MAY 1978

SCIENCE BULLETIN

National Science Council
2 Canton Street
Taipei, Republic of China

Summary and Significance US-ROC Cooperative Science Program Seminar on Mycoplasma Diseases in Plants

The joint seminar sponsored by the National Science Council, ROC, and National Science Foundation, USA, was held from March 27 to 31, 1978, in Taipei and Tainan, Taiwan, Republic of China. Twenty three participants including 8 from the U.S. and 15 from the ROC were present. Also in attendence were 2 observers from the U.S., 35 observers from ROC, 3 observers from Japan and Korea, 3 U.S. representatives and 5 ROC representatives. The seminar included 2 days of presentations on current aspects of research on plant mycoplasmas, 2 days of site visits to observe mycoplasma-like organism (MLO) associated plant diseases in the field, and a one day plenary session. Twenty five papers were presented by the participants, and special lectures on research status of plant MLO diseases were given by the Japanese and Korean observers. A full proceedings of the papers presented at the seminar will be published in the near future.

Distinguished achievements presented in the sessions were:

1. Isolation, cultivation, and characterization of spiroplasma and mycoplasmas from plants and insects: Nine presentations dealing with these topics were given by participants from the U.S. and ROC. Included were conniques, and some new spiroplasmas were reported. The data emphasized the heretofore unsuspected wide distribution and diversity of the spiroplasma group. These results are significant not only in their contribution to our basic knowledge of this new group of microorganisms, but are of direct value in applied studies of plant and insect pathology.

2. Improvement in tetracycline injection technology for controlling MLO-associated diseases of woody plants: Several promissing new techniques of presure injection were presented. Also discussed were the importance of timing, site of injection, dosage, and number of applications required to effect diseases remission, especially in regard to the current methods of tree injection used in Taiwan.

3. Six papers concerning the epidemiology and vector relationships of MLO diseases were presented. The important roles playcd by vector insects and natural alternative plant hosts in the spread of MILO diseases were emphasized. Also discussed were experimental approaches used to find insect vectors and natural hosts of citrus stuborn disease in California, and sugarcane white leaf, sweet potato witches broom and loofah witches' broom diseases in Taiwan. It was agreed that such information is indispensable in formulating effective measures of integrated disease control.

4. Significant advances in etiological studies were reported through optical and electron microscopical techniques. Also, the importance of proper intrepretation of histological data was stressed by pointing out many past errors based on preparation artifacts.

Recommendations and suggested topics for cooperative research programs were:

1. The recent significant breakthroughs on plant and insect spiroplasmas made in the U.S. and ROC must be followed through. Additional studies on the isolation, characterization and pathogenicity of these organisms are necessary in order to clarify their host range, significance to the yellows diseases, and interrelationships among strains. Such basic etiological studies are important to the formulation of effective control measures. For instance, the apparent association of spiroplasmas with rice plants and green leaf bugs suggests that it may play a role in the rice yellow dwarf and the decline of wentan pomelo or citrus likubin. Considerable research foundations have been established in both the U.S. and ROC. Therefore, cooperative research projects beneficial to both countries are recommended for initiation. Possible cooperators are E.C. Calavan, T.A. Chen, R.E. Davis, C.H. Liao, R.E. McCoy, and R.F. Whitcomb in the USA and H.J. Su and other scientists in ROC.

2. The success of tetracycline antibiotics in government regulatory agency approved programs for control of lethal yellowing and pear decline diseases in the U.S. and citrus greening diseases in South Africa demonstrates the value of research into tree injection as a means of control of MLO diseases. It was already been shown that citrus likubin can respond to infused antibiotics. Further research into the use of tetracycline infusion for control of citrus likubin, wentan pomelo decline, and paulownia witches' broom is indicated. Investigations into injection techniques, dosage, timing, and new chemical agents are necessary. The U.S. side may supply injection tools or designs, new information in transfusion techniques, and new test chemicals. Researchers in ROC (R.J. Chiu, Y.P. Tsai, and S.L. Yang) will conduct field trials. Screening of chemical candidates will be done both in the USA (G. Nyland and T.A. Chen) and ROC

(*To be continued on Page* 3)

Summary of NSC-Supported Research in the Field of Natural Sciences in Fiscal 1977

