

AUG 1976

# SCIENCE BULLETIN

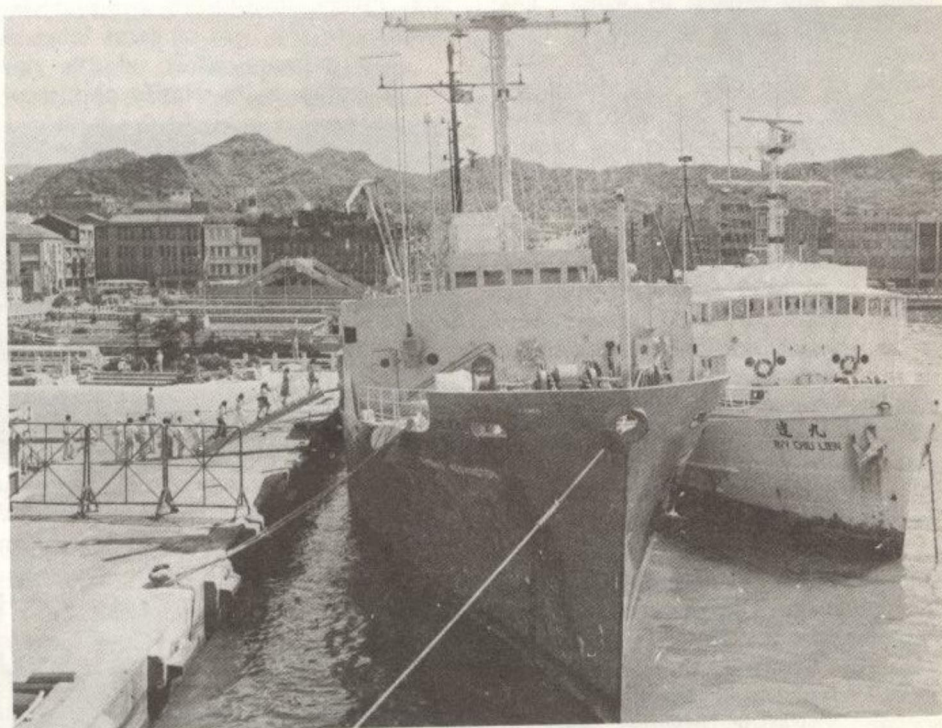
National Science Council  
2 Canton Street  
Taipei, Republic of China

## Joint Sino-U.S. Oceanic Study Conducted in the Philippine Sea

The research ships *Chiu Lien* of the Institute of Oceanography of National Taiwan University, and the *Thomas Washington* of the Scripps Institution of Oceanography of the University of California, arrived in Keelung Harbor July 27 on completion of a cooperative study of the Philippine Sea.

The two ships worked together for 19 days in a study of geological structure of the sea floor; each had been working for the previous month independently on related projects, and they joined for the two-ship program at Guam.

Planned studies had to be modified somewhat because of typhoon conditions. Typhoon Therese went through an area of the Northern Marianas (near Pagan Island) where the two ships were working, causing them to have to divert from original plans. Typhoon Wilda also caused changes in plan when the ships had to move west rapidly to get out of its way.



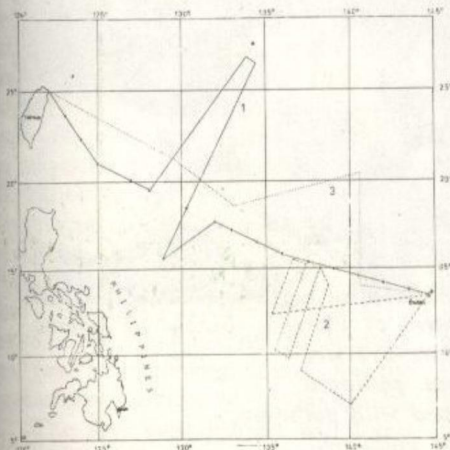
The R/V *Chiu Lien*, right, and the American research ship *Thomas Washington*, left, docked at Keelung upon completion of their joint sea exploration.

Despite weather problems, considerable research was accomplished. The ships carried out 32 seismic-refraction profiles, designed to measure the thickness of the various rock layers in the earth's crust, and they measured water depth, sediment thickness, and magnetic field intensity over most of the cruise.

