庆祝建国十周年

Translation:
Commemorate
The 10th
Anniversary

# Communist Chinese Claims Regarding Scientific Progress In The Last Decade

# 十年来自然科学的重大进展

——为慶祝中華人民共和国建国十周年而作——

杜 潤 生

一

勇敢、勤劳而智慧的中国人民曾經創造过灿烂的中国古代文化，产生过很优秀的古代的科学家。中国天文学家关于岁差、岁周期、日月蝕的研究都比欧洲天文学家早得多。紀元前403—221年的战国时代，我国人民就发現了物质的磁性。在第五世紀，我国数学家定圓周率值为 $\pi=\frac{355}{113}$，准确到七位数字。十世紀时，我国已制成火葯。宋代(十——十三世紀)制成了世界最早的利用喷射气流获得反作用力的火箭。医生华陀在第三世紀时就利用麻醉术进行了一些复杂的外科大手术。不胜枚举的例子表明：古代中国人民对世界科学文化曾有过光輝的貢献。

但是，当世界現代科学不断前进的时候，我們落后了。人們知道，从十七世紀起，現代科学在产业革命推动下开始了蓬勃的发展。十九世紀最后十年和二十世紀的最初十几年，旧式的蒸汽机开始在很多方面被电动机和內燃机所代替；飞机和无綫电由幻想变成了現实；放射性的发現和相对論、量子論的建立开辟了一个新的时代——原子能时代。但是，在这一期間，中国封建社会长期停滞，随后，帝国主义入侵，民族危机日益加深，国民經济日趋破产，社会的扩大再生产都难以繼續，这就造成了科学技术的停滞不前状况。

世界第一次大战爆发，帝国主义不暇东顧的时候，中国的微弱的民族資本主义經济获得喘息和发展的机会，引出科学研究的一綫生机。五四运动中，科学与民主，曾經成为代表进步思潮的口号。但是在人民民主革命未能彻底完成以前，不論用什么形式提出发展科学的任务，都是不可能实現的。

十多年后，爆发了1925—1927大革命。革命沒有成功，中国走上了革命和反革命艰苦搏斗的时期，直到抗日战爭的十多年时間內，馬克思主义的社会科学，尽管受到統治阶級无比的摧殘，但終于在阶級斗爭的推动和工人阶級的撫育下，在战斗中不断成长起来，有了重大的发展。至于自然科学，則由于当时半殖民地半封建經济和政治結构的束縛，依旧沒有得到发展的条件。如果說有一点发展，也只是在下列各种情况下才出現的：反动統治阶級为了点綴他們的"建設"成績，曾經拿出了少得可怜的一点經費，办了点科学事业，如当时中央研究院、北平研究院的19个研究所，每个研究所的研究人員和輔助人員，合計各只有数人至数十人；帝国主义国家为了侵略中国的需要，也曾办过一些科学机构，例如，1873年法帝国主义派来的传教士在上海徐家汇办了一个天文台，英帝国主义控制的中国海关又委托这个天文台开办了气象工作，当时这个台的工作是向航行于中国沿海的外国船舶报告时刻和天气預測，以保障它們的安全；在个别民族資本家帮助下，还在本世紀二十年代成立了几个私人性质的科学机构，如黃海化学研究所、"科学社"的生物研究所等。这些研究机构在当时十分艰苦困难的环境中，为我国科学工作者提供了进行一些研究工作的条件，使得我国的自然科学在1927年至1937年国民党反革命統治时期中，得到維持生存的机会。此外，这个时期，在高等学校中也曾零星地、自发地进行了极为有限的研究工作。

从1937年起，日本帝国主义入侵，全国进入抗敌战爭。我国原来集中在沿海一带的科学机构，大部分为日本帝国主义所摧殘。1940年前后的7—8年里，

First page of article p. 379 in Chinese

# Communist Chinese Claims Regarding Scientific Progress In the Last Decade

## With Appended Bibliographic Notes

➤ THE TENTH anniversary of the establishment of the Chinese Communist regime on Mainland China, which took place last year, was the occasion for the publication by the Chinese Communist government of numerous articles proclaiming massive advances within science and technology. These articles, which range from detailed reviews on progress within narrow fields published in the specialized professional journals to general and popularized accounts carried in newspapers, paint a picture of a new China resolutely endeavoring to narrow and close the gap between its scientific and technological level and that of other nations, and eventually to surpass them. The ideological rationale for this endeavor derives completely from Marxism-Leninism—specifically from the hypotheses that science exists solely to serve the State through its ability to improve technology and thereby economic production, that socialist states inevitably are in a condition of conflict with capitalistic states, and that socialist states (and specifically, Communist China) will inevitably triumph.

This ideological framework has given the development of Communist Chinese science a peculiar orientation and character which is difficult for most Western-trained and oriented scientists to understand. Many concepts and values most prized by Western scientists—such as the importance of conducting research for "science's sake," the non-political nature of science in general, and the necessity for scientists to determine their own courses of research and study—are completely rejected. The strangeness of this scientific environment in Western eyes, combined with the great difficulties imposed by the language and the political barriers to the exchange of scientific information, have led to a general rejection of Chinese Communist claims to scientific achievement as well as a tendency to ignore their literature.

The achievements of the Russian scientific community are built upon a base similar to that being established in China. The Russian progress recently warned us of the dangers inherent in the Marxian viewpoint and have indicated the necessity for a closer observance of the development of science in Communist China. In this respect the numerous reviews, surveys, and general pronouncements prepared for the occasion of the tenth anniversary are of great importance and interest both because of and in spite of their frequent excursions into Marxist ideology. These documents clearly indicate the scope of the Chinese effort, the areas of emphasis, the manner in which scientific philosophy has been subordinated to the political ideology and the probable areas of future development.

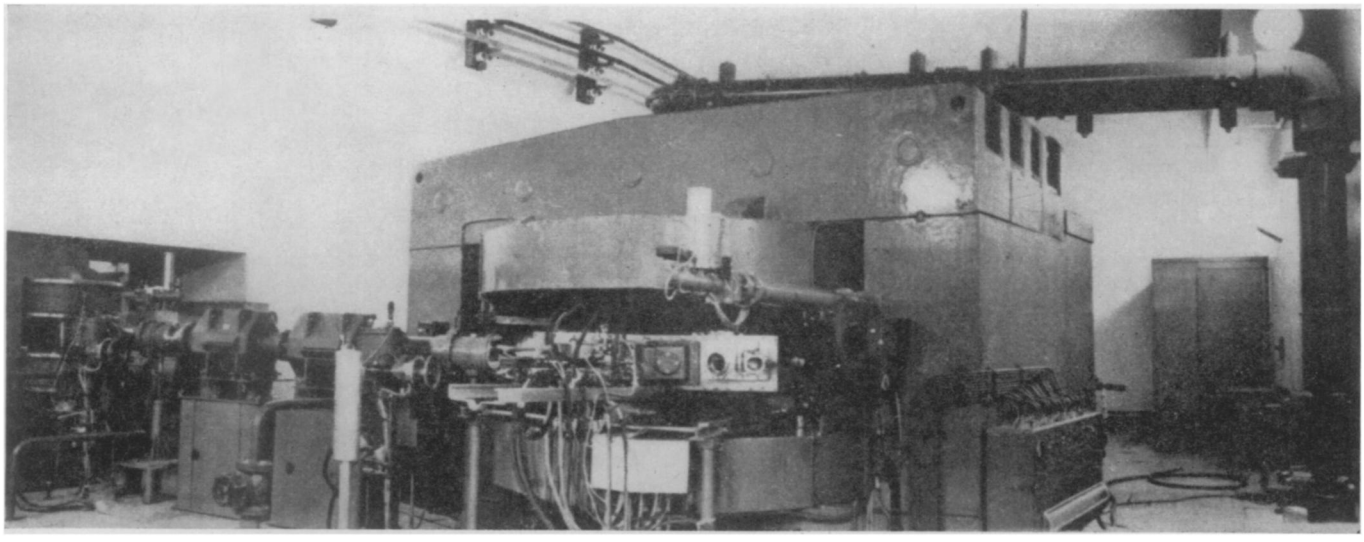
One of the most comprehensive of these documents was published in English by Du Ruen-sheng, Deputy Secretary of the Academia Sinica in Peking, in the November, 1959, issue of Scientia Sinica, Vol. VIII, No. 11, pp. 1196-1217, entitled "Great Progress Made in the Natural Sciences in China During the Last Decade." This document, which appeared in Chinese and English in the original Peking publications, is presented as an introduction both to Communist Chinese scientific philosophy, their claims to progress and achievement and the shortcomings which they have frankly acknowledged. SCIENCE SERVICE, with the financial cooperation of the National Science Foundation, is therefore publishing in SCIENCE NEWS LETTER this statement, uncut and unedited, as a contribution to American understanding of the present state of Chinese Communist science.