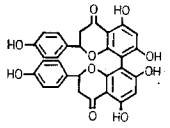
CHEMISTRY

In the fiscal year of 1977, about one-third of the research projects was related to applied purposes or had potential application in their achievement. The other projects were essentially in pure chemistry. Some conclusive results have been obtained from a number of projects, and are briefly described as follows:

Utilization of natural resources

Professors Yau-Tang Lin and Yu-Shia Chen of National Taiwan University devoted themselves to the studies of essential oils in order to develop efficient ways to obtain certain basic chemicals or fragrant materials from native plants. Professor Lin continued his study in search of camphor trees (*Ciunamomum camphora* L. Sieb) with high content of camphor, linalool, cineol, and safrole, respectively, in the leaves by gas chromatographic analysis of the steam distillate. So far he has found 78 trees with very high camphor content, 8 trees with very high linalool content, 7 trees with very high cineol content, and 8 trees with very high safrole content. In collaboration with Mr. Ta-Wei Hu of Forest Research Institute the attempts of grafting and rooting are in progress. Professor Chen analyzed the essential oil obtained from the flower of *J. erandiflorun* L. Kobuski (Suh-Shing) by the combination of silica gel column chromatography and gas chromatography. She found that the quality of the floral absolute was as good as the imported one. The flower is recommended to be harvested at the late bud stage and to be extracted at the stage when the flower has been in full bloom for 2-4 hours. Professor Fa-Chin Chen of National Taiwan University continued the study on the active principles of native plants. From the heart-wood of *Ulmus uyematsui* Hay (Alisan elm) and from the drupes of *Rhus succedanea* L. (waxtree) several new compounds have been isolated. One of them is a new biflavanone neorhusflavonone (8,8"-binarin-genin).

The structure was confirmed by



chemical and spectroscopic methods. Aside from those projects, Professor Ying-Mao Chan of National Taiwan University has developed a simple continuous process which may rapidly separate the major components in monazide in Taiwan.

Spectroscopic studies

Professors Hua Chang and Da-Ming Huang of National Tsinghua University have completed their study on the resonance Raman effect and selective excitation in gaseous bromine and gaseous chlorine, respectively. Professor Sze-Chen Yang of National Taiwan University has developed a modified RKR procedure which can convert high quality laser fluorescence data into effective potential curves without losing the accuracy of the inherent information. The A X transition intensity of cesium hydride was measured and the potential curve was obtained accordingly.

Organic synthesis

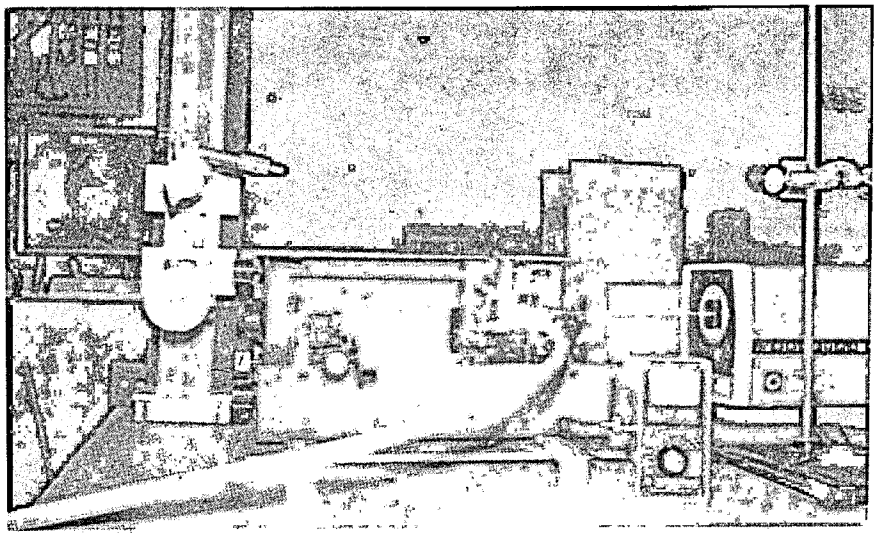
Professor Chao-Tung Chen of Academia Sinica synthesized eight potential antitumor agents of arylpyridine-2-carboxaldehyde thiosemi-carbazone derivatives. Their biological activities are being tested. In the study of solid supported oxidants, Professor Kwang-Ting Liu of National Taiwan University has made three such reagents, namely, thallium(III) nitrate, sodium metaperiodate, and manganese dioxide impregnated on acidic alumina. There new reagents showed higher reactivity, selectivity, and better manipulative convenience than the conventional unsupported ones in selective oxidation of organic functional groups.

