Mediator Metabolism and Respiratory Function in the Presence of Cerebrocranial Trauma	100
Chapter 4. Neurohumoral Correlations and Respiratory Function in the Presence of Combined Trauma to the Skull and Skeletomuscular system	124
Chapter 5. Neuromediators and Respiratory Function in the Presence of Inflammatory Diseases of the Abdominal Cavity	143
Acute peritonitis (A. O. Likhtenshteyn)	144
Acute pancreatitis	159
Conclusion	170
Bibliography	184

COPYRIGHT: Izdatel'stvo "Meditsina", 1979

10,657

CSO: 1840/999

FOR OFFICIAL USE ONLY

CLINICAL RESEARCH LINKS EMOTIONAL STRESS, CARDIOVASCULAR DISEASE

Moscow EMOTSIONAL'NOYE NAPRYAZHENIYE I REAKTSII SERDECHNO-SOSUDISTOY SISTEMY in Russian 1980 (signed to press 25 Jun 80) pp 2-5, 240

[Annotation, table of contents, and introduction from book "Emotional Stress and Reactions of the Cardiovascular System", by Yevgeniy Ivanovich Sokolov, Viktor Petrovich Podachin and Yevgeniya Valer'yevna Belova, USSR Academy of Sciences Institute of Higher Nervous Activity and Neurophysiology, Izdatel'stvo "Nauka", 3,600 copies, 240 pages]

[Text] This monograph is devoted to reactions of the cardiovascular system in response to various forms of emotional stress in healthy people and hypertension patients. The authors employed an extremely broad spectrum of techniques, from analyzing catecholamine excretion to recording rheoencephalograms, GSR's, and EEG's, in order to describe the unique features of emotional stress experienced by the individual in different conditions, including in conflict situations.

Subtle local changes in the tone of cerebral vessels are revealed and described, both in a time of relative rest and in the course of mental activity and emotional stress.

The research is used as a basis for both practical recommendations on how to reveal different forms of emotional stress, and measures for correcting the pathological consequences on the part of the cardiovascular system in response to this stress.

Tables--36, figures--54, bibliography--21 pages.

Contents	Page
Introduction	3
Chapter 1. Modeling Emotional Stress	6
Chapter 2. The Autonomic Nervous System's Reactions to Emotional Stress . .	17
Chapter 3. Changes in the Electrocardiogram in Response to Negative Emotions	82
Chapter 4. Reactions of Cerebral Vessels to Mental Activity	103

FOR OFFICIAL USE ONLY

Chapter 5. The Psychological Profile of the Hypertension Patient's Personality 129

Chapter 6. The Role of Hereditary and Environmental Factors in the Cardiovascular System's Reactions to Psychoemotional Stress and Physical Loads 149

Chapter 7. Change in Blood Coagulation Activity in Response to Emotional Stress in Hypertension Patients 164

Conclusion 206

Bibliography 218

Introduction

Changes which had occurred during the last few decades in the structure of activity, resulting in greater significance of the human factor in production control, and in arisal of a number of new occupations characterized by pronounced emotional stress, have compelled scientists to study the multifaceted mosaic of emotional stress from the positions of psychology, physiology, and clinical medicine.

Man's relationship to the environment is unique in that in his purposeful activity, he must adapt to changing environmental conditions: the accelerating pace and rhythm of life, growth in the flow of information, intensification of activity associated with interpersonal relations, a perpetual lack of time, and so on. Under these conditions man experiences emotional stress not simply as a psychophysiological reaction to some sort of stress factors. Instead, emotional stress is an integrative indicator of mental activity arising in the course of social communication among people at work and at home, and associated with a conceptual model of particular situations, often conflicting ones.

In this time of the scientific-technical revolution, when much money and time must be expended to train a specialist, proper occupational selection of individuals for a given form of activity acquires great significance. The structure of the personality, its psychophysiological determinants, and the given individual's resistance to stressful influences are closely associated with the effectiveness and reliability of activity performed in complex conditions causing emotional stress.

