Meetings

Physiological Sciences

Assessment of data from space flights and extrapolation of data from simulation experiments justify the conclusion (i) that man can survive in earth orbital and space flights with proper cabin environment; (ii) that without countermeasures physiological changes may occur which impair reestablishment of existence on earth; and (iii) that an analysis of the "deconditioning" syndrome emphasizes the need for specific data on the time constants of the physiological systems involved in order to determine the minimal cycling or stress application necessary to maintain the integrity of the response characteristics of the physiological system. Reactions to space flight was just one of the various physiological subjects discussed at the 23rd International Congress of Physiological Sciences held in Tokyo, Japan, 1–9 September 1965. Neuromuscular activity, kidney function, thyroid activity, blood coagulation, and sweat secretion were among the major topics covered.

Approximately half of the 2700 physiologists registered at the congress were Japanese. The other participants came chiefly from the United States, the U.S.S.R., Germany, Canada, and the United Kingdom.

In discussing space flight, Loren D. Carlson (University of Kentucky) noted that the astronaut's confining environment requires investigations of oxygen toxicity, trace substance toxicology, temperature stress, exposure to radiation, and the effects of physical inactivity. Flight dynamics impose gravity forces, vibration, extremes of temperature, and weightlessness. Biomedical measurements on astronauts (in orbit) to date indicate no marked physiological effects. Post-flight measurements indicate that the cardiovascular response is analogous to that brought about by bed rest or inactivity. The best evidence to date (though not unequivocal) supports the hypothesis that this effect is due to a reduction in blood volume. The tilt table and lower body negative pressure tests have been used to study heart rate, blood pressure, and peripheral vascular response after flight and after simulations of weightlessness. Exploration of the hypothesis shows it to be compatible with our knowledge of the control systems involved and suggests the analogy to other facets of the cardiovascular system (heart size and rate, coronary flow, red blood cell production, lipid metabolism, and catecholamine accretion in the heart) and to other systems of the body (bone and muscle metabolism, orientation and nutrition).

In a symposium on cardiovascular integration P. I. Korner (University of New South Wales, Sydney, Australia) reported on the control of the systemic circulation in hypoxia.

The effects of primary tissue hypoxia produced by inhaling carbon monoxide have been compared with those of arterial hypoxia after inhalation of low-oxygen mixtures. The former results in reduction in tissue and mixed venous pO_2 and stimulation of the arterial chemoreceptors. Increased respiratory activity and hypocapnia are superimposed on tissue hypoxia. The tissue pO_2 is determined by both respiratory and circulatory adjustments. The circulatory response to carboxyhemoglobinemia includes a drop in arterial pressure, increased cardiac output, and tachycardia. Peripheral circulatory effects are not uniform, and the extent of activation of the sympatho-adrenal system in this type of hypoxia is less than in arterial hypoxia. The main afferent control mechanisms are the baroreceptor reflexes which limit the local dilator effects of tissue hypoxia by acting on the resistance vessels and by increasing cardiac output.

Species variation in circulatory response is slight in primary tissue hypoxia, but is considerable in arterial hypoxia where it is related to the respiratory performance of a particular species.

In arterial hypoxia two main patterns of circulatory response can be distinguished. The pattern of "high cardiac output" is observed during moderate reduction in arterial pO_2 to 35 to 40 mm-Hg in the presence of hyperventilation. The response includes an increased cardiac output, tachycardia, normal arterial pressure, and marked muscular vasodilatation. Sympatho-adrenal discharge is only moderate and seems to be mainly evoked by increased stimulation of pulmonary afferents and by the action of hypocapnia, associated with hyperventilation. The arterial chemoreceptors thus exert their effects indirectly by their action on respiration. With more marked reduction in arterial pO_2 the "diving response," consisting of bradycardia, transient reduction in cardiac output, elevation of blood pressure, and other evidence of peripheral vasoconstriction, is observed. There is a marked increase in sympatho-adrenal activity resulting mainly from strong stimulation of the arterial chemoreceptors. With maximal stimulation, persistent reduction in cardiac output and oxygen consumption are observed. Thus the "diving response" may be described as a short-term adaptive mechanism in terrestrial animals which helps to maintain cerebral and coronary oxygen in the face of fulminating arterial hypoia.

