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SCIENCE & TECHNOLOGY

CHINA

CONTENTS

SCIENCE & TECHNOLOGY POLICY

Provisional Regulations for Beijing S&T Zone [BEIJING KEJI BAO, 10 Aug 88]	1
Nanjing Formulates Preferential Policy To Facilitate Tech Transfer [Yang Mingzhao; JISHU SHICHANG BAO, 30 Jul 88]	5
Shaanxi Provincial Government Tries Out New Incentives [Li Yaonan; ZHONGGUO JIXIE BAO, 4 Aug 88]	7
300-Meter Saturation Dive Successful [Xin Guangqi, et al.; WEN HUI BAO, 4 Aug 88]	9
World's First Use of Lasers To Produce Polymers Claimed [Liu Luosha; GUANGMING RIBAO, 22 Aug 88]	10
China Could Become World 'Leader' in Mathematics [WEN HUI BAO, 28 Aug 88]	12
Xi'an Professor Develops New Vortex Air Compressor [GUANGMING RIBAO, 12 Sep 88]	13
Ten Major Developmental Trends in S&T Interchanges With Foreign Countries [Hu Genshen; RENMIN RIBAO, 14 Sep 88]	15
Ways Ahead for Electronics (Report on Shenzhen Electronics Group) [Ma Fuyuan; CHINA DAILY, 15 Oct 88]	18

Beijing Electron-Positron Collider Hailed as Major Breakthrough [CHINA DAILY, 20 Oct 88]	20
Advanced Technology Boosts Beijing Industrial Growth [XINHUA, 26 Oct 88]	22
Science Legislation Strengthened [XINHUA, 29 Oct 88]	23
Academy of Sciences To Reform Basic Research Work [XINHUA Domestic Service, 9 Nov 88]	25
New Science, Technology Accounting System Announced [XINHUA Domestic Service, 9 Nov 88]	27
Shanghai Sees Burgeoning Growth of Soft Sciences Rapid Growth Bring Problems [Jin Dan; WEN HUI BAO, 24 Aug 88] 'Maturation' Seen by Year 2000 [Jin Dan; WEN HUI BAO, 25 Aug 88]	29 30
Briefs Sino-Australian Joint Venture	32
SCIENTISTS, SCIENTIFIC ORGANIZATIONS	
Laboratory for Surface Physics, CAS Described [Wang Dingsheng; WULI, No 8, Aug 88]	33
AEROSPACE	
China Plans Manned Space Missions in the 1990s [SICHUAN RIBAO, 24 Aug 88]	35
Modern Missile Test Facility Described [RENMIN RIBAO, 16 Sep 88]	36
ADVANCED MATERIALS	
Growth Mechanism, Crystalline Habits of KTP Crystal in Phosphate Fluxes [Liu Xiangyang, et al.; GUI SUANYAN XUEBAO, No 4, Aug 88] ..	38
Studies of Growth, Defects of LSM Crystals [Wang Ximin, et al.; GUI SUANYAN XUEBAO, No 4, Aug 88]	39
Synthesis, Spectral Characteristics of NaLnTiO ₄ [Yu Yaqin, et al.; GUI SUANYAN XUEBAO, No 4, Aug 88]	40
Synthetic LNPP Laser Glass, Main Properties [Liu Yanbin, et al.; GUI SUANYAN XUEBAO, No 4, Aug 88]	41
New Compound--Ca ₈ ZnSi ₄ O ₁₆ Cl ₂ [Wu Bolin; GUI SUANYAN XUEBAO, No 4, Aug 88]	42

Stabilizing Effects of Hot Electrons on Low Frequency Plasma Drift Waves [Huang Chaosong, et al.; WULI XUEBAO, No 8, Aug 88]	43
--	----

BIOTECHNOLOGY

Isolation of Mycoplasma-Like Organisms From Chinese Jujube Infected With Witches' Broom Disease, Preparation of Its Antiserum [Zhu Benming, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 3, 1988]	44
Characteristic Sequence of S1 Nuclease Sensitive Sites in Cloned rRNA Gene of Silkworm Attacus Ricini [Shen Daiwei, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 3, 1988]	45
Photoaffinity Labeling of Snake Muscle Fructose 1,6- Biphosphatase at Allosteric Site Affecting Catalytic Site [Hu Guofu, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 3, 1988]	46
Total DNA Synthesis, Cloning in E. Coli of Bovine Growth Hormone Releasing Factor Gene [Jiang Zhiwei, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 3, 1988]	47
Isolation, Identification of SRBC Receptor on Surface Membrane of Human T Lymphocytes [Liu Yaxia, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 3, 1988]	48
Export of Hybrid Proteins of Leucine-Specific Binding Protein, Tryptophan Synthetase in Escherichia coli [Su Tizhi, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 4, 1988]	49
Studies of Anti-Epilepsy Peptide From Scorpion Venom of Buthus martensii. I. Purification, Partial Physical, Chemical, Pharmacological Characterization [Zhou Xinhua, et al.; SHENGWUHUAXUE YU SHENGWUWULI XUEBAO, No 4, 1988]	50
Strain of Acinetobacter Calcoaceticus var Lwoffii Isolated From Pleurisy Patient [Liang Chao, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	51
Preliminary Biological Characterization of HFRSV Strain--(XC) Isolated From Cerebral Spinal Fluid of Patient With Hemorrhagic Fever Renal Syndrome [Li Ge, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	52

Studies of Viremia of Patients With Epidemic Hemorrhagic Fever [Yao Zhiqiang, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	53
Study on Attenuated Japanese Encephalitis Vaccine Strain SA ₁₄ - 14-2 Produced in Primary Dog Kidney Cell Culture [Yu Yongxin, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	54
Studies of ELISA in Detection of Anti-DNA Antibody Using UV- Irradiated Polystyrene Plate [Li Zihai, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	55
Study of Polypeptide Patterns of Duck Hepatitis Surface Antigen [Zhang Wei, et al.; ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI, No 4, 1988]	56
Latent Infection of Hemorrhagic Fever Within Families Studied [Zou Wenhua, et al.; ZHONGHUA CHUANRANBING ZAZHI, No 2, May 88]	57
Spread of Hemorrhagic Fever Virus in Utero Studied [Yang Weisong, et al.; ZHONGHUA CHUANRANBING ZAZHI, No 2, May 88]	60
Action of Hemorrhagic Toxin on Body Tissues [Huang Yuchu, et al.; ZHONGGUO KEXUE JISHU DAXUE XUEBAO, No 2, Jun 88]	63
Dengue Virus Type IV Infection in Suckling Mice--Pathologic Changes, Localization of Viral Antigen in Brain Tissue [Ling Jingping, et al.; ZHONGHUA BINGLIXUE ZAZHI, No 2, Jun 88]	69
Studies of Antigen Binding Site of Monoclonal Antibodies to Hepatitis B Core Antigen (HBcAg), Their Affinity [Zuo Dongmei, et al.; ZHONGHUA YIXUE JIANYAN ZAZHI, No 4, Jul 88]	70
Long Lasting, Reproducible Microbe Sensor for Phenol Developed [Huang Kefu; et al.; XIAMEN DAXUE XUEBAO, No 4, Jul 88] ..	71
Study of Caged Bicyclic Phosphates. I. 1-Oxo-4-Substituted- 2,6,7-Trioxa-1-Phosphabicyclo-[2.2.2] Octane, Reactions [Li Yugui, et al.; HUAXUE XUEBAO, No 7, Jul 88]	78
Genetic Analysis of Ribosomal Protein S13, BL18 Mutants in Bacillus Subtilis [Bai Yinglin, et al.; YICHUAN XUEBAO, No 4, Aug 88]	79

Sister Chromatid Exchanges Induced by Restriction Endonucleases [Dong Weifeng, et al.; YICHUAN XUEBAO, No 4, Aug 88]	80
Synthesis, Spectroscopic Investigations of 2,3-Disubstituted Quinoxaline-1,4-Dioxide Antibiotics [Lin Shukun; YINGYONG HUAXUE, No 4, Aug 88]	81
Introducing Exogenous DNA Into Plants After Pollination [Gong Zhenzhen, et al.; ZHONGGUO KEXUE, No 9, Sep 88]	82
Expression of a Zein Gene (Z4) Introduced Into Dicotyledonous Solanum Nigrum [Deng Wanyin, et al.; ZHONGGUO KEXUE, No 9, Sep 88]	89

COMPUTERS

Briefs	
CAD/CAM Program Introduced in Beijing	100
English-Chinese Machine Translation System	101
New CAD Workstation System	101

EARTH SCIENCES

Environmental Protection Policies, Practices Outlined Distinctively Chinese Environmental Control System [ZHONGGUO HUANJING BAO, 16 Aug 88]	103
Environmental Protection Plan for Year 2000 [RENMIN RIBAO, 7 Sep 88]	105
Government Work Report [Qu Geping; ZHONGGUO HUANJING BAO, 18, 20 Aug 88]	106

FACTORY AUTOMATION, ROBOTICS

Research on Flexible Manufacturing Systems at Dalian Modular Machine Tool Institute [Jin Chunhua, et al.; JISHU SHICHANG BAO, 20 Aug 88]	124
New Products, Trends in CNC Machine Tools, Flexible Machining Cells, Flexible Manufacturing Systems	
CNC Cylindrical Grinder [JICHUANG, No 4, Apr 88]	125
Turning FMC [JICHUANG, No 5, May 88]	125
Technical Advances in Machining Industry [JICHUANG, No 7, Jul 88]	126
NC Shaping Grinder [JICHUANG, No 7, Jul 88]	127
Number of FMC's, FMS's Developed [JICHUANG, No 8, Aug 88].	128
Installation of New FMS [JICHUANG, No 8, Aug 88]	128

LASERS, SENSORS, OPTICS

Positron CT Camera System Using Multiwire Proportional Chambers as Detectors [Wang Dewu, et al.; GAONENG WULI YU HE WULI, No 3, May 88]	129
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Wide-Range Magnetic Spectrometer for Electron Scattering in Medium Energy Range [Mao Zhenlin; GAONENG WULI YU HE WULI, No 3, May 88]	130
Fragmentational Function in Pion Inclusive Processes With Dynamic Spontaneous Breaking [Lu Xiaofu, et al.; GAONENG WULI YU HE WULI, No 3, May 88]	131
Diffraction-Limited SRS Stokes Output From High-Pressure Hydrogen Pumped by XeCl Laser [Lou Qihong, et al.; GUANGXUE XUEBAO, No 6, Jun 88]	132
Markov Random Mesh Models for Contextual Information Analysis of [Satellite] Remote Sensing Image [Zeng Xiaoming, et al.; XINXI YU KONGZHI, No 4, Aug 88] ..	139
Tunable IR Stimulated Radiation Generated by Two-Step Hybrid Exciting in Na ₂ -Na System [Tang Xiaoling, et al.; WULI XUEBAO, No 8, Aug 88]	140
Population Inversion of Energy Levels of MgXI 1s3p, 1s4p Under Average High Temperature, High Electron Density [Lin Zunqi, et al.; WULI XUEBAO, No 8, Aug 88]	141
Excited States in Collision Process of Double Charged Ion He ²⁺ with Ne, Ar Atom [Lei Ziming, et al.; WULI XUEBAO, No 8, Aug 88]	142
Excited States in Collision of Single, Double Charged Ions with Atoms, Comparisons of Emission Cross Sections [Liu Jiarui, et al.; WULI XUEBAO, No 8, Aug 88]	143
Many-Body Universal Approach to Thermally Activated Magnetoelastic Relaxation in Ferromagnetic Alloys [Wang Yangpu, et al.; WULI XUEBAO, No 9, Sep 88]	144
Symmetrization Analysis of Vibrational Modes, Study of Raman Spectra for Molecular Crystal RbC ₈ H ₅ O ₄ [Hong Shuili; WULI XUEBAO, No 9, Sep 88]	145
Mechanism of Property Change of Mixed AgI(Cr ₂ O ₃) Ionic Conductor [Wang Yuxia; WULI XUEBAO, No 9, Sep 88]	146
New Method for Studying Spectral Line Structure [Zhao Baocheng, et al.; WULI XUEBAO, No 9, Sep 88]	147
Study of Relationship Between Spontaneous Radiation, Stimulated Radiation in Transition Radiation Free Electron Lasers [Liu Shenggang, et al.; WULI XUEBAO, No 9, Sep 88]	148
Piecewise Correlator in Digital CW Sonar [Wang Shuozhong; SHENGXUE XUEBAO, No 5, Sep 88]	149

Focusing Properties of Acoustic Fresnel Lenses [Gao Jianbo, et al.; SHENGXUE XUEBAO, No 5, Sep 88]	150
Report on 500 MHz SAW Resonator-Oscillator [Zhou Xianming, et al.; SHENGXUE XUEBAO, No 5, Sep 88]	151
Detection of SAW Field of Pulse Compressor by Laser Scanning Probe [Zhang Bufa, et al.; SHENGXUE XUEBAO, No 5, Sep 88]	152
Briefs High-Repetition Pulsed Laser Diode	153

SUPERCONDUCTIVITY

Another Major Breakthrough in Oxide Superconductor Research [Xie Sicheng, et al.; WULI, No 8, Aug 88]	154
In-Situ Study of Superconducting Transition, Internal Friction of High Tc Superconductor YBa ₂ Cu ₃ O [Du Jiaju, et al.; WULI XUEBAO, No 9, Sep 88]	156
Influence of Oxygen Deficiency on Thermoelectric Power in Single Phase YBa ₂ Cu ₃ O _{7-x} System [Ruan Yaozhong, et al.; WULI XUEBAO, No 9, Sep 88]	157

TELECOMMUNICATIONS R&D

General Formulae for the Equivalent Circuit Parameters of Inductive Millimeter-Wave Fin-Line Structures [Liu Ce, et al.; DIANZI KEXUE XUEKAN, No 5, Sep 88]	158
A New Type of Adjustable Permanent Magnetic Circuit [Lang Liang, et al.; DIANZI KEXUE XUEKAN, No 5, Sep 88]....	159
Engineer Invents New Satellite Television Receiver [Xu Deng; GUANGMING RIBAO, 29 Sep 88]	160
Briefs Zhongshan-Zhuhai-Macao Fiber-Optic Line	162
New Aid for Satellite, Microwave Communications	162
Smaller Fiber-Optic Transmission Terminal	162
International Digital Telephone Agreement	163
Major Breakthrough in Microwave Communications	163

SCIENCE & TECHNOLOGY POLICY

Provisional Regulations for Beijing S&T Zone

40080020c Beijing BEIJING KEJI BAO in Chinese 10 Aug 88 p 2

[Article: "Provisional Regulations for the Approval of New Technology Business in the Beijing S&T Experimental Zone"]

[Text] A. These regulations are prepared in order to implement the "Provisional Act Concerning the Beijing New Technology S&T Experimental Zone" (the "Statute") which was recently approved by the State Council.

B. All new S&T business entities in the Beijing S&T Experimental Zone ("Experimental Zone") will be reviewed in accordance to these regulations.

C. The S&T Commission of Beijing (the "S&T Commission") is in charge of managing the S&T zone and is responsible for the implementation of these regulations. The Beijing S&T Experimental Zone Office (the "Office") is a part of the Haiding District People's Government. Under the guidance of the Haiding District People's Government and the monitoring of the S&T Commission of Beijing, the Office will review and approve applications from new S&T businesses.

D. The scope of new technologies and products includes:

- (1) Electronic information technology and associated products;
- (2) Laser technology and associated products;
- (3) Technology for the integration of optical, mechanical and electrical components and associated products;
- (4) Life science and bioengineering technology and related products;
- (5) New materials technology and associated products;
- (6) New energy technology and new energy conservation technology and related products;
- (7) Environmental science and new labor protection technology and related products;

- (8) New construction materials, structural parts, construction techniques and equipment;
- (9) Fine chemical engineering technology and associated products;
- (10) New drugs and biomedical engineering;
- (11) Applied nuclear technology and related products;
- (12) Geoscience, space technology, marine technology and associated products;
- (13) Other highly profitable new technologies and associated products which are suitable to be located at the capital.

The details will be formulated and released by the Commission based on the index issued by the State S&T Commission, the trend of new and high technology development in the world and the specific situation in Beijing.

E. A new technology business is an economic entity which is loaded with knowledge and technology. It must meet the following criteria:

- (1) It must be involved in the research, development, production and operation in one or more areas specified in Section D of this document, excluding pure business operation.
- (2) It must operate independently and be responsible for its own profitability.
- (3) The responsible party must be a technical person in the same line as the business.
- (4) More than 40 percent of the employees must be technical with associate degrees (or equivalent) and above. More than 30 percent of the employees must be technical staff with bachelor's degrees.

In a labor intensive S&T business involved in production and technical service, more than 30 percent of its employees must have associate degrees or above. The number of technical staff with bachelor's degrees must not be less than 20 percent of total employees.

- (5) The business must have a working capital of 20,000 yuan and has the appropriate site and facility in the zone.
- (6) The business must have its charters and have a management system for technology, finance and accounting.

F. A new S&T business must apply with the Office. Upon approval, a new S&T business certificate will be issued. With this certificate, the business can get an operating license from the Haiding District Business Administration

Bureau. Then, it can register with the Haiding Tax Bureau and open an account at the bank.

G. Based on the conditions specified in Section E and the following standards, the Office will review each S&T business annually:

(1) More than 3 percent of the total income in the current year is spent on the research and development of new products.

(2) From the start, technology related income should not be less than 20 percent of the total income in the first year, 25 percent in the second year and 30 percent in the third year. When a business is mass producing new technology products, the value of these products should be more than 50 percent of the total value of all products manufactured in the current year.

Technology related income refers to money received from research, development, consultation, technology transfer, technical training, contract work, engineering design, and technology export and import, as well as the value added to pilot and new products. Pure business operating income will be excluded.

A new technology product will remain on the list for 3 to 5 years. It may be extended to 7 years if it has a long development cycle.

If the above standards and the conditions specified in Section E are not met, the business cannot enjoy the favorable treatment any longer. The Office will revoke its certificate.

H. The following organizations are given priority in the approval process:

(1) S&T businesses formed by research institutions, colleges and universities, and technical people in Beijing;

(2) S&T businesses with foreign investment;

(3) S&T businesses already established in the Zone before these Regulations were issued (including collective and individual entities).

I. The parent organization of the applying S&T company will be reviewed by the Office.

J. The new S&T business may be a company (including corporation and enterprise), center or research institute.

If the name of the new business begins with "Beijing," a business license will be issued upon approval by the Haiding District Business Bureau and the Beijing Business Bureau. If the name begins with "China" or implies that it is a national organization, it must be submitted to the State Business Bureau for review.

K. A publicly owned, economically independent research unit in the S&T Zone that has not been receiving government support for administrative expenses may be converted into a new S&T business upon approval by the Office if it meets the criteria in Section E. However, it must continue and complete the task assigned by the government.

L. Any change in the scope of operation, consolidation, spin-off, change of line of work, relocation and termination must be reviewed by the Office and then recorded at the business bureau and tax bureau.

The review of these applications will be on file at the Beijing S&T Commission.

M. Any business which provides false information in its initial application or in the annual review may be reprimanded by the Office. Or, the Office may take action to correct the problem or even revoke its certificate. Any violation of the business administration regulations and tax laws will be handled by the appropriate organizations.

N. Any specific problem will be further interpreted by the Beijing S&T Commission.

O. These regulations and the "Act" will become effective as of 20 May 1988.

12553/6091

SCIENCE & TECHNOLOGY POLICY

Nanjing Formulates Preferential Policy To Facilitate Tech Transfer

40080017a Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese
30 Jul 88 p 1

[Article by Yang Mingzhao [2799 2494 3564]]

[Text] Nanjing Municipality has turned its institutes of higher learning and its research institutes into bases of science and technology. These bases have played an active role in promoting the economic development of Nanjing.

Realizing the weak technology base that exists in Nanjing, the city's strategy is to absorb and adopt the technological force of the universities and institutes in the area. Specifically, they have made the following efforts.

1. Formulated preferential policy. Preferential policy was formulated to stimulate the technology transfer from the universities and research institutes in Nanjing to the medium and small enterprises in the city and in the counties. After the completion of the task stated in the contract, a certain percentage of the net profit may be allocated as award money. The amount of award money granted to units and individuals that transferred technology to nearby counties has also been increased according to the degree of difficulty of the technology and the benefits accrued from the transfer.
2. Encouraged the establishment of intermediate bases that combine research and production. In order to take advantage of the research results developed locally, a major effort was made to bring research and the production together and to establish intermediate test bases.
3. Facilitated the transfer channels. The city helped the universities and research institutes solve their technology transfer difficulties by conducting information announcement meetings, special topics introductions, and meetings between the supply and demand sides of technology.
4. Proposed major technical problems that affect the economic development of the entire city to be overcome by absorbing the strengths of the research units and universities.

Preferential policy and good service have heightened the interests of the universities and research institutes. Today the universities and institutes in Nanjing have become strong technology bases for the overall development of the economy in the Nanjing area. They have achieved the following specific results.

1. Research institutes have entered enterprise groups.

Institutes No 14, 28 and 55 of the Ministry of Electronics Industry have joined the Zhongshan Enterprise Group and became reliable technology backups for the group. Shortly afterwards, the Community Antenna Television System Company was formed and large-scale engineering contracts such as the installation of 25,000 closed-circuit televisions for Ma'an Shan Steel Works have been obtained. The group has also formed development companies and successfully developed high-tech medical electronics components and engaged in harbor management and transportation.

2. The institutes are becoming technological development centers for the professions.

Five tech centers and spinoff enterprises have been established. One of these centers, the Nanjing Yunjin Research Institute, has become a national technical center for that profession. Since its formation in 1984, Nanjing Food Packaging Machine Institute has collaborated with nine different enterprises and developed three product series. This institute has become a center for the food packaging industry of Jiangsu.

3. Intermediate testing bases have been built.

So far, 12 intermediate testing bases have been built, including the Tangshan Chemical Plant of Nanjing University, the Lishui testing plant of Nanjing Fiberglass College, and the Banqiao composite fertilizer plant of the Nanjing Soil Institute, the Chinese Academy of Sciences. These testing bases provide a bright future for the development of high-tech products and for the promotion of tight cooperation between technology and the economy in Nanjing.

9698/6091

SCIENCE & TECHNOLOGY POLICY

Shaanxi Provincial Government Tries Out New Incentives

40080017b Beijing ZHONGGUO JIXIE BAO in Chinese 4 Aug 88 p 1

[Article by Li Yaonan [2621 5069 0589]]

[Text] Recently the Shaanxi Provincial Economic Commission, the Provincial Financial Office, and the Provincial Office for Machine Building have jointly announced new incentives for the machine industries of Shaanxi. Awards will be provided to efforts that increase the economic efficiency of key projects. These incentives are designed to counter the low economic efficiency of the machine industry in Shaanxi. The new incentives include:

1. The economic efficiency of high-priority projects that affect the industry will receive the most attention. This includes major production technology, product structure, technology structure, and business management. This effort is aimed to substantially increase the economic efficiency of the industry.
2. The population will be mobilized to uncover economic inefficiencies, reveal technical inadequacies, locate potential resources, and set goals and formulate approaches in the effort to increase economic efficiency. The tasks will be debated and evaluated before they are approved and included in the "double-increase, double-save" project.
3. In the feasibility report, proposals that are expected to increase the economic net benefits by 500,000 yuan or more will be forwarded to the superior department for evaluation by experts and for approval. Proposals for increases in net benefits by 500,000 or less will be evaluated by the industry and then the superior department will be notified.
4. Proposals already approved will be carried out under a strict economic responsibility system, or contracted out by the enterprise. After fulfilling the annual profit or payment quota, an enterprise may take a portion of the increased net profit and use it as incentive rewards for workers participating in the effort. Such awards are taken out of the newly created profits; they do not affect the award base and will not be assessed award tax.

The regulation also states that gains obtained by the enterprise by expanding reprocessing or raising prices, or from projects not evaluated and approved following the above procedures do not qualify for the above incentives. Any attempts to defraud the incentive awards will be dealt with severely.

9698/6091

300-Meter Saturation Dive Successful

40080020a Shanghai WEN HUI BAO in Chinese 4 Aug 88 p 2

[Article by Xin Guangqi [5450 0342 3825] and Guo Xinzong [6753 2450 1813]:
"300-Meter Helium-Nitrogen-Oxygen Saturation Experiment Certified, Eight
Gaps in Underwater Research Filled"]

[Text] The "300-meter helium-nitrogen-oxygen saturation experiment," which can be done in only a few countries in the world, has been state-certified. This large-scale experiment was assigned to the Shanghai Institute of Marine Underwater Engineering by the State Science and Technology Commission, the Ministry of Transportation, the Ministry of Petroleum Industry and the State Oceanographic Bureau. It has filled the voids in eight areas in underwater research and has significant meaning in the exploration of ocean resources, deep sea rescue, harbor engineering, and naval construction.

The "300-meter simulated underwater high-pressure cabin" was successfully developed for the first time in China and its performance has been proven to be at an advanced level in the world. The air leakage rate and hermeticity of the cabin are 17 and 21 times better than the international standards, respectively.

In the experiment, four professional divers led by Guo Chunrong [6753 2504 2837] were involved. A pre-designed helium-nitrogen-oxygen mixture was used and the pressure was increased at a rate of 5 meters per minute. When the pressure reached the level simulating 240 meters underwater, the divers stayed for 6 hours. This is the depth where experts believe "high-pressure nerve symptoms" are most likely to occur. Physiologists took advantage of the opportunity and conducted tests on the trembling of the fingers and the heart, brain and nervous system. Nine hours and 40 minutes after we began pressurizing the system, the divers smoothly reached 300 meters. It went down a lot faster than it came back up. After staying "underwater" for 7 days and 7 nights, decompression began to bring Guo Chunrong and company back to "the surface." It took 13 days.

Other products successfully developed by various research and development institutions, such as a deep-sea diving helmet, heating suit, underwater telephone, and cutting tools, have similar quality as their counterparts in the world.

12553/6091

World's First Use of Lasers To Produce Polymers Claimed

40080020b Beijing GUANGMING RIBAO in Chinese 22 Aug 88 p 1

[Article by Liu Luosha [0491 4820 3097]: "First Polymers Synthesized by Laser Enhanced Catalysis"]

[Text] Polymers were synthesized for the first time using laser enhanced catalysis at the Institute of Physics, Chinese Academy of Sciences, by Research Fellow Fu Kejian [0265 0344 1017] and Senior Engineer Yang Junhui [2799 0689 1979].

Laser enhanced catalysis is an interdisciplinary subject involving physics and chemistry which began in the 1980's. Certain compound is excited or dissociated by a laser. The intermediate has very high catalytic activity and may be used as a catalyst for a chemical reaction. The research on laser enhanced catalysis is still limited to organic reactions. Fu Kejian and company successfully used laser enhanced catalysis to synthesize polymers. This is a new application in laser catalysis.

The polymers they synthesized are photoelectrically conductive which have vital importance in information science. Compared to the conventional method, the polymerization of monomers can be drastically accelerated to raise the conversion rate. Furthermore, the reaction is carried out at normal temperature and pressure. Polymers of various molecular weights can be conveniently obtained by controlling the frequency, wavelength and energy of the laser. It is very reproducible.

This work has attracted the attention from experts in the field. They believe that this technique has academic value and good prospect. It is hopeful that this method can be used to synthesize certain special polymers such as electrically conductive polymers, polymers for artificial organs and other lightweight, high-strength, high-temperature resistant materials. This work also aids the further investigation on the mechanism and pattern of laser enhanced catalytic reactions.

Fu Kejian, leader of the team, is a newly promoted female research fellow at the Chinese Academy of Sciences. In 1981, she and Professor Grant collaborated at Cornell University and combined pulse laser with catalytic reaction for the first time. She successfully studied reactions such as olefin

hydrogenation and olefin isomerization and discovered the first gas phase catalyst system. Their work was viewed by Dr Hall, senior researcher and director of Laser Chemistry Department of Exxon Engineering Corporation, as "a possible new application of laser in the chemical industry." Professor Hoffman of Cornell, a Nobel laureate, praised her as a "talented physical chemist." The synthesis of polymers by laser enhanced catalysis is an important achievement since she returned to China.

12553/6091

China Could Become World 'Leader' In Mathematics

40080028b Shanghai WEN HUI BAO in Chinese 28 Aug 88 p 1

[Article entitled: "Chinese Mathematics Will Become the Leader in International Mathematics"]

[Text] "During the 21st century, Chinese mathematics will become the 'leader' of international mathematics!" This was the opening remark by the world-renowned mathematician Professor Chen Xingshen [7115 4164 6500] at the academic conference on "Prospects for Chinese Mathematics During the 21st Century" that was held recently.

The academic conference on "Prospects for Chinese Mathematics During the 21st Century" was first proposed by Professor Chen Xingshen, and was held at the Nankai Institute of Teaching in Tianjin. The prefatory remarks made by Professor Chen have been called by mathematics circles "Chen Xingshen's Dream for 21st Century Chinese Mathematics." Li Tieying [2621 6993 2503], chairman of the State National Examination Guidance Committee for Self-Taught Students, who had come especially to Tianjin to attend this meeting, also spoke, saying that this "dreamer" Professor Chen has proposed an equation for us, and to solve it we must do a good job with the two tasks that are "hardware" and "software." "Hardware" is the necessary material basis, where relevant sectors of the state shall provide specific support in the form of money, etc. The primary component of "software" is developing a plan by which Chinese mathematics of the 21st century will be in the world front ranks, a plan for which we can formulate corresponding policies. In general, we must lay the foundation by the end of this century in order to create the conditions that will bring Chinese mathematics into the rest of the world by the 21st century.

12586

Xi'an Professor Develops New Vortex Air Compressor

40080021b Beijing GUANGMING RIBAO in Chinese 12 Sep 88 p 1

[Article: "Professor Wang Disheng Persistently Develops a New-Generation Compressor"]

[Excerpts] A production prototype of an entirely new-design of vortex compressor developed by Professor Wang Disheng [3769 6611 3932] of the Xi'an Jiaotong University is now undergoing state evaluation at Xi'an. The experts have concluded that this technology "not only fills a gap in compressor production in China, but also makes us one of the few nations that have mastered this new technology, which matches or exceeds the foreign state of the art of the mid-1980's."

Compressors have an extremely wide range of uses in many areas of industry. In recent years, with the rapid growth of the consumer electrical appliance industry, the annual demand has grown by leaps and bounds, and market shortages of refrigerators and air conditioners and shortages of compressors at refrigerator and air conditioner plants have become steadily more acute. China's current yearly output of all types of compressors exceeds 10 million units, and every year we must spend hundreds of millions [of dollars] in foreign exchange to buy compressors or import compressor production lines. But these compressors and lines are for the most part traditional reciprocating designs, which have high power consumption, are noisy and have a short service life. Professor Wang and his colleagues, who had achieved many successes in the compressor field, racked their brains: Was it possible to develop a new generation of compressors with all-round optimized capabilities?

In June 1984, Professor Wang visited the United States to take part in a world compressor engineering technology conference. Foreign research articles dealing with vortex compressors stimulated Professor Wang, who was fully familiar with the vortex principle. Returning to China, he quickly proposed a program for the development of a vortex compressor and obtained the support of the university, his department, and his teaching and research section. A year later, although Professor Wang and his assistants had come up with a tentative model, they still faced the difficult problem of air leakage. In early 1986, a Japanese company applied for more than 30 patents on vortex-type compressors. Full of hope, Professor Wang sent the company a telegram, asking to import the technology or purchase a model. The unexpected response was that the Diet had decreed that there could be no negotiations about or export of the model

for 10 years. Faced with this technology barrier, Professor Wang and his assistants did not become disheartened: they again developed a design program and made more than 100 calculations and tests on vortex lines, finally overcoming the difficulty.

Wang Disheng's project group and his collaborators succeeded, but the astounding thing is that the time elapsing between their successful completion of theoretical experiments and their production of a production prototype was only a year and a month. But this prototype is only one of more than 60 varieties in four series that Professor Wang has developed in the course of his magnificent development and design effort. Some of the design work on his other projects, such as compressors for refrigerators and air conditioners, has already been completed, and prototypes will be ready soon. This new-generation compressor, which is said to have brought about a "compressor revolution," is only a quarter the size and half the weight of similar compressors, and has only a tenth as many main parts and assemblies; it will greatly increase operating life and the state has called it a "maintenance-free compressor." Initial calculations indicate that if this result is rapidly put into production, its production cost will be half that of the old-model compressors, and its efficiency will be 10 percent higher, its power production 20 percent lower, and its noise level 5 to 6 decibels lower; every year it will conserve more than 500 million kilowatt-hours of electricity and save more than 45 percent on steel. When it has fully replaced imported models, it will not only save \$200-300 million in foreign exchange, but is also suitable for development into a major export that will earn foreign exchange.

No sooner had this new member of the compressor family appeared than it attracted extensive attention both in China and abroad. Italy, which sells large amounts of compressors on the world market, has asked to import the production technology in return for U.S. \$2 million in uncompensated aid. Some U.S. universities and companies have suggested cooperation with Wang Disheng. More than 140 enterprises in more than 10 provinces and municipalities have requested technology transfer. The State Education Commission, the State Planning Commission, the State Commission on Science and Technology, the State Machine-Building Commission, and the Ministry of Light Industry, as well as Shaanxi Province, Henan Province, and Guangdong Province, have accorded great importance to this project and supported it. In a report to the Ministry of Light Industry on the development of this result, Premier Li Peng stated that we should make a vigorous attempt to implement the plan, put the compressor into production as rapidly as possible, and get it into international circulation. The Wanbao Consumer Appliances Group has already reached an agreement with Xi'an Communications University under which large amounts of capital will be invested to establish a Communications University-Wanbao compressor research center in Xi'an in order to accelerate the exploitation of this new technology.

8480/7310

Ten Major Developmental Trends in S&T Interchanges With Foreign Countries

40080017c Beijing RENMIN RIBAO [PEOPLE'S DAILY] (Overseas Edition) in Chinese
14 Sep 88 p 2

[Article by Hu Genshen [5170 1649 3947]]

[Text] Under the openness policy, China has recently made rapid progress in its science and technology interchange with foreign countries. There are 10 major development trends.

1. In terms of policy, the interchanges are becoming more open and active.

The authority for approving science and technology interchange with foreign countries is gradually transferred from the central government to provincial, municipal and autonomous-region governments. Many of the interchanges formerly approved by ministries and commissions are now approved by local authorities or even at the plant, university, institute and station level. Also, even China's defense technology, long closed to the outside, is removing its mysterious cover and looking toward more and more active exchanges with the world. Moreover, private science and technology enterprises have mushroomed in China in recent years. Interchanges of the private enterprises with foreign countries are also on the rise. In Beijing, the Foreign S&T Interchange Center, under the jurisdiction of the State Science and Technology Council, alone has processed foreign travel papers for dozens of people.

2. In terms of the exchange countries, the number has increased.

On an equal and mutually beneficial basis, China is interacting with more and more countries. In the past China's S&T interchanges were limited only to developing countries in the Third World. In the beginning of the open period, S&T interchanges with the United States and Japan increased rapidly. In the 1980's, China strengthened its interchanges with the Western European economic consortium. Since 1983 exchanges with the Soviet Union and other Eastern European countries have also increased and broadened. In the last few years, China has also established and maintained unofficial S&T interchanges with countries without diplomatic relationship. Today, China has S&T interactions with more than 100 countries on five continents.

3. In terms of interchange channels, the trend is toward increased frequency and openness.

China is now engaged in a multichannel exchange with foreign countries. There are official channels such as agreements between governments, ministries and provinces; there are semiofficial channels such as academies and societies. There are also civilian channels such as clubs, alumni, associations and so on. Some channels are within the country and others are between countries. The intermingling of these channels makes the interchanges more and more extensive and widespread.

4. In terms of the breadth of interchanges, the trend is toward a more even and wider interchange.

In the early stage of openness, S&T interchanges with foreign countries were concentrated mainly in the central government or at the ministry level. In the last few years the trend has been toward local and base units. Exchange projects concentrated in the coastal areas have now spread to the inland and the west. Agricultural and forestry exchanges and cooperations suitable for the situation in China have progressed rapidly in recent years.

5. In terms of personnel, more attention has been placed on management.

People specializing in management have received more and more attention in China's interchanges with foreign countries. In 1985 the Chinese Academy of Sciences decided to send overseas graduate students and visiting scholars specializing in management. In 1988 the Chinese International Exchange Personnel Association plans to send more than 1,000 senior management and technical personnel overseas. China will also invite 2,200 foreign technical and management experts to work in China.

6. In terms of the field, the trend is toward high technology.

High tech has now become a measuring stick for a country's overall strength. In the next 15 years China will put its best S&T personnel into research on biotech, space technology, information science, laser, automation, energy and advanced materials. In these fields China will also promote a multitude of international interchanges.