No changes have been made in the text other than the insertion of subheadings and footnote numbers referring the interested reader to the appended bibliography of available English translations of Chinese review or summary articles deriving from the tenth anniversary celebration. Although the ideology expressed in this item in no way represents the policies, views, or attitudes of the editors, and although the author's use of English is frequently poor, it was felt that any deletions or amendments would greatly reduce the value of the document.

The list of references to published material and the ability to obtain it in English translation as listed in the bibliography will serve a very useful purpose in giving more detailed information and direct access to these publications.

• Science News Letter, 78:378 December 10, 1960


*COMMUNIST CHINESE SCIENTIFIC PERIODICALS—Include Chemical World, Chinese Medical Journal, Chinese Journal of Internal Medicine, Chinese Science (Scientia Sinica), in which the English language version of article beginning page 379 appeared, Science (pictured beneath Scientia Sinica), in which the original Chinese version of article appeared, Oceanography and Limnology, Journal of Water Conservation, and Silt Research.*



*CHINA'S FIRST CYCLOTRON AT THE ATOMIC RESEARCH INSTITUTE NEAR PEKING*

# Great Progress Made In the Natural Sciences In China During the Last Decade

**Reprinted from Scientia Sinica, Vol. VIII, No. 11.**

**By DU RUEN-SHENG**
**(Academia Sinica)**

➤ THE INDUSTRIOUS, brave and clever Chinese people created a glorious culture in ancient China and produced many distinguished men of science. Studies in the precession of the equinoxes, the periodical year and the eclipses of the sun and the moon had been made by Chinese astronomers long before the Europeans. During the Warring Kingdoms period (403-221 B.C.), our people discovered magnetism in matter. It was in the fifth century that a Chinese mathematician succeeded in determining the ratio of the circumference of the circle to its diameter as $\pi = 355/113$, correct up to seven decimal places. Gunpowder was first successfully made in the tenth century. The first rocket in the world working on the reaction of gas jets made its appearance during the Sung Dynasty (10th to 13th century). The famous medical man, Hua T'o (141-203 A.D.), successfully carried out a number of complicated major surgical operations under narcosis. Instances too many to enumerate bear evidence to the fact that the ancient Chinese people had made brilliant contributions to world culture and science.

## Admit Science Lag

However, while modern science of the world was making continuous advances in recent centuries, we lagged behind. Since the seventeenth century, modern science had begun to develop vigorously under the impact of the Industrial Revolution. In the last decade of the 19th century and the first decade of the 20th, the old-fashioned steam engine began to be replaced by the electric motor and the internal combustion engine; the airplane and the radio turned from mere imagination into reality. The discovery of radioactivity and the founding of the theory of relativity and the quantum theory opened the new atomic era. During the same period, however, owing to the prolonged stagnation of the Chinese feudal society and later on to the imperialist invasion, our national crisis became daily more acute, our national economy headed for bankruptcy and our social extended reproduction could only continue with difficulty. Consequently science and technology remained for a long time in a state of inactivity.

After the outbreak of the First World War, when the Western imperialist countries were too busy to further their plundering in the East for the time being, the very feeble Chinese nationalist capitalist economy had the chance then to take a breath and to develop itself, incidentally giving a spark of life to scientific research. In the May Fourth Movement, "Science and Democracy" was the slogan representative of the progressive thought at that time. But, before the people's democratic revolution could be accomplished in a thoroughgoing manner, the task of the development of science, in whatever form it might be put forward, could not possibly be fulfilled.

Some ten years later broke out the Great Revolution of 1925-1927. It did not succeed, and China then entered into a period of bitter strife between the revolutionary and the counter-revolutionary. In another interval of over ten years until the commencement of the war against Japanese aggression, the Marxist social science at last began to grow continually under the impulsion of the class struggle and the fostering by the working class, and to attain important developments in its battles in spite of the relentless suppression by the ruling class. On the other hand, the natural sciences, on account of being fettered by the semi-colonial and semi-feudal economy and the political structure then prevailing, they remained as before short of conditions for development. Even if it is conceded that they had any development at all, it happened only under the following circumstances. In the first place, the reactionary ruling class gave pitiably small appropriations for running some show of science, such as the former Academia Sinica and Peiping Academy, to decorate their so-called construction. The two institutions together had but 19 research institutes, each of which had from a few to scores of research and auxiliary personnel.

## Missionaries Founded Observatory

Secondly, the Western imperialist powers also set up certain scientific organizations to meet the needs arising from their aggressive exploits in China.

For instance, the Catholic missionaries sent to China by the French imperialists founded an astronomical observatory at Zi-Ka-Wei in Shanghai and the then British-controlled Chinese Maritime Customs commissioned them to render meteorological services. The observatory was to send time signals and weather fore-

casts to the foreign vessels navigating the Chinese waters to ensure their safety. Thirdly, a few scientific institutions of a private nature, under the sponsorship of individual nationalist capitalists, were established during the First World War and the subsequent years, such as the Huang-hai (Yellow Sea) Institute of Chemistry and the Institute of Biology of the Science Society, etc. The above-mentioned organizations indeed furnished our scientific workers with certain research facilities in exceedingly difficult circumstances and were instrumental in maintaining the very existence of the natural sciences in China during the period under the Kuomingtang anti-revolutionary rule 1927 to 1937. Moreover, a very limited amount of research work was also carried out sporadically and spontaneously during this period in certain institutions of higher education.

Beginning with 1937, the Japanese imperialist invasion into China threw the entire nation into a war of resistance. As most of the scientific research institutions were then concentrated along the coast, they were all destroyed by the Japanese imperialists. It was during the years of Japanese invasion that the wonderful development of the most advanced modern techniques such as the atomic energy, the radio electronics, etc., took place in the West, whereas in China, apart from only a few individuals doing odd bits of research at home and abroad and a limited number of personnel trained in institutions of higher education, the record of the development of natural science in this period was almost a blank page.

## China Started Anew

In the year 1949, thanks to the great victory of the Chinese people's revolution under the leadership of the Communist Party of China, science in China started a new life: it returned to the hands of the people. Fostered by the state under the leadership of the working class, science began a new period of growth.

In the few years from the Liberation of the entire country to 1956, the principal measures adopted for promoting science in China consisted in adjusting and strengthening those institutions which were inadequate and overlapping; in appropriately reorganizing and consolidating the formerly scattered and weak scientific forces; in developing higher education for training new scientific cadres; and in encouraging the scientific workers to carry out ideological self-remoulding on the basis of the principles of Marxism-Leninism. It was in 1949 that Academia Sinica was established, and a plan for the development of science was subsequently formulated. The various ministries in charge of production also established their specialized scientific institutions. The All-China Federation of Scientific Societies was inaugurated. Specialized curricula were readjusted or newly set up in the universities and colleges according to the divisions of modern science and the needs of national construction. Owing to their participation in various politcial movements and in social life, and owing to their study of Marxism-Leninism and apprehension gained personally in scientific pursuits, the scientific workers had in various degrees uplifted their political consciousness to a higher level. In the meantime, Chinese scientists accomplished a number of valuable tasks in scientific research in support of the War to Resist America and Aid Korea and for the rehabilitation and the new development of national economy.

## Rapid Advances in Science

The year 1956 was one in which a great victory was won in the socialist revolution in China and one in which rapid advances in Chinese scientific enterprises were made. At a conference convened by the Central Committee of the Communist Party of China on the problems of the intelligentsia at the beginning of this year, Chairman Mao Tse-tung called upon the Chinese scientific workers to struggle for the early attainment to the advanced scientific level of the world. Immediately following this, the Twelve-Year Long-Term Plan for the Development of Science and Technology was formulated under the direct guidance of the State Council. This plan included many important scientific and technical tasks urgently required by our country and laid special emphasis upon certain key problems. In the said plan, appropriate arrangements were also provided for with respect to the organization of scientific research, the establishment of new research institutions, the employment and training of scientific and technical cadres, international scientific cooperation and other problems. Although this plan still remains in draft form, it has in reality become a unanimously-supported programme of action implemented faithfully and conscientiously by our scientific workers in various fields. After three years of exertion, many research tasks and organizational measures stipulated in the plan have already been successfully carried out.

In 1957, on the basis of the completion of the socialist revolution of ownership of means of production, an anti-rightist struggle and an all-people's rectification campaign took place. Both were in fact a socialist political and ideological revolution in which a great victory was also scored on the science front. Through this political movement the broad mass of scientific workers recognized that scientific enterprises should be put under the leadership of the Communist Party, that science should serve socialism and that every scientific worker should handle properly the relations between theory and practice, between the individual and the collective and between the specialists and the masses. Thus was laid the ideological foundation for the realization of a big leap forward in scientific research.