Catalysis

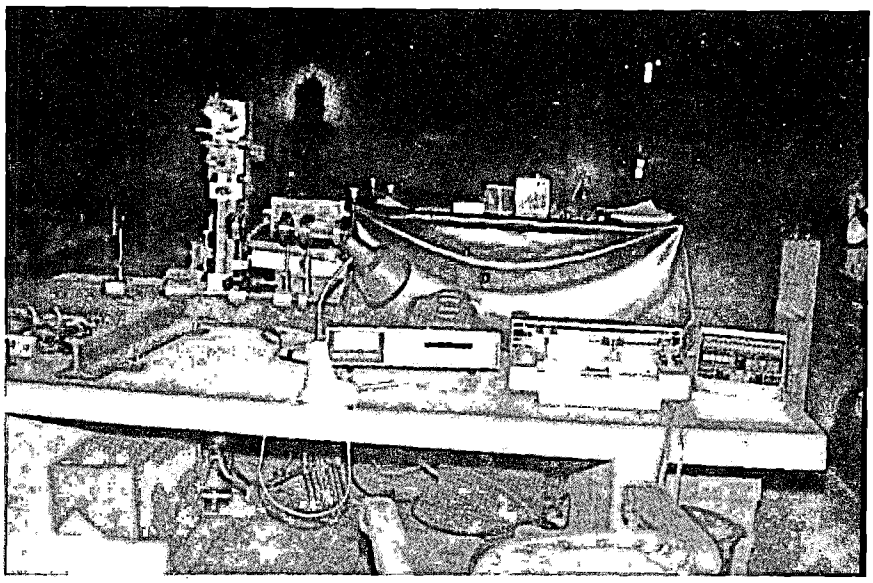
Professor Kun-Huang Hung of Academia Sinica has constructed a gas chromatograph and a reactor for his study on catalysis. He found that among several catalysts the best for dehydration of alcohols was molecular sieve type-13X. In terms of promotion per unit surface area, however, undecamolybdates was the most efficient one. Professor Huei-Ron Chou of National Tsing-Hua University has made a number of zeolites and studied their catalytical effects on the isomerization of cyclopropane. The activation energy of the reaction was measured and the mechanism was elucidated.

PHYSICS

The National Science Council supports research in physics through grants to special projects at the Physics Research Center and other academic institutions. The fields of research include nuclear physics, solid state and applied physics, theoretical physics, etc. Forty research papers were prepared for publication during the 1976-77 fiscal year. In April 1977, the NSC also sponsored a Sino-American Conference on solid state physics with the National Science Foundation of the United States. The major topics of this conference were: physical properties, applications of semi-conduc-



Argon Ion Laser Source



Raman Spectroscopy or Resonance Fluorescence Spectroscopy System

tors and magnetic materials. The following is a brief account of some of the representative projects carried out in 1976-77:

Nuclear Physics

Studies on low energy proton-induced nuclear reactions:

Nuclear targets prepared by vaccum evaporation techniques were bombarded by protons produced by a Van de Graaff accelerator in order to induce nuclear reactions. The energy and angular distribution of the reaction products were detected by solid state dectors. The energy dependence of scattering and reaction cross sections, excitation spectrum, etc. were determined from these data. The resonance state in the 1381-1800 KeV energy range of proton-Al^{27} capture reaction was also studied.

Saudies of nuclear reaction induced by 14 MeV neutrons

$^{45}Sc(n,d)^{44}Ca$ reaction induced by 14MeV neutrons were studied. The energy and angular distribution of deutrons produced by ground state and first exicited state of the ^{44}Ca nucleus were obtained through the study of this reaction. The reaction cross-section of the first and second excited states were also obtained from a theoretical anlysis using the pick-up theory in the DWBA approximation.