7. In terms of the exchange format, the trend is toward integration and practicality.

In the beginning of the openness there were walk-through type visits, and then class offerings with specific contents. Usual stop-over visits become short cooperations in research. Bilateral cooperation of single projects turned into joint institutes and shared graduate students. There were even joint efforts in new-technology development and joint ventures in business. In addition, single-purpose exchanges are on the decline but multipurpose interchanges are on the rise. For example, academic interactions may be combined with business negotiations, technological interchanges may be combined with trade dealings. Importing "hardware" (components, equipment,

facilities) may be combined with "software" (ideas, experience, management skills).

8. In terms of the "flow direction," the trend is toward more attention on export.

As science and technology develop in China, more and more attention will be placed on technology export. Importing of technology in the past will gradually become exporting of technology. For example, in 1987 alone China exported \$1.67 billion, more than the sum of exports made from 1979 to 1986, and had an increase of 89 percent over the 1986 figure. Many technical products are "rushing out of Asia into the world." Agricultural machinery products have moved from the traditional Asian market into the Western European, South American and North American markets.

9. In terms of the level of exchanges, the trend is toward pooling of talent.

In the early days of China's openness, interchanges with foreign countries relied mainly on individual scientists. In recent years such personal interchanges are becoming rare and are being replaced by interchanges between units, several units, or even S&T talent from all over the country. China has now established dozens of national research laboratories that are open to the outside. "World class laboratories" jointly operated with other countries and staffed only by senior researchers have also come into existence. The concentration of superior S&T personnel and the formation of national teams will undoubtedly raise the level of interchange and cooperation.

10. The management of S&T is gradually being perfected.

Driven by the needs in S&T interchanges with foreign countries, a series of management service organizations have been formed, including China S&T Interchange Center, China International S&T Conference Center, and a number of other consulting and service centers and information stations. In the practice of openness, a number of management personnel were trained. Policies, regulations and guidelines regarding S&T interchanges have been gradually formed. Assessment and study of the interchange process itself has also attracted attention. These developments will serve and guide China's S&T interchange with foreign countries more and more effectively.

9698/6091

Ways Ahead for Electronics (Report on Shenzhen Electronics Group)

40100012 Beijing CHINA DAILY (Shenzhen Foreign Trade Supplement) in English
15 Oct 88 p 2

[Article by Ma Fuyuan, president of Shenzhen Electronics Group]

[Text] Shenzhen Electronics Group (SEG) is the largest industrial group in Shenzhen. It develops and produces computers, communication equipment, household electrical appliances, integrated circuits, semiconductor devices and various electronic components.

The group has 158 member enterprises including 21 directly affiliated enterprises and 57 enterprises with SEG investments. In the past two years, it has set up 35 new enterprises. The corporation has become a multifunctional and foreign-oriented group corporation.

In 1987, industrial production value reached 2.08 billion yuan, and 780 million yuan worth of export products were produced by SEG. The export volume was \$150 million, sales income was 1.482 billion yuan and total profit reached 223 million yuan.

In the first six months of this year, the industrial production value, export production, sales income, TV and radio production were all the highest of any corporation in the 26 major Chinese cities.

In the past two years SEG has tried to find new ways to develop an export-oriented corporation in the electronics industry. Its main practices are as follows:

1. Adhering to market guidance and stressing systematization.

With the consideration that market is the key point of development, the group's guideline is "advance technology to meet market requirements, obtain good economic benefits through high technology and promote self growth with good economic benefit." Guided by market conditions SEG established an information system covering China and abroad, a market system, a scientific and technical development system and a quality control system.

2. With Shenzhen as its base and backed by the inland, the group is expanding to the world market.

The group corporation has brought the group's advantages into full play and established cooperative relations with more than 100 companies in about 20 countries and regions. They first set up the Shenye Electronic Company in Hong Kong and later set up branches in the US, Japan, Canada and Kenya. The group has also enhanced cooperation with inland companies.

SEG selected a number of inland enterprises, universities and scientific research institutions as partners and introduced advanced technologies to produce international-standard products. This practice is called "borrowing hens to lay eggs." SEG also "borrows ships to sail the ocean." That is to borrow and make use of foreign technology, trade channels, intellectuals and capital, on a mutual benefit basis, to develop world markets and expand the electronics industry of the Shenzhen Special Economic Zone.

3. Respecting knowledge and intellectuals.

Competition between companies is actually between intellectuals. The group considers intellectuals its foundation and strives to attract intellectuals to help the group prosper. In the past two years, they have recruited, invited and trained various intellectuals. A company training centre was set up shortly after the founding of the group and it has done a well-organized job. It has trained many employees and established a training network. It also organized a policy-making consultative committee and invited 20 experts and scholars to offer scientific data for important decisions.

4. Searching for ways to perfect the group.

Shenzhen Electronics Group is a large-scale comprehensive limited corporation in China's electronics industry. Its founding marked the beginning of the rapid development of the electronics industry of Shenzhen Special Economic Zone.

The ownership and management of the group are separate and the general manager has managing responsibility under the leadership of the board of directors. Tasks are clearly divided among the leaders and they each take their own responsibility seriously. The board of directors makes the strategies for the corporation while the Party committee implements the supervisory work.

The group corporation has realized that capital is the key link in economic relations. Its members have made investment in each other's enterprises and carried out various reforms including the contracted responsibility system and leasing.

Now, SEG is taking advantage of the beneficial international situation to enter the world economic stage. The group will set up more overseas enterprises and develop high-tech products.

/6091

Beijing Electron-Positron Collider Hailed as Major Breakthrough

40100011 Beijing CHINA DAILY in English 20 Oct 88 p 1

[Text] A tremendous mass of photons and electrons, two basic particles travelling at the speed of light (about 300,000 kilometres per second) collided at an underground laboratory in a Beijing scientific institute last Sunday, and the great amount of energy the collision released is expected to help Chinese nuclear physicists study physical phenomena and elementary particles of matter never before seen.

"The completion of the Beijing Electron-Positron Collider (BEPC) is one of the most important advances in science in China in recent years," said Professor Zhou Guangzhao, president of the Chinese Academy of Sciences (CAS) and head of the project, when he disclosed details of this momentous scientific event to Xinhua yesterday.

The BEPC, a huge machine located in a six-metre-deep tunnel at the CAS Institute of High Energy, has a power capacity of 2.2-gev (billion-electron-volts), making China the fourth country in the world to possess such a facility. The other three are the United States, Switzerland and Japan.

The complex housing the BEPC includes a 200-metre-long linear accelerator, a 240-metre perimeter storage ring, a 400-ton detector, a synchrotron radiation laboratory and a computer centre. Its purpose is to explore the fundamental structure of matter.

"This super-laboratory is the first in China for the study of the movement and interaction of the tiniest particles, such as 'quark' and 'charm' particles, which are the fundamental building-blocks of the atom," Professor Zhou said.

When electrons and photons travel at high speeds in the storage ring they emit a strong light called synchrotron radiation, said the professor.

As a national laboratory, the BEPC will be open to users from universities and other institutions throughout the country, and, "scientists from overseas are also welcome to do research here," Zhou said.

"Since high-energy accelerator and detector facilities involve sophisticated high-tech engineering, the construction of the BEPC has greatly promoted China's high-technology development," he said.

In the construction of the collider, Chinese scientists have not only introduced many advanced types of technology from abroad, they have also made their own contributions to the latest technology. National scientific laboratories in the United States and Brazil are purchasing key collider equipment developed and manufactured by Chinese scientists and engineers. In addition, some other countries are negotiating with China for the same purpose.

However, Zhou admitted, further efforts have to be made to conduct advanced experiments and apply synchrotron radiation.

The Chinese Government has consistently given strong support to the building of this 240 million yuan collider. The late Chinese Premier Zhou Enlai gave the project the go-ahead in 1975; it was the last document he signed before his death.

The construction of the BEPC started in October 1984, and Chinese leader Deng Xiaoping attended the ground-breaking ceremony.

/7310

SCIENCE & TECHNOLOGY POLICY

Advanced Technology Boosts Beijing Industrial Growth

40100013a Beijing XINHUA in English 0849 GMT 26 Oct 88

[Text] Beijing, 26 Oct (XINHUA)--Beijing's progress in science and technology has given a strong push to its industrial development, today's BEIJING SCIENCE NEWS reports.

As predicted, of the total 1978-1987 increased production volume, science and technology applied in the period helped increase it by 56.6 percent.

Beijing's science and technology progress is also enhancing the capital's export potential.

The machinery and electrical industries, which have firm foundations in Beijing, for example, account for one out of every three yuan of the municipal industry's production volume.

Its export capability, however, was far from satisfactory only a few years ago. In 1985 exports of machinery and electrical goods recorded only 30 million U.S. dollars in value, six percent of the total municipal export volume.

But, exports in this sector have picked up remarkably along with the recent introduction of advanced foreign science and technology.

Beijing in recent years has put stress on the production of tv sets, radios, and tape-recorders. It has introduced more than 50 assembly lines and 30 items of advanced technology from abroad.

Great changes have taken place in some key outputs, changes from small-size black and white tv sets to wide-screen color tv sets and from semi-conductor radios to combined stereo radios.

The Beijing Jeep Company Ltd, shortly after it entered into cooperation with American Motors Company Ltd, upgraded its 1950s-vintage production techniques, and its joint-venture products are now being sold in the U.S.

High-quality products make it possible to compete with foreign counterparts. In 1986 exports of machinery and electrical products reached 80 million U.S. dollars, 100 percent more than in the previous year, and 1987 saw a 63 percent increase over 1986.

SCIENCE & TECHNOLOGY POLICY

Science Legislation Strengthened

40100013b Beijing XINHUA in English 1605 GMT 29 Oct 88

[Text] Beijing, 29 Oct (XINHUA)--During the past three years China has promulgated over a dozen laws related to science, including items on funding management, the natural science foundation and other aspects of scientific law.

Ruan Chongwu, vice-minister of the State Science and Technology Commission, said that since the State Council issued provisional regulations on management of technological contracts earlier this year, more than 10 provinces, municipalities and autonomous regions have worked out rules for technological market management.

Ruan was addressing a national meeting on science legislation, which opened here today.

Detailed rules for the implementation of technical contract law will soon be made public, he said.

Since the country's patent law went into effect in 1985, China's Patent Office has handled more than 80,000 applications and granted patent rights to 16,000 inventors.

In addition, China also published regulations concerning nuclear safety, supervision of the safety of civilian-use nuclear facilities and control of nuclear materials.

The vice-minister said his commission has organized more than 300 experts from 20 research institutes and universities to conduct 25 research projects on science legislation.

During the meeting, the 150 participants will discuss the five-year plan for science legislation, the law on scientific research institutes, regulations concerning non-governmental scientific organizations and the law on science awards.

It has been learned that regulations are also being prepared for the export of technology, hi-tech industrial experimental areas, bidding for scientific research projects, scientific information and technological contract arbitration.

Ruan said that science laws and regulations have promoted the integration of scientific advance with economic development.

However, he pointed out, of the 600 sets of regulations promulgated by the State Council, only 30 are related to science and technology.

These science laws and regulations cannot meet the demand of the development of science and technology in a commodity economy, he added.

The vice-minister urged participants to attach importance to science legislation, study science laws and regulations in other countries and cooperate with legal workers and jurists to speed up the development of Chinese science law.

/7310

SCIENCE & TECHNOLOGY POLICY

Academy of Sciences To Reform Basic Research Work

40080053a Beijing XINHUA Domestic Service in Chinese 0739 GMT 9 Nov 88

[Text] Beijing, 9 Nov (XINHUA)--The Chinese Academy of Sciences has decided to further reform the work of basic research in an attempt to promote rapid development of the work which plays a great leading role in and science research.

The Chinese Academy of Sciences has scored some new achievements in basic research in the few years after reform was started. It has achieved successes of international level in studying the protoplast regenerative plant of maize, high-temperature superconductors, quintic and octal symmetrical quasi-transistors [dui chen zhun jing 1417 4468 0402 2533], non-linear optical transistors, and rare-earth permanent-magnet materials. The successful collision by the Beijing positive-negative electron collider and the completion of the installation of a telescope for observation of the solar magnetic field indicate continued upgrading of the level of facilities installed for basic research in the Chinese Academy of Sciences. The practice of making scores of research laboratories accessible to personnel concerned is a useful attempt in opening the basic research organizations to the whole nation and promoting interchanges and cooperation between them.

However, the old systems and management patterns still hinder the progress of the work of basic research. The problems of the contingent engaged in basic research getting too old, barriers existing between different departments who seek individual development on their own, and the conflict arising from the trend of unlimited expansion with only limited funds remain yet to be solved. Moreover, the basic research work has sustained some new impacts in the course of its transition from the old system to the new one. In order to extricate itself from such situations as quickly as possible, the Chinese Academy of Sciences has decided to reform and strengthen its work of basic research in the following areas.

-- The contingent of basic research will be reinforced to maintain a relatively stable work force in the face of the constant flow of qualified personnel. Erudite scientists who are quick in thinking, have better organizational capabilities, and are cooperative will be chosen as leaders. Continuous efforts will be made to discover, train, and recruit young scientists and technicians. The flow of scientists and technicians who

are engaged in basic contingent to provide excellent personnel without interruption while constantly replenishing new work force and, thus, to maintain a comparative stability.

-- The research projects will be selected with great care and only limited objectives will be chosen. The basic research projects will be defined on the basis of the existing foundation and with their objectives aimed at achieving international advanced positions. We must not blindly busy ourselves "filling the so-called gaps" in our projects. In those important spheres which cannot get proper development in China, we may firstly send personnel abroad for training or cooperate with foreign countries in the research. Research projects must be either expanded or scrapped through competition and selection of the best to achieve a dynamic balance.

-- We must endeavor to bring about a gradual transition of the basic research work to a new system. The basic requirements of the new system are a system that opens itself to the whole nation and the world; a democratic academic atmosphere; an environment that favors competition between qualified personnel and their flow; excellent equipment and facilities for scientific research and good working conditions; and an organization and management staffed by personnel small in number but highly trained and characterized by reasonable deployment, coordination, and high efficiency.

-- The idea of international competition must be fostered so as to make China move towards the world. We must open basic research work wider to the outside world, actively participate in international competition and cooperation, and assimilate the ideas and technology of excellent scientists of the world. In order to facilitate our participation in international competition, we must actively create conditions to enable our scientists to conduct academic exchanges with their foreign counterparts as much as possible.

/7310

SCIENCE & TECHNOLOGY POLICY

New Science, Technology Accounting System Announced

40080053b Beijing XINHUA Domestic Service in Chinese 1557 GMT 9 Nov 88

[Text] Beijing, 9 Nov (XINXUA)--A key to reform of the management system for science and technology--by XINHUA reporter Zuo Peirong.

The State Science and Technology Commission and the Ministry of Finance have announced today that scientific research units throughout the country will put into effect the economic accounting system. The system has been adopted to promote reform of the management system for science and technology and the development of a socialist commodity economy, and is a key to deepening reform of the management system for science and technology.

Structural reform of science and technology in the past few years has been pounding fiercely at the traditional method of management for scientific research work. The old practice--funds were appropriated by the state, tasks fixed by the state, no calculations made as to the cost of research projects, and nobody cared where research results went--could no longer be allowed to continue. In order to promote this historic reform, since the decision on reforming the management system for science and technology was made by the CPC Central Committee in 1985, the state has promulgated a number of supporting policies, thereby reforming the system of appropriating funds for science and technology and the management of funds for scientific research, expanding the decisionmaking powers of scientific institutions and readjusting the method of collecting taxes on their bonuses and their method of profit distribution. The implementation of these policies has directly or indirectly involved the cost, income, and accounting of returns of scientific research, the depreciation of fixed assets, the prices of technological contracts, and other practical problems. In the course of practice in the past few years, the scientific institutions of many areas and departments have invented their own economic accounting systems through experiments, but there is no unified standard for the limits of costs and expenditure, and there are also problems in the management of funds because of confusion in the method of calculating costs and profits. Therefore, the drawing up and implementation of a practical and effective economic accounting system has become an urgent matter for scientific and technological circles during the current campaign to improve the economic environment and rectify economic order.

This policy embodies the principles of independent operation, profit, material distribution, and contract relations. On the one hand, it has clearly set a standard criterion for rationalizing the relationship between scientific research and the economy in scientific research institutions and rectifying some confusions in the field of technological trading. On the other hand, the policy has given scientific research units greater decisionmaking powers based on policies, thereby safeguarding the legal rights of these units. Therefore, under the present situation of reform, the policy embodies unity between scientific research units, scientists, and technicians as far as duties, rights, and benefits are concerned. Such a policy will ensure the smooth operation of China's new management system for science and technology and will encourage more and more scientific and technological personnel to move into the main field of economic construction.

/7310

Shanghai Sees Burgeoning Growth of Soft Sciences

Rapid Growth Bring Problems

40080028a Shanghai WEN HUI BAO in Chinese 24 Aug 88 p 1

[Article by Jin Dan [6855 0030]: "Soft Sciences in Shanghai Need Strengthening"]

[Text] Over the past few years, soft sciences research in Shanghai has matured into "adolescence" from its "infancy," the results of which have been obvious, but at the same time difficulties and problems are puzzling workers in the soft sciences. This reporter heard all kinds of stories from them: one was that soft sciences research funds are inadequate in Shanghai. The growth of the Shanghai economy, science and technology, and society is making ever increasing demands upon the soft sciences. Topics needing research also steadily rising, but with the limited funds it is hard to meet these demands. The lack of funds forces some researchers to find their own means, which can lead to the phenomenon of "addressing whoever puts up the money," thereby reducing confidence in the research. A second situation arises because the composition of soft sciences structures is not yet equitable, and there are many gaps. For example, there is a lack of soft sciences structures for the research of strategic growth for enterprises; and there is a deficiency of lateral relations and cooperation between soft science structures, which means that it can be difficult to bring together the advantages of a group to carry on with comprehensive large projects. A third situation exists because the level of research by soft sciences workers must be improved, for otherwise this fact will hinder the intensification and continuity of research.

Soft sciences is an applied science, and it demands a proficient grasp of some specialized knowledge. Our existing workers in the soft sciences have primarily come over from the "hard sciences," and they still need some time to become familiar with soft science. Many experts engaged in soft sciences research believe that the items of developing systematic training, establishing a contingent of workers in soft science who have a higher degree of accomplishment, and the attraction of outstanding skilled personnel should be place on current agendas.

At the same time, rules and regulations should be used to standardize and perfect the soft sciences system. Projects that require advisement should be formalized with rules and regulations to avoid the losses created by "head thumping" projects; there should also be clear provisions made about the scope of operations, the nature of structures, and remuneration for consultants. In addition to this, we must perfect and strengthen news and information systems for the soft sciences.

Some insightful persons have recommended the establishment of a semi-official Shanghai soft sciences coordination center, which would serve to enhance soft science coordinating structures, and would aid in the maturation of Shanghai soft science. To resolve problems whereby at present the soft science organizations have yet to form special research directions and characteristics, government at various levels can at the same time "nurture" some higher level soft science organizations in a planned way, which would then constitute a multiple level structure for soft science research in Shanghai.

'Maturation' Seen by Year 2000

40080028a Shanghai WEN HUI BAO in Chinese 25 Aug 88 p 1

[Article by Jin Dan [6855 0030]: "Shanghai Soft Sciences Research Enter Adolescence"]

[Text] Experts in the soft sciences of Shanghai have done their first systematic research on soft sciences itself, and their results show that after growth of the soft sciences in Shanghai Municipality went through four stages of development during 9 years, it is now in its "adolescence." This was learned by your reporter at a meeting to review the "General Report on Research of Growth Strategies for Soft Science in Shanghai Municipality for the Year 2000."

Since a group of soft science pioneers originated some soft sciences organizations in 1979, the soft science research contingent in this city has continued to grow and mature. Types of soft science research organizations have grown from the exclusive responsibility of the science and technology commission into a structure of attention at many levels with responsibilities in all areas. Nearly 60 percent of research personnel in the almost 400 specialized soft science research and consulting organizations throughout the city have a high school or middle school education. Structurally, these organizations make up ten large systems that are concerned with the overall economy, industry, science and technology, capital construction, higher institutions, the social sciences, communications and agriculture, and these have played important roles from overall strategy to the more minute diagnoses of enterprises, all of which have served to display the real power and level of this contingent.

During the 9 years, they continued and completed overall strategic soft science research projects such as "Developmental Strategies for the Shanghai Municipality Economy," "Strategies for the Growth of Science and Technology," and "Chinese Economic Growth Models and Development Strategies," and also did demonstrations of many major engineering projects that had an overall significance, including the 300,000-tons of ethylene project and developing international cooperative research. Among these, the famous "Linking Project" prepared by Fudan University linked up economic models of 79 countries to form a global economic model, which featured a group of little-known science leaders both within China and outside. Corresponding to the functions of the central city within Shanghai Municipality, soft science research radiates out like two fans, and consulting abroad and international research have also begun. This is beginning to constitute a science and technology information network that is hierarchical and categorized by industry. There are now some 600 science and technology information organizations and departments.

Soft science experts are using mathematical modeling to make quantitative descriptions of the regularity and forecast of demand for the growth of soft science in the city. This, too, is a first for soft science research reporting both domestically and abroad. It has been calculated that by the year 2000, investment by society in soft science research projects will reach 140 million yuan, and it cannot be estimated what successful research will mean to society and the economy.

It has been mentioned in research reports that the strategic goals for the growth of soft science in Shanghai by 2000 will be: full-scale responsibility for the function of serving major decision making for all levels of government within the city, as well as for the function of serving major decision making for all types of economic entities; and to form the structure as the "outside expert" upon which to closely rely for major problem solving at all levels of government and for all types of economic entities within the city.

Based on these strategic goals, the strategic mission for the growth of soft science in Shanghai by the year 2000 will be to realize the maturation of soft science growth; to realize universality as the scale for research; to realize the modernization of soft science structures; and to realize the making of the consulting profession into a property.

12586/7310

Briefs

Sino-Australian Joint Venture--Groundbreaking for construction of [a plant for] Tianjin Pulin [phonetic] Circuits Ltd., which will be Asia's largest high-quality facility for production of printed circuit boards, has officially taken place. Construction of the 6000-square-meter facility hopefully will be completed by year's end, and operation can begin by early 1989. This joint venture of the Tianjin Municipal Printed Circuit Board Plant and Australia's Pulin [phonetic] Ltd. has a total funding of US\$11.7 million, and is to have an annual output value that will reach US\$10,208,000, with all products to be sold abroad. [Text] [40080040 Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese 7 Sep 88 p 1]

SCIENTISTS, SCIENTIFIC ORGANIZATIONS

Laboratory for Surface Physics, CAS Described

40080032a Beijing WULI [PHYSICS] in Chinese Vol 17, No 8, Aug 88 p 474

[Article by Wang Dingsheng [3769 7844 4141] of the Institute of Physics, Chinese Academy of Sciences]

[Text] Surface physics is a frontier discipline developed in the last 20 years. It is the study of physical phenomena on the surface of matter, including changes in composition and atomic structure, electronic states and the interaction of the atoms and molecules with the surface, and the effects of these physical phenomena on the material properties. These investigations have provided a reliable basis for improving the performance of electronic devices, controlling surface chemical reactions, and developing various new materials. In order to further advance China's surface physics research, the Chinese Academy of Sciences started organizing a national open laboratory in 1984. The laboratory is called the Surface Physics Laboratory and it is now officially open to the nation.

The main mission of the laboratory is the study of surface and interface physics. It will collaborate with other disciplines and actively develop major topics in surface and interface physics that have an impact on the national economy. The major directions of research of the laboratory are:

- (1) Surface and interface investigations related to new materials and devices in information science.
- (2) Surface and interface investigations related to new energy materials and energy sciences.
- (3) Investigations of surface structure, atomic composition, electronic states, vibration states, surface reactions and other fundamental physical properties of the surfaces. Development of the corresponding experimental techniques and theoretical analysis methods.

The Chinese Academy of Sciences has recruited experts from here and abroad and formed an academic committee to serve as the academic review organization of the laboratory. The first term of the committee consists of 15 experts and is headed by Professor Xie Xide of Fudan University.

Based on China's needs in S & T development, the laboratory has established priority open research topics. The first meeting of the committee decided the following topics for the 1988-1990 three-year period:

- (1) Structure and properties of semiconductor heterojunctions.
- (2) Metal-semiconductor interface physics.
- (3) Surface structure and properties of metal alloys and compounds.
- (4) Oxide superconductor thin films.

The academic committee hopes to achieve high quality research by pooling the resources and combining material research and application, combining property and mechanism, and combining experiment and theory. In order to support research efforts in other units and research topics of interest to the science community, the laboratory has also set proposal guidelines on open topics. Up to this point, the laboratory has received 45 proposals from 16 units.

To accomplish its missions, the laboratory's permanent research team is based on personnel engaged in surface and interface research in the Institute of Physics and the Institute of Semiconductors of the Chinese Academy of Sciences. The laboratory is equipped with material growth and preparation facilities, spectral analysis equipments for surface composition and structure, and instruments and facilities needed for physical testing and theoretical work. Scientists from China and abroad can effectively develop their research at the laboratory.

Material growth equipments and facility include molecular beam epitaxy and ultrahigh vacuum thin film preparation systems. Surface analysis equipment include scanning Auger microprobes secondary ion mass spectrometers, low- and high-energy electron diffractometers for surface atomic structure analysis, and spectrometers based on photoelectron spectra (XPS and AES), high-resolution electron energy loss spectrometers for studying surface absorbed states and vibrational properties, and inelastic electron channelling spectrometers. Physical testing equipment and facilities for theoretical studies include an He³ dilution refrigerator for extremely low temperatures and high magnetic fields computerized semiconductor property testing systems, and a computer network made up of five Apollo workstations.

The laboratory has established a strong research team to help researchers coming to the laboratory to develop new experimental techniques called for in their work.

/7310

China Plans Manned Space Missions in the 1990s

40080035 Chengdu SICHUAN RIBAO in Chinese 24 Aug 88 p 3

[Text] (Hong Kong, WEN HUI PO) China has already begun to develop the technology and formulate plans for manned spaceflight in the decade of the 1990's.

The Beijing Institute of Space Medico-Engineering is studying space suits as well as the medical problems that could crop up during the manned flight of a space shuttle. The involved laboratories have already chosen China's first group of astronauts. Initially, they could be specialists aboard the U.S. Space Shuttle in the 1990s. At the same time a nucleus, or core unit, would be established to fly space missions aboard a Chinese spacecraft of the Gemini (America's second generation manned spacecraft) type before the end of this century.

The development of China's space suits began 4 years ago. The helmets and gloves are detachable. China is also working on the development of liquid-cooled space suits of the type worn by the U.S. astronauts aboard the Apollo spacecraft and the Shuttle. China has established a manned spaceflight agency, an astronaut health care laboratory, and a laboratory for life support for humans in a weightless environment. In addition, China is also studying the application of acupuncture therapy to space sickness.

China wants to have its own small-scale space station in the 21st century, and in the next 15 years will be working on at least four basic research programs:

- (1) the development of a new heavy-lift launch vehicle;
- (2) the development of artificial intelligence technology;
- (3) the launching of many and varied space vehicles; and
- (4) the creation of a Chinese relay communications satellite.

Some of these research projects have already produced results.

There is high-level interest in China in the development of a communications satellite. Also planned are the development of a relay communications satellite, and robot and artificial intelligence technology. It is estimated that China will have its first group of astronauts in space in the 1990s.

Modern Missile Test Facility Described

40080021a Beijing RENMIN RIBAO in Chinese 16 Sep 88 p 3

[Article: "Air Force Missile Weapon Testing Joins the Ranks of the World Leaders"]

[Text] The air force comprehensive missile weapon testing base, which has had the responsibility for all atomic bomb and hydrogen bomb development tests and sample tests, recently carried out all-direction attack tests of a short-range air-to-air guided missile against target aircraft at various altitudes; these tests were at the world state of the art, marking the arrival of China's air force missile weapon testing capabilities at the world forefront.

Located in the northwestern Gobi, the aviation and air defense missile weapon testing base was established in 1958. In the course of 30 years' arduous struggle, it has developed from a small collection of simple and crude facilities to a comprehensive testing system incorporating large computers and a variety of optical measurement, telemetry, radio measurement, and command and control systems, and from single-model design-finalization experiments on copied designs to the ability to carry out testing assignments on more than 100 different models of weapons and equipment, including the army's strategic weapons, unmanned aircraft and sophisticated national defense weapons.

Research and development units and combat units refer to this base as the midwife of China's air-to-air missiles. Over the course of 30 years, several thousand guided missiles have been launched here, and every research experiment, evaluation, lot test and design-finalization test of the Chinese Pili air-to-air missile system have been performed here.

It is also here that Chinese-developed, Chinese-produced surface-to-air guided missiles have received their certification. Since 1965, when China's first independently developed and produced surface-to-air missile was successfully tested here, the base has carried out design-finalization testing of more than 10 surface-to-air missile models, has conducted more than 1000 guided missile launches, and has developed a modern target range, fully equipped with advanced equipment usable for high-, middle- and low-altitude and multiposition tests of all surface-to-air missiles. Surface-to-air missiles certified here have distinguished themselves in national air defense combat, shooting down or damaging intruding aircraft on many occasions.

This base rewrote China's long history of dependence on imported target aircraft, successfully converting decommissioned fighter aircraft to unmanned remote-controlled target drones, providing real combat targets for air-to-air and SAM missile tests.

Here in the inhospitable Gobi, the comrades have worked tenaciously to produce many scientific wonders. They have made measurements on the initial flight stage of satellites, tests of satellite and space vehicle recovery systems and atomic and hydrogen bomb, and research evaluation and test launches of small surface-to-air missiles, antitank guided missiles, high-altitude, high-speed targets and the like, obtaining more than a thousand results in research and modernization projects.

8480/7310

Growth Mechanism, Crystalline Habits of KTP Crystal in Phosphate Fluxes

40090014a Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]
in Chinese Vol 16 No 4, Aug 88 pp 345-350

[English abstract of article by Liu Xiangyang [0491 0686 7122] of Fujian
Institute of Research on the Structure of Matter, Chinese Academy of Sciences;
Jiang Minhua [5592 3046 5478] of the Institute of Crystal Materials, Shandong
University]

[Text] Some kinetic experiments involving KTP in K_5 , K_6 and K_8 phosphate fluxes were performed, and the variations of the crystal growth rate with the supersaturation are discussed in this paper. From the experimental data, a functional relationship between the growth rate and the supersaturation is derived. The growth mechanism of two-dimensional nucleation of small nuclei is suggested. The mechanism is in agreement with the observation of the surface morphology of the KTP crystal. In addition, the experimental results indicate that the steady state growth rate of the interfaces decreases with the increase in relative quantities of orthophosphate in the solutions at the same level of supersaturation.

The cause of the change in KTP crystalline habits is due to the variation of the state of the intermediate products in phosphate fluxes.

9717

Studies of Growth, Defects of LSFM Crystals

40090014b Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]
in Chinese Vol 16 No 4, Aug 88 pp 351-356

[English abstract of article by Wang Ximin [3769 1585 2404], et al., of the
Department of Chemistry and Environmental Engineering, Beijing Polytechnic
University]

[Text] Lithium-sodium formate monohydrate (LSFM) crystals have been grown by the slow-cooling method. The stability of the growth solution, growth habit and crystal defects have been systematically investigated. The solubility curves of both the LSFM and LFM crystals have been determined by the optical effect method, while the metastable zone of the LSFM solution was measured by an improved Dilatometer Method. It has been found that the metastable zone width (ΔT) increases as the saturation point (T_c) of the solution increases. The dislocation of the LSFM crystal has been studied by chemical etching, and three types of etch pits have been observed on the developed faces. The dislocation density ranges from $0.7 \times 10^2/\text{cm}^2$ to $3 \times 10^2/\text{cm}^2$. The macroscopic growth defects, as well as their origins, are described, and some effective ways to eliminate these defects are proposed in the paper. In addition, it is found to be advantageous to grow the LSFM crystals in a low basic solution (pH = 8-11). Finally, high quality LSFM single crystals of sizes up to 43 x 33 x 62 mm have been obtained by employing the +z direction seed, with a temperature reducing rate of 0.02 - 0.3°C/d and a growth solution pH = 9.

9717

Synthesis, Spectral Characteristics of NaLnTiO_4

40090014c Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]
in Chinese Vol 16 No 4, Aug 88 pp 357-362

[English abstract of article by Yu Yaqin [0060 0068 0530], et al., of
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences]

[Text] In this paper, the synthesis of a series of $\text{NaGd}_{1-x}\text{Dy}_x\text{TiO}_4$ (x : 0.01-1) and $\text{NaGd}_{0.7}\text{Ln}_{0.3}\text{TiO}_4$ (Ln: Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm) at 1000°C for 5 hours is studied. These compounds were found to have a superstructure of the K_2NiF_4 -type by X-ray powder diffraction. It is found from the emission and excitation spectra of the compounds that the fluorescent intensities are stronger for the Eu^{3+} , Dy^{3+} and Er^{3+} ions in the compounds.

The Dy^{3+} emission intensities, a function of the Dy^{3+} concentration, decrease strongly and become very weak when x is more than 0.1 in $\text{NaGd}_{1-x}\text{TiO}_4$.

The energy transfer phenomena in $\text{NaGd}_{1-x}\text{Dy}_x\text{TiO}_4$ have been observed and are discussed. By using an approximation, it is possible to derive the critical distance for the energy transfer from Gd^{3+} to Dy^{3+} . This approach implies a critical Dy^{3+} concentration, above which the Dy^{3+} emission is quenched. This distance is approximately $6.46\text{\AA}$. Dy^{3+} is an effective activator for Gd^{3+} excitations, with transfer being possible both from the Gd^{3+} ^6I and ^6P levels. The spectral data indicate that the probability of a high energy transfer from Gd^{3+} to Dy^{3+} ions exists based on the interaction between neighboring ions.

9717

Synthetic LNPP Laser Glass, Main Properties

40090014d Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]
in Chinese Vol 16 No 4, Aug 88 pp 376-380

[English abstract of article by Liu Yanbin [0491 6056 3453], et al., of the
Research Institute of Synthetic Crystals, State Administration of Building
Materials Industry]

[Text] Synthetic LNPP laser glass is a stoichiometrical amorphous solid. It is free from the drawbacks of NdPP crystals, such as the small crystal size, aptness to crack and the very strong self-absorption and poor thermo-optical properties due to the high concentration of pure NdPP glass. The fluorescence wave length, slope efficiency and maximum repetition rate of the LNPP glass have been measured to be 1.053 μm , 2.8 percent ($\phi 60 \times 100 \text{ mm}$) and 20 Hz ($\phi 5 \times 70 \text{ mm}$), respectively. Its maximum output energy reaches 5.5 J/cm³ and is equivalent to 1.6-2.2 times that of silicate Nd-glass, and its maximum average output power is 14.5 cm³, which is 40 percent higher than that of Li-Nd-La phosphate glass. This kind of glass is a new active medium with the highest energy storage and average output power ever known. It is of great practical utility, and can be used as a substitute for silicate Nd-glass and Nd³⁺:YAG in conventional impulse lasers. It will be found advantageous in the miniaturization of the laser device.

9717

New Compound-- $\text{Ca}_8\text{ZnSi}_4\text{O}_{16}\text{Cl}_2$

40090014e Beijing GUI SUANYAN XUEBAO [JOURNAL OF THE CHINESE SILICATE SOCIETY]
in Chinese Vol 16 No 4, Aug 88 pp 381-382

[English abstract of article by Wu Bolin [0702 0130 7792] of Wuhan University
of Technology]

[Text] A new compound exists in the $\text{CaO-ZnO-SiO}_2\text{-CaCl}_2$ system. Chemical analysis shows that the compound's molecular formula is $\text{Ca}_8\text{ZnSi}_4\text{O}_{16}\text{Cl}_2$. The single crystal of the synthetic compound is colorless and transparent with an octahedral shape, refraction index $n = 1.6945$, and density $D_{\text{obs}} = 3.20 \text{ g/cm}^3$. The compound is stable in the range of $850\text{-}1190^\circ\text{C}$, and the incongruent point is at 1190°C . The measurements of X-ray diffraction show that the crystal system of the compound is the cubic system and that the lattice is a face-centered cubic lattice. The unit-cell parameter is $a = 15.07\text{\AA}$, while the space group may be $\text{Fd}3\text{m}$ or $\text{Fd}3$. The isolated group of SiO_4^{4-} is believed to be the basic skeleton of the crystal structure.