In its specific form, emotional stress is not a chance manifestation of certain forms of human activity, but the natural result of the changing content and structure of the production activities of people experiencing the dynamic flow of production in the scientific-technical revolution. Emotions are a special form of the organism's mutual relationship to the external world, mediating change in the social environment and the nature of human mutual relationships. Participating in the outside world's assimilation, emotions elicit integrative changes in the body's physiological and biochemical functions, and they affect various systems: mental, neurohumoral, hormonal, autonomic, and so on. Long-acting negative emotions may sometimes break down regulation of the activities of organs and body systems.

Research on human activity in the presence of emotional stress affords a possibility for evaluating the deviation limits for mental and physiological parameters in

FOR OFFICIAL USE ONLY

situations meaningful and habitual to the subject. Emotional stress has a dynamic influence upon the individual's objective activity, in a sense superimposing itself over this activity as an emotional and motivational component. While the motivational component regulates the individual's mental activity in accordance with his needs, sets, and the meaningfulness of his activity, the emotional component in a sense brings this mental activity into being, turning on all of the mechanisms of the individual's vital activities, in the form of different physiological determinants which define the stability of homeostasis in the activities of different organs and systems. In the presence of emotional stress, such mobilization of mental and physiological mechanisms promotes maintenance of a high functional level in mental and biological processes. In our research, motivation was mainly a means for realizing the individual's potentials.

This monograph presents materials that had been obtained in a therapeutic clinic through the joint efforts of clinicists, physiologists, and psychologists. The authors conducted research for several years on emotional stress in 100 healthy individuals and more than 300 patients with stages I and II hypertension. Hypertension patients were chosen because arterial pressure parameters undergo change in the presence of emotional stress, and one of the etiological factors of hypertension is long-lasting emotional stress. Therefore, studying the reaction of the healthy body and the patient with the initial stages of hypertension to emotional stress, we attempted to study those initial elements of disintegration of the human body's regulatory adaptive mechanisms which make up the basis of the pathogenesis of vascular diseases, hypertension in particular. We selected several models with which to simulate emotional stress: a single standardized situation of mental activity performed against the clock, group interaction, the correction test, and Kraepelin's tables. Creating emotional stress in healthy individuals and hypertension patients, we studied deviations in various physiological constants, and we noted the qualitative and quantitative limits of disintegration of adaptive mechanisms. We devoted special attention to brain biocurrents and autonomic indicators, assuming that homeostasis of nervous and cerebral bioelectric processes is the first adaptive element permitting the individual to maintain an equilibrium with the environment. We found that cerebral blood flow, which correlates subtly with the nature of mental activity and which reflects both the hereditary and the environmental dominant, is a very informative indicator.

The reaction of the coagulation and anticoagulation systems to emotional stress also revealed a large number of interesting laws reflecting the individual psychological determinants of the personality, and the qualitative nature of simulated emotional stress. The mosaic nature of regulatory adaptive mechanisms of the coagulation system operating in response to emotional stress affords a possibility for developing preventive measures against thrombic complications in hypertension patients.

We are aware that when human activity is studied in clinical and laboratory conditions, experimentally simulated emotional stress is not equivalent to that state which arises in a real production situation. But such simulation has a number of advantages. First of all by standardizing the situation for individual activity, we were able to compare deviations in mental and physiological parameters exhibited by different persons in response to the same load. Determination of this load's psychophysiological meaningfulness to individuals with different personality features permitted us to in a sense isolate the most optimum personality traits and the most economical psychophysiological processes in relation to the performance of emotionally stressful activity.

FOR OFFICIAL USE ONLY

This analysis is the result of analyzing data obtained in the course of several years at the department of facultative therapy of the Moscow Medical Stomatological Institute. Research conducted by department colleagues V. I. Volkova, G. B. Golovanova, R. P. Kolokolenkina, and A. S. Mal'tseva played an important role. A. F. Bystritskaya of the Institute of Biomedical Problems served as a consultant in the administration of personality tests to healthy subjects and patients. Professor B. M. Fedorov provided consultative assistance to the research. The authors are sincerely grateful to all of these comrades for their creative cooperation.

