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Some perspectives of our physiology

Translated from an article by prof. Dr. O. Poupá, published in *Čs. fysiologie* 10:113-117, 1961/

The plenary meeting of the Czechoslovak Academy of Sciences, held in the spring of 1960, approved with the draft of the scientific research plan for the years 1961 - 1965. This new 5 Year Plan is, in regard to Czechoslovak sciences, concerned with the concentration of the scientific potential which are of greatest importance from the economical point of view and where the solution of some of the problems could offer a basis for the further perspective development of our society. Each of the 16 main tasks of the plan can only be fulfilled by a close cooperation of several scientific branches. Some of the tasks are mainly concerned with health- and biological problems, others again will, in the near future, be greatly dependent on a major participation of biological and health research. The latter are: research of complex automatization, theory of information and transmission of information, development of material and cultural standards by an increase of the social effectiveness of investment, building research of protection and formation of the countryside and conditions for creating healthy natural surroundings, research of the structure and function of the living substance, the healthy development of the new generation, tuition and education in the period of completing socialism and the transition to communism.

The development of physiological sciences in the last 50 years has been very successful in solving general questions. Let us remember two jubilees which we celebrated last year, the work of

prof. D. Čapek and prof. V. Hons. The first was the founder of our aeronautic medicine, the second founded another branch of physiology in closest connection to practical questions- the tradition of rational nutrition. Both scientists emphasized the importance of physiological sciences in solving questions of social importance. Physiology is therefore expected to γ/β strengthen and develop all previous achievements and to work towards the solution of a great number of new tasks.

We are now going to look more closely at the above mentioned problems. There are two types of tasks which can only be solved in close cooperation with physiological sciences. In four of the tasks we cannot yet talk about a concrete participation of physiological sciences, although it might become desirable in the near future. Even the theoretical basis of automatization must count with the human factor as one of the values, the limits of which can only be expressed by a physiologist. The term "social effectiveness" includes man with all his physiological qualities, as well as the term "healthy natural condition", which is in closest connection to man, his regimen of the day and all its functions, and the slightest interference can accumulate to such an extent that it develops into a pathological state after some time. It is unnecessary to mention that rational education of the young individual can only be successful when carried out in accordance with the developmental stage of the organism of the child. One of the future tasks will be to find the physiologist's part in these great problems. The second type of tasks is already now fully supported by physiological research. Part of the task "Research of the structure and function of the living substance" has been handed over to physiological research centers. Investigations on these problems have brought physiological research up to the molecular level. At this place it seems also opportune

to mention our older tradition connected with the world known
 results, the first molecule to be traced in the organism /Bessis
 and Fruton-Gorius J., 1959/, putting into the shade an older
 study of Laubberger about the cell stroma and the momentary
 metabolism. Regarding the world perspectives and our own efforts
 in developing molecular physiology, we we rightly assume that
 the participation of physiological sciences will increase in the
 near future. One of my next articles will be concerned with basic
 physiological problems which will have to be solved in connection
 with this research task. It seems that physiology will have to act
 more often as a corrective factor at onesided interpretations
 of results achieved by chemical or physical methods.

At present physiological sciences mainly participate
 in the task "The healthy development of the new generation", which
 is divided into 8 parts :

1. Research of the state of health of the population and the long term
 research of its development
2. Physiology and pathophysiology of the developing organism in relation
 to the environment
3. Research of rational nutrition of man
4. Research of problems concerned with physical fitness and the proper
 mental development
5. Research of cardiovascular diseases
6. Research of cancer
7. Research of infectious diseases with special regard to diseases
 of the respiratory organs
8. Research of nervous and mental diseases

This wide spectrum of research problems has not been chosen
 by accident. Point 1 of the list continues in earlier research work

carried out by some of the workers of the ministry of health and will

be further developed. The previous results form a valuable basis and point to the most frequent disturbances of the health of our population. The pathogenesis, their diagnostics and therapy are studied under point 5 - 8. The remaining problems 2 - 4 are concerned with measures of prevention and part 2, moreover, has been assigned to the perspectives of physiological research in finding effective preventive measures in the future. A major role might be played here by evolutionary physiology. We presume that it is necessary to know the evolution of function to make ^{into a} prevention ~~X~~ real, undeclarative basis of medicine.

