JPRS: 3037

2 March 1960

SOVIET REPORTS ON SCIENTIFIC PROGRESS IN CHINA

/Translation/

Distributed by:

OFFICE OF TECHNICAL SERVICES
U. S. DEPARTMENT OF COMMERCE
WASHINGTON 25, D. C.
(Price $0.50)

U. S. JOINT PUBLICATIONS RESEARCH SERVICE
205 EAST 42nd STREET, SUITE 300
NEW YORK 17, N. Y.

JPRS: 3037
CSO: 3326-D

AN EXAMPLE OF SCIENTIFIC COOPERATION BETWEEN THE USSR AND THE PEOPLES REPUBLIC OF CHINA

Vestnik Akademii Nauk SSSR
/Herald of the Academy of
Sciences USSR/
No 10, October 1959, Moscow,
Pages 60-63
Russian, per

P. A. Rebinder, Academician
Ye. D. Shchukin, Candidate in
Physicomathematical Sciences

Scientific and technical development in People's China is characterized by a continued striving for a rapid application of the latest scientific achievements in all the branches of national economy. It is precisely this striving that determines the interest which Chinese comrades express toward the new scientific trend prevailing in the Soviet Union, i.e., physicochemical mechanics of materials. A delegation of Chinese scientists headed by Kuo Mo-jo, President of the Academy of Sciences of People's Republic of China (KNR), visited the Soviet Union in 1957. The purpose of this visit was to organize and develop the cooperation of scientists of both countries in current scientific problems. The delegation noted the necessity for a rapid development of joint operations in this field. Among the numerous other important problems for joint development, the Chinese scientists put forward the problem of the durability of solid materials, particularly of metals, with a view to obtaining highly durable and heat-resisting materials.

With the aim of discussing more fully and concretely plans of the coming joint work, the Chinese physicists, physicochemists and chemists composing the delegation visited the Faculty of Chemistry of the University of Moscow and the Institute of Chemistry of the Academy of Sciences of the USSR. In this way, they were able to acquaint themselves in detail with the basic trends of research in the field of physicochemical mechanics of materials.

As we know, the tasks of physicochemical mechanics of solid bodies consist of finding out ways and of discovering the mechanism for obtaining solids and various materials of given properties and structure. At the same time, physicochemical mechanics studies the regulation and mechanism of the process of deformation and breaking down of solids with regard to the effect of physicochemical factors. The results of these investigations are reflected in widely adopted determination of optimal regimes for the preparation of solids, and selection of corresponding temperatures, pressures and lubricants facilitating deformation.

Chinese builders and specialists in the technology of building materials showed a particular interest in the problems of physicochemical mechanics. This is quite understandable. The development of physicochemical mechanics has already resulted in the USSR in the creation of a scientific basis for the optimal technology of concrete (cement and asphalt concrete) and of other building and road materials. Careful mixing and maximum thickening of the mixture are needed in order to obtain highly durable concrete with the least consumption of cement. The finer the grinding of cement (which is very necessary for its greatest utilization in the concrete and for a quick hardening after placing and shaping) and the finer the filler used (micro-filler, sand and other), the more difficult is the stirring of the concrete mixture and its thickening. Consequently, the old technology of concrete was against using finely ground cement and fine local sands available in large quantities to replace frequently deficient gravel and crushed stone.

The new optimal technology of concrete developed in our country by Doctor of Chemical Sciences N. V. Mikhailov and his collaborators on the basis of physicochemical mechanics has overcome these limitations. This was made possible by promoting the principle of uninterrupted maximum crushing of the obtained structure of concrete mixture until it thickens in moulding with varied frequency vibration and small addition of plasticizers which lower surface tension. It can be expected that in our country and in China, the new technology of concrete will soon replace the old in dwelling and industrial construction as well as in the construction of hydroelectric stations, which is particularly important for the national economy of China with its rivers abundant in water.

The Chinese specialists showed great interest in a number of other basic trends in physicochemical mechanics. This was particularly evident concerning research related to the problems of the durability of solids (primarily of metals) and to the adsorption effect in decreasing durability and facilitating the deformation of solids.

At present it is established that in relation to a number of physicochemical factors the adsorption effect manifests itself in several essentially different forms. These forms can be as follows: a solid (for instance a metallic monocrystal or polycrystal specimen) may become either more plastic or more brittle and fragile and reveal a tendency for spontaneous dispersion into colloid sized particles. The important practical sides of this effect have also been discovered.