9717

Stabilizing Effects of Hot Electrons on Low Frequency Plasma Drift Waves

40090013e Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 8, Aug 88 pp 1284-1290

[English abstract of article by Huang Chaosong [7806 2600 2646], et al., of the Institute of Plasma Physics, Chinese Academy of Sciences, Hefei]

[Text] The MHD equation is used to study the stabilization of low frequency drift waves driven by the density gradient of plasma in a hot electron plasma. The dispersion relation is derived, and the stabilizing effects of hot electrons are discussed. The physical mechanism for hot electron stabilization of the low frequency plasma perturbations is charge uncovering due to the hot electron component, which depends only on α , the ratio of N_h/N_i , but not on the value of β_h . The hot electrons can reduce the growth rate of the interchange mode and drift wave driven by the plasma, and can suppress the anomalous plasma transport caused by the drift wave. Without including the effect of β_h , the stabilization of the interchange mode requires $\alpha \approx 2$ percent, and the stabilization of the drift wave requires $\alpha \approx 40$ percent. The theoretical analyses predict that the drift wave is the most dangerous low frequency instability in the hot electron plasma.

9717

Isolation of Mycoplasma-Like Organisms From Chinese Jujube Infected With Witches' Broom Disease, Preparation of Its Antiserum

40091001a Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 3, 1988 pp 247-252

[English abstract of article by Zhu Benming [2612 2609 2494], et al., of Shanghai Institute of Biochemistry, Chinese Academy of Sciences; Zhou Peizhen [0719 0160 3791], et al., of Shangdong Institute of Pomiculture, Taian]

[Text] A simple procedure for the isolation of mycoplasma-like organisms (MLO) from Chinese jujube infected with witches' broom disease has been developed. The method involves the extraction of freshly infected plants with 0.3 mol/L glycine (containing 0.1 mol/L $MgCl_2$, pH 7.6) and differential centrifugation. A partially purified MLO preparation was obtained. The MLOs were absent in healthy controls, but were observed in both the negatively stained preparations and their ultrathin sections. The MLO antiserum was obtained and gave a titer of 1:16 (by Ouchterlony double diffusion). Using this antiserum the MLO of Chinese jujube witches' broom disease in plants can be detected.

9717

Characteristic Sequence of S1 Nuclease Sensitive Sites in Cloned rRNA Gene of Silkworm *Attacus Ricini**

40091001b Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 3, 1988 pp 253-258

[English abstract of article by Shen Daiwei [3088 0108 0251], et al., of Shanghai Institute of Biochemistry, Chinese Academy of Sciences]

[Text] In previous papers, the authors reported the presence of S1 nuclease cleavage sites in supercolied cloned rRNA genes of the silkworm Attacus ricini and the presence of S1 sites in the native chromatin of rRNA as well.

The fine mapping of S1 nuclease sensitive sites in the cloned silkworm Attacus ricini rRNA gene is described. The Hind III linker was inserted into the S1 site. Sequence analysis by Maxam and Gilbert's method was conducted from both terminals of the Hind III 5' end, and parallel analysis was performed from the Accl site, which is very close to the S1 site. The data from the Accl site covered the S1 cleavage site completely. Combining the above data, the authors found that the DNA sequence around the S1 nuclease cleavage site was very rich in AT. An alternating (AT) exists in the central region of the sensitive site. These findings suggest that cruciform or slippage structures could have formed.

*Project supported by the National Natural Science Foundation of the Chinese Academy of Sciences.

9717

Photoaffinity Labeling of Snake Muscle Fructose 1,6-Biphosphatase at Allosteric Site Affecting Catalytic Site*

40091001c Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 3, 1988 pp 275-282

[English abstract of article by Hu Guofu [5170 0948 1381], et al., of Shanghai Institute of Biochemistry, Chinese Academy of Sciences]

[Text] Snake muscle FruP₂ase can be covalently labeled by ANA-AMP at the allosteric site. The labeling of the enzyme makes it more sensitive to dAMP inhibition at its high concentration region and is without effect on inhibition by AMP.

The labeled enzyme no longer distinguishes between inhibition by AMP or dAMP. The maximum inhibition of the enzyme by extremely high concentrations of dAMP approaches zero. This fact indicates that ANA-AMP covalently bound to an unknown amino acid residue at the allosteric site of FruP₂ase can compensate for the lack of 2'-OH in dAMP with regard to enzyme inhibition.

The results support the authors' previous findings that the interaction between the 2'-OH of dAMP and a certain group at the allosteric site of the enzyme is essential for message transmission from the allosteric site to the catalytic site.

*Project supported by the Science Foundation of the Chinese Academy of Sciences.

9717

Total DNA Synthesis, Cloning in *E. Coli* of Bovine Growth Hormone Releasing Factor Gene

40091001d Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 3, 1988 pp 299-305

[English abstract of article by Jiang Zhiwei [5592 1807 0251], et al., of Shanghai Institute of Biochemistry, Chinese Academy of Sciences]

[Text] The synthesis and cloning in *E. coli* of the bovine growth hormone releasing factor gene are described. The synthetic gene consists of 147 base-pairs, including an EcoRI cohesive end and an initial codon (ATG) at the 5'-terminus, and two terminal codons (TAA, TAG) and a BamHI cohesive end at the 3'-terminus. The coding sequence corresponds to the statistical ratio of the degenerated codon utilization in the gene of highly abundant proteins in *E. coli*. The synthetic gene has been divided into nine fragments. All oligodeoxynucleotides have been prepared by the solid-phase phosphite-triester method. The entire gene is assembled by ligation and cloned into the pWR13 vector. The final identification of the synthetic gene has been made by Southern hybridization and DNA sequencing.

9717

Isolation, Identification of SRBC Receptor on Surface Membrane of Human T Lymphocytes

40091001e Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 3, 1988 pp 332-335

[English abstract of article by Liu Yaxia [0491 0068 7209], et al., of the Institute of Basic Medical Sciences, Academy of Military Medical Sciences]

[Text] CD2 was isolated and purified from the human serum and supernatants of tonsil cells or HPB-ALL cells warmed to 45°C for 1 hour by affinity chromatography with an OKT11-like monoclonal antibody coupled to Sepharose 4B. The biochemical characterization of the CD2 antigen has been studied. By RIA and ELISA it is shown that the CD2 antigen reacted specifically with the OKT11 monoclonal antibody. The CD2 antigen inhibited E-rosette formation after incubating with SRBC. The E-rosette formation ability of the tonsil cells recovered when their CD2 had been partially stripped by warming to 45°C for one hour. This method is useful as a simple method to purify the CD2 antigen. It is of important significance in the study of the immune regulation of the CD2 antigen.

*Project partially supported by the Science Foundation of the Chinese Academy of Sciences.

9717

Export of Hybrid Proteins of Leucine-Specific Binding Protein, Tryptophan Synthetase in *Escherichia coli**

40091001f Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 4, 1988 pp 364-370

[English abstract of article by Su Tizhi [5685 1879 0037] of Beijing Institute of Nutritional Resources; B.R. Copeland, et al., of the Department of Biological Chemistry, University of Michigan]

[Text] The leucine-specific binding protein of *E. coli*, which is a periplasmic component of a high-affinity branched-chain amino acid transport, is exported into the periplasmic space. Protein hybrids have been constructed between the leucine-specific binding protein and the cytoplasmic protein tryptophan synthetase α -subunit, which are exported across the cytoplasmic membrane of *E. coli*. Two in-frame fusions were selected for further study. Both hybrid proteins are exported as soluble proteins from *E. coli* spheroplasts. They also accumulate as precursors in the membranes of spheroplasts when the proton-motive force is dissipated by treatment of the cells with either carbonylcyanide-*m*-chlorophenylhydrazone or valinomycin. These results establish the fact that N-terminal proteins of a periplasmic protein can direct the exportation of a cytoplasmic protein into the periplasmic space.

*Project supported by National Natural Science Foundation and National Institutes of Health (United States).

9717

Studies of Anti-Epilepsy Peptide From Scorpion Venom of *Buthus martensii*.
I. Purification, Partial Physical, Chemical, Pharmacological Characterization*

40091001g Shanghai SHENGWUHUAXUE YU SHENGWUWULI XUEBAO [ACTA BIOCHIMICA ET BIOPHYSICA SINICA] in Chinese Vol 20 No 4, 1988 pp 385-394

[English abstract of article by Zhou Xinhua [0719 2450 5478], et al., of the Department of Biochemistry, Shenyang College of Pharmacy; Liu Chongming [0491 1504 6900] of the Department of Physiology, Shenyang College of Pharmacy]

[Text] An anti-epilepsy peptide (AEP) was isolated and purified from scorpion venom of *Buthus martensii* Karsch. The purification procedure included CM-Sephadex C-50, DEAE-Sephadex A-50 chromatography and gel filtration on Sephadex G-50. Its homogeneity was demonstrated by pH 4.3-PAGE, IFE, SDS-PAGE. The molecular weight of this peptide, calculated from measurements in 15 percent and 20 percent SDS-PAGE, is 8,300. The isoelectric point is 8.52. No hemorrhagic or toxic activities were found. The death of the mice was not noted until the dose reached 28 mg/kg. Pharmacological tests showed that the AEP had no effect on heart rate, blood pressure, or ECG, but it strongly inhibited epilepsy induced by coriaria lactone and cephaloridine. The pharmacological activity is at least 10 times that of diazepam. The fluorescence spectrum indicated that it is rich in tryptophan.

*Project supported by the Committee of the National Natural Science Foundation.

9717

Strain of *Acinetobacter Calcoaceticus* var *Lwoffii* Isolated From Pleurisy Patient*

40091002a Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 214-216

[English abstract of article by Liang Chao [2733 2600], et al., of the Moraxella and Allied Bacteria Reference Laboratory of CMCC(B), Department of Microbiology, Jiangxi Institute of Medical Sciences; Xiao Huayuan P5135 5478 0337] of Nanchang Sanitary and Anti-epidemic Station, Jiangxi; Li Xun of the Second Affiliated Hospital of Jiangxi Medical College]

[Text] A strain of aerobic gram-negative bacteria isolated from the pleural fluid of a pleurisy patient has been reported. The organism is nonmotile, does not form spores, is oxidase negative and catalase positive, does not reduce nitrate to nitrite, and fails to produce acid from sugars. The organism is resistant to penicillin. The mol percent G+C of the DNA is 44.5. According to the main characteristics of this organism, the authors have identified it as a species of *Acinetobacter calcoaceticus* var *Lwoffii*. The pathogenicity of this organism is also discussed.

*This project was supported by the National Natural Science Foundation of China.

9717

Preliminary Biological Characterization of HFRSV Strain--(XC) Isolated From Cerebral Spinal Fluid of Patient With Hemorrhagic Fever Renal Syndrome

40091002b Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 217-220

[English abstract of article by Li Ge [2621 7245] of Guangxi College of Traditional Chinese Medicine; Fang Liang [2455 0081], et al., of the Research Laboratory of Virology, Xi'an Medical University; Ni Dashi [0242 1129 4258] of the Research Laboratory of Virology, Anhui Medical Scientific Institute]

[Text] Through a preliminary study of physical and chemical characterizations, a virulence test, HAT, RIHAT, HIT, a cross-blocking test with IFA, and identification with McAbs and immunoblotting, strain XC was identified as the wild rat type of hemorrhagic fever renal syndrome virus with higher virulence and higher hemagglutination titer and with a 50 Kd polypeptide as its main nucleoprotein.

9717

Studies of Viremia of Patients With Epidemic Hemorrhagic Fever

40091002c Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 221-223

[English abstract of article by Yao Zhiqiang [1202 1807 1730], et al., of the EHF Laboratory, Second Affiliated Hospital of Fourth Military Medical College, Xi'an]

[Text] The duration of the viremic stage of patients with EHF has been studied by means of the immunofluorescence technique and cell culture assays. The EHF viral antigen in PBMC was mainly present within 11 days, especially from the 4th to 7th days of the disease. From 200 specimens, 53 strains of EHFV was recovered by Vero-E₆ cells. The persistence of the virus in the plasma of patients with EHF was about one week, which was basically concomitant with the febrile phase. However, the EHFV peak in PBMC was correspondingly 2 or 3 days later and, therefore, the viremia could still be detected through the 8th to 11th days of the disease. This indicates that the prolongation of the viremia due to the presence of a cell-associated virus is one of the characteristics of EHFV infection, and this will contribute to the understanding of the mechanism of EHFV dissemination in patients' bodies and of the multiorgan damage caused by the viral infection.

9717

Study of Attenuated Japanese Encephalitis Vaccine Strain SA₁₄-14-2 Produced in Primary Dog Kidney Cell Culture

40091002d Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 238-241

[English abstract of article by Yu Yongxin [0205 3057 2450], et al., of the National Institute for the Control of Pharmaceutical and Biological Products, Beijing; Kenneth H. Eckels and Doria R. Dubois of Walter Reed Army Institute of Research, Washington, DC]

[Text] The SA₁₄-14-2 attenuated JE virus was adapted to a primary dog kidney (PDK) cell culture by serial passages at 4 day intervals. After four passages the virus replicates to titers of 5×10^6 to 10^7 PFU/ml in the PDK cell culture. The PDK adapted 14-2 virus showed no virulence to mice either by intracerebral or subcutaneous inoculation, and was immunogenic as well as genetically stable in mice as the original 14-2 attenuated virus.

A 14-2 attenuated vaccine prepared in PDK cell culture fulfilled similar criteria, both in safety and immunogenicity, for vaccines prepared in primary hamster kidney cell culture for human clinical trial.

It is believed that the 14-2 PDK adapted virus strain is a promising vaccine candidate virus strain for the production of JE attenuated live vaccine using the PDK cell substrate.

9717

Studies of ELISA in Detection of Anti-DNA Antibody Using UV-Irradiated Polystyrene Plate

40091002e Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 242-247

[English abstract of article by Li Zihai [2621 1311 3189], et al., of the Institute of Basic Medical Sciences, Chinese Academy of Medical Sciences; Jiang Ming [5592 2494], et al., of PUMC Hospital, Beijing; Wang Xiuwen [3769 4423 2429] of Cangzhou District Hospital]

[Text] Previous studies have shown the increased ELISA sensitivity for anti-DNA antibodies after UV-irradiation on a plate for 12 hours. In the present work, the assay has been applied to detect the anti-DNA antibody in the sera of 56 normal individuals, 43 SLE patients and 55 other patients with non-SLE autoimmune diseases. In 14 of 15 active SLE patients (93.33 percent), the anti-DNA antibody is positive. In contrast, only 1 of 28 inactive SLE patients showed a positive anti-DNA reaction, which indicates the potentiality of ELISA in the diagnosis of active SLE. Studies show that the authors' ELISA is more specific and sensitive than the Farr assay or the Crithidia luciliae immunofluorescent method. In addition, the variation coefficient of the assay within a group and between groups is from 3.2 to 13.4 percent and from 6.58 to 17.82 percent, respectively, showing the assay's good reproducibility. The possible clinical significance of both anti-dsDNA and anti-ssDNA is also discussed.

9717

Study of Polypeptide Patterns of Duck Hepatitis Surface Antigen

40091002f Beijing ZHONGHUA WEISHENGWUXUE HE MIANYIXUE ZAZHI [CHINESE JOURNAL OF MICROBIOLOGY AND IMMUNOLOGY] in Chinese Vol 8 No 4, 1988 pp 258-260

[English abstract of article by Zhang Wei [1728 4850], et al., of the Department of Microbiology, Shanghai Medical University]

[Text] DHBsAg was purified from duck hepatitis B virus DNA-positive local Shanghai duck sera, and was used to immunize New Zealand rabbits. The antisera were absorbed with the normal duck serum to yield more specific anti-DHBs. This anti-DHBs was used to study peptide patterns of DHBsAg. DHBV DNA-positive and -negative sera were employed for electrophoresis in SDS-polyacrylamide gel, followed by Western blotting, and reacted with rabbit anti-DHBs. Peroxidase-labeled staphylococcus protein A was used for the detection and peptide analysis. It was found that all DHBV DNA-positive sera contained DHBsAg, while none of the DHBV DNA-negative sera showed DHBsAg. Peptides were detected in the DHBV DNA-positive duck sera in addition to the 35000 and 17000 daltons that were previously reported, with some showing peptides of 23000, 25000, 27000 and 36000 daltons.

9717

Latent Infection of Hemorrhagic Fever Within Families Studied

40081087b Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 6 No 2, May 88 p 127

[Article by Zou Wenhua [6760 2429 5478], Jiang Zhiyun [3068 0037 0061], and Zhang Zhun [1728 0193], Epidemic Diseases Teaching and Research Section, Xinxiang Hospital; and Li Jianmin [2621 1696 3046], Huang Baotong [7806 0202 0681], and Liu Jiulai [0491 0036 0171], Jixian Sanitation and Epidemic Prevention Station: "Survey of Latent Infection of Hemorrhagic Fever Victims' Family Members"]

[Text] Epidemic hemorrhagic fever (EHF) has become infectious within families within recent years. In order to explore this infection within families, starting in 1984 a random sampling was conducted in Jixian Prefecture, Henan Province among clinically treated and experimentally examined and diagnosed EHF victims. Results are reported below.

Materials and Methods

1. Source of Blood Serum. Serum came from 89 family members in which a patient was diagnosed as having EHF from January through June 1985, 21 of them males, and 48 of them females ranging between 1.5 and 71 years of age.
2. Method: Indirect immunofluorescence assay technique (IFAT) was used to check for EHF antibodies in the blood serum of both victims of the disease and family members.
3. EHF Antigen Plates: The Virus Research Institute of the Chinese Academy of Preventive Medical Science provided Vero-E6 cell antigen plates.
4. Fluorescent Antibodies: Sheep anti-human immunoglobulin G fluorescent antibodies, batch number 8501-2 were provided by the Shanghai Biologicals Research Institute.

Results

IFAT testing for EHF antibodies was done on the blood serum of 23 EHF patients and 89 family members, 53, or 59.55 percent, of the 89 family members testing positive. Detailed questioning of the history of illness of the family members who tested positive for antibodies showed that approximately

40 days before the patients fell ill 26 of the family members, a positive rate of 29.21 percent, had had fevers for unknown reasons (they had no EHF symptoms). Among the 27 people having latent infection but exhibiting no symptoms, the positive rate was 30.33 percent (See table).

Table. Infection Rate of EHF Patients and Their Families

Subject Surveyed	Number of People Surveyed	Number of People Testing Positive for Antibodies	Positive Rate (%)	Number of Antibody- Positive People Having Symptoms	Positive Rate (%)	Number of Antibody- Positive People Having No Symptoms	Positive Rate (%)
Patients	23	23	100	23	100	0	0
Family	89	53	59.55	26	29.21	27	30.33

2. Infections Within the Families of the 23 Patients. In 21 households, or 91.3 percent of the number surveyed, two or more people tested positive for antibodies. Two households, or 8.6 percent, had only one person who tested positive (and that was the patient himself or herself). At a 60 percent positive rate per household, in four out of 17 households 100 percent of the members tested positive for antibodies.

Discussion

Most of the cases of EHF surveyed in the epidemic that began in 1984 in Jixian Prefecture. Henan Province, were of the light type that was transmitted by brown house rats. Toxophoric examination of rats that were caught confirmed the local EHF epidemic as being of rat origin.

Results of the survey showed 21 of the 23 households to have had more than two cases, and four households to have had more than four cases, showing that apart from diffusion of the EHF epidemic, there was a marked cumulative infection within families, exhibiting a rarely seen focal spread. There was a marked difference between one jurisdiction and another in figures reported on the latent EHF infection rate. A report from the Jiaozuo Epidemic Prevention Station showed a symptom-free latent infection rate of as much as 76.67 percent, but the infection rate for members of the family of EHF patients in our group was 59.55 percent, the actual symptom-free number of the latently infected being 30.33 percent, which was markedly lower than the Jiaozuo figures. Therefore, possibly some of the latent infections reported in the past were in sub-clinically infected or non-representative patients who cured themselves and were overlooked or misdiagnosed.

Antibodies may persist for many years following recovery from hemorrhagic fever. The 53 people in this report who showed positive for antibodies as a result of the use of indirect immunofluorescence assay technique should have been tested for antigens and antibodies both before and after so as to be

able to rule out past infection objectively. However, this work confirmed through survey that this prefecture had not had a previous epidemic of this disease. It was a newly infected area in which the epidemic began in 1984, and there had been no epidemics of this disease in the villages in which these surveyed families lived. Thus, past infections could be ruled out; this was a recent infection. As for the 26 people who had had fevers of unknown origin 40 days before the advent of this epidemic, possibly there had been a common focus of infection that produced sub-clinical infections that were mistakenly diagnosed or overlooked. Most of the members of such households were children, so possibly the fevers of unknown origin were related to the children's relatively low immunity or the lack of typical expression of symptoms.

Inasmuch as sub-clinical infection can be easily misdiagnosed, all patients suffering from fevers of undetermined origin during the epidemic season for hemorrhagic fever should consider the possibility that they have EHF and do all possible to have their blood tested for antigens and antibodies in order to obtain an early diagnosis and reduce the possibility of misdiagnosis or mistreatment.

9432/7310

Spread of Hemorrhagic Fever Virus in Utero Studied

40081087c Shanghai ZHONGHUA CHUANRANBING ZAZHI [CHINESE JOURNAL OF INFECTIOUS DISEASES] in Chinese Vol 6 No 2, May 88 p 128

[Article by Yang Weisong [2799 3634 2646], Zhang Wenbin [1728 2429 1755], Bai Xuefan [4010 7185 1581], and Chen Siyi [7115 1835 6230]: Infection Section, No 2 Hospital Affiliated With Fourth Medical University: "Study of the Spread of Epidemic Hemorrhagic Fever Antigens in the Viscera of Infected Fetuses"]

[Text] Animal experiments have demonstrated that the epidemic hemorrhagic fever virus [EHFV] is characterized by pantropic infection. However, current research on the location of viruses in the human body focuses only on peripheral blood cells and bone marrow cells. In order to illuminate further the spread of EHFV in infected human bodies, we used both immunofluorescence and immunoenzyme staining techniques in the study of the viscera of a number of aborted fetuses aborted by pregnant women suffering from HF. This research has preliminarily confirmed that once EHFV has infected a human fetus, it diffuses into most organs.

The specimens came from a patient suffering from hemorrhagic fever who was 8 months pregnant, and who entered the hospital in November 1985. She had a temperature of 40 degrees C, and her skin mucosa showed blood spots. She had conjunctival I hydrops, a blood WBC of $19.8 \times 10^9/L$, and a blood platelet count of $51 \times 10^9/L$. Urinary protein was +++, and EHF-IgM was +++ (using the IFA technique). She was clinically diagnosed as having epidemic hemorrhagic fever (a moderate case). On the third day after becoming ill, she spontaneously aborted a male baby. After death, the baby's heart, lungs, liver, and kidneys were removed, and prepared in wax, frozen, and sectioned in the conventional way. Then immunofluorescence, immunoenzyme, and HE staining was done. In addition, the corresponding organs of a healthy fetus that had been aborted were used as a control.

Immunofluorescence staining employed EHF 25-1 McAb-FITC in direct staining. or rabbit anti-Hantaan virus strain 76/118 immunoserum as an antigen in indirect staining. In immunoenzyme standing, the first antibody was the same as the one used next above, and restaining was done using SPA-HRP, and DAB coloration. Before staining, processing was done using 80 percent ethanol and hydrogen peroxide to eliminate endogenous enzymes from the tissue.

HE staining revealed all organs to be filled with blood and hemorrhaging to a certain extent, and some cells showed degenerative necrosis. Macrophages and lymphocytes had also infiltrated, particularly in the lungs, liver and kidneys. Immunofluorescence/enzyme staining revealed specific fluorescence and dark brown enzyme stained plasmids, notably in Kupffer cells in the liver, in epithelial cells and jianzhi [7035 6347] cells of kidney capillaries, in macrophage cells in the alveolar walls of the lungs, and in the cytoplasm of myocardial cells. In the placenta and the umbilicus, most of the specific dyed plasmids were located in the cytoplasm of infiltrated mononuclear macrophages, and the specific stained plasmids in the thymus gland, adrenal glands, and pituitary gland were located in the cytoplasm of the epithelial cells. Specific coloring was weak in the bladder and testes making cell location difficult. In the stomach and small intestines, specific dyeing was negative (See table). All dyeing of the tissue in control organs was negative.

During the 1950's, Kurata et al reported on the immunofluorescence dyeing of specimens from six corpses that had suffered from hemorrhagic fever, discovering virus antigen affinity fluorescence [6024 0342] in endothelial cells of liver blood vessels and Kupffer cells, in the epithelial cells of the pituitary gland, and in the medulla of the adrenal glands. Our research has expanded the type and scope of the examination of human organs and has produced appreciable results, thereby further demonstrating that EHF can go through the placenta to infect the fetus and can involve and attack various organs in the human body.

Results of Immunohistochemical Staining of EHF Virus Antigens in Various Tissues and Organs of an Aborted Fetus

	Liver	Lungs	Kidneys	Heart	Placenta	Umbilicus	Stomach	Intestine	Bladder	Testes	Thymus	Adrenals	Pituitary
IFA Indirect Method	++	++	++	+	++	++	-	-	+	+	++	++	+
IcAb Direct Method	++	++	++	++	++	++	-	-	-	-	++	+	++
Immunoenzyme	++	+	++	+	+++	+	-	-	+	+	+	++	+
Histochemical Staining													

Note: +++ indicates a fairly deep color or fairly high fluorescence and a substantial number of cells having been stained. ++ indicates less of a reaction, and + indicates a fairly weak color or fairly weak fluorescence, and the smallest number of positive cells. - indicates staining was negative.

09432/7310

Action of Hemorrhagic Toxin on Body Tissues

40081087a Hefei ZHONGGUO KEXUE JISHU DAXUE XUEBAO [JOURNAL OF CHINA UNIVERSITY OF SCIENCE AND TECHNOLOGY] in Chinese Vol 18 No 2, Jun 88 pp 284-287

[Article by Huang Yuchu [7806 7183 0443], Li Daizong* [2621 1486 1350], and Jiang Bo** [1203 3134], Biology Department, China University of Science and Technology: "Study of ^{125}I -Labeled Hemorrhagic Toxin From *Agkistrodon Acutus* and Its Pharmacokinetics in Rabbits"]

[Text] Venom from *Agkistrodon acutus* (long-nosed pit viper) is a circulatory system toxin. This venom causes the highest mortality rate from snake bites, [1] the main cause of death being hemorrhaging throughout the body, and partial tissue necrosis for which there is presently no clinical treatment method. For this reason, study of hemorrhagic toxin is of extreme importance both in order to explore the mechanism that causes death from hemorrhaging and to find an effective treatment method. We used the ^{125}I -labeled tracing method to study the spread of the toxin in rabbits' bodies, and we used a microcomputer to fit a blood concentration-time curve, to calculate model parameters, and to study pharmacokinetics.

1. Experiment Section

1.1 Materials and Equipment Used in the Experiment

The AaT used in this experiment was provided by the molecular biology teaching and research section. The radioactive isotope $\text{Na}^{[125]}\text{I}$ was produced by the Atomic Research Institute of the Chinese Academy of Sciences. The chloramine T, Sephadex G-15 imported separately packaged reagent, potassium iodide, sodium metabisulfite, and trichloroacetic acid were China-produced pure analytical reagents. Three healthy large-eared rabbits, both males and females, weighing 2.6 ± 0.3 kgs were used. Test equipment used was a China-produced FJ-1901 gamma spectograph for medical use, an FT611G1 well-type gamma probe for medical use, and an XSTD-1 small universal digital printer.

* Currently at the Molecular and Biochemistry Research Laboratory of the Shanghai Municipal Tumor Institute.

** Currently in the Physiology Laboratory of the Clinical Research Institute of Sino-Japanese Friendship Hospital, Beijing

1.2 Experimental Methods

1.2.1. Testing of Hemorrhaging Activity

The fur was clipped from the rabbits' backs and a venom specimen injected intracutaneously according to the Konod^[2] method. Twenty-four hours later, the rabbits were killed, skinned, and the size of blood spots measured. The amount of venom required to produce spots averaging 10 mm in diameter was taken as the minimum hemorrhagic dose (MHD).

1.2.2. Labeling of Hemorrhagic Toxin and Isolation of Free Iodine

300ug of purified hemorrhagic toxin was dissolved in 400 ul of a 0.05M pB solution having a pH of 7.4. After electromagnetic mixing in an ice bath to dissolve the toxin completely, 200 ul was removed and put into a labeled flask to which was added 37 M Bq Na¹²⁵I (13 ul). This was electromagnetically mixed in an ice bath while 20 ul of newly prepared 1 percent chloramine T was spurted into it. Mixing was continued for 1.5 minutes after which 50 ul of a newly made up 1 percent pianzhong [0252 6850] sodium sulfite using a pB solution was added to halt the reaction. Then, 100 m ul of 1 percent potassium iodide was added as a vector, the total volume now amounting to 383 ul. Following Sephadex G15(1 x 20 cm) column chromatography, elution was done using 0.05 M of a pB solution at 7pH.4, the speed of flow being 1 drop every 4 seconds, or 1 tube per minute. The radioactivity (cpm) of each tube was tested; the free ¹²⁵I was tested, and the trichloroacetic acid precipitation method of centrifuging was used.

1.2.3. Checking of ¹²⁵I-AaT Hemorrhagic Activity

Use of the same method described above for testing confirmed hemorrhagic activity following labeling.

1.2.4. Animal Experiment

One day before the experiment was begun, a highly concentrated potassium iodide solution was irrigated to block off the thyroid gland. Before the experiment began, 3 percent pentobarbital sodium (1 ml/kg) was injected into the veins of the rabbits' ears to anesthetize the rabbits, and the jugular veins on both sides of the rabbits' necks were exposed. On one side, 4.34×10^7 cpm/80 ul of ¹²⁵I-AaT was injected. On the other side, blood samples were taken at various times following the injection (0, 1, 2, 5, 10, 20, 30, and 60 minutes). A 200 ul microsampling device was used to take a fixed volume of specimen for testing of radioactivity. When the experiment was finished, air was injected into the rabbits veins to kill them, and their viscera were removed for testing of the radioactivity of all samples using the Model FJ-1901 gamma spectograph.

1.2.5. Kinetic Curve Fitting and Calculation

A computer was programmed using the Gauss-Newton method^[3] for the purpose of fitting the blood concentration-time curve to derive a standard formula from which the pharmacokinetic model parameters could be calculated.^[4]

2. Results

2.1. Preparation of ^{125}I -AaT

Labeling was done using the above experimental conditions and steps. The free ^{125}I content of the AaT peak eluent tested at 1.2 percent; its labeling purity was 98.8 percent, its labeling rate was 84.1 percent, and radioactivity was 251.6kBq/ug AaT. The above method was used to test the extent of remaining hemorrhagic activity. The A peak and B peak radioactivity was 9.05×10^4 and 0.56×10^4 cps/10 ul respectively. See Figure 1 for isolation results. The A peak in the number 8 tube was ^{125}I -AaT, 9.05×10^4 cps/10 ul. The B peak in the number 24 tube was free ^{125}I , 0.56×10^4 cps/10 ul.

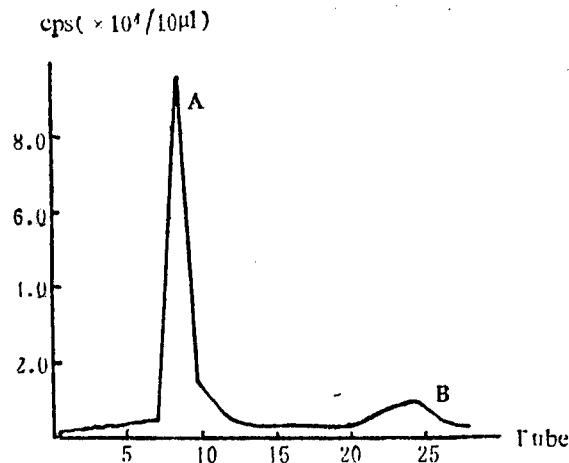


Figure 1 Na^{125}I Labeled AaT Sephadex G15 Column Chromatography Figure

2.2 Pharmacokinetics

2.2.1. Blood Concentration (Radioactivity intensity) - Time Correlation Curve

After intravenous injection of ^{125}I -AaT, blood samples were taken at different times for testing of the intensity of radioactivity, and this intensity of radioactivity in the rabbits at different times was averaged. (See Table 1). This value was inputted into the computer simulation as a dual chamber [0059 1358] model, and the standard formula derived from the simulation was $C = 69.66e^{-0.3827t} + 37.67e^{-0.004948t}$. See Figure 2 for the fitted curve.

Table 1. Radioactive Intensity of Blood at Different Times After Intravenous Injection of ^{125}I -AaT

t (min)	0	1	2	5	10	15	20	30	50	120	225
cpm $\times 10^3$ ml	549.46	411.63	336.92	247.42	199.25	185.60	166.01	153.56	130.75	100.79	81.46

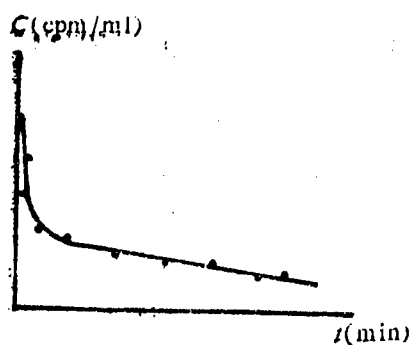


Figure 2. Microcomputer Fitted Curve for the Pharmacokinetics of Intravenous Injection of ^{125}I -AaT.

2.2.2. Pharmacokinetic Parameters

Table 2 shows the Pharmacokinetics Parameters Calculated Using the Model Formula.

Table 2. Pharmacokinetics Parameters 33384.6kBq/kg Following Intravenous Injection of ^{125}I -AaT.

Half life of spread $t_{1/2a}$	1.8 min.
Elimination half life $t_{1/2 B}$	140.0 min.
Biological half life $t_{1/2}$	50.2 min.
Constant K_{12} for transmission speed from the middle [0022 1358] to the outer chamber [1120 1358]	0.2363 min^{-1}
Constant K_{21} for transmission speed from the outer to the middle chamber	0.1375 min^{-1}
Constant K_{10} for middle chamber elimination speed	0.0138 min^{-1}
Apparent spread volume V_p for middle chamber	61.1 ml/kg
Apparent spread volume V_t for outer chamber	105.0 ml/kg
Apparent spread volume $V_{d_{ss}}$ in stable state	166.1 ml/kg

2.2.3. Spread Within the Rabbits 4 Hours After Intravenous Injection of ^{125}I -AaT

See Figure 3 for the comparative percentage of radioactivity in other organs and kidneys when radioactivity in the kidneys is figured at 100 percent.

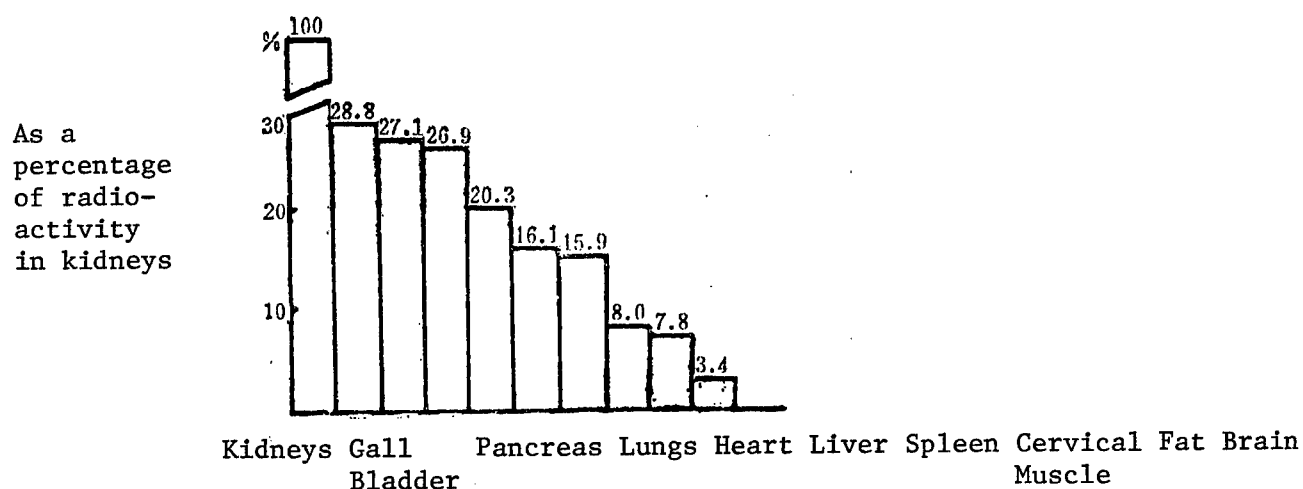


Figure 3. Radioactivity in Various Organs as a Percentage of Radioactivity in Kidneys 4 Hours After an Intravenous Injection of ^{125}I -AaT Into Rabbits

3. Discussion

3.1 The blood concentration spread half life was 1.8 minutes showing that the hemorrhagic toxin could very quickly travel from the middle chamber to the outer chamber. This is consistent with the rapid toxic action following a long-nosed pit viper bite. Its elimination half life was 140.0 minutes, and its biological half life was 50.2 minutes showing that toxicity can continue for a fairly long time and cause damage.