Studies on neutron or proton capture reaction

Ge(Li) and Ge(Li) dectors synchronized counting system were installed. The capture of proton by ^{72}Ge was studied, and the low lying energy spectrum of ^{73}As nucleus was obtained.

Solid States and Applied Physics

Fabrication of thin-film wave guide and studies on surface accoustics waves

This is a project on applied thin-film optics. The main objective of fabrication of interdigital transducer was fulfilled. The techniques of optical probing of surface acoustic waves were also developed. It can be used for measuring the energy distribution of the longitudinal and transverse surface acoustic waves. The characteristics of propagation, dispersion, focusing and scattering loss of the surface acoustic waves can be obtained from such data.

Fabrication and studies of photo-electric effect of the Schottky barrier diode and silicon photo-diode

This project involves the investigation of methods of fabrication of metal-oxide-semiconduction junction sun-light cells, and measurements of its photo-electric properties. It was found that the addition of a non-conducting oxide layer between the boundaries of metal and semi-conductor can improve the open-circuit photo-voltage by 35 percent, and that closed-circuit current does not decrease because of the electron tunneling effect. Another way of increasing open-circuit photo-voltage is to diffuse impurities such as Au into layer, thereby increasing the barrier voltage.

(To be continued)

Summary and Significance....

(Continued from Page 1)

(Y.C. Chang and H.J. Su). Other possible U.S. cooperators are R.E. McCoy, D. Rosenberger, and M.H. Zimmermann.

3. Epidemiological studies with emphasis on the vector insects transmitting paulownia witches broom, citrus likubin, and pomelo decline are urgently needed in Taiwan. These diseases of high epidemic potential are threatening total elimination of their suscept species in Taiwan, yet their vectors are poorly understood or unknown. It is recommended that field surveys of the leafhopper fauna be made for these species and the possible disease-vector relationships be investigated among these insects. Suggested Chinese workers are Y.C. Chang, Y.P. Tsai, and H.J. Su. Additional expertise in insect taxonomy may be necessary. Possible U.S. experts that might serve as consultants are G. Nyland, D. Rosenberger, J.H. Tsai, F.W. Howard, and R.F. Whitcomb.

4. Exchange of light and electron microscopical techniques for observation of plant MLO and spiroplasmas is expected to be enhanced among U.S. and ROC plant pathologists. Detection of MLOs by means other than microscopy could also be of value. Possible cooperators are M.J. Chen, and H.J. Su from ROC and O.E. Bradfute, R.L. Steere, R.E. McCoy and T.A. Chen from the USA. Possible training visits of Chinese investigators to U.S. laboratories might be of direct value in that new techniques and information could be picked up in a "hands on" manner.

The above four areas of need have been identified as possible subjects for cooperative investigation between the U.S. and ROC. Possible investigators for each area have been named from both countries, and the list of investigators has not been limited to participants in the plant mycoplasma seminar. It is our hope that proposals for cooperative research be initiated in these subject matters areas. Such cooperative projects can take the form of scientific visits, information and equipment exchange, or training visits of shorter duration.

Submitted by R.E. McCoy,
U.S. Coordinator, and
H.J. Su, ROC Coordinator.

Symposium on Fermentation Engineering Fundamentals Slated for May 30 - June 1

A three-day Symposium on Fermention Engineering will be held at the University of Pennsylvania under the ROC-US Cooperative Science Program on May 30-June 1. A total of 25 papers will be submitted by the participating Chinese and American scientists. The following is a tentative program for the symposium.

Program

May 30

0830-0900 — Registration TV Classroom, College of Engineering and Applied Science.

0900-0920—Welcome, Drs. Humphrey, Ting, Lih.

0920-0940—Introduction of participants and observers.

0940-1020—Opportunities in Fermentation Technology, Dr. Arthur Humprey, University of Pennsylvania

1020-1040—Coffee.

SESSION I—Fermentor Design and Operation
Session Chairman—Dr. D. I-C Wang.

1040-1120—Status of Research and Fermentor Design and Operation, Dr. H.W. Blanch, University of Delaware.

1120-1200—Novel Fermentor Design, Dr. R.T. Hatch, University of Maryland.

1200-1300—Buffet lunch in reception area.

1300-1320—Tour of Biochemical Engineering facilities at University of Pennsylvania.