Results of the seismic studies will take some time to analyze. Preliminary interpretations made aboard ship indicated, however, that the Philippine Sea has significant differences from the geological structure of the north Pacific basin east of the Marianas. Research programs on the two ships were under the direc-

tion of Dr. Richard Lu aboard the *Chiu Lien* and of Dr. George Shor on the *Thomas Washington*. Some staff members of each institution participated in work aboard the ship of the other institution for training purposes.

For the R/V *Chiu Lien*, which carried a contingent of 15 marine scientists and geologists, the trip began from Keelung on June 11. Before they rendezvoused with the American research ship, they had studied hydrology, oceanic biology, oceanic chemistry and oceanic geology in the Philippine Sea. The whole journey covered 9,000 nautical miles (see map).





# Report on Study of *Fusarium* Wilt

By Taiwan Provincial Agricultural Experiment Institute

*Fusarium* wilt is a major crop disease in Taiwan. More than a dozen important economic crops, such as banana, watermelon, flax and others, are infected by various formae of *F. oxysporum* which have caused heavy losses of these crops. The symptom of the disease varies from crop to crop. Diseased bananas, for instance, show a yellowing of the older leaves or a collapse of these leaves while still green at the junction of the petiole with the pseudostem. All leaves quickly dry up, collapse, and broken by wind. Diseased plants finally die but the pseudostems remain standing for a certain period of time until they decay and fall over. There are also vascular discoloration in the outer leaf sheaths only or throughout the pseudostem and fruit stalk. The rhizome vascular discoloration is also very pronounced in the area of dense vascularization where the stele joins the cortex (Figure 1). At present, there is no practical means to control the disease except by resistant variety of the host plant. A search for an effective measure to control the disease has been continued for decades by plant pathologists throughout the world.

A research group, including Dr. Chin-chyu Tu, Plant pathologist and Head of the Department of Plant Pathology of the Taiwan Agricultural Research Institute, Dr. Shang-shyng Yang, Agricultural Chemist and Associate Professor of the National Taiwan University, and Dr. Min Chen, Bacteriologist and Visiting Associate Professor of the Taiwan Normal University, has begun to study the possible biological control measure of this disease for bananas since April, 1975, under the auspice of the National Science Council. Dr. Chin-chyu Tu reported his discovery of so-called '*Fusarium*-suppressive soil' in Taiwan in the late 1974. However, the phenomenon that some soils are more resistant to *Fusarium* wilt than others is known for many decades. These soils are termed as 'suppressive' or 'long-life' soils. Dr. Tu proved its existence in Taiwan through a series of tests with soils from both diseased and healthy flax fields by (1) inoculating the soil with the flax pathogen, *F. oxysporum* f. sp. *lini* and (2) estimating the pathogen

prior to and after the experiment and by observing the chlamydospore germination and germ tube length under two kinds of soils; one is conducive and the other suppressive to the wilt. In the former the disease becomes serious quickly, the pathogen propagules increase rapidly, and chlamydospores germinate normally. In the latter the disease decreases gradually, the pathogen propagules multiply slowly, and chlamydospores are rather difficult to germinate, and even if they germinate the germ tubes are short and always surrounded by bacteria resulting in the lysis of germ tubes.

The primary effort of this research group is to clarify the sup-

pressive mechanism of the *Fusarium*-suppressive soil. A comparison bacterial populations between conducive and suppressive soils found that the former has a higher count of cocci and actinomycetes whereas the latter has a higher count of anaerobic bacteria and gram-negative rods. They also found that several *Clostridium* and *Bacillus* isolated from the suppressive soil were inhibitory to various formae of *F. oxysporum* including *lini*, *pisi*, *lycopersici*, *niveum*, and *cubense* race 1 and race T. The optimum temperature for the expression of antagonistic effect was varied depending upon isolates of antagonists concerned.

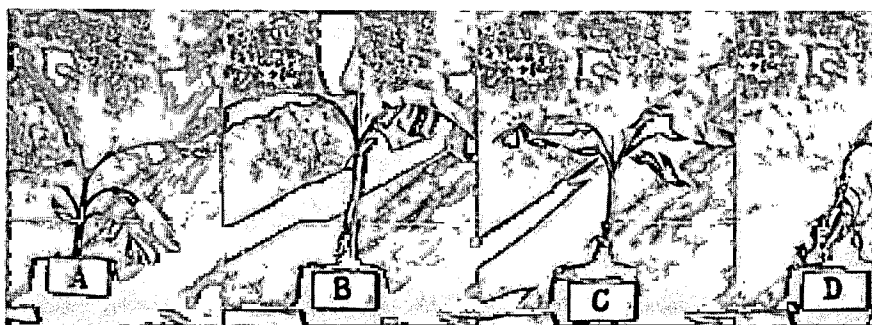


Figure 1. *Fusarium* wilt (Panama disease) of banana. A. Heavily damaged banana field. B. Diseased plant showing yellowing and collapse of leaves. C & D. Vascular discoloration in pseudostem. E. Vascular discoloration in rhizome.