Apparent spread volume, outer chamber apparent spread volume, and middle chamber apparent spread volume under stable conditions were much smaller than the settling of pharmaceuticals in the analogous dual chamber model^[5]. This may possibly suggest that the hemorrhagic toxin functions only at specific sites, that its affinity for these sites is higher, and that it exists only in a fairly small number of locations in the body, rather than the way in which some pharmaceuticals work by spreading widely throughout the body among various tissue cells. The hemorrhagic toxin may very possibly work against only specific tissues, possibly corresponding receptors. This is consistent with the electron microscope observations of He Huaping [0149 5478 1627] et al. He found that hemorrhagic toxins bond only to the external membrane of endothelial cells in capillaries and did not function markedly against other tissues. However, more extensive research is required to determine the existence of receptors.

3.2 The spread of hemorrhagic toxin in various organs or tissues shows that the blood-brain barrier does not allow the free entry of toxin into the central nervous system. The hemorrhagic toxin and the products of its metabolism were eliminated mostly via the kidneys in urine; however, both the hepatic duct system and the lungs were also important routes for their elimination.

The hemorrhagic toxin used in this experiment was extracted and purified under the guidance of Huang Wanzhi [7806 1238 3112] and Wang Zhun [3769 6150], two old professors in the molecular biology teaching and research section, and Comrade Yan Anlu [1693 0043 6424] helped write the computer program, for which gratitude is hereby expressed.

References

- [1] Huang Meihua [7806 5019 5478] et al., Long-nosed Pit Viper, First Edition, Science Press, 1983, 114.
- [2] Kondo, H., et al., Jap. J. Med. Sci. Biol., 13 (1960) 43.
- [3] Weng Xinyuan [5040 0207 3293], YAOXUE TONGBAO [PHARMACOLOGY BULLETIN], 20 (1985) No 9, pp 546-548
- [4] Wang Zhenyue [3769 2182 6885], et al. translation of Drug Loci and Pharmacokinetics, First Edition, People's Health Press, 1981, pp 171-178.
- [5] Zhu Jiabi [2612 13467 1084], Translation of Pharmacokinetics, First Edition, Science Press, 1981, pp 53-56.
- [6] He Huaping et al. Use of Immunoenzyme Labeling Method to Observe the Effect of Agkistrodon Acutus Hemorrhagic Toxin I on Capillaries, "Abstracts From a Paper Presented at the First Scientific Symposium on Toxin Research and Use," p 32.

Dengue Virus Type IV Infection in Suckling Mice--Pathologic Changes,
Localization of Viral Antigen in Brain Tissue

40091003a Beijing ZHONGHUA BINGLIXUE ZAZHI [CHINESE JOURNAL OF PATHOLOGY]
in Chinese Vol 17 No 2, Jun 88 pp 121-123

[English abstract of article by Ling Jingping [0407 7234 5493], et al., of
the China Pharmaceutical and Biological Products Assay Office]

[Text] Suckling mice were inoculated with Dengue virus type IV suspension intracerebrally. Seventy-two hours after the infection, enzymatic reactive antigen materials were obtained in the cytoplasm perinucleally of neurons of the cerebral cortex, hippocampus and thalamus, which appeared either in the crescent form or in clumps. On the fifth day of the infection, viral antigen materials could be found in the cytoplasm and axoplasm of neurons of the mesencephalon, pons, spinal cord and the granular layer, as well as in Purkinje's cell in the cerebellum. Neurons underwent degeneration to various extents or necrosis. In addition, some softening foci, cribriform in distribution, could be found in the cerebral cortex and hippocampus. No viral antigen materials or marked pathologic changes were seen in the endothelium of small vessels, nor in the ependymal or arachnoid epithelium.

9717

Studies of Antigen Binding Site of Monoclonal Antibodies to Hepatitis B Core Antigen (HBcAg), Their Affinity

40091003b Beijing ZHONGHUA YIXUE JIANYAN ZAZHI [CHINESE JOURNAL OF MEDICAL LABORATORY TECHNOLOGY] in Chinese Vol 11 No 4, Jul 88 pp 207-211, 253

[English abstract of article by Zuo Dongmei [1563 0392 2734], et al., of the Immunological Research Department, Hospital 302, PLA]

[Text] Three hybridoma clones, producing antibodies directed against HBcAg, have been established and have been used to research the structure of HBcAg. Through the monoclonal antibodies additivity test, calculations of the additivity index and the ELISA double antibody competitive assay, it is shown that three different monoclonal anti-HBc exist against the same antigenic determinant. In addition, the results of the double antibody competitiveness assay against the HBcAg of three different sources demonstrate that the three monoclonal antibodies to three HBcAg (from the outcome of E. coli, the extract of coupse livers, the splitting of Dane particles) show complete competitiveness. This suggests that the three kinds of HBcAg possess the same antigenic determinant. Different subtype determinants of HBcAg have not been observed. Also, the affinities of three kinds of McAb were determined by ELISA, the results of 0.02 $\mu\text{g/ml}$, 1 $\mu\text{g/ml}$ and 2 $\mu\text{g/ml}$, respectively. With regard to the research methods, the authors used indirect assay of the second antibody to determine the specificity of the antigenic determinants and used ELISA to measure the affinity. The results show that the methods are simple, sensitive, quick, convenient and of practical value.

9717

Long Lasting, Reproducible Microbe Sensor for Phenol Developed

40081092 Xiamen XIAMEN DAXUE XUEBAO [JOURNAL OF XIAMEN UNIVERSITY -- NATURAL SCIENCE] in Chinese Vol 27 No 4, Jul 88 pp 464-469

[Article by Huang Kefu [7806 0344 2591], Zheng Zhonghui [6774 1813 6540], and Liu Yueying [0491 2588 5391], Biology Department, Xiamen University: "A Highly Stable, Readily Reproducible Phenol Microbe Sensor". This project received assistance from the Chinese Academy of Sciences' Science Fund.]

[Text] Abstract: The cells in this sensor are immobilized by tightly entrapping the membrane surface of a Clark oxygen electrode together with the cells of *Trichosporon pollulans* in a coating of alginate gel, then covering the gel with a piece of dialysis membrane. In addition to being equal to or better than a sensor coated with dialysis membrane alone, this sensor has two very important features, namely high stability that permits repeated use for 3 months or more, and ease in incubation that permits reproduction should the sensor be rendered inactive by heat or chemicals.

Key Words: Microbe sensor, phenol, cell immobilization, and *Trichosporon pollulans*.

1. Foreword

Foreign sources have reported work on phenol microbe sensors, [1,2] including the rather high selectivity and sensitivity of immobilized phenol hydroxylase sensors; however, NADPH and FAD have to be added to assay solutions when these sensors are used, thereby limiting their use considerably. Though the selectivity and sensitivity of immobilized cell sensors is not as great as that of enzyme sensors, they have the advantages of ease of assembly and ease of use. Their greatest failing is rather poor stability; they can be used for only 5 days. Because of this major failing of immobilized cell sensors, we used *Trichosporon pollulans* as an experimental microbe to study the assembly, use, and maintenance of sensors, achieving fairly good results. Not only was stability increased considerably, but the sensor could be revived after deactivation.

2. Materials and Methods

Bacterium species: *Trichosporon pollulans* (Lindn.) Didd. et Lodd.) Culture medium and bacterium species preservation: Glucose yeast paste agar slant. Bacterium strain culturing: NH_4NO_3 , 0.2 percent; KH_2PO_4 , 0.25 percent; $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$, 0.05 percent; $\text{Ca Cl}_2 \cdot 2 \text{H}_2\text{O}$, 0.005 percent at a pH of 6.0. After

killing the bacteria, filtered dead bacteria yeast paste was added to 0.5 percent, and phenol was added to 200 ppm. Amplified culturing: Twenty percent bean sprouts were boiled to produce juice; after the bacteria were killed, phenol was added to between 500 and 700 ppm.

Reagents: Either CP or AR grade; phenol double distilled.

Thallus preparation: Thallus preparation was done in accordance with the usual steps for culturing bacteria, expanded. Thalli were collected in the late stage of logarithmic growth and made up to become quiescent cells for later use.

Assembly of sensor: An appropriate amount of thalli (containing approximately 5 percent dry weight) was mixed thoroughly with 4 percent sodium alginate at a ratio of 1:1 (weight/volume). Then 10 μ l of the thallus-sodium alginate suspension was drawn and added to the membrane of a Clark oxygen electrode. Then a piece of dialysis membrane (pore diameter of 1.5-2.0 nm) was used to cover the suspension. A rubber band was used to hold the membrane flat around the electrode sheath. Finally the end of the membrane was soaked in 0.2 M CaCl_2 to fix it. After fixing, the Clark oxygen electrode core was poked into the sheath. A simple semi-transparent membrane was used to encase the sensor using the existing covering method.[1]

Oxygen assay device: Model CY-2 (Shanghai New China Instruments Plant). Assay system: Same as the ammonia sensor method.[3]

Assay method: Constant flow steady state method. Continuous pumping into the sample fluid (at a rate of between 1.7 and 1.8 ml/min) was done until the outputted electric current became stable, responsiveness being expressed as mV. Constant capacity dynamic method: Injection of 2 ml of assay sample for each assay, responsiveness being expressed as mV/min. Before and after assay of samples, sensors were washed in an oxygen-saturated 0.05 mol/l phosphate buffering solution for equilibrium, the recording instruments maintaining 10 mV, or a 100 percent oxygen content.

Phenol colorimeter: 4-aminoantipyrin direct colorimeter method.[4]

3. Results

Responsiveness: By way of comparing the effect on sensor responsiveness of the two different immobilization methods, the steady state method was used to assay their response curves. The results (figure 1) showed similar performance, a steady state being attained in between 6 and 10 minutes, and recovery time taking between 8 and 10 minutes. The linear relationship between responsiveness and phenol concentration was better in the gel-coated dialysis-membrane coated sensor than in the one that was entrapped only in membrane. When phenol was between 1 and 14 ppm, n equaled 8, and the correlation coefficient was 0.999 for the former and 0.981 for the latter. The experiment further used the dynamic method to assay further the responsiveness of the gel-coated and the membrane-coated sensors, the results showing that when phenol was between 1 and 12 ppm, the linear correlation between responsiveness rate (mV/min) and phenol concentration was also

very good. The correlation coefficient of 0.966 ($n=7$) was about the same as that obtained from the dynamic method.

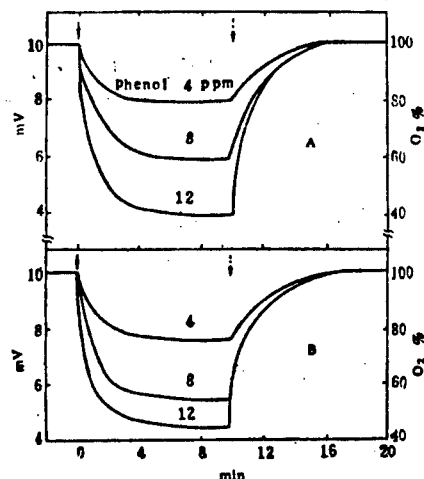


Figure 1. Response Curves of Phenol Sensors

A: Cells immobilized by alginate gel entrapping-dialysis membrane coating.

B: Cells immobilized by dialysis membrane coating
Injection of assay sample

Injection of equilibrium solution

Assayed sample: In 0.05 mol/l phosphate buffer, pH 7.2

Equilibrium solution: 0.05 mol/l phosphate buffer, pH 7.2. The flow velocity of injection = 1.7~1.8 ml/min. Assay at 30 degrees C.

Reproducibility: The dynamic method was used to assay the reproducibility of the two different sensors; and the steady state method was used to assay the reproducibility of the gel entrapped-dialysis membrane covered sensors. The results (Table 1) showed the two to be close. The variation coefficient for 10 separate assays was less than 4 percent, which was higher than the reported results of less than 5 percent.^[1]

Table 1. Sensor Response Reproducibility

Cell Immobilization	Assay Method	Response (X)	σ_{n-1}	CV (%)
Dialysis membrane	Dynamic	1.88 mV/min	0.063	3.35
Alginate gel-membrane	Dynamic	1.22 mV/min	0.042	3.44
Alginate gel-membrane	Steady state	3.64 mV	0.128	3.52

Assay solution: 6 ppm of phenol in 0.05 mol/l phosphate buffer, pH 7.2; $n = 10$

Selectivity. No reports have yet appeared on the degradation of phenols by *Trichosporon pollulans*. Results from the assay of some phenol derivatives (Table 2) show a fairly low responsiveness or no responsiveness from derivatives other than p-Hydroxyphenol. Therefore, this kind of sensor is useful primarily in the assay of phenol and p-Hydroxyphenol. There is a definite pattern in its action with regard to the three kinds of p-Hydroxyphenol. The strength of the response produced by catechol was half that of phenol, and similar to the role of *Trichosporon dermatatans* [4122 3692 4828 132A 3018][5]

Table 2. Sensor Response to Phenols

Phenols	Response (mV/min)	Relative (%)
Phenol	4.64	100
p-Hydroxyphenol	5.00	108
Resorcinol	3.50	76
Catechol	2.40	52
Mixed cresol	1.30	28
Salicylaldehyde	0.85	18
m-Cresol	0.18	4
p-Nitrophenol	0.18	4
2,4-Dinitrophenol	0.03	1
m-Trihydroxybenzene	0	0
Salicylic acid	0	0
Guaiacol	0	0

Assay solution: 0.1 m mol/l phenol or its derivative, pH; 7.2; 30 degrees C

Stability: Stability tests revealed a fairly close correlation between stability and how the sensor was used and stored. It was used between 2 and 4 hours every day or every 2 days, and it was kept in a KCl-CaCl₂ solution in a refrigerator between jobs. The results (Figure 2) showed a decrease in the sensor's responsiveness the longer it was used and stored, albeit at a slow rate of only approximately 25 percent in 3 months for a half-life of approximately 5 months.

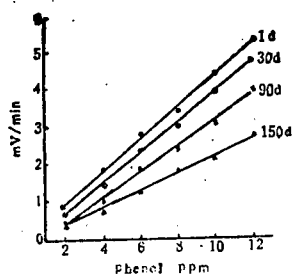


Figure 2. Sensor Stability

Sensor Regeneration. It was found during the course of the experiment that when these sensors were deactivated by heat or chemicals, they could be easily regenerated by aerated incubation in a nutrient solution containing phenol. Their responsiveness could be easily restored, and they could be regenerated. Regeneration could also be done many times over. (Table 3)

Table 3. Sensor Regeneration Test

Sensor (No.)	Test*	Response** (mV/min)	Relative (%)
1	Initiate	6.40	100
	2 percent phenol	0	0
	Incubated for 6 hours	1.80	33
	Incubated for 12 hours	7.25	134
2	Initiate	4.50	100
	5 ppm Ag ⁺	0	0
	Incubated for 12 hours	4.60	102
	100 ppm Hg ²⁺	0	0
	Incubated for 12 hours	5.00	111
3	Initiate	6.00	100
	45 degrees C for 3 hours	3.20	53
	Incubated for 6 hours	6.50	108
	45 degrees C for 3 hours	4.40	68
	Incubated for 12 hours	9.40	157

* Regeneration: The sensor is incubated in a medium containing phenol under aeration at 30 degrees C.

** 0.1 m mol/l phenol, pH 7.2, 30 degrees C.

Assay of waste water containing phenol. Both the sensor and a colorimetric method were used to assay waste water containing phenol. Results of the assay (Table 4) showed the relative difference in results from the two methods within provisional permissible error limits in general trace element analysis.^[6] Initial application tests also showed that the sensor could be used in the monitoring of various industrial wastes containing phenol.

Table 4. Phenol Content of Some Waste Water

Source of Waste Water	Phenol Content (ppm)		Relative Difference (%)*
	Sensor	Colorimetry	
Lake in an industrial area	1.4	1.0	40
Ammonia synthesizing plant	4.4	5.0	12
Coking plant	9.0	11.6	22
Paper mill	7.8	6.4	22
Bekelite plant	12.4	13.7	9

*Relative difference (%) is based on 4-aminoantipyrin direct colorimetry

4. Discussion

During the phenol microbe sensor research, we used several cell immobilization methods; however, they did not turn out very well. The semi-permeable membrane assembly method,^[1] for example, did not have very high stability.^[3] Though stability was increased, it was not suitable for assaying samples containing potash. The mycoderm was also rather fragile. Unless care was exercised in operation, it might easily rip or slough off. Improved experimentation showed that alginic acid embedding in combination with the semi-permeable membrane wrapping immobilization method might be a fairly good method. By comparison with the simple semi-permeable membrane wrapping method, the additional alginate gel coating did not impair response time. Though applicable to steady state assays, it was also applicable to dynamic state assays. Furthermore, the linear correlation between responsiveness and substrate concentration was also better. In addition, stability was high, and convenience in repeated regeneration was also a very important feature.

Both the stability and the useful duration of this sensor far surpassed that of existing phenol sensors, and also was greater than that of the similar type Clark oxygen electrode combination assembly sensor, stability reaching 30 days. It was even greater than the revivable fuel battery type biological sensor^[7] that is usable for as much as 60 days. There may be two main reasons for the high stability of this sensor that is made by encasing alginite gel in a semi-permeable membrane as follows: First of all, alginite gel may be more suitable for sustaining the vector. The gentleness of the vector gelation process, and the long interval during which gelation takes place^[8] help maintain the cell structure intact and vitality stable, and also help the dispersal and penetration of reactants. Second, a combination of work and maintenance methods are combined in the sensor. Use of the sensor for a certain amount of time daily or every other day is like charging the cells with energy, enabling maintenance of the cells' energy load above the survival level.^[9] The work interval and the method of keeping the sensor may be an active maintenance process. At least, it permits regeneration of part of the peptization function in the work process, enabling the cells to be regularly in a state of being stabilized by the gel.

Although possibly the regeneration may be regarded as one of the main advantages of the entire cell electrode probe or of the sensor,^[10] in reality, not all cell sensors can be readily regenerated. Regenerated cells may slough off simple gel encasing, or the entire gel coating may completely collapse. Though it is true that dialysis incubation principles may be used with membrane coverings alone, thereby enabling the resynthesis of the enzyme system concerned or causing reproduction of surviving cells, this may cause an uneven distribution of cells within the enclosing membrane. The phenol sensor's use of two immobilization methods in combination -- use of dialysis incubation regeneration, and the ability to use the gel to bring about a reversible peptization and gelation -- enables the regenerated cell to maintain even distribution and an immobilized state. The microbes used in the experiment were able to live and grow using phenol as their sole source of carbon. This was also a particularly advantageous for regeneration of sensors, permitting immobilization, work, and regeneration under other than sterile conditions without the propagation of unwanted microbes.

References

- [1] Neujahr, H. Y. and Kjellen, K. G., *Biotechnol. Bioeng.*, 21 (1979), 671-678.
- [2] Kjellen, K. G., and Neujahr, H. Y., *ibid.*, 22 (1980), 299-310.
- [3] Huang Kefu, Liu Yueying, Chen Xiaoqiong, XIAMEN DAXUE XUEBAO [Xiamen University Bulletin] (Natural Sciences Edition), 25 (1986), 601-604.
- [4] Environmental Monitoring Standards and Methods Compilation Group, "Environmental Monitoring Standards and Analytical Methods" (Trial), 1980, 130.
- [5] Neujahr, H. Y., *Proc. Biochem.*, 13 (1978), 3-7.
- [6] Environmental Monitoring Standards and Methods Compilation Group, "Environmental Monitoring Standards and Analytical Methods" (Trial), 1980, 16.
- [7] Suzuki, S., and Karube, I. *Immobilized Microbiol Cell*, ACS Symposium Series 106 (1979), 221-236.
- [8] Vorlop, K-D., and Klein, J., *Enzyme Technology* (Ed. Lafferty, R. M.), Springer-Verlag, Berlin, 1983, 219-223.
- [9] Rose, A. H., *Chemical Microbiology*, 342, Butterworths, London, 1976.
- [10] Guilbault, G. G., and Neto, G. O., *Immobilised Cells and Enzymes*, (Ed. Woodward, J.), IRL Press Ltd., Oxford, 1985, 73.

9432/7310

Study of Caged Bicyclic Phosphates. I. 1-Oxo-4-Substituted-2,6,7-Trioxa-1-Phosphabicyclo-[2.2.2] Octane, Reactions

40091004 Beijing HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese Vol 46 No 7, Jul 88 pp 679-685

[English abstract of article by Li Yugui [2621 3768 3802], et al., of the Institute of Elemento-organic Chemistry, Nankai University, Tianjin; Cao Jinhong [2580 6855 7703], et al., of the Academy of Military Medical Science, Beijing; Miao Fangming [4924 2455 2494], et al., of Tianjin Normal University]

[Text] Researchers are paying great attention to the derivatives of caged bicyclic phosphate compounds due to their strong and specific biological activities. The derivatives are potential new pesticides. 1-oxo-4-hydroxymethyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2] octane (1) is oxidized with concentrated nitric acid to the corresponding acid 2. From the reaction of the acyl chloride 3 with various phenols and aryl amines, two series of new bicyclic phosphates with general formulas 4 and 5 have been prepared. The reduction of 4b with iron powder in HOAc gives the O→N acyl migration product 4s. The elemental analysis, IR, ¹H NMR and MS spectra of these new compounds have been recorded, and the crystal structure of 4n has been determined by the X-ray diffraction method.

References

- [1] Verkade, J. G.; Reynolds, L. J., *J. Org. Chem.*, **1980**, *25*, 633.
- [2] Bowery, N. G.; Collins, J. F.; Hill, R. G., *Nature*, **1976**, *261*, 401.
- [3] Ozoe, Y.; Mochida, K.; Eto, M., *Agric. Biol. Chem.*, **1982**, *46*, 555.
- [4] Rätz, R. F. W., *US 3 168 549*, **1965** [*Chem. Abstr.*, **1965**, *62*, 14566c].
- [5] Rätz, R. F. W., *US 3 287 448*, **1968** [*Chem. Abstr.*, **1967**, *66*, 65535k].
- [6] Verkade, J. G., *Coord. Chem. Rev.*, **1972-1973**, *9*, 1.
- [7] Hills, W. A., *US 3 849 522*, **1974** [*Chem. Abstr.*, **1975**, *82*, 112704].
- [8] Rätz, R. F. W., *US 3 180 884*, **1965** [*Chem. Abstr.*, **1965**, *63*, 7023h].
- [9] 张宗炳, *化工进展*, **1986**, *6*, 1.
- [10] a. Pine, S. H.; Herdrickson, J. B.; Cram, D. J.; Hammonel, G. S., *"Organic Chemistry"*, McGraw-Hill, New York, **1980**, p. 311.
b. 张广远, "第三届元素有机化学讨论会", 天津, **1984**, A078.
- [11] a. Höfle, G.; Steglich, W., *Angew. Chem. Int. Ed. Engl.*, **1978**, *17*, 569.
b. Barton, S. D.; Ollis, W. D., *"Comprehensive Organic Chemistry"*, Vol. 4, Pergamon Press, Oxford, **1979**, p. 975.
- [12] a. Vogel's, *"Textbook of Practical Organic Chemistry"*, 4nd Edn., Longman, London, **1978** p. 658; 721; 497.
b. 李玉桂, 包 容, 张宗炳, 杨俭美, 曹金鸿, 蒋晓春, *化学学报*, **1987**, *45*, 697.
- [13] Local Organizing Committee (Ed.), *"Molecular Structure: Chemical Reactivity and Biological Activity"*, An Int. Sym., Beijing, China, **1983**, p. 366.
- [14] Halpern, Y.; Skokie, Ill.; Nisander, R. H.; Jackson, L., *US 4 454 064*, **1984** [*Chem. Abstr.*, **1984**, *101*, 130894j].
- [15] 韩广甸, 赵树伟, 李述文, 编译"有机制备化学手册", 中卷, 石油化学工业出版社, 北京, **1977**, 第 182 页.

Genetic Analysis of Ribosomal Protein S13, BL18 Mutants in *Bacillus Subtilis**

40091005a Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 15
No 4, Aug 88 pp 270-276

[English abstract of article by Bai Yinglin [4101 2019 2651], et al., of the
Institute of Genetics, Chinese Academy of Sciences, Beijing]

[Text] Ribosomes are large complex molecules that play major roles in genetic code transcriptions. In order to effectively study the mechanisms of ribosomal regulation of gene expression and the effect of ribosomal gene mutation on genetic code transcription, the study of ribosomal gene locations on the chromosomes and the gene structure is of great importance. This experiment is intended to determine if *Bacillus subtilis* can replace the traditional research bacterial strain, i.e., *E. coli*.

In this study, 87 temperature sensitive, kasugamycin-resistant mutants were isolated with 250 µg/ml NTG treatment. By using two-dimensional gel electrophoresis analysis of ribosomal proteins, 10 percent of these mutants experienced altered ribosomal proteins, including S3, S7, S8, S11, S13, BL2, BL6, and BL7. Genetic mapping of the ribosomal protein S13 and BL18 mutations showed that the S13 gene was located in the main ribosomal protein gene cluster near the origin of DNA replication, and the BL18 gene was highly linked to the pyrD gene, near 36.5 min. No obvious effects on the RNA and protein synthesis *in vivo* or on the plaque formation efficiency of bacteriophage φ29 in the BL18 protein mutant were found. It is possible that both the ribosomal protein BL18 gene and S16 gene are located in one cotranscriptional unit.

* Project supported by the National Natural Science Fund of China.

References

- [1] 白应林: 1981. 遗传学报, 8(2): 103-108.
- [2] 白应林等: 1984. 遗传学报, 11(1): 12-18.
- [3] 陈玲爱等: 1986. 科学通报, (7): 544-547.
- [4] 张巍等: 1985. 遗传学报, 12(6): 405-415.
- [5] 白应林等: 1985. 遗传学报, 12(2): 102-105.
- [6] Dabbs, Eric R: 1983. *Mol. Gen. Genes*, 192: 386-390.
- [7] Osawa, S. and A. Toku: 1978. *Mol. Gen. Genes*, 146: 113-129.
- [8] Pai Yinglin and Eric R. Dabbs: 1981. *Mol. Gen. Genes*, 183: 478-483.

Sister Chromatid Exchanges Induced by Restriction Endonucleases*

40091005b Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 15
No 4, Aug 88 pp 315-320

[English abstract of article by Dong Weifeng [5516 0251 1496], et al., of the
Department of Medical Genetics, West China University of Medical Sciences,
Chengdu]

[Text] It is reported that the widely-used endonuclease induces chromosomal
aberrations in cell cultures. The purpose of this experiment is to study
the function of endonuclease induction of chromosomal aberrations, and the
mechanism of SCE (sister chromatid exchange) formation.

The induction of SCEs by the restriction endonucleases Pst I, Sal I, Pvu II
and Bam HI was studied in CHO cells. The results show that all the enzymes
used could increase the SCE rate of CHO cells. A comparison of their SCE-
inducing and chromosome aberration-inducing effects revealed that the latter
was more remarkable. This means that DNA double-strand breaks are not strong
stimuli for SCE production. The results also demonstrate that the effects of
restriction endonucleases on DNA are not cancelled after the substitution of
thymidine by 5'-bromodeoxyuridine in DNA.

* Project supported by the National Natural Science Fund of China.

References

- [1] 董伟峰、张思仲: 1986. 遗传与疾病, 3(4): 236—239。
- [2] 张思仲等: 1979. 中华医学杂志, 59: 210—213。
- [3] 吴旻、王秀琴: 1980. 科学通报, 25: 239—240。
- [4] Bianchi N. O. et al.: 1984. *Chromosoma*, 90: 133—138.
- [5] Cleaver J. E.: 1983. *J. Mol. Biol.*, 170: 305—317.
- [6] Latt S. A. and R. R. Schreck: 1980. *Am. J. Hum. Genet.*, 32: 297—313.
- [7] Lima-de-Faria A. et al.: 1980. *Hereditas*, 92: 267—273.

Synthesis, Spectroscopic Investigations of 2,3-Disubstituted Quinoxaline-1,4-Dioxide Antibiotics

40091006 Shenyang YINGYONG HUAXUE [CHINESE JOURNAL OF APPLIED CHEMISTRY]
in Chinese Vol 5 No 4, Aug 88 pp 17-23

[English abstract of article by Lin Shukun [2651 2885 0981] of Lanzhou
Institute of Chemical Physics, Chinese Academy of Sciences]

[Text] Eleven quinoxaline-1,4-dioxide antibiotics (2 α -k) were synthesized by direct oxidation and the Beirut reaction. Detailed UV, IR and NMR data are reported and relevant spectroscopic properties discussed. Electron paramagnetic resonance (EPR) studies show that stable paramagnetic species have been formed in the photolytic process of these N-oxides in solution. A well-resolved EPR spectrum has been obtained from the photolytic solution of 2,3-cyclobutylenequinoxaline-1,4-dioxide (2g) in chloroform, and hyperfine splittings of 9.69G(1N), 3.59G(2H), 1.25G(2H) and 0.76G(H) have been determined from the spectrum. This radical has been assigned as 1-hydroxy-2,3-cyclobutylenequinoxaliny-1-4-oxyl(4). The similarities between naphthaquinones and quinoxaline-1,4-dioxides in molecular structure and properties are also pointed out.

References

- [1] 余竞光等, 药学报 18, 839 (1983)
- [2] 守国强, 贺贤国, 药学报 18, 345 (1983)
- [3] Glazer, E.A., Presslitz, J.E. *J. Med. Chem.*, 25, 868 (1982)
- [4] 赵荣材, 夏文江, 王玉春等, 中兽医医药杂志 51 (1986)
- [5] 林树坤, 汪汉卿, 有机化学 298 (1986)
- [6] Cheeseman, G.W.H., Werstiuk, E.S.G., *Adv. Heterocycl. Chem.* 22, 367 (1978)
- [7] Haddadin, M.J., Issidorides, C.H. *Heterocycles*, 4, 767 (1976)
- [8] Issidorides, C.H., Haddadin, M.J., *J. Org. Chem.* 31, 4067 (1966)
- [9] Landquist, J.K., *J. Chem. Soc.* 2816 (1953)
- [10] 蔡松传, 张章福, 王云祥等, 南京大学学报 245 (1984)
- [11] Ley, K., Eholzer, U., Nast, R., Seng, F., *USP* 3660398 (1972). *C.A.* 77, 88541 (1972)
- [12] Каганский, М.М. et al. *Хим. Гетероцикл. Соедин.*, 118 (1975)
- [13] Borah, H.N., Devi, P., Sandhu, J.S. et al. *Tetrahedron* 40, 1617 (1984)
- [14] Lin Shukun, Wang Hanqing, *Heterocycles* 24, 659 (1986)
- [15] Lin Shukun, Cong Qiuzhi, *J. Mol. Struct.* 159, 279 (1987)
- [16] Lin Shukun, *J. Photochem.* 37, 363 (1987)

Introducing Exogenous DNA Into Plants After Pollination

40101001a Beijing ZHONGGUO KEXUE [SCIENTIA SINICA, SERIES B] in English Vol 31 No 9, Sep 88, pp 1080-1084

[Article by Gong Zhenzhen, Shen Weifang, Zhou Guangyu, (Shanghai Institute of Biochemistry, Academia Sinica) and Huang Junqi, Qian Siying (Institute of Industrial Crops, Jiangsu Academy of Agricultural Sciences, Nanjing); received June 17, 1987]

[Text]

Abstract

The technique of introducing exogenous DNA into plants through the pathway of pollen tube after pollination has been applied since 1978 for transformation of the egg, zygote or early embryonic cells^[1-3]. By introducing the exogenous DNA containing the goal gene(s) into cotton and rice, several new varieties with economic value and genetic stability are obtained. Thus molecular breeding of crops can be realized by this biotechnique.

The pollen tube pathway is demonstrated by tritium-labelled cotton DNA (> 50kb). The labelled DNA is injected into cotton ovaries from the center of the top 24 h after selfing. 30 min to 8 h later, the ovaries are removed. It is clearly shown that the exogenous DNA can only pass from the microphyle to the opened nucellus, and then reach the embryonic sac. ³H-DNA can be found in the embryonic sacs 30 min after injection. In more than 80 percent of the embryonic sacs ³H-DNA can be seen between 2 and 4 h after injection. No ³H-DNA is found inside the pollen tubes. Therefore it is not through the pollen tube that DNA is carried into the embryonic sac. It is pathway of the pollen tube through which the DNA passed.

Key words: exogenous DNA tritium labelled cotton DNA, pollen tube pathway, plant molecular breedings.

The experimental design for introducing exogenous DNA into plants was based on conclusions from studies on hybridization among remotely related plants, a practice which has been widely adopted in China.

Chinese breeders have wished for a long time to enlarge the gene bank to overcome the limitations posed by hybridization among closely related plants. As a way out, they started to work on hybridization among remotely related cereals as well as other crops. Phenotypic variations were often observed in offsprings after interspecies, intergenus and even interfamilies hybridization. The varieted offsprings were still classified as belonging to the same species as their mother plants. Their chromosome number, sizes and shapes were also the same as their mother plants when observed under the light microscopes.^[7] This phenomenon of hybridization below the chromosomal level was also reported in 1977 by Harlen et al.^[7] Zhou started in 1974 to make a survey of this phenomenon in order to explain it with the basic knowledge of modern molecular biology and the newly formulated concepts of genetic engineering at that time. She proposed the hypothesis of DNA segment hybridization for that kind of phenomenon. Preliminary molecular demonstration has been made later on.^[5] Evidence was provided to show that such DNA segmen hybridization as proposed should exist.^[8,9]

If the remote hybridization is the results of DNA segment hybridization without chromosome paring or diplois, how should the formation of seeds be explained? It has been known that parthenogenesis is a possibility, but as is seen from our extensive investigation of the breeders' experiences, the fact is that the conventional technique of emasculation (e.g., by physical, medicinal or temperature treatment, etc.), does not provide 100 percent efficiency when applied in the field. Under such conditions, with the exception of female parthenogenesis pollen might germinate on the stigma, the pollen tube might go into the embryonic sac. The DNA from foreign chromosomes might be degraded and a few DNA segments might integrate into the genome of the acceptor plant cell. Or, the foreign pollen did not germinate on the stigma, it might break and the discharged genetic material might be carried in through the pathway of the pollen tube. It was from such observations and the predictions which followed that the technique of introducing exogenous DNA into plants after pollination was designed. This technique therefore serves as evidence for the hypothesis of DNA segment hybridization. In this sense, molecular breeding is explored with a view to solving the problem of how to put the exogenous gene(s) into plants.

The principle of the technique has been applied many years to crops such as cotton and rice. Not only have variations been found in offsprings of all crops tested but also new varieties of cotton and rice with stable genetics and economic value were bred. The transformation rate obtained by counting variegated survival plants could be as high as 10^{-2} ^[1,3,10].

The plasmid mp7 was recombined with the repetitive sequences of cotton and introduced into cotton by this technique. From Southern blotting it was indicated that mp7 has integrated into the cotton genome.^[11]

In this paper, a demonstration of the pollen tube pathway by which the ³H-labelled DNA was transferred to the embryonic sac is described.

I. Materials and Methods

(1) Preparation of exogenous donor DNA. According to the method of J. Weng et al. [12] the *G. barbadense* "416" seeds were used for the DNA preparation. Seeds were supplied by Industrial Crops Research Institute, Jiangsu Agricultural Academy of Sciences. The M.W. of the DNA is >50 kb.

(2) ^3H -labelled *G. barbadense* "416" DNA. ^3H -labelled *G. barbadense* "416" DNA was prepared by nick translation according to Righy et al. [13] ^3H -dCTP 30 μCi , ^3H -dGTP 15 μCi , ^3H -dTTP 15 μCi (products of Shanghai Nuclear Research Institute, Academia Sinica); dATP (Sigma); DNase I and polymerase I (BRL).

(3) Preparation of ^3H -DNA injection solution. ^3H -labelled *G. barbadense* "416" DNA 5 μg (6.35×10^6 cpm), was mixed with unlabelled *G. barbadense* DNA 6 μg , in 0.1XSSC, 10 mol/L CaCl_2 , total volume 60 μl .

(4) Methods for introducing exogenous DNA. Receptor cotton: *G. hirsutum* L.D.P.L. Shanghai selected 204 (supplied by Shanghai Institute of Plant Physiology, Academia Sinica).

About 24 h after selfing, the corolla of the receptor were removed to expose the ovary, 10 μl DNA injection solution was injected from the center of the top of the ovary with an ordinary 50 μl syringe about 0.5 cm in depth. In this way, the upper part of the ovary would be filled with DNA. Ovaries were taken 30 min, 1, 2, 4, 6, or 8 h after DNA injection and kept in dry ice. The controls were those without selfing or ^3H -DNA injection.

(5) Tissue sections and autoradiograms. Freeze-sections, 25 μ in thickness (assistance from the Neuro-receptor Group of Shanghai Institute of Materia Medica, Academia Sinica), were covered with nuclear-4 emulsion (products of Beijing Nuclear Institute) stored for three months at -80°C , developed by D 19-B and fixed.