COPYRIGHT: Izdatel'stvo "Nauka", 1980

11004

CSO: 1840/192

FOR OFFICIAL USE ONLY

RADIATION BIOLOGY

UDC 355.058

ELIMINATION OF THE CONSEQUENCES OF RADIOACTIVE CONTAMINATION

Moscow LIKVIDATSIYA POSLEDSTVIY RADIOAKTIVNOGO ZARAZHENIYA in Russian 1980 signed to press 18 Apr 80 pp 2, 3-6, 118-119

[Annotation, preface and table of contents from the book "Likvidatsiya posledstviy radioaktivnogo zarazheniya" by Vadim Aleksandrovich Gaydamak, edited by M. T. Maksimov, Izdatel'stvo Atomizdat, 50,000 copies, 120 pages]

[Text] The primary questions are presented for elimination of the consequences of radioactive contamination. Recommendations are made for the use of national equipment for decontamination work, as well as for the technique of training the personnel of nonmilitarized formations of civil defense for elimination of the consequences of radioactive contamination.

This book can be used by teachers of civil defense in educational institutions, civil defense courses, commanders of nonmilitarized civil defense formations, and the population that is studying civil defense as the general, mandatory minimum of knowledge for protection against mass contamination weapons.

Contents	Page
Preface	3
Chapter 1. Radioactive Contamination of the Environment	7
1.1. Radioactive Contamination during a Surface Nuclear Explosion	7
1.2. Characteristics of Ionizing Radiation	10
1.3. Consequences of Radioactive Contamination	11
Chapter 2. Fundamentals for Elimination of Consequences of Radioactive Contamination	16
2.1. Observance of Permissible Irradiation Doses	16
2.2. Decontamination of Contaminated Objects	19
2.3. Measures for Reducing Entrance of Radioactive Substances into the Human Body	23
2.4. Prevention of Radiation Injuries to Skin Integuments	25
2.5. Use of Preventive Resources and Treatment of Injured	26
2.6. Increase in Psychological Stability of Personnel of Formations and the Population	27
Chapter 3. Resources Used for Decontamination	29
3.1. Decontaminating Substances and Solutions	29

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

3.2. Special Technical Means of Decontamination	37
3.3. Machines Used for Cleaning Cities	40
3.4. Agricultural Equipment	44
3.5. Road Machines	45
3.6. Machines for Construction-Finishing Work	47
3.7. Machines of Public Utilities and Enterprises of General Services	48
Chapter 4. Preparation and Conducting of Decontamination Measures	50
4.1. Determination of Possible Volumes of Work to Decontaminate a Territory and Structures in Cities, and Sequence for Conducting It	51
4.2. Preparation of Personnel in Formations	56
4.3. Actions of Formations in Fulfillment of Decontamination Work	63
Chapter 5. Sanitary Treatment of People	72
5.1. Partial Sanitary Treatment	73
5.2. Complete Sanitary Treatment at Sanitation-Washing Stations	73
Chapter 6. Decontamination of Clothes, Shoes and Resources of Individual Protection	78
6.1. Partial Decontamination	79
6.2. Complete Decontamination at Stations for Decontamination of Clothes	81
Chapter 7. Decontamination of Transportation Vehicles and Equipment	87
7.1. Partial Decontamination	89
7.2. Complete Decontamination at Stations of Decontamination of Transport	91
Chapter 8. Decontamination of Territories and Structures	98
8.1. Decontamination of Territory with Hard Pavement	101
8.2. Decontamination of Territory That Does Not Have a Hard Pavement	103
8.3. Features of Decontamination of Territory under Winter Conditions	106
8.4. Decontamination of Structures	108
Chapter 9. Decontamination of Food and Water	110
9.1. Decontamination of Food and Containers	111
9.2. Decontamination of Water	114
List of Literature Used	117
Preface	

Nuclear weapons have the greatest injurious effect as compared to any other known weapons of mass destruction. The destructive factors of nuclear weapons are the shock wave, light radiation and penetrating radiation. They have a short-term effect, while in contrast, the radioactive contamination can create a threat of injury to people on a vast territory for a long time.

As a result of the test explosion about 15 MT in power made by the United States in the Pacific Ocean on the Bikini atoll on 1 March 1954, strong radioactive contamination was observed in a band extending over 530 km and 100 km wide. Several islands located to the east of the test site, and the Japanese fishing vessel

FOR OFFICIAL USE ONLY

the "Lucky Dragon" that was 160 km from the explosion site were exposed to radioactive contamination. The residents of the islands received a radiation dose from 14 to 175 R*. Radiation injuries to the skin integuments and changes in the blood composition were observed in many of them. As a result of radioactive dust fallout on the fishing vessel, all 23 crew members received a radiation dose of about 200 R and experienced radiation sickness. One person died from it. If the ship command had not washed the radioactive fallout overboard after it fell, the consequences of the irradiation could have been even more serious for the people.