During this period, scientific and technical cooperation between China on the one hand and the Soviet Union and other fraternal socialist countries on the other was further developed and strengthened, thus enabling us to receive continuous fraternal helps from these countries.

In 1958, the Central Committee of the Communist Party proposed formally to the entire Party and the entire nation the general line of "going all out, aiming high and getting greater, quicker, better and more economical results to build socialism," and at the same time called upon the people to put politics in command, to emancipate the mind, and to set up the communist style of daring to think, to speak and to do things. Thus, the socialist revolution penetrated a step further into the ideological realm. The revolutionary enthusiasm, the initiative spirit and the subjective activity of the broad mass of the people manifested themselves at once. And the situation of an overwhelming nation-wide big leap forward in industrial and agricultural production immediately took shape.

The thoroughgoing socialist revolution greatly liberated the social productive forces. The question: "Can science march forward with a high speed keeping up with the demands of the general line?" was then posed before the scientists in China, demanding an immediate answer. The answer was soon found and this was that in scientific and technical matters, if politics is put in command and if ideology is put in command; if we rely on man's own initiative and active spirit instead of on the use of material stimulations as the only expedient; if we bring about a combination of the research work of scientific institutions and the movement of technical innovation on the part of the broad masses, a combination of the specialists and the great masses and a combination of the militant zeal for work of the young scientific workers and the positive functions of the experienced scientists; and if we do not depend only upon the small number of specialized research institutions and the small number of specialists and experienced scientists for the carrying out of scientific work, in short, if we take the mass line in scientific work, a great upsurge in the march on science will definitely be brought about and a rapid advance in science will be attained.

## Outlook Changed

It is now obvious that the mass line has given rise to great changes in the outlook of science in our country. For example, with the broad mass of the people cooperating with botanical workers in tackling the problems of the investigation and utilization of wild plants (1), more than a thousand kinds of wild plants were discovered and put to use in 1958 alone, and it is expected that the general survey of wild plants in the extensive territory of this country will be practically completed by the end of this year. If we are to conduct a survey of such great dimensions with the old methods, it will have to take years to complete. As another example, young scientific workers working together with experienced scientists in the research of optical instruments had developed the making of eight kinds of extremely complicated instruments of high precision in only a few months in 1958, a task that would take a number of years to develop even in the scientifically advanced countries. There is also the successful isolation of many kinds of rare-earth elements by the young research workers in the Institute of Chemistry, which took them only ten odd

days of intensive shock work. If such a problem were tackled in the traditional way, it might take many years without getting a satisfactory solution in the end. It is worth while to give the above examples, because some of the work was carried out in the midst of controversy. At that time, some people, mostly scientists of the older generation, were sceptical about the possibility of carrying out the research project in a short time, while some others, mainly youthful scientific workers, positively insisted on working through to a successful end. Eventually, after a year of trial, it is well proved today that the youthful people are correct and the proposition that scientific work can also follow the mass line is definitely a sound one.

To be both red and expert, that is, to be politically mature and professionally proficient, to serve socialism, to bring about a big leap forward, to follow the mass line, such are the directions of advance pointed out to our scientific world by the general line.

## Development of Natural Science

Planned development of science is a characteristic and also a great merit of the scientific undertakings in socialist countries. In order to make clear the current situation of the development of natural sciences in our country, it is necessary to render a fuller account of it.

The development of science according to plan has a special significance for China, because our foundation of science has been a very weak one. To bring our science with such a foundation to the advance world level, it is essential that we should by all means make full use of all the virtues offered by the socialist system. Thus, we cannot but seek to avoid the state of anarchy in scientific work and stress the importance of the development of science according to plan.

Our plan for the development of science was formulated with a view to meeting the long-term needs of our socialist construction. In the process of its formulation and putting it into effect, we have also paid special attention to the following concrete demands: 1) to lay stress on the proper relationship between science and production and to implement the principle of the unity of theory and practice; 2) to fully utilize the scientific resources, devoting our main strength to those aspects which are most significant and most urgently required.

The development of the natural sciences is basically determined by the requirements of the actual production practice. Separated from social requirements, the natural sciences would be totally devoid of significance. To know Nature is for the purpose of transforming it to satisfy the requirements of production. Some maintain that "scientific research would not in the least tolerate utilitarian considerations". In saying this, they forget that all the current scientific inventions in the world are without exception directly related to social requirements and therefore inseparable from considerations of utility. In the world of today, the difference in the question of utility lies only in whether it is for the capitalist or for the people. It is either this or that, but no other. The slogan "science for science's sake" is incorrect. Each and every scientist should clarify his own attitude and take a definite stand as to which class and what nature of production he works for and to which kind of society he is dedicating his work. In so doing, the freedom of scientific exploration will not be affected in the least. On the contrary, that freedom is being encouraged and promoted.

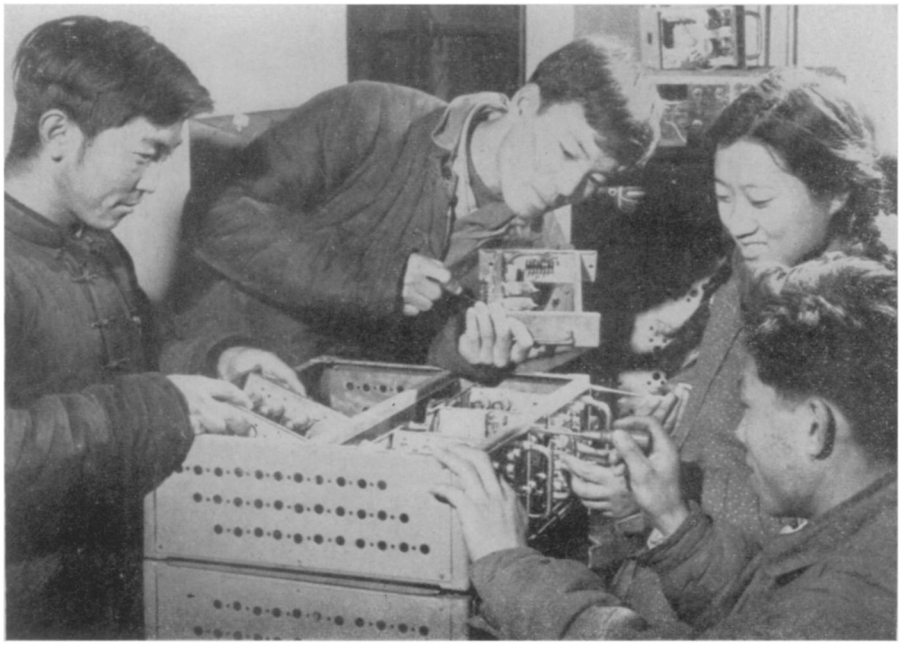
It is indeed our great fortune to find that the socialist economic construction of our country now being developed in full swing is providing for us a production background that is growing stronger and stronger. The continuous implementation of technical innovation in socialist production not only is itself a fundamental propelling force for the advancement of science but also offers conditions under which an abundance of research data and laboratory equipments may be secured. All these are beyond the dream of old China. Scientific research of new China serves her socialist construction and at the same time serves science in its advancement. Thus scientific research must be closely linked with production practice.

Of course, the linking of science and production must not be understood wholly as a sort of hand-in-hand relationship or body-and-shadow relationship. The results of some of the fundamental researches can be made use of in production only through certain other disciplines of science, the relationship between fundamental research and production being often of an indirect nature. Some researches are related to the requirements of production of tomorrow, others are related to production of a general nature and have bearing on basic principles, while still others are only instrumental in the exploration of new directions of scientific development. But all these researches are indispensable for the continuous innovation of production technique. It is precisely for this reason that our Party and government have constantly been emphasizing fundamental theoretical research.

## Twelve-Year Plan

Based on the aforementioned basic understanding, we adopted the following method in drafting the Twelve-Year Long-Term Plan for the Development of Science and Technology. The tasks of scientific research are formulated according to whether they meet the requirements of the development of national economy. Each of the main tasks of scientific and technical research aims at fulfilling a certain major technical requirement in economic construction. Such requirements are to be met not only through research in one single scientific discipline but also through the mutually coordinated efforts of many disciplines, whereas the theoretical research of each discipline is to be carried out round these tasks. Thus, the development of science is closely integrated with the requirements in national production and national construction. Lest subjects of fundamental theoretical research might be inadvertently left out, certain important fundamental theoretical problems are especially included as tasks in the plan. Besides, plans for certain important fundamental disciplines are also provided, subordinate to vital scientific and technical tasks.

Why do we stress the importance of the concentrated use of our scientific resources? It is because our plan for the development of science necessarily reflects the all-inclusive requirement of our socialist construction,



*STUDENTS BUILD ELECTRONIC COMPUTER—At Chinese University of Science and Technology, set up in Peking in 1958 to train research workers in the most advanced branches of science.*

namely, to strive for high-speed development. In other words, to make full use of the comparatively small and feeble scientific resources now available to do more and greater things in the shortest possible time.