Metals which are relatively easily melted are particularly interesting as agents and admixtures which strongly lower surface tension. In particular, a considerable lowering of free surface energy by adding small quantities of a molten component, which is highly active and adsorptive, will facilitate substantially the process of fine grinding

of material. This permits us to obtain an extremely finely dispersed and homogenous structure which, after thickening and hardening, provides materials with high mechanical properties.

All these problems and many others, such as a number of metallo-ceramic problems, encountered a lively interest from the side of the Chinese comrades and formed the basis for a jointly developed plan of scientific cooperation in physicochemical mechanics.

In accordance with the plan the authors of this article visited China at the invitation of the Academy of Sciences of the KNR (P. A. Rebinder, in autumn 1958 and Ye. D. Shchukin, in spring 1959). The purpose of these visits was, on the one hand, to give reports and lectures on the physicochemical mechanics of metals; on the other hand, to organize under the program of scientific and technical cooperation of the KNR and the USSR joint scientific research on the problems of durability, strengthening and processing of metals and alloys by pressure.

In China a number of great scientists work on these current problems. Professor Shin Ju-wei, Director of the Institute of Physics of the Academy of Sciences of China, studies the magnetic and mechanical properties of alloys. Professor Ts'yen Ling-chao directs at present a group working on metals. Earlier, he worked in England with the prominent Professor Andrade on the plastic malleability of metallic monocrystals. Professor Cheng Nin-kuan (in the same institute) who, before the Liberation of China, conducted important research in the same field in the USA, is studying at present the problems of strengthening and the mechanism of breaking down metals of different structures. The prominent Chinese specialist in the inelasticity (elastic hysteresis) and internal friction of metals, K'o T'ing-sui is particularly famous. He also worked in the USA before, returning to his fatherland together with many other scientists after Liberation. We should also point out the work on metal physics performed by Professor K'o Tyun' (Dean of the Faculty of Physical Chemistry of the Institute of Ferrous Metallurgy) and the research of Fu In', Professor of Colloid Chemistry of the University of Peiping, related to the adsorption of substances which lower surface tension and to the structure of adsorption layers.

The principal lectures and discussions on physical chemistry mechanics of metals and on their theoretical foundations (the application of the dislocation theory to the analysis of the effect of substances lowering surface tension on the malleability and durability properties of metals) were conducted in Peiping in the Institute of Physics of the Academy of Sciences of China. They attracted the attention of numerous specialists of Peiping and other cities and, in particular, of the scientists already mentioned.

We were able to acquaint ourselves in detail with the laboratories of this Institute, its equipment, the basic trends of work and a number of concrete experimental investigations conducted at present. The most interesting ones are as follows: the heat resistance and cold brittleness of molybdenum and of other metals with cubic volume centered lattices; the production of heat resistant alloys based on aluminum (by using adsorption active mediums); research on their properties; production of metal crystals in the form of fine threads (so-called tendrils), which approach ideal crystals in their durability, and the attempts to produce high-temperature modification of boron nitride at high pressure with a view to applying this later on to the production of diamond from graphite.

We also visited a number of other scientific institutions in Peiping, Nanking and Shanghai; the Institute of Chemistry of the Academy of Sciences of the KNR, the University of Peiping, the Institute of Ferrous Metallurgy, the University and Polytechnical Institute of Nanking, the Institute of Metallurgy and Ceramics of the Academy of Sciences of KNR in Shanghai and other institutions. We obtained in them data on the organization of scientific work in the field of our immediate knowledge. Reports and discussions were also given there on physical chemistry of metals, the problems of structural formation in dispersed systems, the theory of cement hardening and the physicochemical foundations of the new optimal technology of concrete.

Thus, in Shanghai at the Institute of Metallurgy and Ceramics of the Academy of Sciences (Chief Professor Chou Jen) we studied the manufacturing of metalloceramic articles from the composition of iron and graphite. The practical value of such manufactured articles lies in the fact that they permit us to replace successfully the antifrictional materials of deficient non-ferrous metals. The Chinese comrades were greatly interested in the results of research in this field of V. I. Likhtman and his collaborators. The same institute also prepares and investigates specimens of another heat-resistant metalloceramic material, which is based on aluminum and aluminum oxide. It is necessary to point out that Chinese specialists have arrived at substantial achievements in this field. We think that it would be very useful for both sides to bring about the cooperation of Chinese and Soviet specialists in developing new technology based on a correct accounting of physicochemical factors and on the rational use of adsorption active components.

