

SCIENCE BULLETIN



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Introduction to the Large-scale Project "Research on a Metropolitan Environmental Quality Evaluation System"

I. Foreward

"Research on a Metropolitan Environmental Quality Evaluation System" and "Industrial Development and Environmental Protection" are Stage II in the series of large-scale research projects on environmental protection promoted over the years by the Environmental Protection Task Force of the NSC. Although the formation of these projects and the respective Requests for Proposal differed, the basis on which topics were chosen is the same: they were based on the "Report on Mid-term Upstream Research Needs in Environmental Protection Science and Technology". In addition, both projects require greater integration of academic disciplines than did work during Stage I; problems relevant to metropolitan environmental quality and industrial development and environmental protection involve both science and the humanities. As a result, the selection of members for a given research team must take into consideration the special requirements of multidisciplinary work. There must be a common understanding of overall research topics, goals, and expected results among members of research groups for each subtopic; otherwise, overall integration of the project will indeed be a difficult task.

II. The Research Topic

Metropolitan environmental quality, in the narrow sense, refers to the quality of the air, water, and other environmental media. Traditional environmental engineers re-

fer to the density of these factors to explain why metropolitan sources of pollution cause greater harm to residents than pollution in non-metropolitan areas, which is why the problem requires greater attention. However, given the present-day concept of pollution prevention over pollution control, it is imperative that environmental engineering understand the formation and development of metropolitan areas and how to include environmental quality requirements in choosing metropolitan sites and in setting conditions for and restrictions on metropolitan growth. Control of the population and activity can help to maintain pollution levels to within acceptable limits and can help to avoid the costly and not necessarily effective reparations after the fact. In other words, the natural background of any given area, including the terrain and topography, water resources, and climate, all determine the ease with which the environmental quality of the region can be maintained during the growth of a metropolis. From another perspective, it is important to know whether developmental policies for a particular area are within the limits of the background environment and whether the developmental process lives up to public lifestyle and environmental demands. Another important factor to note is the effectiveness of the administrative system in maintaining the quality of the health, comfort, and harmony of the people living in the area. These are the main factors which affect the quality of the metropolitan envi-

ronment and lifestyle throughout its development.

III. Research Goals and Expected Results

In order to establish an understanding of the formation, development, and administration of metropolitan areas and the direct effects – good or bad – on the environmental quality, a complete system of indices or indicators must be established to point out factors which have been affected. This indicators must be designed with the secondary purpose of being helpful in leading and improving policy-making decisions and administrative efforts in existing metropolitan areas. Therefore, the foremost purpose of this large-scale research project is to design a system of indicators which truly represents metropolitan environmental quality and a method of evaluating quality in general. To this end, with the broad and narrow definitions of environmental quality in mind, those involved in research on similar environmental problems must all work towards a system of indicators and an evaluation methodology which is both localized and international and covers common features of most related topics.

Naturally while researchers are working towards the establishment of such an evaluation system, two other groups within the team have different goals in mind: (1) investigate the relation between metropolitan developmental policy and environmental quality and (2) establish a model of the interaction between environmental administration and environmental quality. In addition,

after preliminary theoretical results are achieved through the first year of research, it is hoped that members of the research team who have an interest in environmental education will start with the available data and begin drawing up a foundation of educational materials for the public to use. Given a broader definition of environmental quality, indicators will have to cover more than just the environment and environmental pollution; researchers involved in the field of public health, lifestyle comforts, and public harmony will also have a great deal to offer to those responsible for the establishment of an environmental quality evaluation system.

These results are the more academically oriented goals the research team has in view for the earlier stages of the project. In a different respect, hoped for applied research results include developing an environmental quality evaluation system to determine the specif-

ic environmental features of domestic metropolitan regions, such as Taipei and Kaohsiung. It is hoped that, in later stages, through evaluative efforts, environmental changes over time can be graded and the long and short points of domestic cities can be compared to those of other cities around the world. It is obvious that, in order to attain these results, the government must be in charge of metropolitan development and all other relevant bodies must cooperate fully. Therefore, future research must pay particular attention to the integration of up-, mid-, and downstream aspects and the problem of carrying out results.