Let us now analyse in detail the single parts of the principal task "The healthy development of the new generation" and try to emphasize the present contribution of physiology to this task and the demands, which are expected and will have to be realized in the near future. We have mentioned already in the chapter "Research of the state of health of the population and the long term research of its development", that this research should be directed to complex diagnostics about the health state and diseases in densely populated areas to become a rational basis for the strategy of health research. There has further to be realized the experiment with the registration of changes in the state of health of the population in connection with changes in living conditions. All these works depend, of course, on the elaboration of a project and on modern techniques, able to cope with the technical side of automatization of the epidemiological services of the new type. The future possibilities for the work of the physiologist will greatly depend on the amount of empirical material serving for a basis for concrete working problems concerned with ecological pathology. The first results gained in this new

branch indicate its contribution to the understanding

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of the causes of some degenerative diseases. To evaluate the effect of any preventive measures, which have to be introduced to the praxis we have to have exact data about the state of health of the population.

The chapter "Physiology and pathophysiology of the developing organism in relation to the environments" should be concerned with all research work on the evolution of functions and their mechanisms. In studying any contemporary textbook of medical physiology we find we that most of the collected material is dealing with adult organisms. There is, therefore, standard physiological knowledge of ^{only} one developmental period. Information about the changes of these functions is either dispersed or completely missing, and any information about the activity of the organism of mammals or man during another period of development are either due to accidental research work or to some demands of the general practise. There exists thus some knowledge about the perinatal period. Research work has been started on the functions of the old organism, and on a very important developmental period, the so called weaning period. We hardly know anything about maturation, when it starts, etc. The periodisation of the development is still very doubtful. That is now the state of physiology nearly everywhere in the world. Research work on the earliest ontogenetic stages has a somewhat different position. Our work on the physiology of reproduction is and the intrauterine life is very much behind world standards. Reproduction physiology does practically not exist in Czechoslovakia. Although our tradition in morphological embryology is rather outstanding we are not studying intrauterine life. Such research could be well developed in our country, regarding our world priority in the discovery of the male gametogenesis and the mechanism of malformation of the cardiovascular system. These discoveries are,

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problems, but could be used as crystallizing points, around which the research of reproduction problems would be developed and brought up to world standards. This should be most desirable, as such questions are of greatest importance not only for the healthy development of the new generation / the rational regulation of the population of man/ but also in agriculture / reproduction of economically important animals/. No physiologist can be satisfied with the contemporary practical solutions in this line of research. Evolutional aspects of other systems than only in the region of electrolytes and water, nutrition and immunity functions, should also be included to a greater extent. With regard to the fact that the analysis of the health state of the population indicates an increase in cardiovascular and respiratory diseases, greater attention should be paid to the functional evolution of these systems. The urgency for evolutionary research work in physiology results from some recent remarkable discoveries in pathophysiology. It has been shown that the agent, which acts chronically in a certain developmental period, may cause disturbances in the near or more distant future. Let me mention the finding of the school of Best about the relation between choline deficiencies in youth and hypertension in the adult age, Kennedy's findings about the relation between overfeeding in the early postnatal period and obesity in the adult age, and, lastly, some findings of the Prague group of ontogenetic research, carried out at the Institute of Physiology of the Czechoslovak Academy of Sciences, about the relation between the nutrition in the early postnatal period and the fertility of the males. The study of the mechanism of adaptation, on which we have been working for some years, is also closely connected with evolutionary problems. Developmental research is naturally in demand of new methods and techniques. To

trace the continuous registration of functions in time it is important to keep the animals in the experiment under controlled conditions during their whole life. This anticipates highly developed breeding techniques and an early solution of the problem of special "evolutionary animal houses".

The third chapter of the plan is concerned with questions of nutrition, problems essential to physiology and less so to the clinic or pathology. The systematic physiological research of nutrition has not such old tradition here as elsewhere and more support should be granted to this line of research. The plan involves studies about the development of nutritious functions and investigations of diseases, which have a definite or assumed relation to nutrition, such as obesity, the goitre and dental caries. It is still doubtful whether all important problems of nutrition have thus been comprised from the physiological standpoint.

At the present physiology already greatly participates on the solution of problems concerned with physical fitness and ~~the~~ the proper mental development. Both problems are standing on a solid physiological research basis. The physiology of physical training and the physiology of labour are two of the disciplines, where physiological knowledge has been systematically applied. Great improvement has been achieved in the research of mechanisms of muscle activity in the last 10 years. Less attention has been paid to studies on the influence of the motor regimen on other functions of the organism. Little is known about questions of functional load during maturation and the physiology of the development of the organism during this period. These problems will have to be studied more intensely. A problem of basic importance is the healthy mental development of man. In accordance with

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the importance of this problem, a physiological basis has been established, which seems to fully guarantee its further development.