1320-1400—Scale-up Study on Stirred Tank Fermentor, Dr. Wei Min Lu, National Taiwan University.

SESSION II—Fermentation Process Modeling and Optimization
Session Chairman—Dr. L.T. Fan.

1400-1440—Status of Research in Modeling Fermentation Process, Dr. Robert D. Tanner, Vanderbilt University.

1440-1520—Kinetic Studies on Algal Culture, Dr. C.H. Lin, Tung Hai University.

1520-1540—Coffee.

1540-1620—Multiobjective Optimization of a Fermentation Process System, Dr. L.T. Fan, Kansas State University.

1620-1700—Optimization of an L-Glutamic Acid Fermentation Plant, Dr. S.Y. Huang, National Taiwan University.

1700-1800—Reception at University of Pennsylvania Faculty Club.

1800-1930—Dinner at University of Pennsylvania Faculty Club.

2000-2200—5-minute informal presentation by observers.

May 31

SESSION III—Monitoring and Control of Fermentation Processes, Session Chairman-Dr. Charles Cooney.

0900-0940—Status of Research in Monitoring of Fermentation Processes, Dr. D.W. Zabriskie, SUNY Buffalo.

0940-1020—Research Opportunities in Fermentation Process Control, Dr. James E. Bailey, University of Houston.

1020-1040—Coffee.

1040-1120 — Manual/Software Programmable Electronic Timing Switch Module for The Process Control of Fermentation System, Dr. C.H. Lin, Tunghai University.

1120-1200—A Microcomputer Controlled General Purpose Fermentation Controller, Dr. C.H. Lin, Tunghai University.

1200-1300—Buffet lunch in reception area.

1300-1320—Informal discussion.

1320-1400—Microcomputer Controlled Digitallized Agitation System, Dr. C.H. Lin, Tunghai University.

SESSION IV—Bioconversion of Agricultural Products and Wastes
Session Chairman-Dr. S.Y. Huang.

1400-1440—A Description of Purdue Solvent Process for Cellulose Hydrolysis, Dr. G.T. Tsao, Purdue University.

1440-1500—Biogas or Biomass Conversion of Cellulosic Africultural Wastes by Solid States Fermentation, Dr. H.H. Wang, National Taiwan University.

1500-1520—Coffe.

1520-1600 — Bioconversion of Sugar Cane Products, Dr. J.A. Polack, Lousiana State University.

1600-1640—Pilot Plant Trial of SCP Production from Bagesse Pith, Dr. M.C. Hsie, Taiwan Sugar Research Institute.

1640-1720—Conversion of Rice Hulls into Single Cell Protein for Animal Feed, W.H. Hsu, Food Industry Research and Development Institute.

1800-1900—Reception at Faculty Club.

1900-2100—Dinner at Faculty Club.

June 1

SESSION V—Novel Fermentation Products and Processes
Session Chairman-Dr. G. Tsao.

0900-0940—Biomass Production from Methanol, Dr. T.F. Kuo, Chinese Petroleum Corp.

0940-1020—Production of Acrylic Acid by Fermentation, Dr. C.L. Cooney, Massachusetts Institute of Technology.

1020-1040—Coffee.

1040-1120—Production of Monascus-Pigments in a Submerged Culture, Dr. Y.C. Su, National Taiwan University.

1120-1200—Enzymatic Hydrolysis of Xylan, Dr. P.J. Reilly, Iowa State University.

1200-1300—Buffet lunch in the reception area.

SESSION VI—Production of Food Materials by Fermentation
Session Chairman-Dr. C.H. Lin.

1300-1340—Production of Food Materials by Fermentation, Dr. S.S. Wang, Rutgers University.

1340-1420—A Rapid Process for Manufacture of Vinegar, Dr. M.N. Lai, Food Industry Research and Development Institute.

1420-1500—Production of Food Grade Acetic Acid by Fermentation, Dr. D.I.C. Wang, Massachusetts Institute of Technology.

1500-1520—Coffee.

1520-1600—Studies on the Process of Inyu Fermentation, Dr. W.H. Hsu, Food Industry Research and Development Institute.

1600-1630—Summary—Drs. S.Y. Huang and A.E. Humphrey.

1630 —Adjournment.

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