(6) Tissue staining. Harris method. [14]

(7) Microsopical photography. Olymplus microscope, Kodak color film ISO100/21, one minute exposure.

II. Results and Discussion

1. Pollen Tube Pathway

(1) Pollen germinates on the stigma

The pollen tube grows, enters the ovary, through the style, extends from the micropyle of the ovule to the nucellus, reaches the embryonic sac, and enters one of the synergids. The end of the pollen tube opens and sets the two nuclei free to accomplish double fertilization. During the elongation of the pollen

tube, there is a pathway preformed. The nucellus is originally a closed tissue. The pathway is formed by a physiological change in the nucellus before the arrival of the pollen tube. A layer of cells from the micropyle to embryonic sac was degenerated to form column cells which were surrounded by micropyle cells (Fig. 1(a-c)). Plate I shows a section of ovule before pollination, the nucellus being still small and closed. After 24 h pollination (2a) shows that the nucellus opens to the micropyle and there are micropyle cells between the micropyle and embryonic sac. (2b) shows that wide pathway is formed in nucellus by degenerated column cells. There are pollen tubes which have already traversed the pathway and entered the embryonic sac. (3) after the injection of ^3H -DNA has reached micropyle but not was inside the ovule. [as printed] A pollen tube with two the ends or two pollen tubes twisted together has entered the embryonic sac through the pollen tube pathway. One end of the pollen tube was open. The polar nuclei can be seen in this photo.

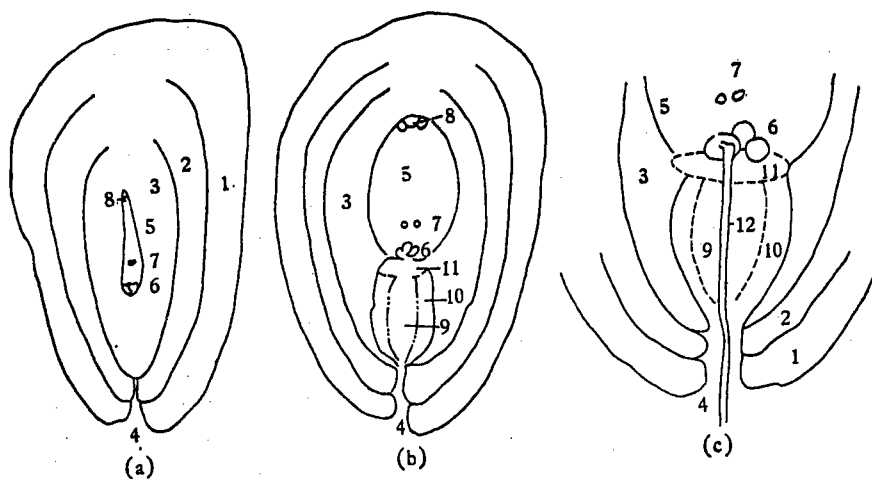


Fig. 1. Diagram of Cotton Ovule

(a) Before pollination. (b) After pollination. (c) Pollen tube traverses the pathway in nucellus into egg apparatus of embryonic sac.
 1, Outer integument, 2, inner integument, 3, nucellus, 4, micropyle, 5, embryonic sac, 6, egg apparatus, 7, polar nuclei, 8, antipodals, 9, pollen tube pathway in nucellus, 10, micropyle cell, 11, collar cells, 12, pollen tube.

The pollen tube pathway has been well described in the book "Cotton Morphology" edited by Li Zhengli.^[15] But it is surprising to find that the pathway is so wide in our freeze sections after pollination.

2. Introducing of Exogenous DNA

Plate II, (1a-c) is a section of the ovary 4 h after injection of exogenous ^3H -DNA (1a) DNA has entered the locule of the ovary along the central placenta. There are ^3H -DNA in embryonic sacs of the locules on both sides. Thus, the center of the top of the cotton ovary is a suitable position for injecting exogenous DNA into cotton. (1b) The exogenous DNA has passed the micropyle, entered the nucellus and approached the embryonic sac. In Plate II, 2a and (2b) the pathway of the pollen tube is full of ^3H -DNA. In Plate III, (1) the DNA has appeared at the position of micropyle cells of nucellus. Besides those photos taken 4 h after injection, it was observed that actually some of the embryonic sacs already had DNA at 30 min. By examining sections of different layers from a single ovary 2 to 4 h after injection, 80 percent of the embryonic sacs had ^3H -DNA.

In all the photos examined as well as in Plate III, (3) showing three ovules together, exogenous DNA has entered the embryonic sac by only traversing the pathway of the pollen tube as indicated by our technique. There was absolutely no indication that DNA had entered the embryonic sac through any other part except the pathway of the pollen tube. From Plate III, (2) it is clear that the DNA is not along the inside of the pollen tube but has been traversed freely outside of the tube.

The pollen tube pathway exists also in the style, especially when several pollen tubes elongate. A pathway formed along the lengths of the tubes, facilitating the entrance of the DNA into the ovary. This technique can also be applied to rice, rape and other plants. Success was obtained by cutting off the stigma at a certain time after pollination and allowing the DNA to drop onto the cut surface of the style.^[3,11]

The transformation rate measured by the growth of variant plants could be 10^{-2} either on cotton (by injection of DNA into the ovary) or on rice (by dropping the DNA into the cut surface).

Hess^[16] used the pollen tube as vector to carry DNA into the embryonic sac to transform the egg cells. The DNA was first absorbed into the pollen during germination. DeWet^[17] succeeded in transferring disease resistance of maize and breeding of the rust resistant varieties by the same way. The transformation rate of 10^{-3} to 10^{-4} obtained by Hess method was lower than that by the method in which the pathway of pollen tube was used. This might be because the first step of absorbing the DNA into the germinating pollen placed a limit on the DNA absorption. The life time of pollen from many plants is short, making the handling difficult. Pena et al.^[18] reported recently that they injected the Kanamycin-resistant gene from the node of a floral tiller of ray 14 days before meiosis of the microspore and obtained good results. The authors entertained the idea that the DNA has pierced the plasmadesmata between cells at that stage. Pena's method needs only one injection for the whole spike. It is specially

attractive for cereals work. With our method the flowers have to be treated one by one, which is the routine for breeders. For big ovary with many ovules, one injection is enough. Breeders would have no difficulty either in estimating the correct time for introducing DNA after pollination, as all breeders know very well the pollination and fertilization time of the plants they work on.

It seems that the technique of using germ line cells in the whole plant as DNA (gene) receptor is much easier and more practical than that using the isolated protoplasts and cells. Cultivars can be directly used for the manipulation of their genetics and for avoidance of somatic cell variations. Thus, on the basis of the original good traits of the cultivars genomic improvement may be achieved. Molecular breeding of cotton and rice in China proved this advantage. About half the time for conventional breeding was necessary. The coveted goal of directed molecular breeding is therefore in sight.

References

- [1] Zhou, G.Y. et al., Methods in Enzymology, 101(1983), 433-481.
- [2] Huang Junqi, et al., Yichuan Xuebao (Acta Genetica Sinica), 8(1981), 56-62.
- [3] Duan Xiaolan, et al., Zhongguo Nongye Kexue (Chinese Agricultural Sciences), 3(1985), 6-10.
- [4] Zhou, G.Y. et al., Plant Molecular Breeding Biotechnology Workshop of International Crop Research Institute of Semi. Arid. Tropic., 1987, ICRISAT India, (in press).
- [5] Zhou Guangyu, Zhongguo Nongye Kexue (Chinese Agricultural Sciences), 2 (1978), 16-20.
- [6] Zu Deming, Yichuan Xuebao (Acta Genetica Sinica), 6 (1979), 414-420.
- [7] Harlen, J.R. et al., Proc. Natl. Acad. Sci. USA., 74(1978), 3494-3497.
- [8] Zhou Guangyu, et al., Yichuan Xuebao (Acta Genetica Sinica), 6(1979), 405-413.
- [9] Zhou Guangyu, et al., Zhongguo Kexue Scientia Sinica), 24(1981), 701-709.
- [10] Gong Zhenzhen et al., Scientia Sinica, (to be published).
- [11] Weng Jian, et al., Shengwuhuaxue Yu Shengwuwuli Xuebao (Acta Biochimica et Biophysica Sinica), 16(1984), 325-327.
- [12] Weng Jian et al., Zhiwu Shengli Xuebao (Journal of Plant Physiology), 5 (1979), 363-366.

- [13] Rigby, P.W. et al., J. Mol. Biol., 113(1977), 237-251.
- [14] Rui Jusheng, et al., Zuzhi Qiebian Jishu (Tissue Section Techniques), 1980, 68-76.
- [15] Li Zhengli, Mianhua Xingtaixue (Cotton Morphology), Science Publishing House, 1981, 111-114.
- [16] Hess, D.Z., Pflanzenphysiol., 98(1980), 321-323.
- [17] DeWet, J.M.J. et al., in Experimental Manipulation of Ovule Tissues (Eds. Chapmen, G.P., Mantell, S.H. and Daniels, R.W.), New York, London Longman, 1984, 197-207.
- [18] A de la Pena, et al., Nature, 325(1987), 274-276.

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Expression of a Zein Gene (Z4) Introduced Into Dicotyledonous *Solanum Nigrum*

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[Article by Deng Wanyin, Shao Qiquan, and Jiang Xinggun (Institute of Genetics, Academia Sinica, Beijing); received August 15, 1987; revised January 26, 1988]

[Text]

Abstract

A maize genomic clone containing a zein gene (Z4) is inserted into the T-DNA of the Ti plasmid pTiT37. *Agrobacterium tumefaciens* strain harboring this modified Ti plasmid is used to infect stem sections of young plants or explants of dicotyledonous *Solanum nigrum*. Axenic transformed calli active in nopaline synthesis are obtained and transgenic plants are differentiated from them. DNA Southern hybridization and RNA dot-hybridization analyses show that the zein gene is really transferred and integrated into the nuclear genome of transformed *Solanum nigrum* and that the zein gene can be transcribed into mRNA in the transformed calli and shoots. But the presence of the zein protein cannot be detected in either the transformed calli or the transgenic shoots. The results of the experiments demonstrate that the promoter of a gene from monocotyledonous plants can function normally in transgenic dicots. The possibility of developmentally-regulated expression of the zein gene in transformed dicots is discussed in the article.

Key words: zein gene, gene expression, *Solanum nigrum*, *Agrobacterium tumefaciens*, Ti plasmid.

Researches on plant genetic engineering have been advanced rapidly in recent years by the developments of molecular biology and tissue culture techniques. There are many methods to introduce foreign genetic substances into recipient plants, but the most commonly used is the gene transfer system which uses Ti plasmid of *Agrobacterium tumefaciens* as vector.

Agrobacterium tumefaciens genetically transforms plant cells by transferring a specific segment of DNA, the T-DNA, from its large Ti plasmid to the plant nuclear genome.^[1] The T-DNA transfer process is controlled by at least three sets of genetic elements, the T-DNA border sequences, the Ti plasmid Vir loci^[2] and the chromosomal virulence *chvA* and *chvB* loci^[3], which control the attachment

of bacteria to the surface of wounded plant cells. Wounded plant cells synthesize and secrete signal molecules, such as phenolic compounds,^[4] and these substances activate the expression of Vir loci of Ti plasmid. Nicks are generated in the 25-bp (base pairs) direct repeat sequences of T-DNA borders after Vir gene activation, and linear single-stranded T-DNA molecules, which are presumably intermediates in T-DNA transfer from *Agrobacterium* to plant cells, are synthesized.^[5] The T-DNA transfer might be via a conjugative mechanism.^[5] Expression of T-DNA genes within the transformed plant cell results in its neoplastic growth and makes it difficult to differentiate into whole plants.^[6] The T-DNA region of Ti plasmid was reconstructed and modified, and its oncogenes were deleted by some researchers.^[6] This modified Ti plasmid was suitable for using as vector in plant genetic engineering, and it did not influence the regeneration of the transformed plant cells.

Early experiments showed that the host range of *Agrobacterium tumefaciens* was very wide, but only limited to gymnospermous and dicotyledonous plants.^[7] It has recently been demonstrated that *Agrobacterium* can also infect many monocotyledonous plants, such as *Chlorophytum capense*,^[8] *Chlorophytum comosum*,^[9] and *Asparagus officinalis*,^[9] of Liliaceae, *Narcissus*,^[9] and *Hippeastrum rutilum*,^[8] of Amaryllidaceae, *Gladiolus*,^[9] of Iridaceae, *Dioscorea opposita*,^[10] of Dioscoreaceae, and even *Zea mays*,^[11] of Gramineae. These facts showed that Ti plasmid might be a versatile vector for both dicots and monocots.

The gene transfer system by using Ti plasmid as vector can be used to introduce valuable foreign genes, such as the gene coding for storage proteins and tolerance of adverse circumstances, into recipient plants to improve their characteristics.^[12-15] In addition, some basic theoretical problems, such as the function of various genes with their regulating sequences from bacteria, fungi, animals and any other plants in transformed recipient plants, can be investigated.

Zein proteins are the major storage proteins of maize. They are encoded by multigene families^[16], and their regulation mechanisms of expression are far from being completely understood. There is no mRNA splicing in the expression process of zein genes because of the absence of introns from them, and so they are very suitable for studying the functions of their flanking sequences in a heterologous background.^[16,17] The main purpose of our experiments is to study whether the promoter of a monocotyledonous gene, a zein gene (Z4), can function normally and direct the expression of the gene in transformed dicotyledonous *Solanum nigrum*.

I. Materials and Methods

1. Bacterial Strains and Their Culture

Agrobacterium tumefaciens strains A208 (pTiT37) and A208 (pTiT37Z4) used in the experiments were kindly supplied by Prof. Rubenstein of the University of Minnesota, USA. In the T-DNA region of Ti plasmid of the strain A208 (pTiT37Z4),

There was a zein gene (Z4) which coded for a 23 kd (kilodalton) zein protein. The construction and restriction maps can be found in [16]. YEP broth^[18] was used for liquid culture of *A. tumefaciens*. When strain A208 (pTiT37Z4) was cultured, 100 µg/ml kanamycin and 50 µg/ml gentamycin were added to the YEP medium.

2. Plant Materials and Their Transformation and Culture Methods

Solanum nigrum, a medicinal herb of Solanaceae, was used as recipient plant. Plants grew up in greenhouse at 25-35°C. When real leaves were developed from the *Solanum* seedlings, bacterial liquid was injected into their hypocotyls or stem segments with syringe. The crown galls or teratomes thus obtained were cut into small pieces, sterilized with 0.1 percent HgCl₂ and then put onto the hormone-free MS medium (MDO) or MS medium containing 1 mg/l kinetin (MSKT). Carbenicillin (Cb) was added to the media in a concentration of 1 mg/ml to kill the remaining agrobacteria. Calli thus formed were cultured in various media with different kinetin/auxin concentrations to induce their differentiation. Shoots differentiated from the calli were inoculated in MSO, 1/2 MSO media or MS medium supplemented with auxin in low concentrations for root induction.

3. Nopaline Qualitative Assay

Improved paper electrophoresis was used for the detection of nopaline.^[19]

4. Plant DNA Isolation and Southern Hybridization

(1) Plant DNA isolation. Plant DNA was isolated according to the miniprep preparation procedure.^[20]

(2) Preparation and labelling of probe DNA. Probe DNA was prepared from plasmid pgZ19AB1 kindly supplied by Dr. Goldsbrough of Purdue University. Plasmid pgZ19AB1 was constructed by cloning a 3-kb EcoRI/HindIII fragment of maize genome into the EcoRI/HindIII site of pBR322.^[17] A 1.2kb XbaI fragment of the plasmid, which contained the whole sequence coding for a 19-kd zein protein, was used as probe. The gene encoding the 19-kd zein and the Z4 gene are very similar, both included in the same A30 gene subfamily.^[16] They are of high homology, and the homology of the sequences in their 5'-nontranslated regions is 90-100 percent.^[16,17]

Low-melting-temperature agarose method^[21] was used to recover the probe DNA. The kit and ³²P-α-dCTP (3000 Ci/mmol/L) for nick translation^[21] were purchased from Amersham Corp., and used according to the supplier's directions. The probe DNA labeled was isolated and recovered using a Sephadex G50 column.

(3) Southern hybridization. About 10 µg plant DNA was digested with restriction endonuclease EcoRI. In the reaction solution, appropriate RNase was added to remove RNA^[20]. Electrophoresis, transfer of DNA to nitrocellulose and Southern hybridization were carried out as described by Maniatis et al.^[21]

5. Plant RNA and RNA Dot-hybridization

(1) Total RNA isolation. Total RNA was isolated according to the procedure of Grjerson et al.^[22]

(2) Preparation of filters for RNA dot-hybridization. 10 μ l (about 20 μ g) of RNA samples was used for each dot. Before being dotted onto the pre-treated nitrocellulose paper, RNA samples were treated first by (i) non-denaturation, (ii) alkali-denaturation^[23] or (iii) heat-denaturation.^[23] Spots of alkali-denatured plasmid pgZ19AB1 (1 μ g) were dotted on every filter as positive control. In order to eliminate the small amount of nuclear DNA contaminants which possibly existed in the RNA preparations, RNA samples were digested with RNase-free DNase I before denaturing and dotting.

(3) RNA dot-hybridization. Probe used in the RNA dot-hybridization was the same as that used in DNA hybridization. Hybridization conditions were the same as in [23].

6. Detection of Zein Protein in the Transformants

Alcohol-soluble proteins were isolated from the transformants of *Solanum nigrum* according to the procedure described by Esen.^[24] Laemmli's polyacrylamide gel electrophoresis method^[21] was used to analyze and compare the alcohol-soluble proteins.

(1) Immunological assay. Antigen (W64A zein) and zein antiserum, which was prepared by injection of rabbits with zein protein,^[16] were gifts from Prof. Rubenstein. Two-directional diffusion method and trace immunological electrophoresis method were used to detect the presence of expressed protein. Agar plates thus obtained were stained with 0.05 percent Amido Black 108 and destained with 5 percent acetic acid before observing the results.

II. Results and Analyses

1. Obtainment of *Solanum nigrum* Transformants

Strains A208 (pTiT37) and A208 (pTiT37Z4) were used to infect the seedlings of *Solanum nigrum* by using the injection method. Visible swelling was seen 7-10 days later at the sites inoculated with agrobacteria and tumors, 1-2 cm in diameter, could be formed within 20-30 days. All the tumors were shown to contain strong nopaline. The frequency of tumor-induction was almost 100 percent.

Teratomes, from which a great number of shoots and plantlets were differentiated, were induced by strain A208 (pTiT37) (Plate I, 1). Where leaves of the shoots were cultured in MSOCb medium after sterilization, small shoots were directly differentiated from them, or calli were formed. Lots of green adventitious buds were generated on the subcultured calli. When the calli below the buds were cut into small pieces and cultured, the buds could grow into abnormal plants. But, undifferentiated green crown gall tumors were formed on *S. nigrum* inoculated with strain A208 (pTiT37Z4) (Plate I, 2).

S. nigrum is a sensitive host of *A. tumefaciens*, and many strains are able to induce teratomas on it.^[25] And so, that strain A208 (pTiT37Z4) only induced crown gall tumors on *S. nigrum* was probably related to the characteristics of the bacterial strain, because the zein gene-insertion into the T-DNA of Ti plasmid destroyed the gene related to cytokinin synthesis.^[16] Similar tumor-inducing experiments on other plants showed the A208 (pTiT37Z4) also induced crown gall tumors on *Datura stramonium* and *Lycopersicon esculentum*, but at the inoculated sites on *Kalanchoe pinnata*, a great number of roots were generated in addition to small tumors and the roots were detected to contain nopaline (Plate I, 3). The results of the experiments demonstrated that, besides the bacterial strains used for infection and the age and physiological state of plant materials,^[25] the differentiation ability of the tumors might also be related to the plant species and their genotypes.

After sterilization, the tumor induced by A208 (pTiT37Z4) was cut into small pieces and incubated in MSOCb medium. Visible calli were formed on two pieces of the tumor tissues in about two weeks, but the calli grew very slowly on the MSOCb. When transferred to MSKTCb, these calli grew well and shoots, which could grow into normal plants, were immediately regenerated from one of the calli (Plate I, 4, 5).

Using leaf-disc transformation method, transformed plants of A208 (pTiT37) and transformed calli of A208 (pTiT37Z4) were also obtained. This method was more advantageous than the injection method because of its short period for obtaining transformants. By using this method, only 2-4 weeks were needed to gain transformants.

2. Characteristics of *S. nigrum* Transformants

(1) Hormone-independence. Transformants of A208 (pTiT37) and A208 (pTiT37Z4), either calli or adventitious bud clumps, could both grow in the hormone-free MSO medium. This was due to the T-DNA transformation of plant cells. But transformants of A208 (pTiT37Z4) grew more vigorously in MSKT than in MSO. This might be because the insertion of Z4 gene in the T-DNA destroyed the gene controlling cytokinin synthesis. Our results were consistent with those of Matzke et al.^[16]

(2) Failure in root induction. Although several rooting media were tested, transformed shoots of both A208 (pTiT37) and A208 (pTiT37Z4) did not initiate any roots. When transformed by other *Agrobacterium* strains, some transformants of *S. nigrum* were shown to be capable of developing into intact plants.^[25] The failure of the transformants of A208 (pTiT37) and A208 (pTiT37Z4) in root development was probably due to the abnormal phytohormone balance in transformed cells.

(3) Nopaline synthesis. Presence of nopaline in the transformed calli and shoots of both A208 (pTiT37) and A208 (pTiT37Z4) was demonstrated by paper electrophoresis (Plate I, 7). This result indicated that T-DNA was really transferred into the plant cells.

(4) Kanamycin-sensitivity. Common *S. nigrum* is very sensitive to kanamycin and 50 µg/ml kanamycin added to its culture medium is lethal to it. When strain A208 (pTiT37Z4) was used to infect *S. nigrum*, a kanamycin-resistant gene from *E. coli* was also transferred to the plant cell, along with the Z4 gene and T-DNA fragment. When cultured in the MSKT medium containing 50 µg/ml Km, the transformants stopped growing and began to become yellow within one week, and then they turned white and died (Plate I, 6). This fact implied that the T-DNA was integrated into the nuclear genome of *S. nigrum* after transformation. If the T-DNA had been integrated into the genomes of chloroplasts or mitochondria, the transformants would have been resistant to kanamycin, because the Km^R gene with its prokaryotic promoter could be expressed in the chloroplasts or mitochondria.^[16]

(5) Phenotypic comparison between transformants of A208 (pTiT37) and A208 (pTiT37Z4). Transformed calli of both strains could all differentiate out a great number of adventitious buds and the shoots derived from the buds did not produce roots. But the transformed plants of the two strains were different in phenotype. While the transformed plants of A208 (pTiT37) were abnormal in stems and leaves, the transgenic plants of A208 (pTiT37Z4) were the same as the normal plants in phenotype. When another *Agrobacterium* strain harboring a Ti plasmid similar to pTiT37Z4 in structure was used to infect tobacco, intact transformed plants were obtained.^[18] This was partially consistent with our results.

3. Biochemical Identification of *S. nigrum* Transformants of A208 (pTiT37Z4)

(1) DNA Southern hybridization

DNA Southern hybridization analysis demonstrated that the zein gene (Z4) was really transferred into plant cells and integrated into the nuclear genome of transformed *S. nigrum* (Plate I, 8). And as expected,^[16] the zein gene was present in a large EcoRI fragment (about 23 kb) within plant DNA. Because the transformants synthesized nopaline and were of neoplastic growth, we considered that the zein gene was transferred into plant cells along with T-DNA. The fact that the transformants contained nopaline after approximately 20 times subculture proved that the integration of the zein gene and T-DNA in the plant genome was stable, and that they could be transmitted nonsexually.

In the experiments, another hybridization band (about 9 kb) was found in the DNA EcoRI digests of both the transformed and control plants. This indicated that DNA sequences homologous with the Z19 gene existed in the nuclear genome of *S. nigrum*. Matzke et al. found that specific sequences homologous with the T-DNA sequence were present in the sunflower genome, and that a protein, which had some homology with zein protein, existed in the normal sunflower tissues.^[16] As can be seen on the photograph, the hybridization bands are relatively wide. This might be due to the degradation of the isolated DNA samples.

(2) RNA dot-hybridization

Because the dot-hybridization techniques are rapid, sensitive and easy to perform, they were adopted in our experiments. The results of RNA dot-hybridization indicated that RNA homologous with the Z19 gene was contained in both the

transgenic shoots and transformed calli of A208 (pTiT37Z4)-transformed *S. nigrum* (Plate I, 9). The RNA should be mRNA and it should be transcribed from the Z4 gene in the T-DNA located in the plant genome. By analyzing the gene map of plasmid pTiT37Z4, we could conclude that the transcription of Z4 gene was not due to the read-through from any other promoters in the T-DNA. So, we thought that the transcription of the detected mRNA from the Z4 gene was controlled by its own promoter. Because the size or length of the mRNA was not determined in our experiments, it was not sure whether the transcription of Z4 gene was initiated and terminated precisely. The same *Agrobacterium* strain was used to infect sunflower by Matzke et al.^[16] In their experiments, the transcription of Z4 gene in the transformed calli was shown to be controlled by its own promoter, and the initiation of its transcription was at the same site as that used in maize. Similar results were achieved when other zein genes were used to transform sunflower.^[17] In all these experiments, they only demonstrated that the promoters of zein genes could function normally in transformed tumors^[17] or transformed calli.^[16] Our experiments have demonstrated for the first time that the promoter of a zein gene (Z4) can also function in the differentiated transgenic plants of dicots.

No RNA homologous with Z19 gene was detected in non-transformed control plants of *S. nigrum*. This indicated that the DNA sequences, which were shown to have homology with Z19 gene by DNA Southern hybridization, were not transcribed into mRNA in *S. nigrum*.

In the experiments, the effects of different methods of RNA denaturation were compared. The RNA samples were treated by three methods before dotting onto filters: non-denaturation, alkali-denaturation, and heat-denaturation. Among them, the effect of the alkali-denaturation method was the best. The reason for the failure of the other two methods may be as follows: (i) Non-denatured RNA cannot be absorbed onto the filter and be washed down in the process of hybridization because of its secondary structure, and (ii) heat-denaturation made the RNA samples too viscous to attach to the filter because of the high concentration of the RNA samples and the existence of a small amount of proteins and polysaccharides in the RNA preparations.

(3) Detection of expressed protein of Z4 gene in the transformants

Polyacrylamide gel electrophoresis technique was used to compare and analyze the alcohol-soluble proteins extracted from the *S. nigrum* transformants of A208 (pTiT37), A208 (pTiT37Z4) and normal control plants. It could be seen from the results that there was no difference among their alcohol-soluble proteins. When purified zein protein was used as standard control, no protein with the same migrated distance as the control was found in the alcohol-soluble proteins isolated from the transformants of A208 (pTiT37Z4). This showed that there was no zein protein expressed from the zein gene in the transformants. Another possibility was that the efficiency of mRNA translation was too low to be detected by our method, or that the zein protein was degraded into small peptides in *S. nigrum*, just as the degradation of phaseolin protein in engineered sunflower tissue.^[26]

And then, more sensitive immunological methods were used to detect the proteins. But the results of all these techniques were negative, and no zein protein was found in the transformants.

In conclusion, although the Z4 gene in both the transgenic plants and calli was transcribed into mRNA, the mRNA could not be translated into protein. The reason for this case was not known yet. These results showed that the performance of the zein gene was the same in all the heterologous systems: transformed tumor, calli or transgenic plants. It could be transcribed into mRNA, but its mRNA could not be translated into protein.

III. Discussion

Introduction of foreign genes into plant cells is relatively easy at present due to the development of plant gene transfer techniques. Researchers can now use these techniques to study some basic theoretical problems in transformed plants, such as the recognition and function of promoter, polyadenylation and intron-splicing signals of genes derived from various sources. The study of these problems will undoubtedly benefit the introduction of valuable genes from other organisms into plants to improve their characteristics.

The experiments in early stage demonstrated that, when the genes from prokaryotes such as bacteria were directly transferred into plant cells, they could not be expressed. This is because there are great differences in the gene expression mechanism, such as transcription-regulated signals, between prokaryotes and eukaryotes. If the promoters of bacterial antibiotic-resistant genes were substituted by plant-expressed promoters, these genes could function normally in the plant cells.^[6]

Many similarities exist in the structure of the promoters, intron-splicing signals and pre-mRNA polyadenylation signals of eukaryotic genes. But, when some unchanged eukaryotic genes from yeast^[18] and animals^[27] were introduced directly into plant cells, they could not be expressed; even if they could be expressed, the initiation of their transcription was not accurate.^[27] The experiments of introducing the gene of human growth factor into plant cells demonstrated that plant cells utilized the intron-splicing and polyadenylation signals of the human gene in an abnormal and inefficient way.^[27,28] From all the results mentioned above, we can conclude that, although some similarities are present in the structure of transcription-regulated signals in both the plant and animal genes, there are still certain differences between them. By now no firm conclusion can be drawn about the consistency of the transcription-regulated mechanism of plant and animal genes.

Angiosperm is divided into Monocotyledoneae and Dicotyledoneae. By using the gene transfer system of Ti plasmid, it was proved that the promoter, intron-splicing mechanism and other transcription-regulated signals were identical among at least some dicots. For example, when some genes of storage proteins, such as phaseolin^[13] and β -conglycinin,^[12] were transferred into other dicots, they were correctly expressed and developmentally-regulated in the seeds of transformants. In addition, when light-inducible pea rbcS gene^[29] and other distinctively-regulated genes were introduced into other dicots, their ways of regulated expression were kept unchanged. In that case, are there any differences in the mechanism of gene expression regulation between the monocots and dicots?

No experiment has been done to study the expression of a dicot gene in a monocot plant because of the absence of appropriate vector system for gene transfer. But, many scientists have studied the function of monocot genes in dicot plants. Lamppa et al. demonstrated that a monocot (wheat) cab transcript could be correctly initiated in transgenic tobacco plants and that the gene correctly showed light/dark and tissue-specific regulation in its new host.^[27] Rochester et al. proved that the heat shock protein (hsp70) gene of maize was heat-inducibly expressed in transgenic petunia and that the intron of hsp70 gene could be precisely spliced.^[30] In contrast to the facts mentioned above, the recent results of Keith and Chua indicated that there were some differences in the efficiency of intron-splicing and polyadenylation of transcripts between the genes of monocots and dicots.^[27] This reflected the differences in the signals used by monocot and dicot plants to regulate these processes.

A series of experiments have been done by using zein genes. Matzke et al. demonstrated that a 23-kd maize zein gene could be accurately initiated in sunflower crown gall tumors.^[16] Goldsbrough et al. showed that a similar 19-kd zein gene, as well as a 15-kd zein gene, could be both correctly initiated and terminated in sunflower tumors.^[17] But the mRNA transcribed from the zein genes was not translated into proteins in their experiments.^[16,17]

We chose *S. nigrum* as recipient plant to study the expression of zein gene. *S. nigrum* and sunflower belong to different families. We intended to observe whether the zein gene (Z4) could be expressed in *S. nigrum*, and to see if there were any differences of the expression of the zein gene in different families of dicots. The results of our experiments indicated that the zein gene could be transcribed into mRNA under the control of its own promoter in transformed *S. nigrum* shoots as well as calli. This demonstrated that the promoter of the zein gene could function in transformed dicots in different families (Compositae and Solanaceae).

Why is the zein gene, which is developmentally-regulated in maize, transcribed from its own promoter in differentiated shoots and undifferentiated calli of transformed *S. nigrum*? The reason is not clear yet. It is possible because of the lack of maize-specific regulatory molecules in *S. nigrum*. Another explanation may be that the developmentally-regulated zein gene can be expressed in all the tissues at a low level. For example, in the experiments of Murai et al.,^[26] a developmentally-regulated phaseolin gene was transcribed, and then translated into protein at a low level in the transformed undifferentiated sunflower callus. But in our experiments, although specific mRNA was detected in the transformed *S. nigrum*, no translated protein from the mRNA was found. This case was also found by Matzke et al.^[16] in sunflower, and moreover, they found that the mRNA isolated from transformed sunflower calli could be translated into a protein of expected molecular weight in *in vitro* wheat germ system. This implied that the mRNA was active. The reason that it was not translated in sunflower tissue but translated in a wheat germ system might be that maize and wheat were both monocots and that there might be similar regulating molecules in the wheat embryo and maize endosperm.

Zein proteins are the major storage proteins of maize. Their synthesis is primarily in the endosperm and the synthesis process is developmentally-regulated. And so, zein genes are likely to be expressed in only the seeds of transformed dicot plants. *S. nigrum* is a plant with high regeneration ability. The vector used in our experiments allowed the regeneration of whole plants from transformed tobacco tissues,^[18] but due to unknown reasons, only shoots were regenerated from the transformed calli of *S. nigrum*. The plants developed from the shoots were small and difficult to graft and therefore we could not study the expression of the zein gene in the seeds of *S. nigrum*. In order to make clear whether zein genes can be expressed in dicots by developmental regulation, we have constructed an expression vector pGV3850::Z19Km by introducing the Z19 gene in plasmid pGZ19AB1 into the Ti plasmid pGV3850 of *Agrobacterium* strain C58C1 (pGV3850). The oncogenes in the T-DNA of this vector completely removed. It should allow transformed tissues to regenerate whole plants.^[6] Furthermore, this vector contained a selectable marker, a chimaeric kanamycin-resistant gene, which could be expressed in plant cells. Transformation of plants using the *Agrobacterium* strain containing this vector is still in progress.

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References

- [1] Chilton, M.D. et al., Proc. Natl. Acad. Sci. U.S.A., 77(1980), 4060-4064.
- [2] Stachel, S.E. & Zambryski, P.C., Cell, 46(1986), 325-333.
- [3] Douglas, C.J. et al., J. Bacteriol., 161(1985), 850-860.
- [4] Stachel, S.E. et al., Nature, 318(1985), 624-629.
- [5] Wang, K. et al., Science, 235(1987), 587-591.
- [6] Caplan, A. et al., *ibid.*, 222(1983), 815-821.
- [7] DeCleene, M. & DeLey, J. Bot. Rev., 42(1976), 389-466.
- [8] Feng Xinhua et al., Scientific Communications, 32(1987), 613-615.
- [9] Graves, A.C.F. & Goldman, S.L., J. Bacteriol., 169(1987), 1745-1746.

- [10] Feng Xinhua et al., Genetic Manipulation in Crops Newsletter, 2(1986) 52-59.
- [11] Grimsley, N. et al., Nature, 325(1987), 177-179.
- [12] Beachy, R.N. et al., EMBO J., 4(1985), 3047-3053.
- [13] Sengupta-Gopalan, C. et al., Proc. Natl. Acad. Sci. U.S.A., 82(1985), 3320-3324.
- [14] Comai, L. et al., Nature, 317(1985), 741-744.
- [15] Shah, D.M. et al., Science, 233(1986), 478-481.
- [16] Matzke, M.A. et al., EMBO J., 3(1984), 1525-1531.
- [17] Goldsbrough, P.B. et al., Mol. Gen. Genet., 202(1986), 374-381.
- [18] Barton, K. et al., Cell, 32(1983), 1033-1043.
- [19] Jiang Xingcun et al., Scientia Sinica, Series B, 28(1985), 11: 1004-1008.
- [20] Dellaporta, S.L. et al., Plant Mol. Biol. Reporter, 1(1983), 19-21.
- [21] Maniatis, T. et al., Molecular Cloning--A Laboratory Manual, Cold Spring Harbor Laboratory, New York, 1982.
- [22] Grierson, D. et al., Planta, 163(1985), 263-273.
- [23] Thomas, P.S., Meth. Enzym., 100(1983), 255-266.
- [24] Esen, A., Plant Physiol., 80(1986), 623-627.
- [25] Jiang Xingcun et al., Acta Genetica Sinica, 10(1983), 283-290.
- [26] Murai, N. et al., Science, 222(1983), 476-481.
- [27] Gelvin, S.B., Plant Mol. Biol., 8(1987), 355-359.
- [28] Hunt, A.G. et al., ibid., 8(1987), 23-25.
- [29] Nagy, F. et al., EMBO J., 4(1985), 3063-3068.
- [30] Rochester, D.E. et al., ibid., 5(1986), 451-458.