My next concern will now be more specialized questions about the research of pathological states. The pathogenetic research is going to remain in the foreground of some years to come. Clinical workers should, therefore, consider the necessity of pathogenetic research and support it when making their tactical plans. As an example there is the problem of hypertension which has been studied mainly from the clinico-physiological standpoint by applying well known physiological facts. No physiological basis has so far been established, which could bring new aspects about this most frequent disease. New facts will therefore, have to be found about the factors, which determine the tension of the smooth muscle vessels, new findings will have to be considered which point to the fact that experimental hypertension in the adult organism can be caused by some agents during the early postnatal development. The new findings of our Slovak colleagues about the mechanisms regulating the height of the blood pressure, should be mentioned here. There still remain many more problems to be solved about the physiology of the regulation of the blood pressure. It is questionable whether the (of arteriosclerosis) the problem has been rightly listed under the heading of the cardiovascular research despite of the facts which indicate, that arteriosclerosis is a primarily metabolic disease and only the its last link is concerned with the arterial wall. As far as ischemic heart failures are concerned, the physiology can play a major role in finding new knowledge about the function of the coronary circulation and about the metabolism of the

about cardiovascular physiology will greatly contribute to the solution of the pathogenesis of cardiovascular diseases and that the cardiovascular laboratory will be the place where the final battle with these diseases will be fought more successfully than at the patient's bedside.

Questions of malignant growth are nearing their solution via the cellular and subcellular level. The plan contains studies on experimental therapy and pathogenesis. It is to be doubted whether it has been correct to separate the whole complex of questions on the metabolism of nucleoproteins, solved by the work of biochemists and whether the biochemistry of nucleoproteins should not be supported by physiology. This might mean better progress in studies on pathological and physiological growth. We will have to reconsider the question whether we should try to find new knowledge of the mechanism of pathological growth before there is enough information about the physiological growth.

An interesting feature of our new plan is the fact that less attention has been paid to infectious diseases. This is due to the numerous practical successes in bacteriology and epidemiology in the last decades, including the successful struggle against infectious diseases, endangering mankind. These medical disciplines seem to have reached their summit. The study of infectious diseases will now be mostly concerned with diseases of the respiratory system, which is in accordance with the analysis about the state of health of our population. I have to mention here the great debt which we owe to the research of pulmonary diseases, and which has been greatly neglected by our physiologists. In consequence the techniques

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for examining respiratory functions are far behind world standards. We need people trained in physiological centers and complete technical equipment. Only then will we be able to find our own original ways in the physiology of the lung.

The last chapter of the plan deals with the pathogenesis, clinic and therapy of nervous and mental diseases. The studies concentrate on the research of neuroses and reactive psychoses, on problems of diseases of demyelination, on the research of discopathies and on epilepsy. This last disease possesses an excellent experimental basis and can therefore be studied from all physiological aspects. The physiological research of emotion has been fully developed during the last 10 years. It is, therefore, astonishing, how little use of this effort has been made in the physiology of neuroses, one of the most frequent diseases. We are in need of an experimental basis to secure a physiological access to the solution of the pathogenesis of this widespread disease. The newly established should consider this fact and concentrate part of its research plan on this disease. A great deal of work has been done in the biochemistry of the nervous system. The research should now serve as a basis for the solution of the pathogenesis of the demyelination processes.

This review on perspectives and needs of our physiology is the result of many discussions of the last two years on the structure of our scientific plan for the next years. Our physiology has passed through a period of successful development during the past 10 years. It remains, however, questionable, whether ~~the development~~ its growth has been equal in proportion to all other medical disciplines. The fact that we are talking about the physiologization of our medicine is proof of the opposite. We feel therefore fully justified to ask

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by medical institutes of the ministry of health and vice versa, how many institutes, belonging to the ministry of health, employ fully trained physiologists, in their physiological departments? How much of the money, reserved for medical research, has been allocated to physiological research? What is the proportion of clinical workers in medical research and physiologists? We will have to consider even the proportions inside physiology itself. We have tried to point out the branches of physiology, which need to be more developed with regard to social demands on physiology, expressed in the plan. It is quite clear that the development cannot be equal for all branches of physiology. It will be our obligation to develop such branches which are of principal importance for the main tasks of our perspective plan, which should be neither an armour nor byrocracy. This plan is not perfect, as no human work can be, and it will need new amendments. It should, however, be the backbone of a healthy proportionate development of physiological sciences. We all know that there are moments when we are trying to decide on the right direction of our research work. This review might be helpful at such moments of decision, as we have tried to lay before you all possibilities for individual research work. The review is certainly most disputable in many respects, but it contains one deep, dogmatic conviction: that the complex of physiological sciences will most probably be able to transfer medicine from its repressive past to its preventative future.