Different countries have currently accumulated a large quantity of nuclear ammunition. Their mass application in case of the outbreak of a nuclear war will entail radioactive contamination of vast territories.

As one of the destructive factors of nuclear weapons, radioactive contamination can cause an increase in losses among the personnel of nonmilitarized formations of civil defense (CD)** and the population, and create difficulties in guaranteeing the stable operation of many branches of industry and agriculture in wartime.

One should note that it is possible for radioactive substances to enter the environment in peacetime as well. Each year the quantity of radioactive materials used in different branches of science and technology rises. Thousands of scientific research institutes, nuclear power engineering enterprises and laboratories in different countries currently employ radioactive substances. These substances are produced, transported, used, and in the final analysis, destroyed in the form of wastes. At each stage the possibility is not excluded of a mishap or accident that could create a contamination danger for the service personnel.

As the result of an accident, as a rule, such vast zones of radioactive contamination are not created as during explosions of nuclear ammunition. But the danger of contamination of people from this is no less. This danger can be eliminated or reduced by a set of measures for elimination of the consequences of radioactive contamination that are taken by the forces and resources of civil defense and the population. These measures include: observance by people of the permissible irradiation doses, decontamination of contaminated objects, reduction in the entrance of radioactive substances into the human body, prevention of radiation injuries to skin integuments of people, use of preventive resources and treatment of the contaminated, and increase in the psychological stability of the personnel in the formations and the population as a whole.

It is stipulated that these measures be implemented in a unified complex, simultaneously. Only then can conditions be created for effective protection of people who are in the zones of radioactive contamination, and for the stable operation of the national economic facilities. Comprehensive conducting of measures to eliminate the consequences of radioactive contamination is only possible with the organization of advance training and equipping of the forces and resources of civil defense with the means of protection, instruments and equipment. This requirement can refer, in the first place, to decontamination measures. Even when they are conducted in a differentiated manner, they require the fulfillment of considerable volumes of work with the involvement of formations and the population.

* 1 R=2.58·10⁻⁴C/kg

** Instead of "nonmilitarized civil defense formations" we will further use "formations."

Thanks to the enormous efforts of the Soviet government, in August 1963 the Moscow agreement on banning tests of nuclear weapons in the atmosphere, outer space and underwater was concluded. Later, agreements were concluded between the USSR and the United States on limiting underground tests of nuclear weapons and surface nuclear explosions for peaceful purposes. All of these agreements laid a good foundation for complete resolution of the problem of banning all tests of nuclear weapons. The specific draft of such an agreement was developed by the Soviet Union and presented for examination of the United Nations in 1975. The Soviet initiative on concluding an agreement about the complete and universal banning of nuclear weapon tests met with approval in the United Nations by many states: almost 100 delegations voted for the USSR's suggestion. The Soviet suggestion, however, was not supported by the other nuclear powers.

The Soviet Union is making great efforts to eliminate the danger of nuclear weapon usage and to solve the problems of nuclear nonproliferation. However, the problem has not yet been solved of complete banning of nuclear weapons and elimination of all the accumulated reserves of these weapons. The danger of outbreak of a nuclear war has not diminished. The threat of contaminating enormous territories with nuclear radioactive substance has consequently not been eliminated.

One should now, in peacetime, learn to eliminate the consequences of radioactive contamination in the diverse, at times very complicated situation that can be formed in the contamination zones. This is necessary for both the specialists of the CD services, the commanders and fighters of the formations, and the population. It is required that all the individuals who are in the zones of radioactive contamination know the most general information about the nature of contamination of different facilities, the properties of radioactive substances, and practical recommendations on decontamination questions so that each at his place could skilfully fulfill his duties for protecting himself, his family and industry from the consequences of radioactive contamination. These requirements determine the selection of the materials for this book and its arrangement.