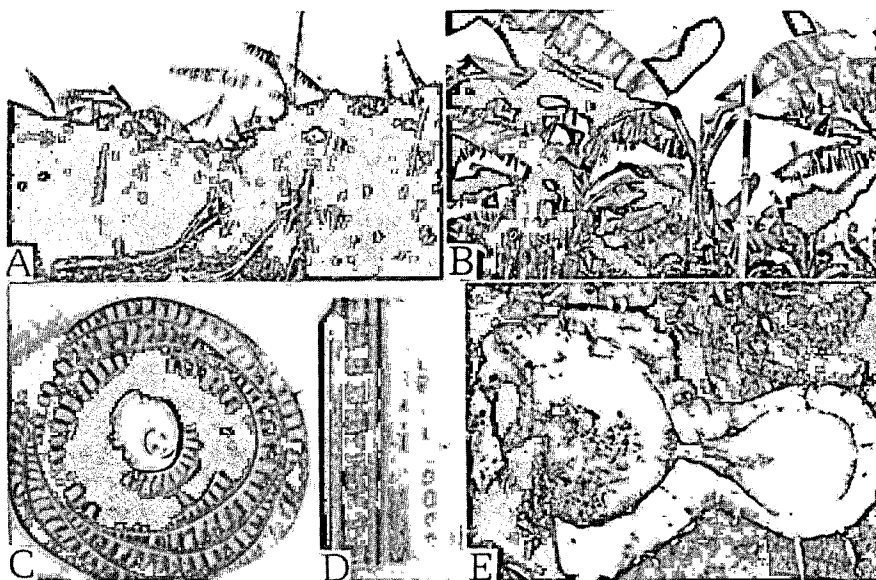


Figure 2. Pot experiment on the control of Panama disease of banana with flax *Fusarium*-wilt suppressive soil.

- A: Suppressive soil without pathogen.
- B: Suppressive soil inoculated with pathogen.
- C: Conducive soil without pathogen.
- D: Conducive soil inoculated with pathogen.

Control of flag *Fusarium* wilt succeeded in pot tests by inoculating a suspension mixture of several bacterial isolated and amending organic nutrients, such as cornmeal, into the soil. Maintaining the soil moisture at a suitable condition was needed for better control. Unfortunately field tests proved that the antagonistic effect of these bacteria lasted only for two months after application.

Since the antagonistic bacterium is probably not the only factor involved in the suppressive soil, inter-

duction of suppressive soil to *Fusarium*-infested field may provide a way to protect the susceptible host plant from the infection of the pathogen. This idea has been proved to be very promising from the pot tests. Inoculation of *F. oxysporum* f. sp. *cubense* to both conducive and suppressive soils revealed that the banana plants were diseased and dead in four months in the former but were healthy throughout the growing period in the latter (Figure 2). A small scale experiment was conducted

in the field by the introduction of suppressive soil to the infested field at the planting hole with the amount of 2-9 kg soil/per seedling in early July, 1975. All treated banana plants were free from the disease and were harvested in early June, 1976. Because research is still continuing on this project, the final and full results of the control of Panama disease (*Fusarium-wilt*) of banana by the introduction of suppressive soil to the infested field can not be reported at this time.

## Probability Weather Forecast in Taiwan

**George Tai-jen Chen**  
Department of Atmospheric Sciences  
National Taiwan University

Atmospheric motion is so complicated with circulation systems of different time and space scales that no existing numerical model can completely describe all the processes involved. Lack of understanding on the dynamics of the atmosphere together with the inaccuracy and sparsity of observational data, especially over the ocean, leads to some problems on numerical weather prediction as well as traditional subjective weather forecasting. Consequently, meteorologists in Taiwan are not perfectly confident on the prediction of circulation pattern and the associated local weather neither numerically nor empirically. The event is therefore a forecast of occurrence on weather question of degree of belief. The idea of probability was then brought out by Traveler Weather Service in 1955 and was issued to the public nationwide by the National Weather Service, the United States of America in 1965.