China is a big country with a population of more than six hundred million. For the purpose of building an advanced scientific organization in the country so that we may be able to rely on our own strength to resolve all the scientific and technical problems in the prosecution of our large-scale socialist construction it is absolutely necessary that all the departments of science must have a balanced development. Now, the development of modern science has expanded its sphere of research to such unprecedentedly vast proportions. And, as a late comer, China has but scanty scientific resources. Under such circumstances, there are two possible courses we may take: either we adopt a policy of giving priority to the development of special-emphasis subjects with due attention paid to the others, so that we may concentrate our limited and not too strong resources in the directions that are the most useful, the most significant and the most productive of results, or otherwise, we use our strength evenly in all directions and leave out none. Which course is the better and the quicker? We have chosen definitely the former. Experiences in the past few years show that when we hold fast on certain most important objectives in the pursuits of science, other objectives that are only of secondary importance will be influenced thereby, with the result that they too would move forward. If we could get hold of the central links in the chain of science development, we should then be able to set in motion the remaining links without any difficulty. Should we distribute our forces evenly over the entire front, we should find that all our positions were but poorly guarded and we had to suffer losses.

## Science for the Economy

There are two fields of scientific research which call for a greater concentration of our strength. In one field are the scientific problems of great significance in our national economy, including those concerning the utilization and exploitation of natural resources, those bearing on technical innovations in departments of industry and communications, those relating to agricultural production, etc. (2-7). Any one of these problems not only involves a huge amount of work but includes quite a number of inquiries of theoretical significance as well. For example, to raise a bumper crop, there is involved a number of theoretical problems relating to cultivation techniques, seed selection, plant physiology, etc. If all these problems are successfully resolved, then quite significant results will be obtained and the science of high-yield agricultural production, biology and agronomy will be raised to a much higher level. It must be pointed out, however, that our work is by no means confined to these endeavours only, and there are further demands, namely, to industrialize our agriculture so as to convert by degrees manual labour into mechanical operations, and accordingly to bring along rural electrification, chemification and overall scientific management. As regional peculiarities are a predominant feature in agricultural production, it is therefore of little use for our agriculture merely to take over the available techniques of foreign countries. Consequently it becomes necessary for us to carry out an enormous amount of systematic and original scientific research. And this is the responsibility of our scientists. Similar conditions exist also in domains other than agriculture, such as geological prospecting, exploitation and utilization of water resources, metallurgy and others. To concentrate our scientific resources in these problems is entirely necessary and the results obtained therefrom will definitely be considerable.

Another important field of problems which we should get hold of consists of certain new techniques and important border line sciences, such as nuclear technique, computing technique, semi-conductors, radio-electronics, automation, chemical physics, biophysics, etc. All these are now developing fast, being the spearheads of the science front in its march forward and the new growing points in the development of scientific theories, and in consequence they are inevitably the domains where we shall reap the richest harvests and the directions in which victories can be easily won. However, it is precisely in these directions that the scientific forces we used to have are the weakest. Thus today, unless we concentrate our forces with the greatest shock spirit, nothing can be achieved.

## Review of Developments

Now let us review briefly the developments and accomplishments of the natural sciences in the last ten years in the light of the basic requirements for the development of science in our plan mentioned above. As it is impossible to relate all the achievements in detail within the limited space, we shall then give an account in general outline below.

Socialist economic construction should be carried out under some plan. It requires the full utilization of our rich natural resources and favourable natural conditions as well as the rational allocation of productive forces in different regions. In the series of investigations and studies to be carried out for the fulfillment of these tasks, complex expeditions play an important role (8). This undertaking requires synthesis of the research results of all the departments concerned and a huge amount of organization work, both of which are time-consuming tasks.

In the past ten years we have sent from time to time a number of complex expeditions to study and investigate Tibet, the Yellow River, the Amur River (or Heilungkiang), Sinkiang, Chinghai (Koko Nor) and Kansu, and the Tsaidam salt lakes, and also to take up numerous important problems, such as the diversion of the southern streams to the north (that is, diversion of the surplus water from the Yangtze River northward to the Yellow River basin), the utilization of the glaciers and snow cover on the higher mountains, the fixation of the sand dunes, the survey of the tropical biological resources of South China and Yunnan Province, the pursuit of oceanographical studies and so on. Now, whether in the number of scientific disciplines involved, or in the immensity of the areas covered, or in the enormousness of their scope, these expeditions are unprecedented in the history of science in China. Participants in these expeditions include not only our own scientists from various ministries and departments but also a number of Soviet scientists. These undertakings are of great significance to our national economy and also of immense value to science. The important directions for our endeavours from now on will be the creation and expansion of our specialist forces and the strengthening of the scientific analytical work and the processing of the data and materials obtained.

In addition to the complex expeditions mentioned above, a large number of surveys and investigations of a specialized character in the earth sciences and the biological sciences have also been carried out.

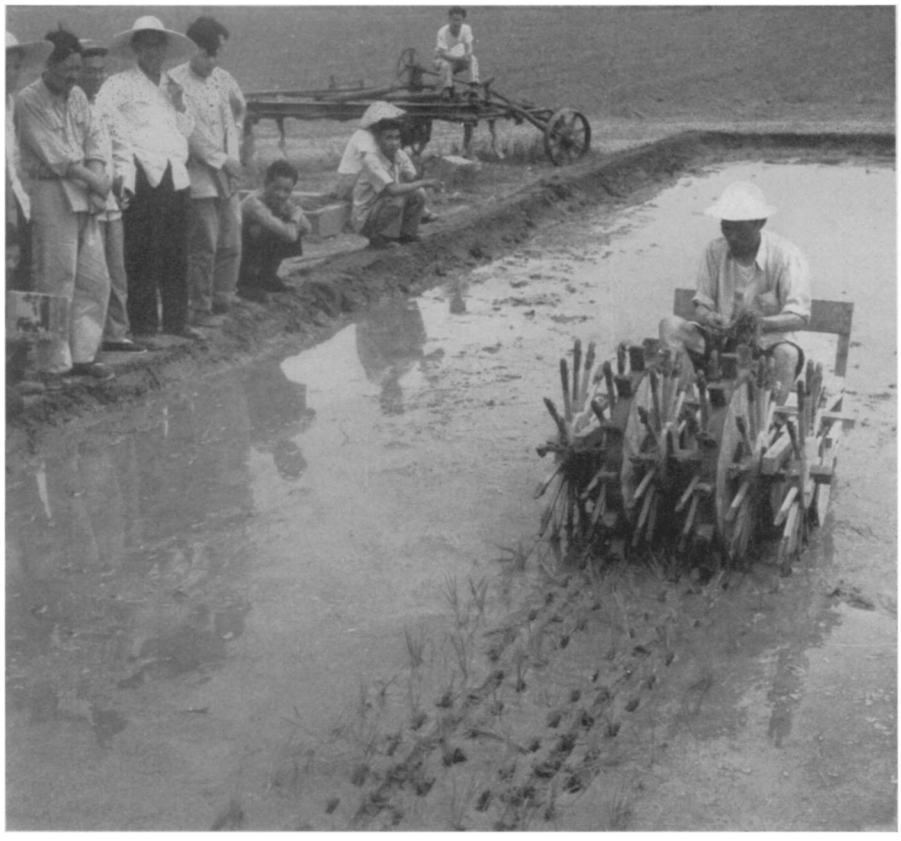
## Geological Research Began Early

Geological research work began at a comparatively early date in our country, but because of the shackles imposed by the old social system, the science of geology was divorced from practical needs and remained undeveloped for a long period. During the 40 years prior to the Liberation, geological prospecting was limited to only 18 kinds of minerals. Under such circumstances it is not surprising that absurd statements such as "China lacks mineral resources", "China is poor in oil and copper", "There are no coal deposits south of the Yangtze River", etc., were fabricated by scholars in the employ of imperialist interests.

Now, in the face of realities all these lies and nonsenses have been utterly shattered. During the short period of ten years after Liberation, Chinese geological workers have newly found 88 kinds of mineral deposits in our country in prospecting. It has been positively proved that China is a country with very rich mineral resources. Rich deposits of important minerals such as iron, coal, petroleum, copper, manganese, tin, aluminum, zinc, mercury, tungsten, antimony, molybdenum, etc., have been discovered (9). For instance, in Kiangsi, Kwangsi and Honan Provinces, regions formerly considered to be lacking in iron and coal, deposits of both with great economic value have now been found. Large oil fields have been discovered in the Northwest and the Southwest. The oil fields have also been found to possess a much greater reserve than formerly estimated. In recent years, large ore beds of rare and dispersed elements have been found by prospecting. Making use of the abundant data and materials accumulated in the course of prospecting work, research work in ore deposits has also greatly advanced.