Chapter 1 briefly examines the features of radioactive contamination of environmental objects and its consequences for man. We intend to acquaint the reader with these questions in order to help him to have a greater understanding in evaluating the need to fulfill a whole series of requirements included in the measures for elimination of the consequences of radioactive contamination.

Chapter 2 presents the fundamentals for elimination of the consequences of radioactive contamination. It relates the main measures that need to be taken in order to prevent or reduce losses in the zones of radioactive contamination.

Chapter 3 covers a description of the decontaminating substances and solutions, special and national economic resources for special treatment and decontamination of territories and structures.

Chapter 4 examines questions of preparing and conducting decontamination measures. General recommendations are made to determine the possible volumes of work for decontaminating territories in cities and the sequence for conducting them. Method recommendations are made for conducting studies of the clothes decontamination station personnel on the subject "Actions of Formations of Antiradiation and Antichemical Protection to Eliminate Consequences of the Enemy's Use of Weapons of Mass

FOR OFFICIAL USE ONLY

Contamination." The technique for organizing and conducting these studies is mainly valid for other formations of antiradiation and antichemical protection that are set up on the basis of stationary institutions of general services for the population. The order is indicated for conducting the decontamination work by the decontamination command at different facilities in the focus of contamination and outside it.

Chapter 5 and the subsequent chapters present detailed practical recommendations for the fulfillment of specific measures of sanitary treatment of people, decontamination of food, transportation, territories, food and water.

COPYRIGHT: Atomizdat, 1980

9035
CSO: 1840/145

FOR OFFICIAL USE ONLY

UDC: 577.3:539.12.04+612.015.3

METABOLIC PRODUCTS IN THE PRESENCE OF RADIATION LESIONS

Moscow PRODUKTY METABOLIZMA PRI RADIATIONNYKH PORAZHENIYAKH in Russian 1980
(signed to press 18 Jan 80) pp 2-4, 140

[Annotation, introduction and table of contents from book "Metabolic Products in the Presence of Radiation Lesions", by Leonid Andreyevich Tiunov and Viktor Vasil'yevich Kustov, Atomizdat, 1000 copies, 140 pages]

[Text] A summary of the authors' studies of the effects of ionizing radiation on formation and elimination of metabolic products involved in forming the gas composition of the atmosphere of ecologically confined systems. There is discussion of the patterns of formation and elimination of ammonia, acetone, carbon monoxide and hydrogen peroxide after acute and chronic irradiation. Information is furnished about the modifying effects of radioprotective and radiosensitizing agents on formation and elimination of metabolic products in the presence of radiation lesions.

This book is intended for radiobiologists, toxicologists, as well as specialists in allied professions, concerned with the problem of studying the end products of metabolism.

There are 25 tables, 16 figures; bibliography lists 549 items.

Introduction

The study of metabolic disturbances in the presence of radiation lesions is a large and difficult problem. We deal with only one of the aspects of this problem, which is related to investigation of elimination of mainly gaseous metabolic products from the irradiated organism.

Refinement of methods of analytical chemistry, development of gas chromatography and mass spectrometry made it possible to determine that man eliminates hundreds of chemicals in gas form, both organic and inorganic, into the environment [9]. Some of these gases are formed as a result of bacterial activity. Most of them, however, are referable to the end products of metabolism. In the presence of pathological states, including radiation lesions, there is a substantial change in quantitative and qualitative composition of these products. Studies of these changes yield data on the nature of disturbances of metabolic processes related to formation of some metabolite or other. It is also quite important that these studies were as sparing [conservative] as possible; they were not associated with the painful procedures of taking blood or tissue biopsies.

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

The study of elimination of gaseous metabolic products in the presence of radiation lesions varying in severity is also of substantial importance for hygienic evaluation of the artificial atmosphere of manned pressurized quarters. We discussed this problem as it relates to long-term space missions in a special study dealing with toxicology of waste products and their role in forming the artificial atmosphere of pressurized [sealed] quarters [28]. It was demonstrated that some factors of space flight can modify elimination of gaseous waste products. Ionizing radiation is among the most important factors of space flights [18, 45]. A summary of the literature and our own experimental findings on the effects of ionizing radiation on elimination of gaseous metabolic products constituted the contents of this book. We only discussed a few of the many compounds contained in waste gases, the ones with the most significance to hygiene.