Before our visit, our personnel had already established ties with the scientists and scientific institutions of China. Candidate of Chemical Sciences Wu Shu-chiu completed and defended successfully his thesis on the structural formula reaction of admixtures in polymers at the Faculty of Chemistry of the University of Moscow. Now he has returned to China and is developing this branch of science at the Nankow

University in Tientsin. Tu Yu-ju wrote and defended her dissertation also at the University of Moscow. Later she returned to China to work at the Institute of Applied Chemistry of the Academy of Sciences of KNR in Chang-chun. Finally, in the Institute of Physical Chemistry of the Academy of Sciences of the USSR, Kiang Lung conducted successful research on the phenomena of structural formation of earth and soil. Having successfully defended his dissertation, he returned to China.

Problems closely connected with industry play an important role in the research of Chinese chemists and physicists. A bold and creative solution to important industrial problems always serves as a foundation for the development of great science. The cooperation of Chinese and Soviet scientists contributes to this development and is very useful to both sides.

We should note that in China, in working on certain problems, there still remains a fairly sharp separation between "pure" science and its application. Due to this separation, certain investigations involving an applied character may limit themselves to the execution of narrow private industrial tasks. These should not be dealt with by central scientific institutions but by the forces of plant laboratories.

We believe that the present cooperation of scientific institutions of the USSR and KNR will lead to productive and practical results valuable for the people's economy of both countries. In our opinion, this cooperation should not be limited only to the durability of metals and their hardening and processing, but should also embrace metalloceramics (and later on ceramics and refractory materials), physical chemistry mechanics of building materials and, primarily, the new optimal technology of concrete successfully developed in the USSR.

In conclusion we wish to add that wherever the authors went during their visit, their Chinese comrades met them with an unfailing welcome and attention. They reflected the friendship between our people and the sincere deep love of China for the Soviet Union and the Soviet culture.

RECENT ACHIEVEMENTS IN THE WORK OF CHINESE EMBRYOLOGISTS

Vestnik Akademii Nauk SSSR
/Herald of the Academy of Sciences USSR/
No. 10, October 1959, Moscow
Pages 64-67,
Russian, per

T. A. Detlaf
Doctor, Biological Sciences

Embryology, like many other branches of science, is now in a period of rapid growth in China. The network of scientific institutions is spreading quickly; new collectives are being formed and an increasing number of young high school graduates and university students are drawn into scientific work. Chinese embryologists face a number of problems in pisciculture, sericiculture, poultry raising and medicine. These problems required an important reorganization of science, changes to new topics and development of practical work. At the same time, theoretical research started to develop along lines which did not previously exist in China, such as immunoembryology and electron microscope study of the processes of cellular differentiation.

At the invitation of the Academy of Sciences of the People's Republic of China (KNR), I worked for five weeks (December 1958 - January 1959) at the Institute of Experimental Biology in Shanghai and became acquainted with embryological research of other scientific research and educational institutions of the Republic. At the same time, I delivered reports and lectures and discussed with the Chinese colleagues the Soviet work on embryology. The chief purpose of my trip was to exchange research problems and methods, and, on this basis, to find out ways for establishing closer cooperation of embryologists of our countries.

The Institute of Experimental Biology of the Academy of Sciences of the KNR in Shanghai is the principal center of embryological research where most embryologists work. Chu Hsi, Director of the Institute, is one of the greatest embryologists of China; he is famous for his studies of artificial parthenogenesis in amphibians, echinoderms and silkworm moths. Recently he has engaged in a new cycle of studies with great prospects. This concerns an experimental study of mechanisms in the ovogenesis of Chinese toad. He succeeded to produce a normal maturation and ovulation of egg cells outside the organism in saline solution to which he added ground hypophysis. Using this method, Chu Hsi and Wang Yu-lang have already performed a number of experiments on the mechanism of ovogenesis and the effect produced on ovogenesis by various external conditions as well as the physiology of fertilization. These investigations widen the possibilities of experimental reaction of the more plastic stages of development, which before were less accessible to such experiments. This will undoubtedly prove to be very important for pisciculture and will make it possible to discover conditions necessary for maturation and their effect on the quality of ova.