A foundation has already been laid in China for the important branches of science like geochemistry, geophysical prospecting (10-12), hydrological geology and engineering geology.

Even greater strides are being made in geophysical observation work (12). The



*WOODEN RICE PLANTING MACHINE—Invented by Tai Mao-yang, a doctor in Fukien Province, is being tested in the Peking Research Institute of Agricultural Machinery. Four types of rice planting machines will be popularized among rice growers in China.*

total number of meteorological observatories and stations in the country has increased to more than 21 times the figure immediately after the Liberation (13-14). In short-range weather forecasting and the prediction of weather adversities such as cold waves, rainstorms, frostbites and gales, the accuracy has been greatly enhanced as a result of systematic researches (13-24). From 1953 onward, we have also gradually established facilities for forecasting summer precipitation.

Seismologists cooperating with historians have systematically collated all the historical data about earthquakes in China beginning from 1189 B.C. and determined the intensity of earthquakes in many industrial cities and districts under construction.

A good many kinds of scientific maps, charts, monographs and documents have been compiled during the past ten years on the basis of the abundant data and materials accumulated in large scale investigations and surveys together with the utilization of the past research results. The more important documents consist of the schemes and specifications of China's natural division as well as geomorphology, climatology, hydrography, pedology, vegetation and fauna. In connection with the division work of this country have been compiled the 1:4,000,000 vegetation map, soil maps, geomorphological maps, map of Quaternary deposits and division schemes and specifications of hydrological geology of China. Other works completed include a 1:4,000,000 geotectonic map, a treatise on the outline of the tectonics of China, a treatise on the mineral ore deposits of the Northwest of China, a palaeogeographical map of China, etc. Very recently a number of works on the flora of China (one volume each for the *Pteridophyta,* the *Gymnospermae,* the *Cyperaceae,* the *Aceraceae* and the *Scrophulariaceae)* and on the economic fauna of China (one volume each for helminthology, ornithology and mammalogy) have been compiled, these being dedicated by the Chinese botanists and zoologists to commemorate the tenth anniversary of the founding of the People's Republic of China.

## A Decade of Industrial Construction

In the past ten years, our scientists have done a lot of work about the immediate needs of industrial construction in three domains: 1) multiple utilization of important natural resources, 2) improvement and advancement of production techniques and 3) supply of scientific data with which to design large-scale engineering construction projects. In carrying on the work in these domains, we have inaugurated studies in fuels, power engineering, electrical engineering, mechanical engineering, etc., and we have also developed research in metallurgy, ore dressing, civil engineering, architectural engineering, hydraulic engineering, etc. None of these studies could have developed in old China. In the deplorable past, there were few institutions of higher education for training scientific personnel in these specialties, still less facilities for scientific research. After the Liberation the People's Government took immediate action and hastened to bring about a change of such a lamentable state. In paying the greatest attention first of all to the establishment of factories and schools, the Government also launched programmes of scientific research even though the manpower then was in an extremely strained condition. It may now be said that a fairly adequate foundation has already been laid for the development of production, education and research, and of the three, research work is to grow in proportion by degrees.

After ten years of exertion, our techniques in ferrous metallurgy (25-26), so far as the utilization coefficients of blast furnaces and open-hearth furnaces are concerned, now rank among the world's most advanced. The technique of three-tapping troughs for steel smelting is an outstanding Chinese invention. The newly-developed small blast furnace and small converter embody also many original technical features devised by the mass of people and adapted to characteristic local conditions. Preliminary solutions have also been reached in the problems of the smelting of complex iron ores containing fluorides, titanium-containing iron ores and high phosphorus content iron ores. In non-ferrous metallurgy (25-26), the technique of fluidized bed roasting has successfully been introduced in the zinc-smelting industry and will soon be introduced in copper-smelting. Researches in hydro-metallurgical methods for ores containing copper oxides difficult to dress have greatly increased the recovery rate of copper.

In the course of the big leap forward, we have practically built up a new metallurgical system for alloy steels suited to the conditions of our natural resources that require the economy of nickel and chromium. Systematic researches have also been conducted in regard to special alloys.

## Techniques For Liquid Fuels

For increasing the sources of our liquid fuel supplies (27), researches in the low-temperature distillation of shale and coal have resulted in an improvement of the design of the retorts with conspicuous success. The hydrogenation of coal tar and the medium-pressure gas synthesis for the production of liquid fuels and other chemical products are outstanding achievements in research. And in the course of the research in the latter projects, catalysts with higher activity have been discovered, with which the yield of hydrocarbons above propane is 191 grams per cubic meter of carbon monoxide and hydrogen. Remarkable advances have also been made in the chromatographic method techniques which are indispensable for petroleum analysis.

In our power engineering techniques an all-round improvement has been obtained. At present we have already mastered the techniques of designing, manufacturing, and construction for hydroelectric stations of 1,000,000 kilowatts capacity and thermal power electric stations of 450,000 kilowatts capacity, as well as the designing and manu-

facture of new-type free-piston gas turbines.

Our electric power technology is now heading for big power systems, high-voltage generation and transmission and automation (28-32). For the improvement of the performance of large-type power equipments, we have commenced experimental research work on the hydrogen and liquid cooling in the interior of electric machine conductors so that their capacities will be conspicuously raised. We have studied a series of problems of the high-voltage power transmission systems of 330 kilovolts and have also completed the designing work for the automation of the power systems in the Northeast.

In machine-building technology in the past ten years we have radically changed the former backward condition of being capable only of doing repair work and entered into the designing and production of various kinds of large-type and precision machineries (31). In the casting of machine parts, attempts have been made to produce them by employing the permanent melting mould technique. Our indigenous method of clay-mould casting, after having been studied and improved upon, can now be used in the iron-casting shops in place of the sand-mould casting requiring one mould for each cast so that the production rate has been multiplied threefold. Advanced technological processes such as the thin-shell clay mould casting, the casting of large-sized machine parts and pressure-casting of light metals, etc., have all been adopted in the factories. A research system is being built up to delve into the theories of the strength of machine parts.

## Develop Processing Techniques

Achievements have also been made in a series of processing techniques. Citable examples include researches on hot-rolling of gear wheels and threaded rods in the field of pressure processing; the popularization of ceramic cutters in metal-cutting processing; the successful trial making of electric pulse processing lathes in electrical processing and the invention or improvement of friction welding, electro-slag welding and pile welding in the field of welding processes.

In the past ten years, systematic studies have been made for the improvement of the treatment, processing and mechanical properties of spheroidal-graphite cast iron, thus greatly extending the sources of raw materials for the machine-building industry.

In regard to optics and fine mechanics, a series of high-precision instruments have been successfully produced, such as the large-type electron microscope with a resolving power of 25 Å and a magnifying power of 100,000; the automatic-recording infra-red spectograph; the new-type universal tool measuring microscope; the wide range phase contrast microscope; the large-type interferometer, etc. In optical systems certain conditions of the formation of high order aberrations have been clarified, and as a result the ultra-large aperture F/0.8 photo-objective with a viewing field of 40° and the F/2 continuously variable focus objective with a maximum viewing field of 60° and a focal variation of 1:5 have been successfully designed.

We have also carried out researches on the making of optical glass containing rare earth elements.

Keeping up with the requirements of post-Liberation large-scale capital construction schemes, the scientific and technical levels of civil and architectural engineering have been brought to new heights (30), (32-36). A comparatively large quantity of work has been done in the theories of structure. The study of pre-stressed reinforced concrete structures has been advanced and its results obtained have been put to application. In large-span structures for civilian use, the thin-shell structure of reinforced concrete has been introduced and the largest span of cylindrical long-shell structure has reached 55 metres. For the economy of steel bars, timber and cement, a number of substitutes have been found. In the railway (32), highway and bridge construction projects (34), the high-power directional explosion technique and also the reinforced concrete colonnade foundation method initiated in the building of the Yangtze River Bridge at Wuhan have been widely introduced.

Workers in soil mechanics in their study of the characteristics of loess and clay have made new progress both in theory and in research method (37).

In connection with the series of hydraulic engineering construction and the vast-scale construction tasks of the key hydraulic project at the Sanhsia Gorges of the Yangtze River, a large number of model experiments in hydraulic engineering and stress analysis have been carried out in addition to the on-the-spot experiments of concrete pouring of immense volumes. Scientists have also obtained results in the research in the silt disposal by density currents. They also submitted a proposal for the revision of the designs of the sluices for the key hydraulic project of Sanmenhsia and it is estimated *ad interim* that the adoption of this proposal would make it possible for the Sanmenhsia Reservoir to commence the disposal of silt ten years earlier than originally designed.

Mention should also be made here of the rapid development of the research on silicates (38). The production techniques and the quality of cement, refractory materials, glass and ceramics have been considerably improved.