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Briefs

CAD/CAM Program Introduced in Beijing--China's first national marketing exhibition of CAD/CAM software, held in Beijing, marked the continuing expansion of this modern technology within the country. One of the design systems on display, a system developed by the Great Wall firm, recently received a distinction from the Ministry of Machine-Building & Electronics Industry. The system operates with a Chinese-language command structure and, in its specifications, should reflect the current international state-of-the-art. [Excerpt]
[23020006 East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German No 9, 1988 p 3]

Briefs

English-Chinese Machine Translation System--At a press conference held in Beijing on 8 September, the China Software Technology Company (CSTC) formally announced its introduction of the logical-semantics-based "Transstar [Yixing 6230 2502] 1.0 English-Chinese Machine Translation System"--the world's first such commercialized system--to domestic and foreign markets. The system requires no preprocessing of the inputted English documents and performs in a fully automated fashion functions similar to human translation such as consultation of dictionaries, application of grammatical-rule analysis (functional relationship grammar is incorporated into the system's kernel language SCOMT), and step-by-step context-based generation of connected translation. The system contains over 100,000 English words in its memory, including over 40,000 commonly used entries. In addition, entries in specialized fields such as computers, communications, and economics average about 30,000 per field. This software can be run on Chang Cheng [Great Wall] 0520CH and GW286, Taiji 2220, IBM-PC/XT and AT, Wang, VAX, and 68000 computers. Inputting can be via keyboard, optical scanner, teletype, or FAX. "Transstar," which underwent accreditation in March 1987, received a prize for software excellence at the 1987 National Computer Applications Exhibition and was favorably critiqued at the 1986 Singapore International Information Exhibition, the 1987 Hong Kong Second International Software Exhibition and the 1987 Hong Kong International Translation Association Conference. Together with the Hong Kong Translation Center, CSTC is currently establishing Transstar (Hong Kong) Ltd. and Transstar (Shenzhen) Ltd.; with the largest American translation company, Alps, CSTC is now negotiating cooperative development of language-translation software and a jointly-run translation services company. [Summary] [40080034a Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 34, 7 Sep 88 pp 1, 40]

New CAD Workstation System--A key project in the state's Seventh 5-Year Plan, the KSJ-2413 machinery-design CAD workstation system, developed by the Chinese Academy of Sciences' (CAS) Shenyang Computing Technology Research Institute, passed technical certification by CAS in Shenyang on 30 August 1988. Having exceeded design targets, the KSJ-2413 has achieved card-level physical compatibility with the Applicon 4650 workstation's hardware, and is completely software compatible. Based on absorption of foreign technology, this independently designed and manufactured system is the first domestically developed host CAD workstation system; with an independently developed 2000-series computer, it forms a complete domestically produced CAD system which is at the forefront of domestic technology and whose advanced technological level is on a par with that of similar international products. For China's integrated electromechanical

industry, its development represents a major breakthrough. The hardware system, including five workstation boards, three interface boards, the power supply and the digitized instruments, is domestically manufactured. The software configuration is quite abundant, including systems software, support software, a methods library, an independently developed SAP5 [structural analysis program; cf with SAP84 in JPRS-CST-88-012, 12 Jul 88, p 75] preprocessor program, an ADINA preprocessor, Chinese-character editing software, and dBASE III document retrieval software. In addition to operating with Chinese-made 2000-series computers, the system can run on VAX and MicroVAX II computers. Of the several thousand VAXs, MicroVAX IIs, and 2000-series computers in the country today, a fair number of them are equipped with this workstation, a trend which can create enormous economic benefits and save the state a great amount of foreign exchange. [Summary] [40080034b Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 35, 14 Sep 88 p 1]

Environmental Protection Policies, Practices Outlined

Distinctively Chinese Environmental Control System

40081093 Beijing ZHONGGUO HUANJING BAO in Chinese 16 Aug 88 p 1

[Article: "Taking a Distinctively Chinese Road of Environmental Control. State Environmental Protection Bureau Chief Engineer Jin Jianming [6855 7003 2494] Replies to Reporters' Questions About the State Council-Promulgated 'Provisional Measures For Making Compensated Use of a Special Fund for Control of Pollution Sources'"]

[Text] At a symposium convened on 15 August, State Environmental Protection Bureau Chief Engineer Jin Jianming replied to reporters questions about the "Provisional Measures for Making Compensated Use of a Special Fund for Control of Pollution Sources" promulgated by the State Council.

Question: What is the role in the country's environmental protection work of charges for the discharge of pollutants?

Answer: Charges for the discharge of pollution hold an important place in the country's environmental protection work. The country's system of charges for the discharge of pollutants is both an important integral part and a symbol of China's distinctive environmental control. Charges for the discharge of pollutants is the use of economic means to toughen environmental monitoring and control, and to toughen monitoring and control of the sources of pollution. These charges are a concrete application of the laws of value of the socialist commodity economy to our environmental protection work. The institutionalization of charges for discharge of pollution and their codification in law is a first for China. After several years of exploration and practice, China has basically shaped a system of charges for the discharge of pollution that is fairly complete, and that is distinctively Chinese both in terms of a body of theories for collecting fees for the discharge of pollutants, and a series of guidelines for the levying of fees for polluting. The methods that the State Council has recently promulgated may be said to mark a major breakthrough in the making of payments for control of pollution, and for the theory of economic control of the environment.

Question: Won't the change from charges for the discharge of pollutants to the use of funds for which compensation is paid add to the burdens of enterprises?

Answer: The change from charges for the discharge of pollution to the use of funds for which compensation must be paid will not increase the burden on enterprises, but rather will make it more convenient for enterprises to raise the funds needed for pollution control. Currently, charges for discharge of pollution in China account for between .001 and .003 of enterprises' production costs, a percentage that is much lower than the depletion of, and damage to, resources caused by the discharge of pollutants in the course of enterprises' production, and which should be carried as a labor cost. The "Provisional Measures for Making Compensated Use of a Special Fund for Control of Pollution Sources" that has now been promulgated by the State Council has the following benefits for polluting units in making use of these funds to control sources of pollution: First is the low rate of loan interest, which is .24 percent per month for 1 year, .27 percent per month for 2 years, and .3 percent per month for 3 years. The measure provides for exemption from repayment of a certain portion of the funds by enterprises for quality and on-time completion of pollution control work. In addition, the measures also open four new channels for the repayment of funds by enterprises that insure enterprises' ability to make repayment. Of course, once a change has been made from charges for the discharge of pollutants to the use of funds for which compensation must be paid, this will increase polluting units' sense of urgency about controlling pollution. However, it will also genuinely increase enterprises capabilities and zest for controlling pollution, and this is precisely one of the major hoped for goals of this reform.

Question: Why is it that a "change from charges to loans" has been instituted for only some pollution expenses in the current change?

Answer: It should be said that a complete "change from charges to loans" is one of the directions of reform of the country's system for providing funds for pollution control. However, there is a problem here of changing and supplanting ideas, and enterprises have to go through an adaptation process too. Comrade Li Peng has stated explicitly that past provisions for using 80 percent of charges collected for the discharge of pollutants to help enterprises control pollution were in the nature of encouragements and special benefits. If an enterprise did not control pollution, or was unable to make effective use of these funds, these funds would not be given to the enterprise. There is a general understanding nowadays that payment of 80 percent of charges for the discharge of pollutants is an entitlement for enterprises, but this is theoretically untenable. One idea that some enterprises and some of our comrades must get through their heads is that it is the state and not enterprises that own the charges for the discharge of pollutants. In addition to thinking about the foregoing factors, we should also realize that China is a vast land that differs from one place to another in which the development of levies and charges for discharge of pollution is uneven, and cannot be done with arbitrary uniformity. It is necessary to begin with "both charges and loans," accumulate experience,

and set the stage for a gradual transition to a complete "change from charges to loans." The State Council measures take account of the above circumstances, and they were formulated after repeated discussions and serious study.

Question: What is the orientation of reform and the outlook for development of the country's system of payments to control pollution?

Answer: The overall orientation of reform of the system of charges for pollution control is for a steady deepening in keeping with reform of the country's political and economic systems, the better to serve the country's environmental protection endeavors. Specifically, the main actions to be taken within the near future in reform of the country's system of charges for control of pollution are as follows:

1. Formulation of more scientific standards for the discharge of pollutants, and going on to revise prevailing standards, following the principle that charges should be somewhat higher than control costs.
2. Strict law enforcement and tougher monitoring of the sources of pollution will require a strengthening of organizations and the building of a corps to supervise the levying of fees for pollution in order to improve and strengthen methods for collecting pollution expenses.
3. Every effort should be made to institute as quickly as possible the collection of cumulative fees for multiple offenses in accordance with the principle of equivalent fees for equivalent pollution. Because of the shortage of sources of water in China, fees should be collected as soon as possible for the discharge of waste water, using a two-track system of fees for discharges that exceed standards and for simple discharge.
4. Gradual complete institution of a total "change from charges to loans" for pollution control expenses, putting the country's environmental protection fund system on a broader basis.
5. Setting up a special environmental protection investment company or environmental protection bank for more scientific and rational methods of controlling and using pollution charges, and environmental protection funds.

Environmental Protection Plan for Year 2000

40091093 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 7 Sep 88 p 4

[Article: "China Sets Environmental Protection Plan Outline for 2000. Environmental Pollution To Be Basically Controlled by End of Century; Beginning of Change for the Better in the Trend Toward Ecological Deterioration"]

[Text] Xinhuashe. Beijing, 6 September. By the end of the present century, China's environmental pollution will have been basically controlled; environmental quality of key cities will have been improved; the trend

toward deterioration of the ecological environment will have begun to be reversed, and there will be coordinated development of the environment, the economy, and society.

This is the goal set here today in the "National Environmental Protection Plan Outline for 2000" following review and appraisal. This outline was drawn up by scientific research personnel from the Chinese Environmental Science Research Academy and the Ecological Environment Research Center of the Chinese Academy of Sciences following more than a year of wideranging surveys and the collection of data, the complete text of which was approximately 150,000 words.

According to the outline, by the year 2000, the discharge of industrial waste water will be held at approximately 50 billion tons; discharge of sulfur dioxide will be held at 20 million tons, and the discharge of dust will be less than 18 million tons. The forested area will have increased by 29 million hectares.

In order to realize the goals set forth, the plan lays out principle actions to be taken in environmental protection, including gradual implementation of a reporting and registration system for sources of industrial pollution, and a permit system for the discharge of pollutants. A registration system is to be instituted for toxic wastes and toxic chemicals, a production operations association for the rational use of resources is to be set up, and a system for compensated use of resources is to be instituted. The outline also proposes specific actions to be taken for a complete clean up of the environment of cities and key economic areas, for prevention and control of industrial pollution, for the production and building of township and town environments, for the exploitation and protection of natural resources, protection of water resources and bodies of water, protection of the marine environment, environment control, and environmental research.

The experts and professors who took part in the review and assessment meeting consider the outline to be an original scientific research achievement, and that the environmental goals and actions it sets are consistent with China's national circumstances. This research achievement will provide a scientific basis for future national and regional formulation of economic and social development, and environmental protection plans.

Government Work Report

40091094 Beijing ZHONGGUO HUANJING BAO in Chinese 18, 20 Aug 88

[Article by Qu Geping [2575 2706 1627]: "Exploration and Practice of China's Environmental Policy. 'Government Work Report' Delivered at the First Session of the Seventh National People's Congress on 25 March 1988"]

[18 Aug 88 p 3]

[Excerpts] A review of the history of the development of China's environmental problems enables us to see clearly that economic development

strategy has had a major influence on environmental protection. Every time a consistent and coordinated development strategy was instituted, the economy developed rapidly; the people's livelihood improved, and the environment also gained a certain amount of protection. Conversely, every time a rash advance strategy was carried out, economic development was slow or even went backwards, the people's livelihood suffered, and the environment also sustained very heavy pounding and damage. Economic development strategy not only was of decisive significance for economic development itself, but also generated decisive effects on environmental protection.

The major changes that have taken place in China's development strategy during the 1980's have generated far-reaching effects on the protection and improvement of the environment, which have been manifested primarily in the following ways:

First, the development policy has stressed sustained and coordinated development with emphasis on the readjustment and maintenance of a proper proportional relationship among all aspects of economic and social development, protection of the environment and safeguarding of the ecological balance being an important aspect of coordinated development.

Second, development goals have given attention not only to increasing quantity, but also to developing quality. They have paid attention to improving the people's livelihood, including improvement of the quality of environmental conditions.

Third, coming down on the side of improved benefits in the relationship between speed of development versus economic benefits has changed the past unconcern about economic benefits and the tendency toward one-sided pursuit of speed. This has greatly reduced the waste of energy and various resources in development and construction, and has also reduced pressures on the environment. An integration of economic benefits, social benefits and environmental benefits was explicitly called for; no longer can attention be given only to economic benefits to the neglect of environmental benefits.

Fourth, in the expansion of reproduction, emphasis was placed on the tapping of potential and the technical transformation of existing enterprises, meaning that new technologies and new techniques were used to expand production capacity and scale, instead of foolishly building new plants and expanding old ones. This policy held major significance for the prevention and control of industrial pollution.

Progress in China's Environmental Policies

China was later than western countries in understanding environmental problems. Up until 1972, environmental problems that had appeared and developed had not yet alerted people. Consequently, for more than 20 years, despite some relevant policies, there was no special policy for protection of the environment.

The Stockholm Human Environment Conference of 1972 spurred China's environmental protection endeavors. This conference made us realize the seriousness of environmental issues, and we began to formulate environmental protection policies. We drew up environmental protection plans, and we prescribed standards for the discharge of toxic industrial wastes.

The environmental protection plan called for complete planning, rational patterns, multiple use, turning disadvantages into advantages, reliance on the masses, everyone lending a hand, protecting the environment, and creating benefits for the people. This plan stated clearly that the goal of environmental protection was to bring benefits to the people. It also provided for a plan pattern and multiple use of resources as basic actions for environmental protection. It should be said that this plan was a good one.

"Various Provisions Pertaining to Environmental Protection and Improvement of the Environment" set forth policy provisions in ten areas as follows: A good job of master planning; a rational pattern for industry, gradual improvement of the environment of old cities; multiple use of things, turning disadvantages into advantages; greater protection of soil and plants; greater control over water systems and maritime space; afforestation and the greening of the motherland; diligent development of environmental monitoring; vigorous development of scientific research for environmental protection; doing a good job of propaganda and education; and all the investment, equipment, and materials needed for environmental protection should be planned for and provided. These regulations played the role of a provisional environmental protection law during the period 1973 through 1978.

In 1973, "Standards For the Discharge of the Three Industrial Wastes" [waste water, waste gas, and industrial residue] was additionally promulgated. The policy provisions in the above three regards, though incomplete, were necessary and correct. Nevertheless, during the tumultuous years of the Great Cultural Revolution, conscientious implementation of these policies was impossible. Naturally, the policies themselves were deficient to some extent. For example, some provisions were exhortatory, not binding, and some provisions were too drastic and difficult to enforce. In addition, environmental control organizations were not sound, and both monitoring and control were weak and ineffectual.

Since 1979, the country has promulgated a series of environmental protection laws, and single laws for protection of the marine environment, for prevention and control of water pollution, for prevention and control of atmospheric pollution, and for natural protection, as well as a series of regulations and standards. The Second National Environmental Protection Conference, which was convened in late 1983, pushed China's environmental protection endeavors to a new stage. It was this conference that drew up major policies for China's environmental protection endeavors.

First, it stated explicitly that environmental protection is a strategic task in modernization, and is a basic national policy, thereby defining the important position of environmental protection in economic and social development.

Second, it formulated a strategic plan for the country's environmental protection endeavors, namely, synchronized planning, synchronized execution, and synchronized development in the building of the economy, the building of cities and the countryside, and the building of the environment for the realization of unified economic, social, and environmental returns. This was a new development plan that put "prevention first." It was the correct way to deal with and solve conflicts between development and the environment.

Third was preliminary planning of the main goals, steps, and actions for China's environmental protection by the end of the present century.

Fourth was the decision to make tougher environmental controls a key link in current work, using controls to solve those environmental problems that could be solved without spending money or by spending only a little money.

Guided by the foregoing plan, all levels of government from the central to the local continued to formulate concrete policies, laws, regulations and standards that gave powerful impetus to the development of environmental protection endeavors. This showed that we had taken a step forward in understanding China's circumstances and in adopting corresponding policies.

Practice showed repeatedly that correct policies can guide and give impetus to the smooth development of endeavors, while mistaken policies may muddle endeavors. By policies is meant the rules for action that the state or regions formulate in order to realize certain lines and tasks during a certain historical period. China's environmental policies may be summarized under three major policy headings, namely preventive policies, policies requiring those who pollute to clean up, and policies to toughen environmental controls. Now let us look at how these policies have been executed.

2. The Prevention First Policy

At the Second National Environmental Protection Conference, which was convened at the end of 1983, the Deputy Premier at the time, Li Peng, announced two major policies. The first was that environmental protection is a basic national policy for China; the second was synchronized development in the building of the economy and the environment. He pointed out that "We stand for the need to solve environmental pollution and damage to the ecology in the course of building the economy, so that the building of the economy and protection of the environment develop in tandem. Environmental protection work should create a fine environment in which people are better able to work and live. At the same time, environmental protection should insure and promote development of economic construction. In a word, the building of the economy, the building of cities and the countryside,

and the building of the economy require synchronized planning, synchronized execution, and synchronized development to achieve unified economic benefits, social benefits, and environmental benefits. We have to proceed from this guiding idea to actively prevent pollution, improve the ecology, advance the four modernizations, and bring benefits to the people." Facts have demonstrated that pursuit of a policy of synchronized development is the correct way in which to solve conflicts between development and the environment. Not only does it help protect the environment; it also helps sustained and consistent development of the economy. Of course, synchronous development is not the same thing as equal development. Environmental protection absolutely cannot lay the same claim on the nation's financial and material resources as economic construction. For a very long historical period, economic construction will, and should, hold priority for the allocation of resources. What we require is unified planning that takes all factors into consideration, and proper planning for development of the economy and protection of the environment. One important standard for examining the appropriateness of environmental protection is whether it is consistent with what the economy can bear at the time. At the present time, environmental protection funds amounting to approximately 1 percent of national revenues is about right for China. This is the overall policy limit.

China's promotion of a synchronized development policy for building the economy and protecting the environment is of fairly recent origin; nevertheless, it has begun to be carried out in many ways, and has achieved very good results.

(A) Environmental protection has been made a part of national economic and social development plans. During the 33 year period from 1949 through 1982, China carried out five 5-year plans, none of which included environmental protection as part of national economic and social development. Under the economic system at the time, environmental pollution and damage were deemed to be unavoidable, and practice has fully attested to this point. In the Sixth 5-Year Plan for economic and social development announced at the end of 1982, environmental protection was included for the first time. It provided for prevention and control of industrial pollution, protection of the water quality of rivers, lakes, reservoirs, and the oceans, protection of the environment of major cities and the countryside, and protection and improvement of the natural ecological environment. It also proposed five measures, including policies, rules and regulations, monitoring and control, and funds. Every jurisdiction and every department concerned also made provisions for environmental protection in their own plans in accordance with requirements of the national plan.

During the Sixth 5-Year Plan period, 12 billion yuan was invested in prevention and control of industrial pollution. This was 0.36 percent of gross industrial output value. Remarkable advances were scored in completion of the harnessing of a number of sources of industrial pollution. Not only was the trend toward a dramatic worsening of pollution brought under preliminary control, but some pollution indices also declined.

Very great advances were scored during the Sixth 5-Year Plan period in curbing industrial and urban pollution, making this the most effective period for environmental protection for more than 30 years in New China. Environmental protection continued to be made a part of the 1986-1990 Seventh 5-Year Plan for national economic and social development, and the emphasis and actions were more realistic than during the Sixth 5-Year Plan. Implementation during 1986 and 1987 showed a marked improvement in both investment and achievements in the prevention and control of pollution. This demonstrated that environmental protection had begun to be addressed as a problem in national economic and social development.

Nevertheless, some of the environmental protection goals and criteria set in the Sixth 5-Year Plan were not achieved for two main reasons: First, plan targets had not been put into effect at every level. Though the state and the top levels of provinces had produced plans, these plans had not been completely put in place in cities and in industrial and mining enterprises. Nor had there been a strict system of inspection and examination like the one used for industrial and agricultural production. Environmental protection plans did not become "hard" quotas that had to be fulfilled, but "soft" quotas that could or could not be fulfilled. Second, investment was proportionally too low. In terms of the newly built and expanded large and medium size industries, investment should have been 13.6 billion, but it was actually only 4.3 billion, or 31.6 percent of the required amount. These problems showed that serious shortcomings remained in plan control and environmental control.

(B) Complete Clean-Up of the Urban Environment. Cities are the places in which environmental pollution is most concentrated and most serious. Despite many years of clean-ups, not much has been achieved. The main reason for this is insufficient understanding of the complexity of urban environmental problems. Band-Aid solutions were sought instead of regarding the urban environment as a huge piece of systems engineering requiring complete renovation. In recent years, we have come to realize as a result of a summarization of experiences that such individual treatment methods do not suffice, and we have come up with plans for complete renovation of urban environments. Practice has demonstrated this to be a correct policy that has produced fine results. The main policy actions taken have been as follows:

First has been to begin by drawing up master plans for cities that prescribe a rational pattern for industry. The serious pollution of China's urban environment is directly related to the irrational pattern of industry. During the 1960's, city plans began to be destroyed as large numbers of seriously polluting industries were placed in the middle of cities, in densely inhabited areas, near headwaters, and in scenic tourist areas where they created serious pollution damage. For this reason, unless the problem of the location of industry was solved from a policy standpoint, it would not be possible to improve the quality of the urban environment. During the 1980's, cities throughout the country instituted master plans. A rational pattern for industry, and the prevention and control of environmental pollution became the key ingredients of these master plans. As of

the end of 1985, 98 percent of the 324 cities not under direct central government or province control, and 83.9 percent of the 2,014 county seats throughout the country had completed master plans, and their examination and approval. At least six of the eight master plans for Xian city that the State Council approved had to do with environmental protection issues. It should also be noted that henceforth there was to be no further new construction or expansion of polluting industrial projects in urban areas that antagonized the populace. Comprehensive technical transformation plans had to be drawn up for existing industries for active control of existing industrial pollution. Even for a heavy industrial city such as Anshan, in approving the urban master plan, the State Council repeatedly stressed the importance of environmental protection and a proper pattern of industry. Seven of 10 instructions related to environmental protection. It was explicitly stated that where there was an irrational layout of enterprises and serious pollution that could not be readily brought under control within a short period of time, a decision would have to be made to make readjustments or to move them. In all the urban master plans that the State Council approved, the importance of a rational pattern of industry and protection and improvement of the environment were stressed. As a result of urban master plan requirements and the strictures of related laws, the problem of large and medium size industrial projects being placed helter-skelter without regard for environmental protection requirements was substantially controlled, and the existing irrational industrial pattern was also actively readjusted. During the first 2 years of the Sixth 5-Year Plan alone, more than 11,000 seriously polluting plants were closed, halted, merged, or retooled. Improvements to urban industrial patterns became the main avenue for controlling urban environmental pollution. Today the problem is, first, the need to continue to readjust irrational industrial patterns, and second, the need to diligently control an irrational pattern of small industries.

Second, atmospheric pollution was brought under control by changing the make-up of urban energy sources and burning methods. Atmospheric pollution in China's cities is of the "coal smoke type." Prevention and control of this kind of pollution requires proper energy policies. China is a developing country with limited economic strength; it is unable to change completely from coal to gas in cities, much less to electricity. For the time being, it can only follow the road of combining the "native" and the "foreign," using multiple means. First, it has to actively expand the percentage of gas used for fuel, combining urban use of coal gas with the use of combustible gases produced by industrial and mining enterprises, oil well gas, and oilfield associated gas. Current statistics show the urban gasification rate to have risen from 13.9 percent in 1978 to 28.5 percent in 1986, and plans call for it to reach 50 percent by the end of this century. Second is the development of central heating in cities, replacing the present scattered and backward methods of supplying heat with heat supplied to whole sections and areas of cities. Electric power plants in cities should also be required to link thermoelectricity to production. Third is promotion of briquets, running raw coal through simple processing to convert it into different shapes to meet different needs. Practice has shown that the promotion of briquets both saves coal

and reduces pollution. In addition, it has the advantages of requiring little investment, showing fairly quick results, and being simple to do. Generally speaking, there is a more than 15 percent saving from the burning of briquets versus raw coal, and a more than 50 percent reduction in the amount of smoke and dust released. If a sulfur stabilizer is mixed with the briquets, the amount of sulfur dioxide discharge may be reduced by between 60 and 70 percent. This may be termed a "native method." China is presently actively taking action to promote briquets vigorously.

Thanks to the adoption of the foregoing measures, despite a great increase in the amount of coal used, there has been no corresponding worsening of urban atmospheric pollution, and practice has shown these multiple actions to have been effective. Nevertheless, the level of use of these multiple measures is still not very high; specifically, the supply of heat from central sources and the rate at which briquets are used is not high, and atmospheric pollution remains very serious. How to improve the effectiveness of these multiple measures remains a major task confronting us.

Third was making a start in safeguarding and conserving water sources, preventing and controlling pollution of urban water sources. Like pollution of the atmosphere, pollution of water sources is also a large environmental problem confronting cities. China has very few facilities for the processing of waste water, and almost all waste water is discharged untreated. Multiple methods were also used to control water pollution. We made prevention and control of pollution of water sources the key point in prevention and control of urban water pollution. We formulated unified plans for the development, use, and protection of urban water resources, and we designated protected areas for urban drinking water, strictly prohibiting the building of any water polluting projects within the protected areas. Accompanying development of economic construction has been a year-by-year increase in the amount of urban waste water. However, the good quality of urban drinking water sources has been maintained, showing the role of policies in safeguarding sources of drinking water. The widespread launching of a campaign to conserve use of water was also an important measure in curbing water pollution. Policies such as the setting of water consumption quotas for industries, institution of planned use of water, encouragement to enterprises to remove pollution and separate water from different sources, and to increase the water recycling rate were very effective in the water-short northern part of the country. In addition, a policy of combined decentralized and centralized processing was instituted for the processing of urban waste water. This both hastened the building of urban sewage disposal plants, and also promoted decentralized processing by industrial enterprises, particularly for the processing of waste water containing heavy metals and high toxic materials. The adoption of the foregoing policies ameliorated the trend toward a dramatic worsening of water quality.

Fourth was the launching of a campaign of "realistic actions for realistic results." This was a call made on behalf of the State Council by Li Peng, the deputy premier at the time, that required provincial governors, mayors, and county magistrates to do several things within a certain period of time

to protect the environment. Statistics show that during the past several years more than 5,000 projects have been carried out to protect the environment, more than 2,500 of them having been completed in 1987 alone. Statistics from 60 key cities show the building in 1987 of 190 smoke and dust control zones covering an area of 758 square kilometers, the dredging of 147 streams having a length of 968 kilometers, and the dredging of 22 lakes. Some cities also instituted new and stricter measures for the protection of their sources of drinking water. Newly built zones in which noise levels met standards numbered 350 covering a 710 square kilometer area. These achievements were applauded by the masses.

Practice has shown the clean-up of the urban environment in multiple ways to be a correct policy. Its correctness lies in improvement of the quality of the urban environment having been made an important government responsibility that must also be done in combination with urban renewal and development. Currently, this policy is very imperfect, particularly with regard to specific provisions. It lacks annual plan provisions under guidance of intermediate term plan; key points have not been highlighted; and goals are not concrete. Consequently it awaits further perfection and improvement.

(C) Strengthening environmental control over new construction, expansion, and renovation projects for strict control over new pollution. More than 70 percent of water, air, residue, and noise pollution comes from industry; therefore, control of environmental pollution requires control of industrial pollution first of all. The building of China's industry is being carried out on a large scale, industrial output value growing by as much as 10 percent annually. Therefore, control of new industrial pollution holds special significance. We have instituted two principal policies in this regard. The first is a system for evaluating environmental impact; the second is a system for building facilities to prevent and control pollution at the same time as the main production project is being built. These two policies have been very successful.

The evaluation of environmental impact is an assessment of the possible bad effect on the surrounding environment generated by the building of a project. Its main role lies in making rational selections of project sites. Other locations must be found for projects that may produce good returns on investment, but that may not be built because they are sited wrong, seriously pollute the environment, damage the ecological balance, and affect long-term development. The promotion of such policies fundamentally insures a rational pattern for industry. Yet another role of the environmental impact evaluation system is that it can provide requirements for the prevention and control of pollution in the development of construction projects, preventing new sources of pollution from arising. Results have been outstanding during the past several years from the system of environmental impact statements inaugurated in the 1980's. Statistics show that between 1981 and 1985, 76 percent of all large and medium construction projects in the country instituted the environmental impact statement system; and during 1986 and 1987, 100 percent of large and medium industrial construction projects throughout the country instituted the environmental impact statement system.

In order to improve the quality of environmental impact statements, in 1986, the State Environmental Protection Bureau began a one time examination of the qualifications of units throughout the country engaged in environmental impact evaluations work, issuing "evaluation certificates" to more than 400 units meeting requirements. In addition, environmental protection units in all provinces, autonomous regions, and municipalities under direct central government control were also issued certificates, bringing the total number of units throughout the country receiving certificates of qualification to make evaluations to 1,000.

Regulations requiring the building of facilities to prevent and control pollution simultaneous with the building of the main production project include the simultaneous planning, simultaneous construction, and simultaneous going on stream of facilities for the prevention and control of pollution and the main production project. This is termed the "three simultaneous" regulation, for short. The goal of this policy is to insure that once a project has been built and goes into production that all emissions will be consistent with the requirements of environmental discharge standards. This regulation was first proposed during the 1970's; however, it was only after promulgation of the environmental protection law in 1979 that it was generally extended to industrial construction. The "three simultaneous" regulation has been perfected through several years of effort to play a major role in controlling new sources of pollution. In 1978, the "three simultaneous" compliance rate for small scale construction projects had also reached almost 70 percent.

Practice has shown that the environmental impact statement system, and the "three simultaneous" system have had a positive effect in curbing new sources of pollution. The country's economic construction, and particularly its industrial construction, has developed with lightning speed, but environmental pollution has not correspondingly worsened, thanks to the role played by these two systems. Numerous problems also exist in carrying out these two problems, the principle one being the "arbitrary uniformity" of the "three simultaneous" standards. For large, medium, and small projects alike; and for seriously polluting projects and relatively light polluting projects, the same standards are enforced. This flies in the face of the basic principle of applying different requirements to different situations. Likewise, no distinction is made between present standards and future standards with regard to time limits. For example, the construction period for some projects is fairly long, so by the time the project is built, it may be unable to meet the standards at that time. In addition, numerous projects have established facilities for the prevention and control of pollution in accordance with the "three simultaneous" requirements, but no one operates them conscientiously. Surveys show that approximately one-third of facilities are not operated. The foregoing problems show that the country's environmental controls are still in a backward state.

3. The Policy of Pollution Clean Up To Be Done by the Polluters

Ever since the United Nations Economic Cooperation and Development Organization proposed the Japanese environmental policy of "polluters bear responsibility" as a principle, this principle has been adopted by numerous countries. China's principle of "whoever pollutes cleans up" stems from this principle. Institutions of this policy mostly requires solution to two problems. The first is to spell out responsibility for the environment. Enterprises and entrepreneurial units unabashedly pollute the environment without bearing responsibility for cleaning up the pollution, instead saddling the government and society with the responsibility. Implementation of this policy requires, therefore, the rectification of this upside down responsibility, the responsibility for cleaning up being borne by those who pollute. Second is to solve the problem of funds to clean up environmental pollution. Because of the past upside down responsibility for the environment, the government bore much the responsibility for providing clean up funds; however, the government's financial resources are limited, so it can scarcely bear this tremendous pressure. As a result, there has been no effective clean up of the environment for a long time. Implementation of this policy will require that polluters bear responsibility for providing clean up funds.

Nevertheless, when this policy became codified in the "Environmental Protection Law" of 1979, it was very difficult to enforce. This was because the economic system at that time did not favor enforcement. Since the government controlled enterprises too much and too closely, enterprises lacked initiative for taking charge of operations and participating in market competition. Enterprises' production plans were assigned by government departments; enterprises' raw and processed materials, and energy were allocated by the government; and the products that enterprises produced and the profits they earned had to be turned over to the state in toto. When enterprises expanded reproduction, they had to obtain approval from government departments, and the government disbursed the necessary funds. In short, enterprises had no authority to run operations themselves. Likewise, enterprises' prevention and control of pollution had to be made a part of state plans for the allocation of funds. Enterprises had neither responsibility for the prevention and control of pollution nor the authority and ability to control pollution.

With the pervasive development of economic system reforms during the 1980's, there has been a separation of government and enterprises, and the delegation of administration and control to enterprises. Only after this time had arrived did enterprises begin to have the internal and external conditions needed to clean up pollution, and only then did the policy of "whoever pollutes cleans up" begin to be enforced.

The policy of "whoever pollutes cleans up" is manifested today mostly in the three following ways:

(A) Prevention and control of industrial pollution in concert with technical transformation. Most of China's industrial enterprises got started during

the 1950's. Surveys show that the technology and techniques used in approximately 60 percent of them are outdated. Consequently, raw materials consumption is high, large amounts of wastes are discharged, and pollution is serious. Thus, the technical transformation of industries is not only a positive means of expanding production capacity and improving economic returns, but also is an important way in which to reduce pollution and improve the environment. In February 1983, the State Council promulgated "Several Regulations On Combining Technical Transformation With Prevention and Control of Industrial Pollution," the principal content of which was the use of advanced techniques and equipment to improve the utilization rate of resources and energy, eliminating pollutants in the production process; making multiple use of industrial wastes in combination with technical transformation in an effort to turn wastes that harm the environment into resources. It also provided that funds used for the prevention and control of pollution should be no less than 7 percent of gross investment. Very great advances have been made during the past several years in combining technical transformation with the prevention and control of pollution. Between 1981 and 1985, 152.4 billion yuan was spent nationwide for technical transformation in the transformation of more than 200,000 industrial enterprises. In addition to improving production capacity and economic returns, there has been a marked reduction in effluent that harms the environment such as waste water, waste residues, and waste gases. Statistics for the years 1983 through 1987 show that technical transformation has saved the equivalent of 160 million tons of standard coal alone. Gross output value increased 92.4 percent between 1981 and 1986. However, except for an increase in the amounts of waste water and waste residues discharged, there was varying degrees of improvement in other indices.

However, by comparison with enforcement of the environmental impact statement system and the "three simultaneous" system, there is a very great shortfall in enforcement of the regulations regarding the combining of technical transformation with the prevention and control of pollution.

By regulation, no less than 7 percent of the investment made in technical transformation should be used in the prevention and control of industrial pollution; however, only 2.2 percent has been used in practice, an amount far lower than the prescribed lowest limit. This also reveals a lack of effective monitoring in environmental control.

(B) Time Limit for Clean-Up of Industrial Pollution. As a result of the long neglect of environmental protection work in the course of China's industrialization, pollution is serious, and there is a very large backlog of work to be done that cannot be handled in a very short period of time. Thus, it is possible only to divide up priorities for pollution damage to the environment, and deal with them over a period of time. In accordance with the principle of "whoever pollutes cleans up," in 1978 the state assigned 167 key sources of pollution to be cleaned up within a prescribed period of time. By 1985, all of these projects had been completed one after another. In addition, all jurisdictions also assigned a number of clean-up projects for completion within a prescribed period of time totaling more than 100,000. All of these clean-up tasks have also been substantially

completed as required. Liaoning Province is one of China's old industrial bases having a high percentage of heavy industry. Adhering to the principle of "concentrating forces to seize key points," this province listed 132 large and medium size enterprises that accounted for more than 70 percent of the total amount of pollutants in the province as key points for the prevention and control of pollution, and fixed a time limit for clean-up. In recent years, when the gross output value of the province industry has increased by an average 7.8 percent annually, the amount of industrial pollutants has decreased year by year, the amount of waste water discharged has dropped 14.5 percent, and the industrial waste processing rate has risen 23 percent. Oil, phenol, and cyanogen pollutants in waste water have decreased 80 percent, and heavy metals such as mercury, cadmium, lead, arsenic, and chromyl have declined by 88 percent.

The removal of those plants that were improperly sited, and the discontinuation of industrial manufactures that cause serious pollution were also important parts of the clean-up to be done within a limited period of time. In recent years, large and medium size cities, particularly cities noted for their scenery, have closed or moved out a number of plants that produced serious pollution. One example was Hangzhou, which closed or moved 76 plants in order to protect the scenic area around West Lake. Guilin also removed or closed more than 20 plants in order to protect the Guilin scenic area. In the machine industry, more than 7,600 production sites engaged in casting, forging, heat treatment, and electroplating, which cause heavy pollution, have been eliminated. The petrochemical industry, non-ferrous metals industry, light industry, and chemical industry have discontinued a number of products that cause serious pollution as part of their industrial readjustment and product updating. In 1983, the chemical industry halted production of organic chlorine pesticides such as hexachlorocyclohexane [BHC], and DDT at scores of plants, and mercury and arsenic pesticides are also being phased out.