Professor Chuang Hsiao-hui, Chief of the Department of Embryophysiology of this institute, together with Tsen Mi-pai and other collaborators is investigating the causal relationship between the start of typical differentiation in different organs and the conditions. They completed extremely interesting experiments on the problems of the appearance of neural differentiation and the dismemberment of mesoderm as well as of regeneration and chemical embryology (the chemical nature of the phenomenon of embryonic induction). Chuang Hsiao-hui worked for many years in this field, publishing famous works on foreign inductors. In addition to microsurgical methods, the scientific workers of the Department are beginning to use in their research those of immunology (Khuan), biochemistry and electron microscopy (Tsen Mi-pai).

A new very interesting study of Chuang Hsiao-hui explains the effect of the nervous system on differentiation of the rudiment of extremity and on its regeneration. At present, the scientist and his collaborators are engaged in studying the possibility of breeding domestic fish in closed reservoirs (this name is used in China for Ctenopharyngodon, Mylopharyngodon and Hypophthalmichthys, principal fish bred in ponds and lakes).

Until recently pisciculture in China was carried out in the following way; at first, larvae were fished out of the Yangtze and then distributed throughout the internal reservoirs of the country. Since pisciculture in the internal reservoirs has grown, it is impossible to supply satisfactorily the needs by the previous method. Besides the projected regulation of the Yangtze flow will inevitably decrease greatly the amount of larvae in the river. The necessity has arisen to discover quickly methods for obtaining mature ova and for its insemination and incubation. This obliged many embryologists to undertake research in this field in many different scientific and educational institutions of the country.

In particular, this research is carried out at the Institute of Oceanology of the Academy of Sciences of the KNR (earlier the Institute of Marine Biology) in Tsingtao, the second center of embryological research in China. Professor T'ung Ti-chou, Director of this institute, is a famous Chinese embryologist and the Academic Secretary of the Biological Department of the Academy of Sciences of the KNR. He is in charge of the Ichthyological Commission and, at the same time, supervises research on the embryology of fish although his individual research lies in another field. Chang Chih-i directs the Embryological Laboratory of the Institute; his work is divided between embryology and endocrinology. He performed a series of experiments on the effect of different hormones on the internal secretion of embryos (in particular, in connection with sex determination), endocrine correlation of a developing embryo and relation between the internal secretion glands and the nervous system (hypothalamus-hypophysis).

Chang Chih-i with a large group of students is now carrying out experiments on the stimulation of maturation and ovulation in fish. The task which the Chinese embryologists have set themselves is not limited to the stimulation of the last stages of maturation and ovulation. They aim at mastering the process of ovogenesis from the earliest stages with a view to stocking the ponds several times a year since the vegetative period is very extended in China.

This work is conducted on a large scale at the Wukang Institute of Hydrobiology of the Academy of Sciences of the KNR, in its Laboratory of the Physiology of Reproduction under the direction of young scientist Shin Shyn-fang and in the Laboratory of Pisciculture under the direction of Ni Do-shu. By combining the speed of the current, temperature effects and hypophyseal injections, it was possible to make the carp spawn in December. The stages of maturity in females of the same size, inhabiting the rivers, ponds and lakes as well as suitable but geographically remote reservoirs, are in the process of being compared. The first experiments on the insemination of Hypophthalmichthys proved to be successful. Professor Wu Hsing-venem performed interesting work concerning the hatching mechanism.

The problems of embryology, including that of fish, are being studied in the biological and ichthyological departments of higher educational institutions, of the Institute of Hydrobiology of Shanghai (The Faculty of Ichthyology, Professor Chu, Chief) and of the Universities of Wuchang and Peiping. A special department of embryology exists at the University of Nanking (Wang Hsi-chin, Chief) where, at present, research is carried out on the means of stimulating maturation of gonads in domestic fish of various sizes and kept under different conditions.

Speaking of studies related to pisciculture, we should also mention the first experiments in artificial breeding of sturgeon at the Fish Hatchery of Harbin. Lu Dzen-ling and Ho Leng-fang, scientific workers of the Institute of Fish Husbandry of Harbin, participated in these studies. These experiments are very important for China, particularly in connection with the planned breeding of sturgeon (Acipenser dabryanus) in storage lakes, which will form after the flow of the Yangtze has been regulated.

Chinese embryologists and ichthyologists are greatly interested in the Soviet studies concerning the stimulation of maturation in fish by hypophyseal injections (N. L. Gerbil'skiy method) and insemination, incubation and embryology of fish in general. Many Soviet books and articles have been translated into Chinese. On the other hand, the studies of Chinese embryologists, assaulting unanimously this branch of science, are undoubtedly of great interest to us. A close scientific contact along this line is very desirable. At the Institute of

Experimental Biology, we started joint research on certain problems of the physiology of insemination and experimental investigations of the processes of ovogenesis. At present, these investigations are continued simultaneously on the amphibians and sturgeons, and it is projected to widen the investigations.