## Increase Agricultural Production

Ever since Liberation, agronomists and biologists, with a view to increasing agricultural production and to supporting the movements of agricultural collectivization and the people's communes, have gone into the country, summed up the experiences of the peasants in bringing forth high yields and inaugurated extensive experimental and research work. Since 1958, several hundred working bases have been established in the extensive rural areas by the different agricultural and biological research organizations and institutions of higher education to carry out systematic summing up of the experiences obtained in connection with the measures for increasing agricultural production based on the Eight-Point Charter (that is, water conservancy, application of fertilizers, deep ploughing and soil improvement, seed selection, close planting, plant protection, reform of tools and field management), and on the basis of this summing-up to initiate multifarious new research projects. The integration of the specialized researches of the scientific workers on the one hand and the technical innovation movement of the mass of the peasantry on the other has the exceptional advantage of supplementing each other in their effort to increase agricultural production.

## Claim 400 Superior Varieties

Agronomists in China have succeeded during the last ten years in selecting more than 400 superior varieties of farm crop seeds. One of these that has been introduced widely into many areas is the new variety of winter wheat known as "Pi Ma No. 1", which has raised the output by about 20%.

Agronomists in various parts of China have been working for the reform of cultivation methods, and, owing to the introduction of measures for the conversion of rice cultivation from one harvest to two harvests a year, the replacing of intercropping by successive cropping and the planting of *Oryza sativa* subsp. Keng instead of *O. sativa* subsp. Hsien, remarkable results have been obtained. Chinese soil scientists working together with the broad masses completed the soil surveys for 19 provinces, covering 79% of all the land under cultivation (39). Researches on the amelioration of saline soil and lateritic soil yielded good results. Very good improvements have been obtained in the methods for the preparation and application of organic fertilizers. Nodule bacteria of the soya bean and peanut and other microbial fertilizers have been extensively used. The success gained in researches in antibiotic fertilizers has enabled us to control certain plant diseases and promote the growth of the crops.

In plant protection, plans for reconnoitring the locust pest and for its effective control have been formulated to furnish a scientific basis on which the locust threat which is as old as this country's history may be eventually exterminated. For the control of orange wheat blossom midge, effective measures have been found in spraying hexachlorocyclohexane and in treating soils with chemicals. Measures for the forecasting of insect pests of the cotton plant have already been applied throughout the country. The spread of the late blight of potato, through the institution of prediction and forecasting systems and by the elimination of the primary infection foci and other measures, has been effectively arrested. Measures for the prevention of wheat rust, wheat black stem rust and wheat stinking smut, etc., have been discovered through research. To combat the red leaf disease of the foxtail millet, it has been conclusively found out that the origin of this disease is a virus propagated by a species of aphids and corresponding preventive measures have been suggested. Ten research units working in collaboration summed up the experiences of the masses in the use of indigenous agricultural insecticides, and consequently a book entitled "Chinese Indigenous Agricul-

tural Insecticides" was compiled and published toward the end of 1958.

In forestry research, too, noteworthy results have been obtained. Four new varieties of poplar (Populus spp.) have been bred which grow 30% to 80% faster than their parent plants and are resistant to diseases and strong in adaptability. Other research projects have resulted in the formulation of a series of measures for the forecasting of forest fire hazards suited to actual conditions in China.

Chinese veterinarians have developed many attenuated bacterial vaccines and viruses for the prevention of certain important plagues of livestock and poultry. As a result of researches culminating in the development of the lapinized rinderpest reactor virus and ovinized rinderpest virus, rinderpest, a prevalent plague of long historical standing in China, was virtually exterminated throughout the country in 1956.

In aquatic products, our algologists have successfully unfolded the life cycle of porphyra *(Porphyra tenera* Kjellm), thus resolving the key problem in the cultivation of this edible alga. Experiments for the transplantation southward of kelp *(Laminaria Japonica* Aresch.) have been crowned with success and large-scale cultivation has already been started in the coastal waters of Kiangsu, Chekiang, Fukien and Kwangtung provinces. For the solution of the problem of the supply of fish fry, scientific workers made experiments on the artificial ovulation of *Hypophthalmichthys* molitrix and *Aristichthys nobilis* and obtained successful results in 1958. Very recently they have found another method in making the above-mentioned two varieties of fish spawn in pools and ponds by the combined use of hormones and certain ecological stimulations.

The widespread introduction of castor-oil plant silkworm *(Attacus ricini* Boids) has been a success after the problem of keeping the insect over the winter had been solved, thus ushering in a new branch of sericulture in China.

## Traditional Medicine Valuable

In the course of the past ten years, a number of research undertakings in the medical sciences have been concentrated in the prevention of certain parasitic and infectious diseases seriously endangering the health of our people (40-88). The deplorable conditions of the serious harms done by schistosomiasis to the people in the past are familiar to many, but at present this disease has been practically wiped out in approximately 60% of the former areas of prevalence (74). The prevalence of kala-azar, filiariasis and malaria has been brought under control in many areas (72-74).

A series of research work has been carried out for the improvement of the working conditions of the cadres and workers and for the control of the principal professional diseases (82). Preventive measures against silicosis and occupational poisoning have shown conspicuous results. After the emergency resuce of Ch'iu Ts'ai-k'ang, the steel worker who suffered severe burns over 89.3% of the total skin area and was cured in 1958, notable results have been scored in the treatment of many patients suffering from burns over large skin areas.

A very large amount of work has been done in the past few years in uncovering, studying and summing up our valuable heritage in traditional medicine (83-84). The treatment for acute appendicitis, the withering therapy for internal hemorrhoids, the "thread-drawing method" for the curing of anal fistula, the treatment to remove edema in chronic nephritis, the treatment for reducing the ascitic fluid in cirrhosis of the liver as well as the clinical experiences of acupuncture against pains, inflammations and acquired deafism, of Ch'i Kung therapy against peptic ulcers and other chronic diseases, of massage therapy for the treatment of acute sprains—all these traditional healing methods offer new data and materials for and suggest new approaches to theoretical research that has aroused wide-spread interest in the medical world.

In materia medica (85-86), the research work of antibiotics has been most actively developed in China. We used to depend entirely upon imports for all our needs of antibiotics before the Liberation, but today we have fully mastered the techniques for the production of many kinds of common antibiotics (85). The researches into the physiology of *Streptomyces aureofaciens* and into the production of aureomycin have enabled us to increase the output of aureomycin. A new antibiotic against cancer, actinomycin K, was discovered in 1957 from certain kinds of soils in this country and its trial production was successfully carried out in 1958. A successful result in the research work in the field of pharmaceutical synthesis is the manufacture of cortisone and cardiazol, specific medicines for rheumatic arthritis, from certain plants of the family *Dioscoreaceae*.

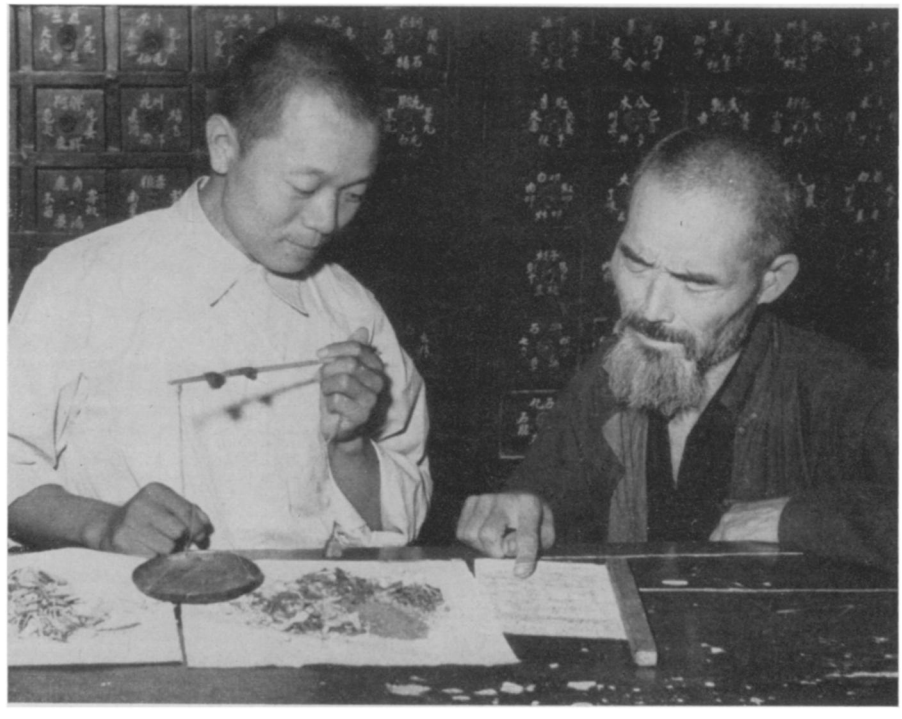
At the time when the Twelve-Year Long-Term Plan for the Development of Science and Technology was formulated in 1956, a decision was made to concentrate our resources to reinforce the study of certain new technical subjects of great significance that were either non-existent or still very weak. And after a lapse of only three years the speed of advance in the study of these subjects is much higher than we expected. Here are some instances.