IV. Research Personnel

For the first year of this large-scale research project, 25 subtopics were applied for and were all approved. Eight of the subtopics are part of the research on devising indices and indicators. Prof. Shih-Chiao Chang of the Geography De-

partment of National Taiwan University will be in charge of research on natural environmental indicators, while Associate Prof. Ching-Fang Lin of the National Taiwan University Environmental Engineering Institute will be in charge of research on environmental pollution indicators. Another eight of the subtopics are related to metropolitan development policy. Prof. Shu-Li Huang of the Chunghsing University Urban Planning Institute will be in charge of this portion of the project. Environmental administration accounts for the final nine subtopics and will be supervised by Associate Prof. Mingshen V. Wang of the Department of Business Administration of National Sun Yat-Sen University. For the first year, 32 of the research personnel are associate professors or above, 3 are doctoral candidates, 32 are working towards a Master's degree, and 14 are research assistants.

Coordinated Research Project to Study Coral Physiol-ecology and Develop Organic Natural Products

I. Introductory Remarks

The ocean has consistently been referred to as the "last frontier" for developing civilization on earth. The over development and exploitation of land resources over the past century has resulted in many natural disasters that cannot be remedied, such as the dwindling number of primitive forests and the extinction of various species, a shortage of water resources, and an increase in pollution. Add to this the exhaustion of usable resources, and pertinent research on the development and exploitation of land resources is running up against limits. Thus mankind's exploration and development of the ocean has grown increasingly intensive.

The development of the ocean near Taiwan has in fact gone on for years, at times in the past wreaking severe damage because of a prior lack of reasonable understanding and management. Witness the excessive net fishing in the adjoining sea by the fishing industry, and the filling in of coastal marshes and mangroves as trash dumps or land fills.

In order to avoid a repetition of similar mistakes, and in order to develop new scientific knowledge and open up a new area of resources, we have formed a designated research group under the auspices of the Division of Life Sciences, National Science Council to study an ocean ecosystem that has increasingly drawn attention in recent years, coral reef ecological areas, in line with the implementation of marine technology in the ROC Key Science and Technology Policy.

II. Project Goals

The goals comprising the *Coordinated Research Project to Study Coral Physiol-ecology and Develop Active Natural Products* are as follows:

1. Study the development of ROC marine resources in line with the ROC Marine Technology Policy.
2. The abundant coral reef ecosystem of Taiwan and its adjoining islands is one natural resource unique to the ROC which we must quickly begin to study and understand for basic marine biological exploration as well as for planned cul-

tivation to meet the needs of tourism and recreation in the future.

3. Over the past decade or so, we have achieved a good track record in extracting basic organic chemical substances or developing new medicines out of active natural substances derived from marine life. This indicates that they are new territory for developing natural chemical substances and medicines.

4. The development of marine biological technology has ranked high on the research agenda of American, Japanese and European universities and national research programs since 1985. The prodigious variety of marine life in coral reefs provides just the ideal storehouse of research material we need.

5. During the global climatic change project, the ability of coral to stabilize fix carbon dioxide during the formation of its calcite skeleton has gradually drawn the attention of scientists. Because coral reef ecosystems have been termed "marine tropical rain forests," an enormous amount of scientific at-

tention has been paid to the cause and effect relationship between changes in their species and changes in climate.

III. The Project Process

Starting in 1988, Professor Lee-Shing Fang of the Department of Marine Resources at National Sun Yat-sen University, Professor Yang-Chang Wu and Associate Professor C.-Y. Duh of Kaohsiung Medical College, initiated discussions about the feasibility of extracting active natural substances from southern Taiwan coral. Thereafter, Associate Professor Jyh-Horng Sheu attempted to extract and purify some substances from seaweed and coral. In 1989, pursuant to a recommendation from its marine biotechnology planning task force, the Division of Life Sciences, National Science Council asked Professor Fang to assemble a research team, which included Associate Professor C.-F. Dai of the Institute of Marine Biology, National Taiwan University; Associate Professors Keryea Soong and Li-Lian Liu of the Institute of Marine Research at National Sun Yat-sen University; Professor Yang-Chang Wu and Associate Professor C.-Y. Duh of Kaohsiung Medical College. In April of 1990 this became a small-scale research team. After critical review and suggestions by a review panel, the team began to carry out the project in June of 1990. In June the following year, Professor Jyh-Horng Sheu was invited to join the group to increase its research capabilities in the area of basic chemistry.