Current short-range weather forecast at Central Weather Bureau and Air Force Weather Central of the Republic of China is either qualitative or descriptive. Quantitative forecast, for example the probability forecast, rather than qualitative forecast is required as far as the scientific verification is concerned. Furthermore, the users of weather forecasting (e.g. decision maker) need the quantitative forecast in order to make an appropriate decision. Sanders' experiment at MIT showed that no objective predictions can not be improved upon by the forecaster's subjective modification.

The first year project will focus on obtaining the climatological probability of precipitation, maximum

and minimum temperature as well as some pertinent climatological parameters at five largest cities in Taiwan. These climatological expectation will provide the reference point for both the forecast and verification for the time period from 12 hours to 96 hours. The forecasts of winter

frost and summer thundrestorm will also be included in the probability forecast experiment as the data and time permit. It is hoped that the probability forecast of some weather events will be used to replace the current qualitative description in the near future.

## 9 New Academicians Elected

Nine new members of Academia Sinica were elected on July 29 after three ballots.

They are:

1. Ting Chao-chung, 43, a professor at Massachusetts Institute of Technology.
2. Ke Shou-jen, 48, dean of the College of Engineering of the University of California, Berkeley.
3. Veichow C. Yan, 64, professor of geology at the National Taiwan University.
4. Chien Hsu, 45, a professor at the Medical College of Columbia University.

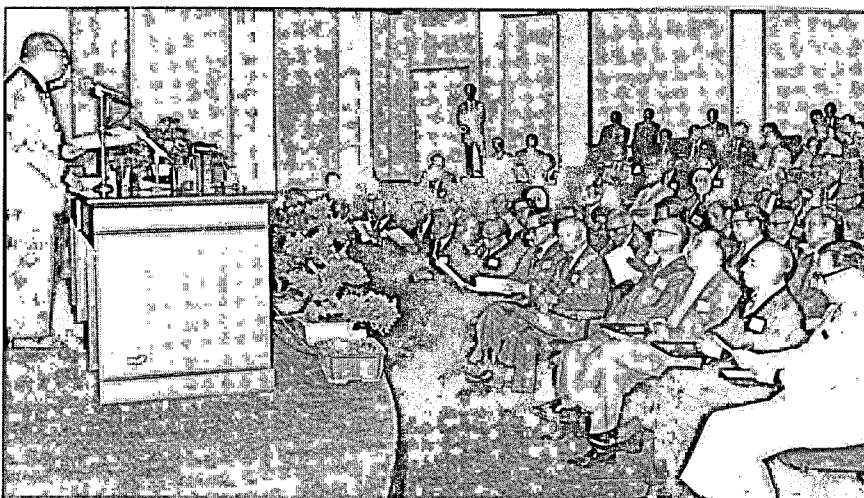
5. Chang Chuan-chun, 48, a professor at the Medical College of National Taiwan University.

6. P.N. Yu, 51, a professor at the University of Rochester in New York City.

7. Tiao Chin-huan, 43, a professor at the University of Wisconsin.

8. Chen Chi-lu, 53, dean of the College of Liberal Arts of National Taiwan University and concurrently director of the Institute of American Studies of Academia Sinica.

9. Liu Kuan-ching, 55, a professor at the University of California, Davis.



President C. K. Yen addressing the opening session of the 12th Conference of Academicians which opened at Academia Sinica, on July 27.

# 3 Long-term Visiting Scientists Approved Under Bi-national Program

The National Science Council of the Republic of China and the National Science Foundation of the United States have approved three long-term visiting scientists to Taiwan to conduct cooperative research with their Chinese counterparts. The visiting scientists and their proposed projects are given below:

(1) Donald B. Zobel, associate professor of botany, Department of Botany and Plant Pathology, Oregon State University, shall be the principal investigator of a project bearing the title "Water relations of *Chamaecyparis* in Taiwan." The 10-month project will start in Taipei on Sept. 1. Prof. Zobel's abstract of the work states:

The cooperative study of the ecology of *Chamaecyparis* in Taiwan and the western United States would continue. Analysis of vegetation, soils and successional data taken earlier in both Taiwan and the United States would be completed. Monitoring of soil and air temperature, seedfall, phenology and late summer moisture stress of *C. lawsoniana* would continue at ten sites; humidity sensors would be added. More detailed seasonal and daily trends of plant moisture stress would be determined. Microenvironmental conditions necessary for establishment of *C. lawsoniana* seedlings would be determined by both observation and experiment, in the field and laboratory. Plant characteristics affecting water relations of native *Chamaecyparis* saplings, and its associated species, would be studied in the United States and Taiwan; nursery studies of seedlings of three species would be done in Taiwan. The stomatal opening pattern, and its response to light and moisture stress, stomatal size, density and distribution, and the relationship of stress to water content would be determined.