## Russia Helped Build Reactor

The 7,000 to 10,000 kilowatt heavy-water type experimental reactor, the largest in Asia, which the Soviet Union helped us to build, and a cyclotron which can accelerate alpha-particles to 25,000,000 electron volts have been in formal operation for more than a year. Several kinds of small-type accelerators of our own design and making are also in operation. Moreover, we have also designed and manufactured various kinds of good quality beta-spectrographs, heavy particle spectrographs, gama-spectrographs, neutron spectrographs, etc. As a result of systematic research, the making of nuclear emulsions and counter tubes has attained a very high level.

Researches in the chemistry and in the technical use of radioactive isotopes have been set up from nothing. We have already succeeded in making more than 30 kinds of isotopes including phosphorus 32. The techniques in the use of isotopes have already been introduced extensively to industry, agriculture, medicine and other scientific and technical fields (87).

The development of semi-conductor phys-



*TRADITIONAL CHINESE—The Weising People's Commune has its own hospital and a traditional Chinese medicine clinic. A traditional Chinese physician and a druggist work together in the pharmacy.*

ics has also been very rapid. Prior to 1956 researches were carried out in a limited scope in regard to semi-conductor current rectifiers and semi-conductor photosensitive electric resistances. Beginning in 1956 we started the extraction of germanium and introduced the zone melting purification technique and the making of single crystals. Then we began to use germanium to make alloy - junction medium - frequency triodes, point-contact diodes, gold bonded diodes, etc. Research on new semi-conductors also started at the same time.

In the past two years, with the assistance of the Soviet Union, we have successfully carried out the trial-making of a universal large-scale high-speed electronic digital computer with a speed of 10,000 operations per second, three addresses and a storage capacity of 2,048 words.

## Computer Technique Developing

On account of the demands made by the atomic energy techniques, electronic computers (88), multi-channel communications, detection and ranging, remote control and other new techniques, the work in radio-electronics and especially in the fields of electric pulses and microwaves is expanding rapidly in scope. Researches in the theory of microwaves and the theory of waveguides, in electron optics and in cathode electronics have all been developed. Results have also been obtained in the making of micro-wave measuring instruments, microwave cyclotrons, mass spectrographs, etc.

Following the development of radio-electronics, ultrasonic technology has also been rapidly built up. In the course of the big leap forward many kinds of ultrasonic equipments were produced, including defect detectors, geological prospecting instruments, mechanical processing machines, etc. In addition, scientific workers have also successfully resolved the acoustical problems of the Great Hall of the People which was newly built in 1959 with a seating capacity of 10,000 people.

Among the important achievements made in the course of the big leap forward, those in automatic control and telemechanics should be included. High quality composite telemetering and remote control units composed of contactless elements and electronic analog computing equipments of various types have been made, some of which have already been used in the design of control systems. In 1959, an automatic chemical analyzer and an automatic power system swing curve computing equipment were made.

## Fundamental Research

Fundamental research aiming at building a foundation for further scientific theoretical development had received due emphasis ever since the first day of new China. Our scientists had devoted their main efforts during the last ten years to master the existing scientific achievements in the modern world on the one hand and to collect data and materials for study, to set up research facilities and to train scientific personnel on the other. Owing to these efforts we have been able to build a firm foundation for fundamental research and proceed along the direction of healthy development. Shortcomings in science research in the past, such as "theory for theory's sake" in utter disregard to its application, research without any well-defined objective, have been or are being overcome so that the scientific workers now emerge from the dingy little alley, step onto the big open boulevard and march triumphantly towards great and far-reaching objectives. In the following we shall give a brief account of the research activities in the major fundamental sciences.

## Mathematics Strengthened

In mathematics (89-92), those branches which were formerly weak or void but are very closely related to our national construction, such as differential equations, the theory of probability, mathematical statistics, computational mathematics, cybernetics and mathematical logic, have now been respectively strengthened or established. In partial differential equations we lay emphasis on researches in non-linear partial differential equations. After the big leap forward of 1958, Chinese mathematicians have been paying greater attention to the relations between mathematics and other disciplines of science and using mathematics as a tool for solving many concrete problems in production. This should be considered a progress of the greatest significance made in the Chinese mathematical world. In the theory of the functions of several complex variables a series of work of a pioneering character has been done and a general, and in a certain sense complete formula has been obtained (91). In regard to the research of the basic problems of the characteristic class and the imbedding class in topology, fairly complete results have been procured. In the researches on geometry of the space of $K$-spread, the geometry of the general metric space and curves in a projective space, a series of new theorems have been proved (92). New advances have also been made in the theory of one variable functions, the theory of numbers and algebras.

## Plastic Research Strengthened

In mechanics, researches in plastic mechanics, fluid mechanics and chemical fluid mechanics which used to be either very weak or totally void before Liberation have been strengthened or built up.

In astronomy, researches newly set up or strengthened after Liberation include longitudinal variations, the calculation and compilation of astronomical almanacs, solar physics, stellar physics, radio-astronomy and other branch fields.

In physics (88), (93-96) the nuclear theories and theories of elementary particles have received due attention. We have improved the methods of calculation for the shell-model nuclei and proved that the theory of universal V—A Fermi weak interaction is superior to all the other types (including the Yukawa type) of theories of universal weak interaction. At the Joint Institute for Nuclear Research at Dubno in the U.S.S.R., Chinese and Soviet scientific workers working in cooperation, under the guidance of Soviet scientists, have in a comparatively systematic way studied the problem of how to determine experimentally the spins and relative parities of the strange particles.

In physics of solids (95), researches in physics of metals, semi-conductor physics and solid luminescence are no longer blank spots. Magnetism and X-ray crystal analysis which had some foundation before Liberation have witnessed new developments. In the physics of metals, the problem of the internal friction in metals has been studied. In the field of semi-conductor physics the spectral distribution of photoconductivity of germanium has been studied and an effective method for the measurement of the surface recombination velocity has been proposed. In X-ray crystal analysis, we have studied the crystalline structural change of the $\pi$-phase in the tertiary Al-Cu-Ni alloy system. Since the big leap forward of 1958, important advances have been made in the researches about ferrites, solid luminescence and the growth of crystals. Many kinds of ferrite storage elements, high-frequency magnetic cores and micro-wave units have been made. We have already made a kind of material of field-induced luminescence with an efficiency reaching 15 lumens per watt and another kind of long-duration luminescence which still retains a brightness of $21 \times 10^{-4}$ apostilb after 13 hours, while techniques for the growth of crystals have been mastered by many departments. Owing to the aforementioned researches new fronts in the theoretical research of physics of solids in China are being opened up.

Spectroscopy is another branch in physics that has made significant advances, among which an important achievement is the spectral analysis of rare earth elements (97). Molecular spectroscopy has also received due attention in recent years.

## Steps Taken to Provide Facilities

For the development of research work in low-temperature physics and high-pressure physics, positive steps are being taken to provide the necessary technical facilities.

In chemistry (27), (97-103), the fields which had foundations have been strengthened. On the other hand those fields, such as analytical chemistry (98), rare elements chemistry, high polymer chemistry (103), basic organic synthesis and element organic chemistry (98), which were weak or had no foundation at all have developed at a phenomenal speed. Important results achieved include the mastery of the techniques for the extraction and isolation of rare elements and rare earth elements and the making of high polymers of silicon and fluorine, polyaldehyde, polyethylene, polymethylmethacrylate, butadienestyrene and butadiene-vinylpyridine synthetic rubbers, several kinds of polyamide and polyethylene resins and different kinds of ion exchanger resins (103).

Researches in chemistry of natural organic compounds and pharmaceutical chemistry which had comparatively good foundations formerly have all shown advances (85). Researches about the molecular structure of citrinin and that of Fritillaria alkaloids have been very carefully carried out.

In addition to the above, a series of theoretical problems have been studied.

These include the different kinds of catalytic reactions, chemical kinetics, the determination and distribution of the molecular weights of high polymer compounds, complex reactions, physico-chemical analysis, theory of chemical bonds, structural chemistry, etc.

## Foundation for Biophysics Laid

In biology (104-109), the new tendency is to open up new fields of research through the introduction of new techniques and to make use of the results made in modern physics and chemistry. Some foundation for research in biophysics has also been laid in recent years. Researches in the electrophysiology of nerves, central nervous system and vision have been developed and some valuable results have been obtained (110).