Tuesday, 7 September, was designated as "Pharmacology Day" and particular emphasis was placed on scheduling papers of interest to pharmacologists. The papers dealt with mechanisms of drug action upon the kidney, excitation and inhibition in smooth muscle, transmitters in the central nervous system, and long-term drug administration and chronic toxicity. A paper by H. C. Hodge (University of Rochester) summarized the future of studies involving chronic toxicity.

Urgent questions of toxic hazards press upon those responsible for the public health.

1) Closed ecological systems (space craft, submarines) must support normal health and preserve mental faculties. The threshold limit values for continuous exposures are unknown. Thus, behavioral studies are essential.

2) The effects of radiation, fallout, and internal emitters: additional data from continuous exposure are required. Data from studies of life-span shortening by Po^{210}, Pu, and Ra, and a 5-year inhalation exposure of monkeys and dogs to 5 mg/m^3 of UO_2 dust illustrate some unsolved problems.

3) Food additives, intentional or unintentional, water pollution, and air

pollution raise extraordinarily intricate questions. The mysterious smoking-lung cancer puzzle awaits new approaches.

4) Drugs administered for prolonged periods (for example, tranquilizers, agents for substitution therapy, "the pill" for contraception) may affect almost any system of the body, generally in unpredictable ways. The thalidomide tragedy dramatically highlights effects on reproductive performance.

5) Carcinogenesis remains high on the list of the leading causes of death. Studies of chronic toxicity offer advantages (for example, predictability of calendar and of costs). The disadvantages are well-known—the empirical results, the fallibility of predictions based on animal data. The responses of many species and strains must be related to those of man. New statistical procedures can strengthen chronic studies. An international center of toxicological information should be established; the World Health Organization might logically serve as the repository.

Although there was no specific grouping on any one day of papers emphasizing general physiology, the interests of this group were represented throughout the program. Areas covered included excitable membranes, molecular physiology, cell physiology, and subcellular structures. There was also a perceptible and welcome trend in papers dealing with comparative physiology in connection with functions of all systems.

The relatively small number of papers presented in other fields may have been due to the fact that many other meetings and symposia were held before, during, and after the congress meetings, and their programs and proceedings were not included in the congress program or in the official registration lists. Thus, symposia on the physiology of the activity of the "AMA" were held on 31 August and 1 September in Tokyo, on comparative neurophysiology on 10–12 September in Tokyo, on olfaction and taste on 11–13 September at Lake Yamanaka (together with a conference on food and water intake), and on environmental physiology in Kyoto to 13–17 September. There was also a symposium on structure and function of the limbic system in Hakone on 10–12 September which supplemented the papers given at the congress meetings.

The congress was also the occasion for meetings of other groups which now

have established programs of their own. A typical example is the group of investigators working in respiratory physiology who, at the previous congress in Leiden, held an excursion and dinner in honor of Wallace Fenn. A similar program was developed in Tokyo where the VA/Q Club of Japan arranged a tour to Mt. Fuji and Hakone on 5 September.

An important by-product of the congress meetings was the opportunity for the various groups in Japanese schools to have the privilege of visits and lectures from the many scientists attending the meetings. Many of the participants visited the medical schools in Tokyo, Osaka, Kyoto, and in other cities.

The congress was held under the auspices of the International Union of Physiological Sciences. The lectures and symposia are available in a monograph published by the Excerpta Medica Foundation as International Congress Series No. 87.

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Great Lakes Research

The Great Lakes contain about 30 percent of the world's fresh water, and their basin is estimated to be capable of supporting about 3 billion people. However, much of the water in the lakes is not referred to as fresh, and we are experiencing difficulties in supporting 1/100 as many people. The 9th conference on Great Lakes Research was held at IIT Research Institute in Chicago, 28–30 March 1966. Over 400 persons attended to listen to 120 papers and panel discussions. The topics included water budget and quality, biology, physical limnology, air-water interactions, marine geophysics, geology, and inorganic materials, as well as some economic and legal aspects.

Introductory remarks by B. M. McCormac (IIT Research Institute) emphasized that in planning this conference he concluded that, (i) no single U.S. government agency was responsible for the total Great Lakes problem; (ii) there is poor management of water, but no water shortage; (iii) current pollution control steps are based on very fragmentary information; (iv) the failure of industrial organizations to present papers at the conference was due to fear that the data might be used