In addition to information about the nature of effects of acute and chronic radiation on formation and elimination of waste products, this book submits data on changes in these processes when radiation lesions are modified by means of some radioprotective and radiosensitizing agents.

	Contents	Page
Introduction		3
1. Ammonia		5
1.1. Ammonia metabolism		5
1.2. Effect of acute radiation on elimination of ammonia		15
1.3. Effect of chronic exposure to low doses of ionizing radiation on intensity of elimination of ammonia		21
Bibliography		24
2. Acetone		31
2.1. Brief information about acetone metabolism		31
2.2. Effect of acute radiation on elimination of acetone		40
2.3. Effect of chronic exposure to low doses of ionizing radiation on elimination of acetone		45
Bibliography		47
3. Carbon Monoxide		56
3.1. Metabolism of carbon monoxide		56
3.2. Effect of acute radiation on formation and elimination of endogenous carbon monoxide		63
3.3. Effect of chronic exposure to low doses of ionizing radiation on elimination of carbon monoxide		72
Bibliography		73
4. Hydrogen Peroxide		81
4.1. Brief information about metabolism of hydrogen peroxide		81
4.2. Effect of ionizing radiation on production of hydrogen peroxide		90
Bibliography		91
5. Effects of Radioprotective and Radiosensitizing Agents on Elimination of Some Metabolic Products		105
5.1. Effects of Radioprotective agents on elimination of some metabolic products		105
5.2. Effects of radiosensitizing agents on elimination of some metabolic products		115
Bibliography		121
Conclusion		127
Bibliography		135

COPYRIGHT: Atomizdat, 1980

10,657

CSO: 1840/999

64

FOR OFFICIAL USE ONLY

FOR OFFICIAL USE ONLY

UDC: 575.24./25

MUTAGENESIS INDUCED BY PHYSICAL FACTORS

Moscow MUTAGENEZ PRI DEYSTVII FIZICHESKIKH FAKTOROV in Russian 1980 (signed to press 10 Nov 80) pp 2, ...

[Annotation and table of contents from book "Mutagenesis Induced by Physical Factors", edited by Academician N. P. Dubinin, Izdatel'stvo "Nauka", 1300 copies, 225 pages]

[Text] This monograph discusses the mutagenic effects of various physical factors that pollute the environment. There is discussion of questions of evaluating the genetic hazard of radiation to man, genetic effects in irradiated natural populations of plants and animals, patterns of spontaneous and induced mutability of organisms.

This book is of interest to geneticists, ecologists and radiobiologists.

There are 73 illustrations and 40 tables; bibliography lists 650 items.

Contents	Page
Genetic Sequelae of Exposure of Populations to Ionizing Radiation (N. P. Dubinin, V. A. Shevchenko, V. A. Kal'chenko, V. I. Abramov, S. A. Famelis, A. V. Rubanovich)	3
Evaluation of Genetic Hazard of Radiation to Man (M. D. Pomerantseva)	45
Genetic Sequelae of Decay of Incorporated Radionuclides (V. G. Korolev)	65
Somatic Effects of Radionuclides in Animals (Yu. I. Moskalev)	79
The Place of Immunogenetics in Assessing the Effects of Environmental Physical Mutagenic Factors (V. I. Svatkov)	94
Some Problems of Radiation Genetics of Hydrobionts (V. L. Pechkurenkov, G. L. Pokrovskaya)	109
Genetic Processes in Ontogenesis of Higher Plants (N. F. Batygin)	130
Effects of Physical Factors on Recombination Processes in Tomatoes (A. A. Zhuchenko, D. A. Vyrodov, A. B. Korol', V. K. Andryushchenko)	148
Use of Physical Factors in Genetic Breeding Work with Fruit Crops (O. S. Zhukov, S. D. Ryzhkov)	163
Evolutionary Approach to Determination of Genetically Significant Doses of Radiation (A. M. Stepanov)	176
Biological Effects of Cosmic Rays (L. I. Miroshnichenko)	187
Studies of Mutagenic Factors of Space Flights (E. N. Vaulina)	206

COPYRIGHT:Izdatel'stvo "Nauka", 1980

10,657

CSO: 1840/999

END

65

FOR OFFICIAL USE ONLY