In biochemistry (100), studies of proteins and enzymes are comparatively thorough. Research in nucleic acid has begun to attract the attention of the scientists.

Researches in genetics consist mostly of the genetics of agricultural crops (1). In the heredity of animals, systematic analysis has been made in regard to the domestication of the goldfish. Research in radiation genetics has begun to develop gradually.

Chinese microbiologists engaged in the researches of the induced adaptation in yeasts have obtained strains of yeasts adapted to high-temperature fermentation or resistant to sodium fluoride and these results have been applied in production. The isolation of the virus of trachoma has been a success and a question in the etiology of trachoma which has consistently defied solution since the last part of the 19th century is now settled.

## Discovery in Southern China

In recent years the new discovery in Southern China of certain relic plants including *Cathaya argyrophylla* of *Pinaceae* and the new records of certain tropical plant families and genera furnish important materials for the elucidation of the complicated Chinese Flora (111). The systematics of the genus *Pedicularis* of *Scrophulariaceae* has been extensively investigated and a new system for the arrangement of various taxa within the genus has been proposed. The phenomenon of the intercellular transmigration of the nucleus has been investigated rather intensively and good results have been obtained. Systematic studies have also been made in pollen morphology, wood anatomy and the early embryogeny of certain conifers.

Researches of great scientific value in the maturation of sex cells, fertilization, sex differentiation and ontogenesis of animals have been carried out. Certain results have also been obtained in the researches in skin, muscles, and nerve fibres and nerve cells.

In geology (6), (111-112), researches in the vortex structures and in the complex problems of the tectonic systems of China's Northwest have opened up a new avenue for the solution of the problems of tectonic movements of the earth crust.

In meteorology, systematic researches have in the past ten years been done on the theories of atmospheric circulation, particularly in regard to the principal factors affecting the atmospheric circulation in Southeastern Asia and the main weather processes in China. For instance, "Some Fundamental Problems of the General Circulation of the Atmosphere", published in 1958, embodies a systematic summary and review of the research results in this respect.

In palaeontology (111-112), valuable results have been obtained in the research in the flora of the Mesozoic Yenchang formation in Shensi Province, the research into the corals of the Siluvian and Ordovician periods, the trilobites and the fossils of the dinosaur from Laiyang in the Shantung Province. Palaeontologists through their researches of the human fossils and stone artifacts newly discovered at Tingtsun in Fenyang district in Shansi Province and at Mapa and Liukiang in South China have enriched palaeoanthropology (113).

In ten years' time the number of scientific research institutions and of scientific workers has grown in large proportions. At the end of 1958 there were already more than 840 research institutions for natural and technical sciences and more than 32,000 research workers, showing increases of 20 times and 50 times the Pre-Liberation figures respectively.

During the same period, organizations for scientific research have also been greatly strengthened. The total number of publications in the collections of the main library of Academia Sinica and the libraries of its various institutes has increased from 630,000 volumes at the time of Liberation to more than 6,000,000 volumes today. The main library has made arrangements for exchanging publications with 1,290 institutions in 56 countries. The Science Press, the publishing house of Academia Sinica, published from the beginning of 1950 to September, 1959, a total of 2,050 titles in books and about 2,700 issues in periodicals, containing in all 661,000,000 words and aggregating 30,800,000 copies. Besides, the Institute of Scientific and Technical Information has been established. At present this institute publishes 89 kinds of periodical publications on scientific and technical information and exchanges scientific documents in large quantities with most of the countries in the world.

The foregoing is a brief outline of the progresses made on China's science front during the last decade.

## A Decade of Training

In the short period of ten years, China has already made great progress in developing her science. Along both fronts, scientific research work and the training of scientific workers, she has scored great victories. But what is more important is that we for the first time have gained the invaluable experience of promoting the development of science at high speed. Thus, it has become possible for us to launch scientific research in China into an era of big leap forward development. The creative talents of our people long buried under the old social system have now been stirred up into action by the great socialist revolution. The occurrence of such a great change in a country with a population of more than six hundred million is indeed an event of world significance. Each forward stride in the popularization and advancement of science taking place in this country will certainly have important effects upon the cause of peace and human progress.

## Must Not Be Complacent

However, we should on no account indulge ourselves thereby in complacency, for when the level of natural sciences attained in China at present is compared either with the needs of the country and the people or with the level attained in the scientifically more advanced nations, we find that we are still a long distance behind. On the other hand we should not at all be discouraged thereby. For we have in our possession every favorable condition that enables us to do away with this distance in a very short time. The socialist system has already firmly established itself in our country; the dynamic developments in industrial and agricultural production are building up an environment extremely favourable to scientific research; our work in ideological education in the past ten years has resulted in a general heightening of the ideological consciousness among our scientific workers.

## Scientific Ranks Expanding

The scientific ranks have been continually expanding; a buoyant revolutionary vitality and a creative spirit now pervade the whole scientific world in China. Furthermore, we have the invaluable assistance from the great Soviet Union, and from the fraternal socialist countries; and we receive help also from our friends all over the world who are concerned about the welfare of China, and about the cause of peace and human progress. The most important thing is that our cause is most enthusiastically supported by over six hundred million people and that leading us in our march forward is the Communist Party of China, the party that has been long tried and armed with Marxism-Leninism. Under the beacon light of the general line of our Party, our people will certainly bring our technical revolution to a complete victory and continuously score great successes in our march forward in the conquest of Nature. And China will undoubtedly emerge as one the great nations pre-eminant in science and culture.

## Bibliographic Notes

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# Bibliographic Notes

As illustrated on the cover page, written Chinese, rather than being expressed by an alphabet, is expressed by characters or ideographs used individually or in various combinations corresponding to words. The ideal method for accurate documentation of a Chinese language article is to reproduce the characters appearing in the title, author's name, and journal title. As an aid to use, title translations for the article and journal may be provided in brackets after the Chinese characters, while the author's name may be transliterated in some standard system. In this way, confusion resulting from transliteration of the characters is avoided and correct identifications can be made. However, with the unavailability in the Washington area of type for Chinese characters, the following method has been used to identify the Chinese sources cited below:

Transliteration of title by the Wade-Giles system in quotes followed by the compiler's bracketed translation in quotes.

Transliteration of the author's name; those names appearing in the Communist Chinese article or table of contents in the *pin-yin* transliteration system are so given, followed by the Wade-Giles transliteration in brackets.

Transliteration of journal title in the same manner as explained above, with the compiler's bracketed translation; when titles appear bilingually, they are cited in order of the predominant language of publication and separated by a colon.

Sources of translated reference material:

*Office of Technical Services,* Annex 1, Dept. of Commerce, Washington 25, D. C.

Give OTS number and English title. When number not available, give full identification. JPRS translations to be requested from OTS.

*Library of Congress,* Photoduplication Service, Washington 25, D. C.

Facsimile prints or microfilms. Minimum charge per item $1, per order $1.50.

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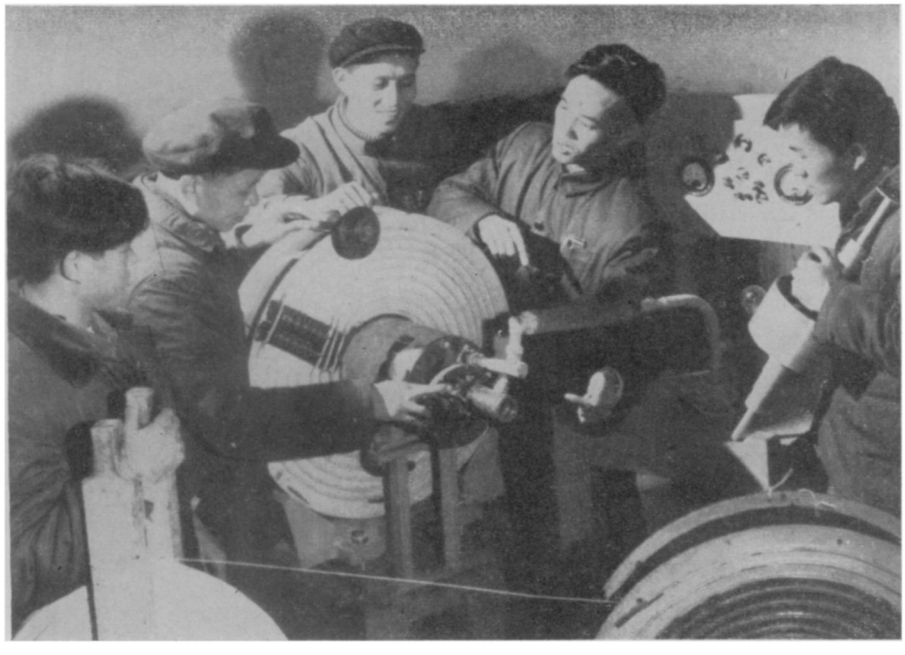

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