Practice during the past several years has demonstrated that placing time limits for the clean-up of industrial pollution has been a successful policy. Its success stems from, first, the focus on key sources of solution against which financial and material resources can be marshaled for a clean-up; therefore, results are outstanding. Second, simultaneous with the pressures brought to bear, industrial enterprises also have a certain amount of freedom and time. Within the time constraints that have been set, enterprises may select the most economically effective way of preventing and controlling pollution. Third, to a certain extent it also solves the problem of funds for the prevention and control of industrial pollution. This is of particular importance, because enterprises frequently emphasize their lack of funds as a reason for not cleaning up. Statistics from key enterprises in the metallurgy industry show that prior to 1980, enterprises themselves supplied 50.7 percent of the funds used in the prevention and control of pollution. During the period 1981 to 1985, this increased to 61.5 percent, and during the 2 year period of 1986 and 1987, if the portion of pollution fees returned are included, it amounted to 100 percent.

[Excerpts] There were two main shortcomings in carrying out the policy of limited time clean-up. First, though plans were made, there was a lack of regular monitoring and inspection. Some limited time clean-up projects dragged on and on. In addition, once the limited time clean-up projects had been completed, no one conducted a diligent inspection preliminary to acceptance. Many projects started out with a bang only to fizzle out, degenerating into formalism. Second, no regular system had been shaped for the limited time clean-ups. Once a group of them had been completed, there were no plans to get on with the second group, and the third group at once.

(C) The system of charges for discharging pollutants. This system employs economic means to achieve the goal of controlling or reducing environmental pollution. The background to the extension of this system is as follows: Industrial enterprises created very large economic losses by discharging large quantities of pollutants into the environment. If this were allowed to continue, not only would it increase the burden on society, but it would also obscure responsibility for the environment, and this would be very bad for the prevention and control of pollution. Promotion of a system of charges for discharging pollutants had as its purpose the changing of this inequitable situation.

This system prescribed no levying of charges for the discharge of pollutants on those who abided by the standards set by the state or by local jurisdictions for the discharge of pollutants; charges were levied only against those who exceeded the prescribed standards for the discharge of pollutants. This was a way of preventing industrial enterprises from passing on to society the charges for prevention and control of pollution. The turning inward of costs that should not be borne externally resulted in the amassing of pollution prevention and control fees that enterprises should have paid but did not. These funds were then used to prevent and control local pollution or major sources of pollution. This policy holds positive significance in both theoretical and practical terms, and it has been developed further as a result of several years of practice. Not only does it prescribe the "collection of charges for exceeding standards," but "collection of charges for polluting" has been prescribed in addition. This means that all polluting units have to pay pollution charges based on the amount and concentration of the pollution they cause, even when the pollution meets prescribed standards. This is because the ever increasing discharge of pollutants resulting from the steady development of industry requires more severe restrictions.

The system of charges for polluting has been gradually extended throughout the country during the past several years, the area covered increasing. Today, collections are made in 50 percent of the places where collections should be made. Collections, which began with industrial enterprises, have been extended to public agencies, official organizations, and official groups. They have begun to be expanded from large and medium size urban enterprises to township and town enterprises, and collections are beginning to be made for multiple infractions instead of the former single infraction.

Nearly 1.5 billion yuan annually is now being collected in fees amounting to one-third of current expenses for cleaning up environmental pollution.

The system of charges for polluting is an important method used in China to toughen environmental control, and it has played a positive role in controlling environmental pollution. First, it has made enterprises institute controls and it has promoted a clean up of pollution. Since the collection of fees for polluting affects enterprises' own economic interests, the operators of enterprises have changed from being negative and passive to being positive and active in their prevention and control of pollution. Enterprises have begun to set up strong control system, and to spell out the environmental responsibilities of individual workshops, sections, and positions. By curbing evaporation, seepage, drips, and leaks, they have decreased consumption of raw materials and energy. Multiple use and purification of pollutants have steadily reduced the amount of pollutants discharged for very good environmental and economic benefits. Second, a source of funds for cleaning up the environment has been found. Statistics from more developed provinces show charges for pollution account for between one-fourth and one-third of expenses for cleaning up pollution, giving powerful impetus to cleaning up pollution.

Of course, this system is not yet perfect. There are still many places requiring improvement in the collection, control, and use of funds. For example, collections are made in only 50 percent of the places where collections should be made, and there is an additional large amount that should be collected, but is not. How to effectively use the fees that have been collected also poses quite a few problems. In addition, rates are too low, with the result that many enterprises would rather pay the charges than clean up the pollution. These problems will have to be steadily resolved practice.

4. Plan For Toughening Environmental Control

The main actions to be taken in toughening environmental control are as follows:

First is the formulation of laws and regulations. We have successively promulgated the "Environmental Protection Law," the "Marine Environment Protection Law," the "Law For the Prevention and Control of Water Pollution," and the "Law for the Prevention and Control of Atmospheric Pollution." The State Council has also published more than 10 administrative regulations on environmental protection, and has also drawn up more than 100 environmental standards of various kinds in conjunction with these regulations. Individual provinces and regions have also formulated a number of local laws and regulations. Though China's environmental protection laws and regulations are not yet as completely developed as those of industrially developed countries, nevertheless, there are laws and regulations that apply to the main objects of environmental protection and the main sources of pollution. These address the key points and crucial areas. They provide a foundation to which all trades and industries can adhere, and they also provide a basis for environmental control.

Second is the building of environmental control organizations and improvement of monitoring and control. More than 10 years of practice tell us that no matter how good plans, policies, programs, and regulations, unless there is an organizational structure to provide support, and unless there is a well trained corps of people to carry out monitoring, they are of no significance. China's environmental control organizations have gone through a development process that began with nothing, grew, and became strong. Since the Second National Environmental Protection Conference of 1983, in particular, control organizations have expanded greatly in response to the need for tough controls, from the top level of the central government to all levels of local governments. Today, environmental control organizations have been preliminarily established at five levels, namely the national level, the provincial level, the city level, the county level, and the township and town level. At the state, province, and city levels, associated scientific research, monitoring, and publicity and education centers have been set up. According to 1986 statistics, environmental control units at the county level and above together with subordinate organizations totaled 4,403, and had 46,130 personnel.

The main duties of environmental control at all levels of government are as follows: To formulate environmental protection plans, and to monitor enforcement of environmental protection laws and regulations; to coordinate contacts among all parties, and to guide environmental work in all regards. This is to include the monitoring of law and regulation enforcement as the main duty. Very great progress has been made in environmental control during the past 5 years, and has been manifested primarily in the following ways:

Formulation of environmental protection plans and policies that are quite in keeping with the country's circumstances, environmental protection and economic construction beginning to tend toward coordinated development.

Strengthening of monitoring and control, environmental planning, rules and regulations, and standards for a beginning in achieving conscientious enforcement; institution of a pollutant discharge system, particularly with regard to changing the irrational pattern of industry; institution of an environmental impact statement system and a "three simultaneous" system for the building of industries, transportation and energy producing plants, with monitoring having been very effective.

Improvement of organizational coordination, with the building of working relationship among planning, economic, agriculture and forestry, urban construction, scientific research, publicity, and educational groups at all levels to effect a coordination of planning and relevant policies to bring about the beginnings of a change in the situation existing in which environmental control units battled independently.

Third is the launching of widespread publicity about environmental protection to heighten consciousness of the environment among all nationalities. China has a huge population with a relatively backward cultural and educational level, and little knowledge of environmental protection.

Therefore, raising public consciousness of the environment becomes an important requirement for good performance in environmental protection work. Several environmental protection publicity month campaigns have been launched nationwide in the past, but in recent years, more emphasis has been given to day-to-day publicity. In addition to the use of publicity units available in society to provide publicity, environmental control units in all jurisdictions have set up their own publicity and education centers that have widely used radio broadcasts, television, films, newspapers, and magazines, as well as exhibits, information competitions, public lectures, academic discussion conferences, and press conferences to conduct publicity. Public awareness of the environment has risen markedly as a result of many years of publicity. One social survey showed that 85 percent of the people knew that the country had environmental protection laws, and 62 percent knew that the job of environmental protection is the prevention and control of pollution and safeguarding the ecological balance. Public monitoring, criticism, whistle blowing, and complaints about violations of environmental laws and regulations have become increasingly frequent.

In its publicizing of the environment, China has paid special attention to publicity directed against policy makers and people in control positions. How well policy makers and those in control positions are informed has a major effect on environmental protection. One might say that as a result of many years of publicity, policy makers and control personnel at all levels have a much greater consciousness about the environment, and that a marked change has taken place from open resistance to environmental protection to active concern for environmental protection. Today, a large number of control personnel who are enthusiastic about environmental protection has appeared in all areas, and all industries, among them numerous ministers, provincial governors, mayors, county magistrates, township leaders, and plant managers. The advances made in environmental endeavors in recent years are closely associated with the support given by control cadres at all levels.

What results have been gained from China's toughening of environmental control? Practice has provided an answer. All the accomplishments made in recent years in the control of pollution and improvement of the environment might be said to be the result of a strengthening of environmental controls. Experts predict that no less than 1.5 percent of national revenue will be required to control the spread of environmental pollution and to clean up the environment. On this basis, 38.1 billion yuan would have to be spent between 1981 and 1985 to clean up pollution. In fact, however, only 17 billion, or 44.5 percent of the needed expenditure, was spent. During the period, environmental quality criteria for most cities and principal rivers were maintained at around the 1982 level, except for individual instances of a worsening; the tendency for a deterioration in environmental quality as the economy expanded was brought under preliminary control. Why was this? The main reason was the strengthening of controls. Of course, the level of this control of pollution was not high, nor was it solidly based. Nevertheless, despite a relatively small amount of investment, pollution

was brought under preliminary control, showing the power of tougher controls. This was also a rarity in environmental protection among the countries of the world.

It is apparent from the foregoing brief review that the several environmental policies that China has instituted have been in keeping with the country's circumstances. Consequently, not only have they yielded marked environmental benefits, but very good economic and social benefits as well. The outcome of environmental protection is not to impede economic development, but rather to promote it. Practice has shown China's policy of developing the economy while protecting the environment to be correct.

However, the foregoing several policies have not been pursued for long; achievements do not yet amount to very much; and insufficient experience has been gained. In the process of carrying out these policies, we have also had the feeling that specific policies lack coordination, that monitoring and control is not rigorous, that there are quite a few problems, and that they are not in keeping with the needs of national economic and social development. In particular, we are faced with numerous environmental problems that are very serious; there is no reason at all to be conceited or smug.

Recently, Premier Li Peng said, "We can neither copy mechanically the methods found in books or used by foreign countries in construction and reform, nor can we proceed from subjective desires, be divorced from realities, or just do as we please. We must act on the basis of our national circumstances, adhere to the principle that practice is the sole criterion for testing truth, and strive to explore our own road." We will abide by this policy, and continue to explore and pioneer a distinctively Chinese road for environmental protection and do a good job in China's environmental protection work.

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FACTORY AUTOMATION, ROBOTICS

Research on Flexible Manufacturing Systems at Dalian Modular Machine Tool Institute

40080037 Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese 20 Aug 88 p 4

[Article by Jin Chunhua [6855 2504 5478] and Cao Yimei [2580 6146 2734]: "For the Sake of the Future of the Homeland's Machine Tool Industry--Interview with Jin Zhenhua [6855 2182 5478], Director of the Dalian Modular Machine Tool Institute"]

[Excerpts] Early in the seventies, Jin Zhenhua began to focus his attention on three types of high technology: flexible manufacturing systems (FMS), then developing rapidly all over the world; industrial robots; and computer aided design. Frequent travel abroad made him clearly realize the gap between China and foreign countries [in these areas]. While the international machine tool industry had long since quietly entered the "flexibilized" stage, the vast number of users in China were feeling a critical need for flexible machining equipment that could broadly adapt to changing products.

Seeing an opportunity to make their move, they [i.e., Jin and his comrades] began to invest heavily in research on flexible technology. Jin Zhenhua supported enterprises which had incurred losses; at a plant in Xiamen, a flexible manufacturing product was developed which lost 300,000 yuan. In this manner they slowly learned from experience.

Since 1986, the "automatic change multiple-axis box flexible manufacturing components" and "triple-coordinate demonstration FMS" developed at the institute made their successive appearance; [the institute's] pneumatic and hydraulic industrial robots have been used in toxic and hazardous sites in Shanghai and Tianjin; and [the institute's] CAD systems have received unanimous approval from domestic experts. Since the Third Plenary Session, they have come up with over 200 scientific and technological achievements, among which almost one third meet international standards, and 65 of which have been awarded S&T development prizes at the municipal level or higher. The institute's fixed assets have tripled since 1980, and 1987 net income is more than eight times that of 1980.

New Products, Trends in CNC Machine Tools, Flexible Machining Cells, Flexible Manufacturing Systems

CNC Cylindrical Grinder

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 4 (Apr) 1988 p 55

[Summary] The MGK1320A high-precision computer numerically controlled (CNC) cylindrical grinder, a new product from the Beijing No 2 Machine Tool Plant, has conical, cut-over, longitudinal, facing, circular arc, cam, threading, and drum functions, among others, and provides highly accurate machining of stepped-axis parts for aerospace, defense, and automobile industries. The tool's X, Z, and C axes use the Siemens 1FT-5 ac servo machinery drive, with a Sinumerik 3G numerical control system. The system's smallest input increment is 0.001 mm, and uses the [Italian firm] Marposs Company's Micromar 3 cylindrical drive gauge. This product can be employed in an automatic emory-wheel change (AWC) arrangement or automatic piece-change (APC) arrangement to make up a flexible machining cell (FMC), or can be a single machine in a flexible manufacturing system (FMS). Machining specifications are as follows:

Maximum grinding diameter x length: 200 x 750 mm
Grinding precision: roundness, 0.5 micron; cylindricity, 2 microns/300 mm
Surface roughness: R_a 0.04 micron (V12)
Range of diameters for self-operated radial measurement: 8-90 mm
Instrument measured grinding dimensional precision: ± 1.5 microns (15-20 pieces)
Positioning accuracy: X axis, $\pm 0.002/160$ mm; Z axis, $\pm 0.005/750$ mm; C axis, $\pm 0.01^\circ/360^\circ$
Contour following precision: ± 0.02 mm
Numerical control coordinate axial parameters: numerically controlled travel, X axis/Z axis, 160/750 mm; feed rate, X and Z axes, 0.06-6000 mm/min

Turning FMC

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 5 (May) 1988 p 56

[Summary] The MOC200MS3 flexible turning machining cell, a new product from the Shenyang No 1 Machine Tool Plant, is a high-precision fully functional machining system composed of a turning machining center, a rectilinear-motion

planer-type rack, a workpiece bracket system, and a cutting tool library. It can handle individual production of sleeve (muff) pieces, small batch production of flanges, mid-size batch production of gears, a small variety of nut sleeves, a large variety of inner- and outer-ring bearings, plates with diameters of 5-615 mm, and axles with lengths of 20 to 1750 mm. Main specifications are as follows:

Machining diameter over bed	610 mm
Diameter of rotation over bed	615 mm
Machining length	1750 mm
Bore diameter of main shaft	75 mm
Diameter of main shaft	120 mm
Feed rate of main shaft's C coordinate	0.01-63 rpm
Height of machining center line from surface	1231 mm
Machine tool dimensions (L x W)	5150 x 2550 mm
Overall dimensions, including rack (L x W x H)	11500 x 5350 x 5000 mm
Maximum travel of robot	X = 6350 mm, Z = 875 mm
Surface roughness	0.8 micron
Roundness	0.003 mm
Control system:	
Main machine	3TE/GA4B, S5-130WB
Vertical-motion robot	Prim-SG, S5-115U
Cutter-change robot	Priimo-SD, S5-130W
Cutting jig positions	12
Rotary cutting jig positions	6
Cutter holding device (per VDI 3425SH2 standard)	40 mm
Rotary cutter drive power (bidirectional)	3.6 kW
Main machinery power	335 kW
Maximum rotation rate of main shaft	2800 rpm
Number of main shaft rotation speeds	2
Maximum weight of pieces held by robot	60 kg

Technical Advances in Machining Industry

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 7 (Jul) 1988 pp 4-9

[Excerpts] Since the early eighties, a number of machine tool plants have developed quite a few NC machine tools based on absorption of foreign technology. In 1981 several new machining centers made their appearance, and in 1984, the first FMC's and fully functional NC lathes came out; one after another these were put into batch production to satisfy customers. Among the 211 new machine tools exhibited at the [first machine tool] trade fair [12-22 March 1988, Beijing], 52.1 percent were NC machine tools. While a small number were cooperatively produced [with foreign countries], the vast majority of products on display were indigenously developed by the various machine tool works. Their technical performance and prices were on many levels, in order to suit different needs. There were high-quality machining centers, FMC's, turning centers, fully functional NC lathes, etc. as well as more economically priced NC machine tools. Examples of the high-quality [products] were the Dalian Modular Machine Tool Research Institute's three-coordinate FMC, with software and hardware equipment for expansion into an

FMS; Wuhan Chongxing Machine Tool Plant's XK2116 NC planer-type boring and milling machine and CH5116 single-pillar vertical turning center; Qiqihar No 1 Machine Tool Plant's CHK5120 vertical turning center; Shanghai No 2 Machine Tool Plant's CHK6463 horizontal turning center; Beijing Machine Tool Research Institute and Beijing No 1 Machine Tool Plant's vertical machining centers with different specifications; Shanghai No 4 Machine Tool Plant and Dahe Machine Tool Plant's XH764 and TH6350 horizontal machining centers; Great Wall Machine Tool Plant's turning FMC and CKS-7832 four-axis NC lathe; and Suzhou Electromechanical Machine Tool Research Institute's DK7632 NC slow-speed thread cutter, etc. These exhibited products all meet the standards of similar foreign products.

In addition to research and development in software technology, China is also stepping up development in high technology. Based on absorption of foreign technology, flexible manufacturing systems (FMS's) have already been developed or are currently being developed. Examples include the Beijing Machine Tool Research Institute's JCS-FMS-1 flexible manufacturing system (introduced in 1985) for machining servo machinery parts, a plate-machining FMS currently being developed by Jinan Casting and Forging Machinery Research Institute and Great Wall Switch Factory, a freezer-machining and compressor-machining FMS in development by the Dalian Modular Machine Tool Research Institute and Dalian Freezer Plant, etc. Also, joint development of an FMS designed for typical spare parts and box-shaped pieces used in machine tools, automobiles, construction machinery, and farm machinery is currently being planned by Qinghai No 1 Machine Tool Plant and Dalian Modular Machine Tool Research Institute. Although some of these are still experimental, with imperfect performance and an effectiveness that has not been demonstrated in actual performance, some of them are farther along in the course of R&D, and are pending further work. But after the experimental research is completed, not only can talent be trained, the barriers to new development of high technology can be broken; this hastens the provision of a basic need for technical progress in machine tool manufacturing.

NC Shaping Grinder

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 7 (Jul) 1988 p 56

[Text] The MK7125 precision NC shaping grinder, a new product from the Tianjin Municipal Machine Tool Plant, uses Japan's Fanuc-3MA numerical control system, which separately controls vertical movement of the grinding head, crosswise movement of the work table, and operation of the dividing head, for joint three-coordinate operation. Equipped with a swing angle metal pen trimmer, the emory wheel can be used for numerically controlled shaping and trimming; the machine can directly carry out numerically controlled shaping and grinding. This machine tool is suitable for machining of individual and small batch production of precision shaped parts used in tool and die making, defense, and similar manufacturing industries.

Number of FMC's, FMS's Developed

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 8 (Aug) 1988, pp 6-9, 30

[Excerpt] In addition to new machining methods continuously being developed in China, 12 FMC's and 3 FMS's have been jointly developed in the Seventh 5-Year Plan by the government's research subsidy organization and various production plants. Among the FMS's is a line for machining box-shaped parts that has been cooperatively developed with England's KTM Company, another is an indigenously developed line for machining box-shaped parts, and yet another is an independently developed line for book-plate [bu ban 4689 2647] piercing and shearing. In addition, a number of enterprises, according to their finances and needs, will choose NC machine tools and FMC's, which will be developed into FMS manufacturing lines.

Installation of New FMS

40080049 Beijing JICHUANG [MACHINE TOOLS] in Chinese No 8 (Aug) 1988 p 55

[Text] According to a plan for technological transformation, the Beijing No 1 Machine Tool Plant and Japan's Hitachi Seiki Co., Ltd. will jointly design and install a flexible manufacturing system (FMS). Its completion will create an excellent environment for this plant's production of NC milling machines and machining centers.

/6091

Positron CT Camera System Using Multiwire Proportional Chambers as Detectors

40090015a Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 12 No 3, May 88 pp 289-297

[English abstract of article by Wang Dewu [3769 1795 2976], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing]

[Text] A positron CT camera system using multiwire proportional chambers as detectors is reported. This system is composed of two high density MWPC γ -ray detectors, an electronic readout system and a computer for data processing. Three-dimensional tomography has been obtained, with an imaging matrix of 64 x 64 x 16.

9717

Wide-Range Magnetic Spectrometer for Electron Scattering in Medium Energy Range

40090015b Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 12 No 3, May 88 pp 298-306

[English abstract of article by Mao Zhenlin [3029 2182 7792] of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing]

[Text] A non-focusing magnetic spectrometer design for electron scattering in the medium energy region is proposed. The positions read out from the position-sensitive detectors in the spectrometer are used for track reconstruction and momentum measurement by means of a computer program. The construction of this spectrometer is rather simple, and there is no special technique or element for corrections to aberrations. It is suitable for usage as a spectrometer with a large solid angle and wide momentum range. The momentum resolution, momentum range and acceptance are calculated by Monte Carlo simulation.

9717

Fragmentational Function in Pion Inclusive Processes With Dynamic Spontaneous Breaking

40090015c Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 12 No 3, May 88 pp 307-314

[English abstract of article by Lü Xiaofu [0712 2556 1133], et al., of Sichuan University, Chengdu]

[Text] The pion fragmentational function is calculated. In the high energy region, the asymptotic freedom perturbation theory is used. After passing through a certain distance, the quarks break into hadrons due to confinement, playing a role in the low energy region, and the pions must be thought of as Goldstone boson and must be a result of dynamic breaking. In this article the fragmentational function in the low energy region is calculated with the dynamic breaking mechanism. The results obtained for the fragmentational function are in agreement with experimental ones.

9717

Diffraction-Limited SRS Stokes Output From High-Pressure Hydrogen Pumped by XeCl Laser

40080181 Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 8 No 6, Jun 88 pp 509-513

[Article by Lou Qihong [2869 4388 3163], Cheng Xusan [2052 1645 0005], and Wang Runwen [3769 3387 2429] of the Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, manuscript received 27 February 1987 and revised 8 July 1987, work sponsored by the Chinese State Natural Science Foundation]

[Text] Abstract: Diffraction-limited first order Stokes output (353 nm) with peak power of 0.2 MW was obtained by stimulated Raman scattering (SRS) in high pressure hydrogen gas pumped by an XeCl excimer laser. The effect of the divergence angle of the pumping laser on the conversion efficiency of Raman scattering was studied.

Keywords: Stimulated Raman Scattering, Diffraction-Limited Output

I. Introduction

Raman beam clean up of the excimer laser is an important technique to obtain high quality coherent ultraviolet beam. It is a new technology developed in the mid-1980's.[1] Diffraction-limited first order Stokes output was obtained from a single path Raman tube. This high-quality light beam is used as the input signal into another Raman tube to obtain a high efficiency Stokes output. This beam retains the quality of the input signal. If the input signal is diffraction-limited, the cleaned up high energy Stokes beam will also be diffraction-limited.

The 308 nm XeCl excimer laser is converged into a Raman pool using high-pressure hydrogen gas as a non-linear medium. The wavelength of the first order Stokes is 353 nm which is also in the near ultraviolet region. The purpose of this paper is to study the energy of the pumping laser and hydrogen pressure on the Raman scattering conversion efficiency. Because higher order Stokes and frequency mixing exist in the conversion process, the optimal condition to produce first order Stokes must be determined. On this basis, the study is focused on the extraction of the diffraction-limited portion of the first order Stokes which serves as the input signal in the Raman beam clean-up. A flat parallel cavity and an unsteady cavity

are used as the pumping sources to analyze the effect of the quality of the pumping laser on the diffraction-limited portion of the first order Stokes and the quality of its light beam in order to provide a good source for Raman beam clean-up experiments.

It was experimentally shown that although the overall Raman conversion efficiency is quite different when using an XeCl excimer laser with a plane-parallel cavity as compared to an unsteady cavity, however, diffraction-limited first order Stokes (353 nm) of the order of 10 mJ could be obtained in either case. In order to improve efficiency, we also designed a space filter to raise the extraction efficiency of diffraction-limited first order Stokes by approximately one-third.

II. Experimental Apparatus

Figure 1 shows the experimental set-up. The pumping light comes from an X-ray pre-ionized excimer laser with its output wavelength at 308 nm. Two types of optical resonance cavity were used. When a plane-parallel cavity is used, the divergence angle is approximately 2 mrad. When an orthogonal confocal unsteady cavity is used, the divergence angle is reduced to 0.3 mrad.

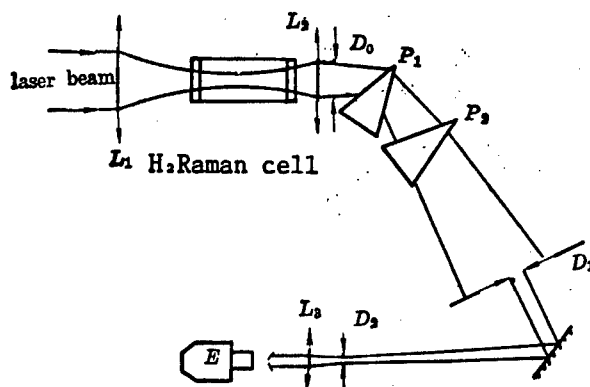


Figure 1. Experimental Set-up for Stimulated Raman Scattering

The 110 cm long Raman pool is made of stainless tube and the hydrogen gas pressure can be varied from 1 atm to 17 atm. Two quartz plates are used as the windows for the Raman pool. Both sides of the quartz plate were coated with a film to enhance transmission at 308 nm. The total reflection is less than 2 percent with respect to the XeCl excimer laser.

In Figure 1 L_1 is a focusing lens with a focal length of 100 cm. It is used to focus the pumping laser. L_2 is a collimating lens with a focal length of 50 cm. When L_1 and L_2 are set up in a confocal manner, parallel Stokes can be obtained. When the two are slightly off from confocal arrangement, they become a long focal length lens.

P₁ and P₂ are two 60° prisms which are used to split up the pumping laser and various orders of the Stokes. D₂ is a diaphragm which is used to extract the diffraction-limited component in the Stokes. The lens L₃ and the energy meter E are used to measure the energy of the laser and various orders of the Stokes.

III. Experimental Results and Discussion

1. Condition for Maximum First Order Stokes Output From Single Path Stimulated Raman Scattering

The experimental apparatus shown in Figure 1 was used previously in reference [2]. The resonance cavity for the excimer laser was a plane-parallel cavity. Because of poor beam quality and large divergence angle, the overall Raman energy conversion efficiency was approximately 20 percent and the principal component was first order Stokes. In order to compare the effect of pumping light quality on Raman scattering, a confocal unsteady cavity was used in this work. The overall Raman energy conversion efficiency is approximately 55 percent. In terms of quantum efficiency, the maximum quantum efficiency is over 90 percent. In this conversion process, the first order Stokes conversion efficiency still depends upon the pumping power density and hydrogen gas pressure. To this end, a systematic study was done.

Figure 2 shows the effect of the Raman pool hydrogen pressure on various conversion efficiencies. The pumping energy of the laser E_{p0} remained at 900 mJ and the peak power at 18 MW. After the dependence of the optical energy of the first order Stokes E_{s1} upon the hydrogen gas pressure is measured, the energy conversion efficiency η_{s1} of the first order Stokes can then be determined. Let the optical energy of the *i*th order Stokes be E_{si}. In the experiment, we observed the fifth order Stokes output. Then, the total energy conversion efficiency can be expressed as

$$\eta_s = \sum_{i=1}^5 E_{si} / E_{p0}$$

Behind the two prisms, we could also measure the residual pumping light energy E_p. Thus, the energy drain rate of the pumping light is

$$\eta_p = E_p / E_{p0}$$

Figure 2 shows the variations of η_s, η_{s1} and η_p with hydrogen pressure. η_s and η_p remained practically unchanged after the pressure exceeded 5 atm. However, η_s is smaller than η_p in low pressure area. Let us consider the number of stimulated Raman scattering photons and let the photon energy of the *i*th order Stokes be hν_i. Then, the number of *i*th order Stokes photons is

$$N_i = E_{si} / h\nu_i$$

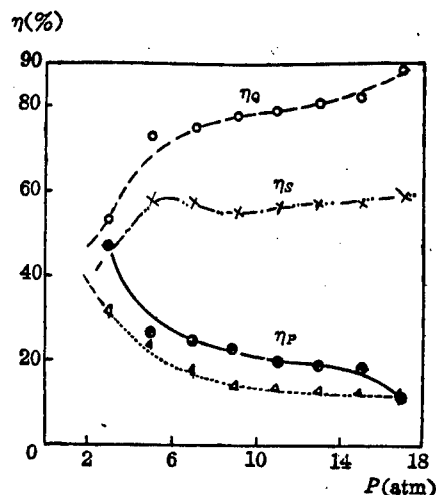


Figure 2. SRS Efficiencies and Pumping Laser Depletion Efficiency as the Functions of Hydrogen Gas Pressure

Let the number of pumping laser photons be N_{p0} ($h\nu_p$ is the energy of the pumping photon)

$$N_{p0} = E_{p0}/h\nu_p$$

Then, the overall quantum efficiency of stimulated Raman scattering is

$$\eta_0 = \sum_{i=1}^5 N_i / N_{p0}$$

From the η_0 curve in Figure 2 we can see that η_0 increases with rising hydrogen pressure. At 17 atm, η_0 is approximately 90 percent. At that time, most of the pumping light is emptied. This is because lower order Stokes is converted to higher order Stokes as the hydrogen pressure rises. Since the Raman frequency shift of hydrogen is high, the total energy conversion efficiency is approaching saturation.

As for the conversion efficiency of the first order Stokes, it decreases with rising hydrogen pressure. In order to maximize the first order Stokes output by using high-power laser pumping, the hydrogen pressure should not be too high, usually less than 3 atm.

After the appropriate Raman pool hydrogen pressure was determined, we also wanted to determine the desired pumping light power. Figure 3 shows the η_s , η_{s1} , η_p and η_0 versus pumping power curves at a fixed hydrogen pressure of 17 atm. Based on these curves we know that η_s and η_0 increase with rising pumping power. The first order Stokes conversion efficiency η_{s1} , however, decreases with rising pumping power. This is because the first order Stokes is emptied by higher order Stokes at high pumping power. Therefore, there are two ways to achieve a high first order Stokes conversion efficiency. One is low hydrogen pressure and high pumping power and the

other is high hydrogen pressure and low pumping power. Both can be successful. Under our experimental conditions, η_{s1} is approximately 40 percent.

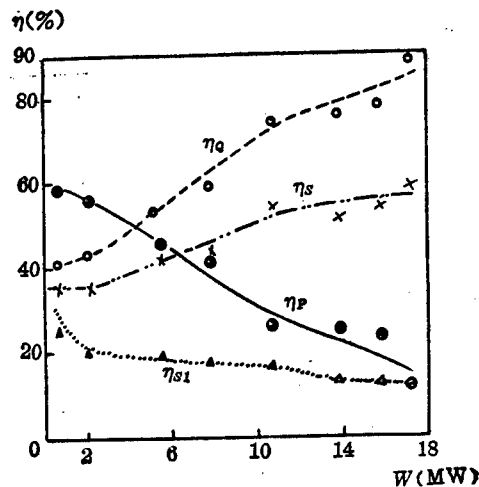


Figure 3. SRS Efficiencies and Pumping Laser Depletion Efficiency as the Functions of Pumping Laser Power

2. Extraction of Diffraction-Limited Divergence Angle Beam From First Order Stokes

The diffraction-limited divergence angle beam of the first order Stokes can be extracted by using the space filter technique. The diaphragm D_2 in Figure 1 serves this function. D_2 is usually located at the focal plane of the Stokes. L_1 and L_2 form a long focal length lens and the aperture of D_2 can vary from 100-400 μm .

The space filtered beam has good directivity. In order to measure its spatial distribution, an energy gauge was placed behind D_2 . The diaphragm D_2 was scanned in x and y directions to measure the energy profile. Figure 4 shows the experimental results. Figure 4(a) is the energy profile of the first order Stokes when using a plane-parallel cavity for the pumping laser. Figure 4(b) is the energy profile of the first order Stokes when using a confocal unstable cavity for the pumping laser. The half widths are 0.3 mm and 0.18 mm, respectively. Better results were obtained with the pumping laser using an unstable cavity.

However, we notice that the divergence angle of the plane-parallel cavity laser is approximately one order of magnitude higher than that of the unstable cavity laser. This indicates that in the stimulated Raman scattering process the higher order spatial components of the pumping light are not effective. Only the highly focused lower order components are contributing significantly to the conversion of the Stokes.

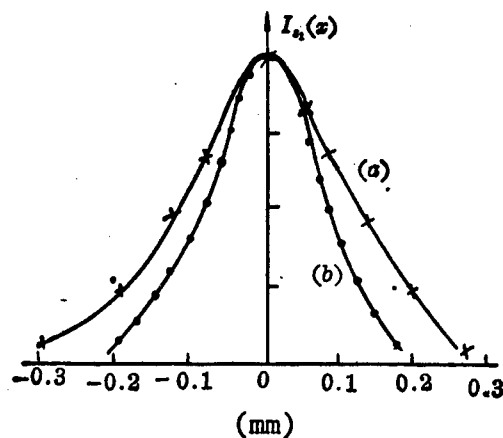


Figure 4. Laser Beam Profiles of the First Stokes SRS Output

- (a) for pumping laser with plane-parallel optical cavity;
- (b) with unstable optical cavity.

In the optical path of the experiment, the first order Stokes profile in the x direction is wider than that in the y direction because of the two prisms. Since the line width of the free oscillation of the XeCl excimer laser is of the order of $10 \text{ \AA}$ and the line width of the first order Stokes is also of the same order of magnitude, the first order Stokes diverges in the horizontal direction (x -direction) after passing through the two prisms. To this end, we improved the light splitting system and used the apparatus shown in Figure 5. In the figure, M_0 is a bicolor mirror which has a reflectance of over 99 percent with respect to the pumping light. It transmits approximately 40 percent of the first order Stokes. M_1 and M_2 are total reflective mirrors with respect to the first order Stokes (353 nm). It reflects less than 10 percent of the Stokes above the second order. After double reflection from M_1 and M_2 , only approximately 1 percent of the higher order Stokes remains. Thus, essentially all the light passing through the diaphragm D is first order Stokes. This arrangement minimizes the absorption loss in the prisms and improves the extraction efficiency of the diffraction-limited first order Stokes by one-third. In addition, the spatial profile in the x direction is essentially the same as that in the y direction. It may be used as an input signal source. The peak power of diffraction-limited first order Stokes is 0.2 MW.

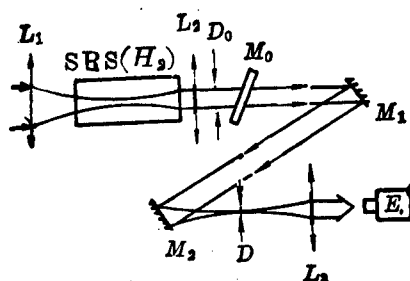


Figure 5. Experimental Arrangement Using Bicolor Mirror as the Spectroscopic Element

References

- [1] R.S.F. Chang, et al., IEEE J. Quantum Electronics, 1985, QE-21, 5 (May), 477-487.
- [2] Lou Qihong, et al., [ACTA OPTICA SINICA], 1985, 5, No 12 (December), 1069-1073.

12553/6091

Markov Random Mesh Models for Contextual Information Analysis of [Satellite]
Remote Sensing Image

40090016 Shenyang XINXI YU KONGZHI [INFORMATION AND CONTROL] in Chinese
Vol 17 No 4, Aug 88 pp 18-23

[English abstract of article by Zeng Xiaoming [2582 1420 2494] and Tan Feng
[3389 2800], Laboratory for Remote Sensing & Imagery, Nanjing Forestry Univ.]

[Text] There exist the spectral information and the spatial distribution and
structure information in a remote sensing image. To discriminate a pixel, one
should consider not only its spectral value but also its spatial structure and
the relation between the pixel and other pixels--that is, the contextual
information.

Remote sensing image analysis using spatial contextual information is investi-
gated. Three Markov random mesh models are presented, and the computational
methods for the models are given and proved. A least squares estimate for
correlation parameters of the models is discussed. Using these models, the
joint probability function is taken as the decision function, and recursive
iteration is used to gradually improve the knowledge of the neighboring
classes, and therefore improve the contextual classification results. Experi-
mental results show the effectiveness of the models presented. Figures 2,
tables 4; references: 3 English.