* * *

Chinese embryologists also conduct important theoretical and practical work in other directions.

At the Institute of Oceanology in Tsingtao, Professor T'ung Ti-chou and his collaborators use the finest methods for isolating and recombining blastomeres with a view to investigating the appearance of bilateral symmetry, the differentiation of cytoplasm and the regulating processes of lancelet. They continue their earlier famous investigations which they performed on the ova of teleosts and ascidians.

At the same time, Professor T'ung Ti-Chou and Wu Sang-ching are studying the life cycle of the acorn barnacle (Balanus) and look for methods to prepare substrates which would prevent the Balanus larvae from attaching themselves to objects, i.e., to prevent the overgrowth of submarine life. This has an important practical significance.

In Peiping, embryological research is done at the Institutes of Zoology and Biophysics of the Academy of Sciences of the KNR and at the Academy of Medical Sciences where scientific workers Shih Tsa-tsu and Chang Tso-ke study the embryological development of sheep and chicks. Professor Ping, Director of the Institute of Zoology, is the teacher of all modern morphologists and embryologists of China. Quite recently, an embryological laboratory was formed at the Institute under the direction of Professor T'ung Ti-chou. The laboratory includes the group of his young collaborators, who until recently have been engaged in a phytoembryological research.

Professor Stse directs embryological work at the Institute of Biophysics. He is the author of embryophysiological studies, in particular, of the ones related to the respiration of the parts of gastrula and to the breathing gradient in the ova of amphibians and of coelentrates. The task of the current investigations consists of finding out the effect of nucleic acid on the embryological development of amphibians, birds and silkworm moths.

A special department of the Institute of Experimental Biology is concerned with the study of silkworm moths. The students and collaborators of Professor Phu Hsi work in it. They conduct research on the methods of regulating diapause (Tyan Tien-chih and Wang Gau-sheng) and of

parthenogenetic activation (Chang Ko) and the cytology of fertilization and of parthenogenetic development (Chu Hsi and Chang Ko). In connection with the work on acclimatization of Indian silkworm moth, experiments were completed on the optimal conditions of its life at different stages of development and the effect of various external factors.

Chinese embryologists also work in medical fields. There are several remedies in the Chinese people's medicine which, according to the testimony of Chinese doctors, produce favorable results in some forms of cancer (cancer of the uterus, breast, esophagus and stomach). The problem remains to explain biologically the process of the effect of these remedies. Inasmuch as the problem of malignant growth is closely related to experimental embryology and, in the opinion of some scientists, makes up a part of its problem, Chinese embryologists have included it among their tasks.

Research in this field has been started, in particular, in the Department of Experimental Oncology of the Institute of Experimental Biology. It is directed by Professor Yao Hsin, an embryologist and endocrine-histochemist and an author of a number of original studies. Yao Hsin, together with a group of young people under his direction, studies the effect of remedies of Chinese people's medicine on tumors transplanted and inoculated to animals from man. Professor Cheng Jui-ming of the same Department, great specialist in tissue cultures, together with a large group of collaborators conducts research on the effect of medical remedies of Chinese people's medicine on the growth of carcinoma cultures. At the same time, Professor Liu To-khun (?) and his group study biochemical processes of tumors by the method of radioactive tracers.

Work closely related in subject was completed at the Department of Embryophysiology of the Institute of Tsen Mi-kai. This involves finding out the effect of cancerous substances (methylcholanthrene) on the appearance of tumors in tailless amphibians and on the process of morphogenesis.

Chu Zhun', Chief of the Department of Tissue Regeneration of the Institute, completed a series of investigations of the healing of wounds and on the regeneration of muscles.

All embryological laboratories where I visited and worked were well equipped and had refrigerator rooms, nationally produced polythermostats, installations for accelerating exposures, etc. The Institute of Experimental Biology has at its disposal a laboratory of optic instruments and of cinematography, and the Institute of Biophysics, a factory for the maintenance and production of instruments.

Within a short time I became comparatively well acquainted with the work of Chinese embryologists and learned many interesting things. This was possible because of the exceptional attitude of the Chinese comrades, who shared their achievements with great willingness.

Chinese embryologists, just as we do, aim at deepening their scientific contacts. I hope that this article, in spite of its brevity, will contribute to this cause.

5253