IV. The Structure of the Project

Domestic research concerning coral reefs is still in its infancy, so its cannot compare with the precise coordination of many large research fields that have developed for 20 or 30 years. Thus, while planning, we paid particular attention to organizing it structurally to allow the originally disparate efforts of scientists in various schools and departments working on their own to develop along mutually coordinated and mutually supportive lines (Fig. 1).

V. Details of the Project

This coordinated project consists of five subsidiary projects in all. Although each is independent, in fact they are all mutually coordinated. Each will be elaborated below according to its nature:

A. Coral Ecology

Keryea Soong and Li-Lian Liu are to carry out a study of the biology

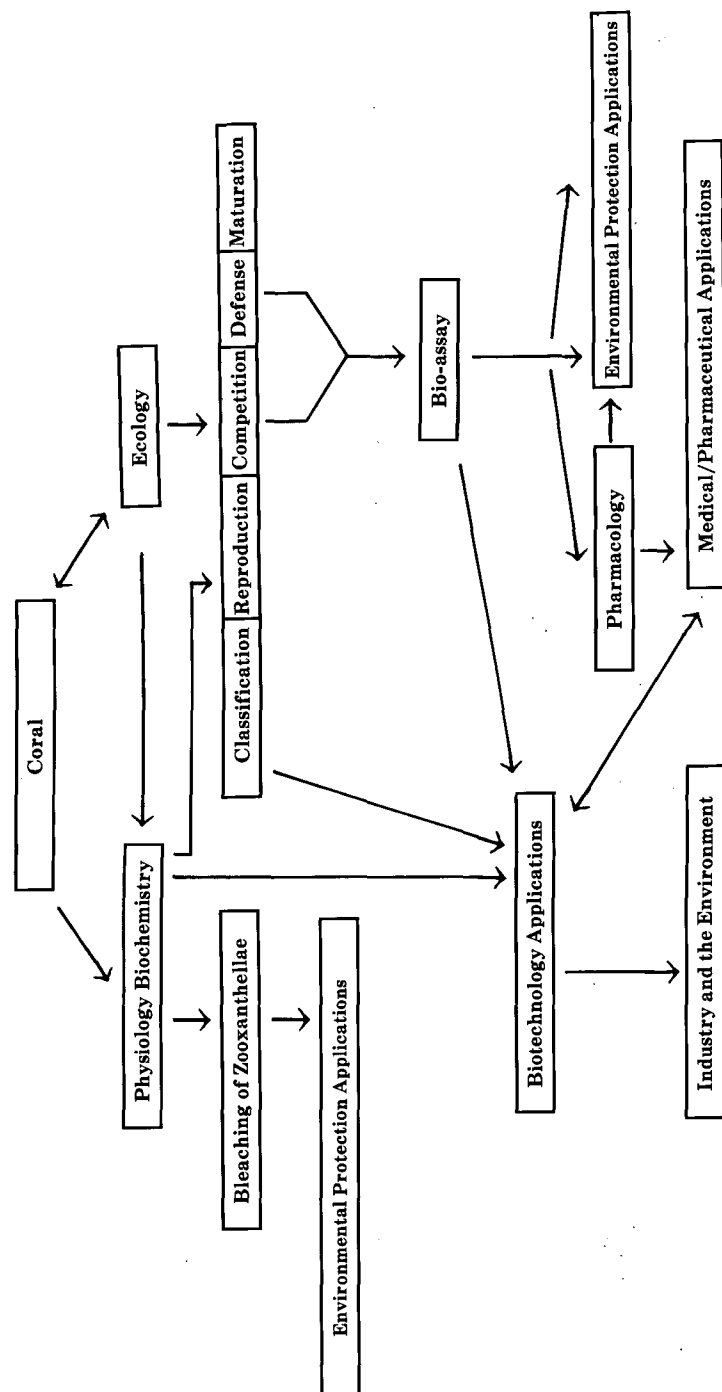


Fig. 1. Coordination Structure for the Coordinated Project to Study Coral Physiol-ecology and Develop Active Natural Substances

of fire coral and its species determination, since the verification of species is the basis of much research. Simultaneously, Keryea Soong's research will touch upon the defense phenomena of coral, and thus will also generate population studies of coral-inhabiting snails that catch and eat coral.

C.-F. Dai will conduct research on the eating activities of soft coral. The position a particular life form has in the food chain is an important link in basic ecology and is an important element deciding the distribution of coral. Since many ma-

rine biological natural substances are secondary metabolic products, determining the source of what soft coral eat is in fact important information for delineating where the natural substances are produced.