Tunable IR Stimulated Radiation Generated by Two-Step Hybrid Exciting in $\text{Na}_2\text{-Na}$ System

40090013a Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 8, Aug 88 pp 1227-1235

[English abstract of article by Tang Xiaoling [0781 1420 3781] of the Department of Physics, Shanxi Normal University, Xi'an; Wang Zugeng [3769 4371 6342], et al., of the Department of Physics, East China Normal University, Shanghai]

[Text] The authors report the generation of tunable IR stimulated emission covering 3.39-3.46 μm by using a new exciting mechanism, called "two-step hybrid exciting," in a sodium molecular-atomic system. The authors analyze and discuss this IR emission. The computed relative intensity of the IR emission varies with the pumping detuning. The computed results coincide well with the experimental data.

9717

Population Inversion of Energy Levels of MgXI 1s3p, 1s4p Under Average High Temperature, High Electron Density

40090013b Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 8, Aug 88 pp 1236-1243

[English abstract of article by Lin Zunqi [2651 1415 3825], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A microtube target with a side jet burner has been designed. Strong population inversion is observed along the whole side of the jet burner between the energy levels of MgXI 1s3p $^1P_0^0$ and 1s4p $^1P_0^0$, while the average laser irradiance reached about $3.5 \times 10^{13} \text{ W}\cdot\text{cm}^{-2}$ on the inner wall of the microtube targets. The corresponding environment average electron temperature 470-520 eV and density of 2×10^{-3} of the plasma at the inversion area have been measured. The possible mechanisms of population inversion under the average high temperature conditions have been analyzed.

9717

Excited States in Collision Process of Double Charged Ion He^{2+} with Ne, Ar Atom

40090013c Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 8,
Aug 88 pp 1244-1253

[English abstract of article by Lei Ziming [7191 1311 2494], et al., of the
Institute of Physics, Chinese Academy of Sciences]

[Text] The emission spectra in the collision process between He^{2+} and Ne, Ar have been measured, using optical methods, by the Optical Multichannel Analysis System. The experimental results demonstrate that there are three channels of excitation in these collision systems: double-electron capture into excited states, single-electron capture into excited states and direct excitation of projectile and target by incident ion impact. Emission cross sections of HeI , HeII , NeI , NeII and ArI , ArII have been obtained from calculations. Some comparisons of emission cross sections between $\text{He}^{2+} + \text{Ne}$ and $\text{He}^{2+} + \text{Ar}$ have been made.

Excited States in Collision of Single, Double Charged Ions with Atoms,
Comparisons of Emission Cross Sections

40090013d Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 8,
Aug 88 pp 1254-1259

[English abstract of article by Liu Jiarui [0491 1367 3843], et al., of the
Institute of Physics, Chinese Academy of Sciences]

[Text] Recent experimental results involving the generation of excited states in collisions of single, double charged ions with He, Ne, Ar are presented. The laboratory energy range of the beams of He^{q+} , Ar^{q+} ($q = 1, 2$) ions is $(70-170) \times q$ keV. The optical measurement was performed by the Optical Multichannel Analysis System, and the wavelength range covered was 200-800 nm. Different excitation processes have been observed in single and double charged ion collisions with atoms. The dependence of the emission cross sections on the charge number of the incident ions and the potential energy defect is discussed.

9717

Many-Body Universal Approach to Thermally Activated Magnetoelastic Relaxation in Ferromagnetic Alloys

40090017a Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9, Sep 88 pp 1401-1405

[English abstract of article by Wang Yangpu [3769 7402 3877], et al., of the Department of Physics, Suzhou University]

[Text] Thermally activated magnetoelastic relaxation in disordered ferromagnetic alloys is studied using a new relaxation mechanism based on the concept that many-body interaction leads to an infrared divergence response. It has been found that, except for the thermally assisted transitions of directional ordered atoms, the directional ordering, which causes relaxation of the magnetic domain walls, includes two different classes of configurational tunnelling caused by many-body interactions. Based on this mechanism, a new relaxation law of magnetization and a new formula for magnetic disaccommodation have been derived. Using Boltzmann's superposition principle, a universal formula for internal friction has also been derived, which has been verified by experimental data.

References

- [1] 斯图阿著,铁磁畴,李仲卿和孙熙民译,科学出版社,(1960),141页.
- [2] A. S. Nowick & B. S. Berry, Anelastic Relaxation in Crystalline solid Academic Press New York and London. (1972), p. 541--542.
- [3] 曾文光、张进修,物理学报, **36**(1987), 39.
- [4] K. L. Ngai, *Phys. Rev.*, **B20**(1979), 2475; *ibid.*, **B22**(1980), 2066.
- [5] H. Kronmüller *et al.*, *Nuovo Cim.*, **33B**(1979), 205.
- [6] E. W. Montroll and J. T. Bendler, *J. State. Phys.*, **34**(1984), 129.
- [7] B. S. Berry & W. C. Pritchett, *J. Appl. Phys.*, **52**(1981), 1865.
- [8] 王养璞、金其淑,物理学报, **37**(1988), 1083.

Symmetrization Analysis of Vibrational Modes, Study of Raman Spectra for
Molecular Crystal $\text{RbC}_8\text{H}_5\text{O}_4$

40090017b Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9,
Sep 88 pp 1450-1460

[English abstract of article by Hong Shuili [3163 3055 0500] of the Department
of Physics, Fuzhou University]

[Text] Based on the features of molecular crystals, the author applies the theorem that the factor group of the space group is isomorphic to the point group and, combined with the structural analysis method, classifies the modes in internal vibrations of $\text{RbC}_8\text{H}_5\text{O}_4$ directly, according to the compatibility relationships of the irreducible representations. When spectra of the fundamental frequency coupling and Fermi resonance in the vibration spectra are involved, determination has to be made according to the relative spatial position of each functional group and the symmetrization of each fundamental direct product representation. The Raman scattering spectra of three kinds of isomorphous crystals (i.e., RAP, TAP and KAP) have been obtained and are compared. The modes of external vibrations in the crystal lattice were then isolated from the overall spectra.

References

- [1] G. Bohm and K. Vulnor, *J. Cryst. Growth*, **10**(1971), 157.
- [2] R. A. Smith, *Acta Cryst.*, **B31**(1975), 2347.
- [3] Liu Shixiong and Zhang Zhenke, *JIEGOU HUAXUE (J. Struct. Chem.)*, **4**(1985), 93.
- [4] Y. Okaya, *Acta Cryst.*, **19**(1965), 879.
- [5] International Table for X-ray Crystallography. Vol. I. Birmingham: Kynoch Press. (1952), p. 546.
- [6] C. J. Bradley and A. P. Cracknell, *The Mathematical Theory of Symmetry in Solids*, Clarendon Oxford, (1972), 128.
- [7] 洪水力等, 福州大学学报, **15**(1987), 87.
- [8] E. B. Wilson, Jr., *et al.*, *Molecular Vibrations*, McGraw-Hill, New York, (1955).
- [9] W. Gordy and W. J. O. Thomas, *J. Chem. Phys.*, **24**(1956), 439.

Mechanism of Property Change of Mixed $\text{AgI}(\text{Cr}_2\text{O}_3)$ Ionic Conductor

40090017c Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9,
Sep 88 pp 1471-1479

[English abstract of article by Wang Yuxia [3769 3768 7209] of the Department of Physics, University of Science and Technology of China, Hefei]

[Text] The author has studied the infrared absorption spectrum, the ultra-violet and visible reflection spectrum of the $\text{AgI}(\text{Cr}_2\text{O}_3)$ mixed ionic conductor, as well as its micro shape, and results of composition analysis obtained using TEM. It is found that some differences exist between the $\text{AgI}(\text{Cr}_2\text{O}_3)$ mixed ionic conductor and the pure AgI , Cr_2O_3 with a microcosmic meticulous structure.

A new model of the electrical medium is developed. Because of the micro shape, the author suspects that the reason for the change in the microcosmic meticulousness is that the deformation electrical polarization has been deformed. The mechanism of the property change of the $\text{AgI}(\text{Cr}_2\text{O}_3)$ mixed ionic conductor is discussed.

References

- [1] C.C. Liang, *J. Electrochem. Soc.*, **120** (1973), 1298.
- [2] T. Jow and J. B. Wagner, Jr., *J. Electrochem. Soc.* **126**, (1976), 1963.
- [3] 陈立泉、赵宗源、王刚、李子荣, 科学通报 **26**(1981), 79; *Kexue Tongbao* (in English), **26** (1981), 308.
- [4] Z. Y. Zhao, C. Y. Dai and L. Q. Chen, *Solid State Ionics*, **3**(1983), 1175.
- [5] K. Shaihi and J. B. Wagner, Jr., *J. Solid State Chemistry*, **42** (1982), 107.
- [6] 王玉霞、俞文海, 中国科技大学学报 **15**, (1985), 37.
- [7] 赵宗源、陈立泉, 物理学报, **35**(1986), 1158.
- [8] A. Khandkar and J. B. Wagner, Jr., Extended Abstracts, San Francisco Meeting of the Electrochem. Soc., (1983), No. 83.
- [9] 陈立泉、赵宗源、王超英、李子荣, 物理学报, **34**(1985), 1027.
- [10] 桐山良一, 固体构造化学, 第十二章, 第十三章, 共立出版社, 株式会社, 1978 年 2 月.
- [11] 何福城、朱正和, 结构化学, 人民教育出版社, (1979), 第四章, 286 页.
- [12] 哈里德等著, 李仲卿等译, 物理学, 第二卷, 第一册, 高等教育出版社, (1965), 94 页.
- [13] 饶东生, 硅酸盐物理化学, 冶金工业出版社, (1980), 第七章, 186 页.
- [14] A. D. Brailsford, *J. Solid State Ionics* **21** (1986), 159.
- [15] 黄子卿, 物理化学, 人民教育出版社, (1962), 第六章.

New Method for Studying Spectral Line Structure

40090017d Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9, Sep 88 pp 1499-1504

[English abstract of article by Zhao Baochang [6392 5508 1603], et al., of Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences]

[Text] The attempt to reconstruct a high resolution spectrum using the interferogram of the Fabry-Perot interferometer has been achieved theoretically by solving an integral equation. However, the solution to the equation is generally unstable. It is necessary to keep the antinoise ability at the level of 10^{-4} . Currently it is very difficult to manufacture such a device that can maintain this level. It is demonstrated through computer simulation experiments that solving the equation will become rather stable under certain conditions and the antinoise ability can be improved to 10^{-2} . These results make it possible to develop a satisfactory device.

References

- [1] V. G. Cooper, *Appl. Opt.*, 10(1987), 523.
- [2] D. M. Zipoy, *Appl. Opt.*, 18(1979), 1988.
- [3] P. B. Hays and R. G. Roble, *Appl. Opt.*, 10(1971), 193.
- [4] 吉原邦夫,北出笃夫,分光研究, 29(1980) 173.
- [5] K. Yoshihara, B. C. Zhao and A. Kitade, *Jap. J. Appl. Phys.*, 24(1985), L207.
- [6] K. Yoshihara and B. C. Zhao, *Jap. J. Appl. Phys.*, 24(1985), L575.
- [7] K. Okada, K. Yoshihara and A. Kitade, *Jap. J. Appl. Phys.*, 25(1986), L918.

Study of Relationship Between Spontaneous Radiation, Stimulated Radiation in Transition Radiation Free Electron Lasers

40090017e Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9, Sep 88 pp 1505-1509

[English abstract of article by Liu Shenggang [0491 4141 4854] of Chengdu Institute of Radio Engineering; Sun Yan [1327 7159] of the University of Science and Technology of China, Hefei]

[Text] As a fundamental theorem in the study of free electron lasers, Madey's Theorem reveals the relationship between spontaneous radiation and stimulated radiation. In this paper, this problem is studied for the transition radiation free electron lasers. The results show that a formula corresponds to the first part of Madey's theorem, but the former is more complicated while the second part remains the same. The results obtained are used to simplify the small signal gain calculation.

References

- [1] J. M. J. Madey, *Nuovo Cimento*, 50B(1979), 64.
- [2] N. M. Kroll, *Physics of Quantum Electronics*, 8(1982), 315.
- [3] 刘盛纲, 相对论电子学, 科学出版社, (1987).
- [4] L. K. Grover and R. H. Pantell, *IEEE J. Quantum Electron.*, QE-21(1985), 944.
- [5] D. A. G. Deacon *et al.*, *Opt. Commun.*, 40(1982), 373.
- [6] D. A. G. Deacon and M. Xie, *IEEE J. Quantum Electron.*, QE-21(1985), 391.
- [7] M. Ter-Mikaelian, *High Energy Electromagnetic Processes in Condensed Media*, New York, Wiley, (1972).
- [8] M. A. Piestrup and P. F. Finman, *IEEE J. Quantum Electron.*, QE-19(1983), 357.
- [9] 孙雁, 成都电讯工程学院硕士论文.
- [10] J. D. J. Jackson, *Classical Electrodynamics*, 2ed. John Wiley & Son, Inc., New York, (1975), p. 688.
- [11] Sun Yan (孙雁), *IEEE J. Quantum Electron.*, QE-23(1987), 1642.

Piecewise Correlator in Digital CW Sonar

40090010a Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 5,
Sep 88 pp 349-355

[English abstract of article by Wang Shuozhong [3769 2592 0022] of the
Institute of Acoustics, Chinese Academy of Sciences]

[Text] Piecewise correlators can be used in sonars transmitting continuous narrow-band random signals to avoid decorrelation caused by the phase fluctuation of signals received. Unlike a conventional heterodyne correlator, the piecewise correlator does not include a bandpass filter, making it particularly appropriate for use in a digital system. This paper derives the expressions for the output signal-to-noise ratios for both analogue and polarity piecewise-correlators and gives some fundamental principles for choosing the number of pieces and their lengths. A polarity piecewise-correlator designed according to these principles has been used in a practical system and has produced satisfactory results.

9717

Focusing Properties of Acoustic Fresnel Lenses

40090010b Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 5,
Sep 88 pp 369-375

[English abstract of article by Gao Jianbo [7559 0256 3134], et al., of the
Applied Acoustics Institute, Shaanxi Teacher's University]

[Text] The focusing properties of some types of acoustic Fresnel lenses, such as bevel-shaped, arc-shaped and phase compensation plates, have been studied theoretically and experimentally. A formula, convenient for the numerical calculation of pressure and intensity distributions of focused fields formed by acoustic lenses with large apertures, has been derived from the Huygens-Fresnel Principle by using a higher order of approximation than Fresnel's. Both the theoretical values and experimental results show that these types of lenses have good focusing properties and their field distributions near the focus are approximately the same, but their gains vary significantly. For a case in which the F-number is 1.1 and the wavelength is 1.4 mm, the lateral resolution is 2 mm, the focal depth (3 dB) is 17 mm, and the first side lobe is 17 dB lower than the main lobe.

9717

Report on 500 MHz SAW Resonator-Oscillator

40090010c Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 5,
Sep 88 pp 376-382

[English abstract of article by Zhou Xianming [0719 0341 2494], et al., of the Institute of Acoustics, Chinese Academy of Sciences; Zhou Lianheng [0719 6647 0077] of the Communications Telemetry and Control Research]

[Text] The SAW resonator-oscillator is characterized by its high fundamental frequency, low phase noise, reliable performance, simplicity, light weight, compact volume, and its resistance against mechanical vibration. It has begun to be used as a valuable device in practice. The 500 MHz one-port SAW groove resonator made in the authors' laboratory, which has an unloading quality factor $Q_u \geq 20,000$ and motional resistance of $R_1 = 20-30 \Omega$, has been used as a frequency controlled element to construct an oscillator. Its short-term stability, measured in 0.001 second, is 4.2×10^{-10} , in 0.01 second is 2.8×10^{-10} , in 0.1 second is 2.5×10^{-10} and in 1 second is 5.5×10^{-10} , while the single sideband phase noise for 1 kHz offset from the carrier is 108 dBC. When not enclosed in ovens, for the ambient temperature range from -30°C to $+60^\circ\text{C}$, the total fractional change on the frequency of the oscillator is 1.1×10^{-4} and the average value is 1.2×10^{-6} . At room temperature the average frequency fluctuation is $2.7 \times 10^{-6}/\text{d}$.

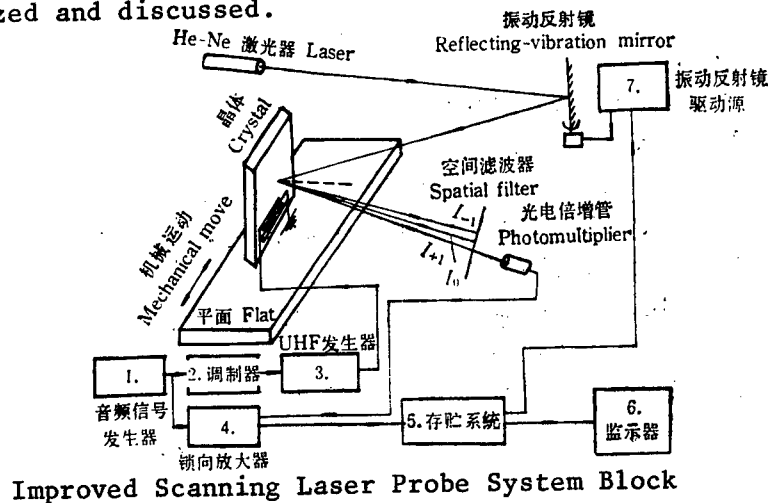
9717

Detection of SAW Field of Pulse Compressor by Laser Scanning Probe

40090010d Beijing SHENGXUE XUEBAO [ACTA ACUSTICA] in Chinese Vol 13 No 5,
Sep 88 pp 383-390

[English abstract of article by Zhang Bufa [1728 2975 3127], et al., of Nanjing University; Wang Zhemín [3076 0772 3046] of Nanjing Research Institute of Electronic Technology]

[Text] In this article, the theory of acousto-optical interaction with metal strips on a crystalline surface is presented. The original optical probe system is improved. The weak SAW field can be mapped by the new system. In the experiments, the authors have detected the distribution of the SAW field in the SAW compressor deposited on the surface of YZ-LiNbO_3 , and the results are analyzed and discussed.



Improved Scanning Laser Probe System Block

1. Audio-signal generator
2. Modulator
3. UHF generator
4. Lock-in amplifier
5. Storage system
6. Monitor
7. Source of vibration mirror

Briefs

High-Repetition Pulsed Laser Diode--A "high-repetition ultrashort pulsed semiconductor laser," developed by Xidian University (Xi'an University of Electronic Science & Technology [formerly Northwest Institute of Telecommunications Engineering]), recently passed ministry-level technical certification in Xi'an. This type of laser diode is a critical component in high-speed fiber-optic communications systems, high-speed optoelectronic instruments, and optical data processing systems. Currently, only a small number of countries--such as the U.S., the Soviet Union, and Japan--have developed such a product; it is a high-cost, export-restricted item. Xidian University's independently designed and developed 5-milliwatt semiconductor laser costs only about one-fifth that of the product developed by the aforementioned nations. [Summary] [40080050 Beijing WUXIANDIAN [RADIO] in Chinese No 9, Sep 88 pp 20-21]

Another Major Breakthrough in Oxide Superconductor Research

40080032b Beijing WULI [PHYSICS] in Chinese Vol 17 No 8, Aug 88 p 511

[Article by Xie Sicheng and Ju Guanglan of the Institute of Physics, Chinese Academy of Sciences]

[Text] In 1986 J.G. Bednory and K.A. Muller first discovered an oxide superconductor in the La-Ba-Cu-O system with a K_2NiF_4 structure and a superconducting transition temperature of 35K. Subsequently, researchers have made extensive studies of the rare earth-Ba-Cu-O system and the $YBa_2Cu_3O_7$ superconductor with a transition temperature above 90 K. This superconductor has a distorted ordered perovskite structure. C. Michel then reported a non-rare earth $Bi_2Sr_2Cu_2O_7$ superconductor and with a transition temperature in the 7-22K range. Reports then came from Japan, the United States, and China that new superconductors with a transition temperature higher than 84 K have been found in the Bi-Sr-Cu-O system and that pronounced diamagnetism was observed at 110 K.

On 1 March 1988, we found a superconductor in a new system, Tl-Ba-Ca-Cu-O, that has so far the highest transition temperature. The zero resistance temperature is 114 K and pronounced diamagnetism is observed from 117 K to 120 K. Preliminary experiments have yielded bulk superconductors with a J_C value of 1630 A/cm^2 . There is potential for much higher J_C .

The raw materials are analytic purity Tl_2O_3 , BaO, CaO, and CuO. With proper weight ratios, the four oxides are mixed thoroughly, cold pressed into bulk and sintered at $770-800^\circ\text{C}$ for 8-10 hours. It is then cooled to room temperature in the furnace. Resistance measurements are made with the standard four-probe method and the magnetic susceptibility of the specimens is measured with a mutual inductance bridge.

High-quality superconductors are obtained over a wide composition range in this system. Figure 1 shows the temperature dependence of the resistance (R) and the magnetic susceptibility ($X_{a.c.}$). The system has two superconducting phases:

$$Tl_4(Ba_{3\pm x}Ca_{3\mp x})_{z=6}Cu_6O_{18+x}, T_c > 110K;$$

$$Tl_4(Ba_{3\pm x}Ca_{3\mp x})_{z=6}Cu_4O_{16+x}, T_c \approx 100K.$$

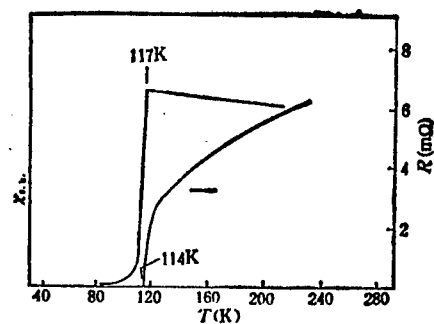


Fig. 1

The lattice parameters are respectively:

$$a = 3.84 \text{ \AA}, c = 36.0 \text{ \AA}; a = 3.84 \text{ \AA}, \\ c = 29.5 \text{ \AA}.$$

The space group is $I_{4/mmm}$. These structures can all be derived from the Aurivillius phase. Further research is currently underway.

We believe that the high T_C and large J_C of the Tl-Ba-Ca-Cu-O system of superconductors, and the ease of fabrication and stability of properties, make this system very worthy of further research as a potentially valuable high T_C superconductor.

9698/7310

In-Situ Study of Superconducting Transition, Internal Friction of High T_c Superconductor YBa_2Cu_3O

40090017f Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9, Sep 88 pp 1556-1559

[English abstract of article by Du Jiaju [2629 1367 7467], et al., of the Institute of Solid State Physics, Chinese Academy of Sciences, Hefei]

[Text] The resistance, internal friction and Young's modulus of a high T_c superconductor, $YBa_2Cu_3O_{7-\delta}$, have been measured in situ at 80 to 300 K. Two obvious peaks of internal friction were observed near T_c . Due to the characteristics of the peaks, the authors suggest that these two peaks are associated with the electronic relaxation between Cu^{3+} and Cu^{2+} . The peak and anomalies of Young's modulus observed in the range of 160 to 280 K may be related to the positional adjustment of oxygen vacancies.

References

- [1] T. Siegrist *et al.*, APS, 1987, Mar. Meeting in New York.
- [2] Du Jia-ju *et al.*, Progress in High Temperature Superconductivity 2 (1987), 333.
- [3] Yin Hua-qing, Gao Yi-mei, Du jia-ju *et al.*, *Appl. Phys. Lett.*, (1988). to be published.

Influence of Oxygen Deficiency on Thermoelectric Power in Single Phase $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ System

40090017g Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 37 No 9, Sep 88 pp 1560-1563

[English abstract of article by Ruan Yaozhong [7086 5069 6988], et al., of the Department of Physics, University of Science and Technology of China, Hefei; Pan Guoqiang [3382 0948 1730], et al., of the Department of Applied Chemistry, University of Science and Technology of China, Hefei]

[Text] The influence of oxygen deficiency on the superconductivity and thermoelectric power in a single phase $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ system has been studied. The results show that the superconducting transition temperature decreases and the magnitude of the thermoelectric power increases with the number of oxygen vacancies. From the experimental results the authors suggest that hole conduction is predominant in the single phase $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ system, and the relatively large phonon-drag thermopower indicates that a strong electron-phonon interaction exists in $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ superconductors.

References

- [1] R. J. Cava, B. Batlogg, R. B. Van Dover, D. W. Murphy, S. Sunshine, T. Siegrist, J. P. Remeika, E. A. Rietman, S. Zahurak and G. P. Espinosa, *Phys. Rev. Lett.*, **58**(1987), 1676.
- [2] J. D. Jorgensen et al, *Phys. Rev.*, **B36**(1987), 3608.
- [3] S. Tanaka, S. Uchida, H. Takagi, S. Tajima, T. Hasegawa, K. Kishio, K. Kitazawa and K. Fueki, Proceedings of the Beijing International Workshop on High Temperature Superconductivity Beijing, P. R. China, 29, June-1, July (1987), 219.
- [4] Z. Z. Wang, J. Clayhold, N. P. Ong, J. M. Tarascon, L. H. Greene, W. R. Mckinnon and G. W. Hull, *Phys. Rev.*, **B36**(1987), 7222.
- [5] 阮耀钟,王瑞平,黄伟,李强,低温物理学报, **10**(1988), 47.
- [6] R. D. Barnard, Thermoelectricity in Metals and Alloys John Wiley & Sons Inc., New York, (1972).
- [7] D. K. C. MacDonald, Thermoelectricity: an introduction to the principles, John Wiley & Sons Inc., New York London, (1962).
- [8] Zhao Yong, Zhang Qirui, Kuan Weiyan, Xia Jansheng, He Zhenghui, Sun Shifang, Chen Zuyao, Qian Yitai, Pan Guoqiang, *Solid State Commun.*, **64**(1987), 885.
- [9] Chen Zhaojia, Yang Hongshun, Zheng Dongning, Wu Baimei, Wang Keqin, Zhao Yong, Chen Zuyao, Qian Yitai, Zhang Qirui, *Solid State Commun.*, **64**(1987), 685.

General Formulae for the Equivalent Circuit Parameters of Inductive
Millimeter-Wave Fin-Line Structures

40090018a Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese
Vol 10 No 5, Sep 88 pp 454-461

[English abstract of article by Liu Ce [0491 4595] and Feng Enxin [7458 1869
0207] (Xi'an Jiaotong University, Xi'an)]

[Text] General formulae for the equivalent circuit parameters of multi-fin-line structures are derived by using field matching technique and eigenvalue concept. Several inductive fin-line structures are analysed with this formula. Inductive parameters of the equivalent circuits of these structures decrease as the number of the fins increases and the thickness of the fins becomes greater. When frequency increases, the circuit parameters x_s and x_p become larger. The parameters decrease as the distance between each two metal fins increases. With different mode number considered in the computation, the inductive parameters of dielectric fin ($\epsilon_r = 2.22$) sandwiched in two metal sheets are analysed. The results show that when the mode numbers in continuous region and discontinuous region are greater than 20 and 80 respectively, errors due to truncation are less than 1 percent. In the case of single metal inductive fin and dielectric fin sandwiched in two metal sheets, the calculated data with this method are in good agreement with those calculated by variation method and S parameter method respectively. (Manuscript received 29 December 1986, revised 17 March 1988.)

References

- [1] 刘策等, 西安交通大学学报, 20(1986), 51—58.
- [2] Y. Shih, *IEEE Trans. on MTT*, MTT-31(1983), 135—142.
- [3] F. Arandt, et al., *IEEE Trans. on MTT*, MTT-32(1984), 1391—1394.
- [4] R. Vahldieck, et al., *IEEE Trans. on MTT*, MTT-33(1985), 1333—1339.

/6091

A New Type of Adjustable Permanent Magnetic Circuit

40090018b Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese
Vol 10 No 5, Sep 88 pp 469-473

[English abstract of article by Lang Liang [6745 5328] and Jiang Junji [3068 6874 1015] (Institute of Electronics, Chinese Academy of Sciences, Beijing)]

[Text] An adjustable permanent magnetic circuit that is staked by three layers of samarium-cobalt permanent magnets magnetized in radial direction and magnetic conductive material such as iron, is developed. By means of CAD, a uniform magnetic field distribution having a flux density of 1.2 kGs on the axis and a fluctuation of ± 0.7 percent within the axial length of 270 mm is achieved. It is a good magnetic circuit for a permanent magnetic focusing system for high-power microwave tubes. (Manuscript received 28 December 1986, revised 25 December 1987.)

References

- [1] E. L. Lein, Advance in Klystron Amplifier, 16(1973), 33—39.
- [2] AD-A012405, 1975, 6.
- [3] A. Staprans, E. W. McCune, J. A. Ruetz, *PIEEE* 61(1973), 299—330.
- [4] D. D. Hayes, S. V. Logan, *Microwave Journal* 16(1973), 4, 37—44.
- [5] 郎良, 忻宝碌, 改善高功率速调管磁聚焦的均匀性, 中国科学院电子学研究所内部资料, 1963 年.

/6091

Engineer Invents New Satellite Television Receiver

40080041 Beijing GUANGMING RIBAO [GUANGMING DAILY] in Chinese 29 Sep 88 p 2

[Article by Xu Deng [1776 3397]: "Engineer Hu Guangqing Invents New Television Receiving System--Direct Home Reception of Multiple Intelsat TV Programs Is Becoming a Reality"]

[Text] (Special Report)--The dream of being able to sit at home and simultaneously receive multiple international television programs transmitted by communications satellites has now become a reality. The viewer need only connect a small new satellite receiver [box] to his television and hook up a new cleverly constructed compound antenna, and clear color TV pictures from different countries appear before him along with the accompanying sound. This achievement of Northwest Polytechnic University engineer Hu Guangqing [5170 0342 1987] is now patent pending, and the State Science & Technology Commission has decided that it be shown at the International Technological Exhibition opening on 7 October in Grenoble, France.

With today's higher standards in entertainment, a great many families and groups desire a greater range in their choice of television programs: the ability to simultaneously receive multiple programs. However, the satellite television receivers currently available around the world are basically single-channel models; they can only receive one television program at a time. If simultaneous multiple-channel reception is desired, several distribution boxes must be connected in; this increases the cost of production and is not suitable for broad dissemination.

The satellite television receiving system invented by Hu Guangqing resolves this problem in a very nice way. Through its use of large-dynamic-range battery [dian ping 7193 3910] tracking technology, it can receive satellite television programs arbitrarily in three bands: L, C and K. The receiver not only has a simultaneous output of eight different TV program channels (different contents and different color systems), it can also directly and with a high degree of linear modulation enter the community antenna television [i.e., cable TV] broadcasting transmission system. The receiver comes equipped with four DPSK-PCM [differential phase-shift keying--pulse-code modulation] and MAC [multiplexed analog components] digital communications interfaces for easy upgrading to high-quality digital sound/image systems. Integrated circuit design has been utilized within the system for high reliability, clear output

color image, and excellent sound. In external appearance, the receiver has a design based on accepted international methods, is small in volume, and weighs only 3 kilograms. The keys are designed for light touches, and functional control is via digital storage methods. The compound antenna system is designed on the elliptically polarized feed technique, which has an excellent radiation capture coefficient; the same antenna can [simultaneously] convert feed sources of three different wavelengths and polarizations. Using antennas of different diameter [to form the compound antenna], the system is suitable for receiving satellite television programs broadcast by countries all over the world.

In addition to being cleverly designed and technologically advanced, Hu Guangqing's system also has the virtue of being low in cost. Each receiver requires an expense of only 3000-5000 RMB, which will permit the one antenna to put out multiple programs. For this reason, there is a broad international market for this system, which will have enormous competitive power. China currently has as many as 10,000 TVRO [television receive-only] satellite ground stations; if this new equipment is put into use, not only can it satisfy the needs of disseminating educational satellite television programs at provincial, county, and municipal levels out as far as remote mountain areas, it will also eventually make inroads into ordinary households, to satisfy the varying tastes of different people. After Hu Guangqing's achievement makes its world debut, the China National Aero-Technology Import & Export Corp. as well as businessmen from the U.S., the FRG and other countries one after another will want to purchase samples or set up cooperative production [ventures]. A team of experts sent by Japan's JVC (Victor Corporation) to make a preliminary inspection of the system's [television] reception gave it a very high rating. Authorities at the Central Television Broadcasting branch of the Broadcast Satellite Office are hopeful that this system can be certified at the ministry level as quickly as possible, so as to be popularized throughout the country.

Hu Guangqing is 35 this year; in 1977 he graduated from Xi'an Jiaotong University with a major in radio communications. Prior to this invention, he designed high-dynamic-range L- and K-band satellite television receiving systems as well as some other technical devices, production rights to which have been granted to the Shaanxi Television Broadcasting Equipment Plant (also known as the color television plant), to the Xi'an Radio Plant No 1 (also known as the Haiyan ["Petrel"] Color Television Plant) and to other plants.

Briefs

Zhongshan-Zhuhai-Macao Fiber-Optic Line--The Zhongshan-Zhuhai-Macao long-distance fiber-optic communications cable project has been completed and recently put into trial operation. This is the longest fiber-optic communications trunkline cable yet completed in Guangdong Province. Equipment for this long-distance fiber-optic communications cable was imported from abroad and will eventually have a capacity of 3800 circuits. In the initial phase, 960 circuits between Zhongshan and Zhuhai and 360 circuits between Zhuhai and Macao have been opened, with a total length of 60 km. The line cuts across a component of the Zhujiang triangle's Guangzhou-Macao long-distance fiber-optic communications trunkline project and will be interlinked with the operational Zhongshan-Foshan 960-circuit microwave communications system and with the Guangzhou-Foshan fiber-optic communications cable to create a Guangzhou telecommunications hub. [Text] [40080033a Beijing DIANZI SHICHANG [ELECTRONICS MARKET] in Chinese 18 Aug 88 p 1]

New Aid for Satellite, Microwave Communications--Fang Yonghan [2455 3057 3352] and Hu Ang [5170 2491] from the Materials Department of Shanghai University of Science & Technology recently developed an A7 ceramic. This information was revealed yesterday at the accreditation meeting held by the municipal Higher Education Office. The development of A7 ceramic is a major breakthrough for China's research on microwave dielectric resonator materials and fills a void in China's development of high-inductivity dielectric resonators. Experts feel that this materials meets advanced international standards and provides a new aid for modernization of China's Intelsat direct broadcast television, microwave communications, and other technologies. [Text] [40080033b Shanghai WEN HUI BAO in Chinese 25 Aug 88 p 2]

Smaller Fiber-Optic Transmission Terminal--Shanghai Jiaotong University's Fiber-Optic Technology Research Institute recently put out a lower price, reduced-volume fiber-optic data transmission module. Principally used for point-to-point data transmission, this module is already in production at the university's plant. With a cost only one-sixth or one-seventh that of the currently cheapest optical data transmission terminal, this modular matchbox-sized optical microterminal has a transmission rate of 0-20 bits/second [sic] and a maximum transmission range of 1-2 km. Under normal conditions, it can meet the requirements of computer data transmission. It comes with TTL and RS-232C interface levels and is equipped with a 0-5-volt analog signal interface; it can therefore also be used for computer control of analog quantities such as temperature and humidity. [Text] [40080033c Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 33, 31 Aug 88 p 1]

International Digital Telephone Agreement--Jiangsu Province's Posts & Telecommunications Administrative Office recently signed an agreement with Sweden's [LM] Ericsson Company to import a 200,000-switch [stored-]program-controlled (SPC) telephone exchange. The provisions of the agreement are as follows: within three years from now, Jiangsu will purchase one of Ericsson's Axe-10 200-switch digital SPC telephone exchanges with 60 long-distance lines; in the same period, four centers will be constructed in Jiangsu Province: a maintenance and support center, a repair center, a parts center, and a training center. The 200,000-switch telephone exchange will be installed in three phases, the first phase of which can be operational by the end of 1989. [Text] [40080033d Beijing DIANZI SHICHANG [ELECTRONICS MARKET] in Chinese 15 Sep 88 p 1]

Major Breakthrough in Microwave Communications--China's first 4GHz all-solid-state digifax-compatible microwave communications transceiver, developed in a three-year effort by Xi'an Posts & Telecommunications Department's Research Institute 4, recently passed ministry-level technical certification. This means of modernizing China's microwave equipment, which can reduce the fifteen-year gap between domestic technology and the state-of-the-art to ten years or less, represents a great savings in power, a great reduction in size, and a 400-500-percent improvement in reliability. Experts feel that installation of this equipment in the first thousand microwave stations in China's 20,000-km-plus system of microwave repeater circuits can generate economic benefits of 100 million yuan in addition to the benefits of greatly increased circuit quality and expanded capacity. [Summary] [40080033e Beijing DIANZI SHICHANG [ELECTRONICS MARKET] in Chinese 15 Sep 88 p 1]

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10

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