(2) Dr. Kang-jei Ho, associate professor at the Department of Pathology, University of Alabama in Birmingham Medical Center. He will work with Dr. Jui-san Chen and Dr. Shu-chien Hsu, both department chairmen at the College of Medicine, National Taiwan University, on a project entitled "Biliary lipid composition and excretion in Chinese and its relationship to cholelithiasis." It

will be a 12-month project starting on Oct. 1. Dr. Ho has submitted the following abstract for their work:

We propose that: (1) the basic, hepatic, biliary composition in regard to the relative and absolute concentration of cholesterol, bile acid, and phospholipid varies among different ethnic groups and is determined primarily by genetic factor but can also be modified by the dietary intake and habits; (2) a large pool of bile acid is probably the most important factor in keeping the cholesterol soluble in the bile; and (3) a circadian rhythm of biliary excretion of lipids may exist in man which is exaggerated by the cyclic storage and discharge of the gallbladder bile. The hepatic bile may become more lithogenic at certain times of the cycle than at other times.

Since we have analyzed the gallbladder bile composition in various ethnic groups, including U.S. Whites, New Zealanders, Finnish Whites, Masai of Kenya, and U.S. Black, we will apply the same technique to analyze the gallbladder biles of the Chinese without gallstones and those with stones in the first step of the proposed study. We anticipate that the gallbladder bile of the general Chinese population in Taiwan would fall within the soluble zone or lower portion of the metastable supersaturation zone which would account for their low prevalence of cholesterol cholelithiasis.

In the second step of the study, bile acid pool size will be determined in Chinese by isotopic dilution technique. We expect that the Chinese may have a large bile acid pool which is important for protecting their bile from becoming lithogenic.

In the third step of the study, we will try to demonstrate a circadian rhythm of biliary excretion of lipids in patients with indwelling, biliary T-tube. Such rhythm will be first demonstrated in patients with continuous biliary flow from liver to the duodenum, which will be followed by intermittent interruption of such flow to mimic the cyclic storage and discharge of the gallbladder bile. The circadian rhythm may be exaggerated by the latter manipulation.

The proposed project may reveal the importance of genetic factor in

determination of the basic biliary composition, importance of bile acid pool size in biliary cholesterol solubility, and the phenomenon of persistent daily fluctuation of biliary excretion and composition of lipids. A physiological approach may thus be developed for the prevention of cholesterol cholelithiasis, such as administration of chenodeoxycholic acid at a proper time to lower or prevent the lithogenicity of the bile occurring at a particular time of the circadian cycle.

(3) Dr. Tsau-young Lin, associate Professor at the Department of Mathematics, University of South Carolina, will work together with Prof. C. Hsiung of the Mathematics Center in Taipei on a 12-month project entitled "Problems in stable homotopy theory and cohomology theory of transformation groups." The project will start Sept. 1. Prof. Shen's brief description of the project is as follows:

## I. Purpose of the Project:

Let  $M$  be a smooth, closed and oriented  $2n$ -manifold.  $M$  is said to have an almost complex structure if there exists a complex vector bundle  $W$  on  $M$  whose underlying real  $2n$ -bundle is isomorphic to the tangent bundle of  $M$ . Necessary and sufficient conditions for the existence of such structures in terms of the cohomology ring and characteristic classes of  $M$  have caught interests of topologists and geometers. Up to now, there were only partial results. In this work, we try to solve this problem via Adams type spectral sequences or any other type of spectral sequences of the tangent bundle.

## II. Results Known:

Let  $M$  be a manifold. Wu gave the necessary and sufficient conditions for  $M$  to be almost complex when  $\dim M=4$ ; Ehresmann for  $\dim M=6$ ; Heaps for  $\dim M=8$  and partially for  $\dim M=10$ . W. Massey and E. Thomas solved also some special cases.

## III. Method:

We hope that we can find some kind of Adams type (or any other type) spectral sequences related to tangent bundles of manifolds from which our problem can be solved. It is too early to say what precise results we can obtain.

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