B. Coral Physiology

Lee-Shing Fang will be responsible for two principle topics. The first is to study the basic physiological parameters of coral, and to use this to search for whether they can serve as indicators of the health of coral. This will provide useful reference material for an early warning system when cultivating coral in the

days to come. The second topic is to study changes in the internal photo-pigment of coral while its is bleaching, and use this to understand the symbiotic relationship between coral and its internal zooxanthellae. For this portion, Li-Lian Liu will provide research data on all kinds of isozymes in coral to mesh with the overall physiol-biochemical research effort.

C. Sieving Natural Substances

With the support of Keryea Soong, Yang-Chang Wu and C.-Y. Duh will extract natural substances from the soft coral grasses in the sea area of Taiwan, sieve and purify anti-cardiovascular disease ingredients and cancer-fighting substances which are toxic to cancer cells, purify and assay their structure, thereby further understanding their operating mechanism in hopes of discovering new drugs to fight cancer and for other medical treatments among the coral resources surrounding Taiwan.

D. Chemical Combination

Although Jyh-Horng Sheu only entered the coordinated project in 1991, he has years of experience in extrating natural substances from seaweed and soft coral. Hereafter, in coordination with Kaohsiung Medical College, he will conduct active sieving of such substances after they have been further isolated and purified, then will examine and analyze their organic molecular structure to understand the relationship between their organic and molecular structure and define it more precisely.

VI. Results and Outlook for the Project

From the four subsidiary projects carried out in 1990 (a new one was added in 1991), this coordinated project has already produced two articles concerning coral physiology and coral-inhabiting snails, respectively, for publication in international journals. This is an indication of the potential in marine biology for domestic basic coral research.

More than eight kinds of active substances have been sieved from 12 species of soft coral. Their influence to varying degrees upon inhibiting cancer cell growth and blood clot-busting has profound research potential. Furthermore, domestic coral resources not only have their unique value for natural ecosystem and academic research, but also are important resources for marine tourism by our citizens in the future. Nationally, a policy that must be put into practice and followed for the continued future utilization of marine resources involves how we research and exploit these resources as early as possible and plan for their management. Finally, because global warming is becoming increasingly intense, and the ocean is the world's largest temperature-regulating device, to be able to stabilize the amount of carbon dioxide in the ocean on a large scale and nurture coral reefs of boundlessly beautiful marine life surely is a research object we must not neglect.

The Head Advisor to the Russian Minister of Science and Technology Leads a Visit to the R.O.C.

Dr. Ezhkov, the head advisor to the Russian Minister of Science and Technology responded to the Minister's invitation from NSC Chairman Han M. Hsia and led a group of five to visit the R.O.C. Representatives included members of the Russian National Academy of Science and executives from the Sci-tech Transfer Company. Their visit lasted from March 13 through 21 of this year (1992). The purpose of the visit was to review the sci-tech cooperative agreement signed by the NSC and the former Soviet Academy of Engineering; Dr. Ezhkov, acting on behalf of the Minister, and the NSC formally signed a more concrete Sino-Russian sci-tech cooperative agreement. The agreement lays out the establishment of sci-tech repre-

sentative bodies and a technology transfer fund. The agreement is to help actively promote sci-tech cooperative projects between Russia and the R.O.C.

Based on the existing foundation of cooperation, emphasis will be placed on the development of high-efficiency, low-polluting automobile engines and high-value capacitors required for electric cars, research on the applications of low- and high-temperature superconductors, and medical applications of laser technology. High-tech personnel from Russia will be recruited to participate in domestic sci-tech research.

On March 18, a detailed discussion of the direction and content of future mutual cooperation in sci-

ence and technology was held. For the purpose of this discussion, the NSC invited experts in the relevant fields to attend. The list of delegates included the Dean of the Mechanical Engineering Institute of the ITRI, Mr. C. H. Liu; an expert in laser cutting at the National Taiwan University Hospital, Dr. M.C. Kao; a material scientist from Tsing Hua University, Dr. H. L. Hwang; the research project manager for the large-scale research on high-temperature superconductors being carried out at Tsing Hua University, Dr. M.K. Wu; and Dr. W. T. Tsuei from the Innovative Sci-tech Transfer Company. At the discussion, concrete cooperative programs were drawn up to attain the goals of mutual sci-tech cooperation.

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