Report of visit of RCBAS Advisory Board to the Academia Sinica, Taipei  
March 22-23, 2004

(1) Seven members of the Advisory Board were able to visit Taipei on these dates -- Chang-Hung Chou, James Edwards, Nancy Knowlton, Wen-Hsiung Li (co-chair), Yao-Sung Lin, Peter H. Raven (co-chair), and Barbara Schaal. More notice would have been given, doubtless allowing additional members to attend, but the transfer of 19 staff members from the Institutes of Botany and Zoology to the new Center for Biodiversity in January created conditions under which it was deemed important to meet soon.

(2) All members who attended wish to thank the staff of Academia Sinica for their careful preparation and generous hospitality, elements that made our visit both successful and enjoyable.

(3) Biodiversity -- plants, animals, fungi, and microorganisms; their genetic variation; and the communities and ecosystems they comprise -- is fundamental to the continued existence of human and other life on Earth.

(4) Taiwan, with an area of only about 40,000 square kilometers, is a rich center for biodiversity on a world scale, with an estimated 150,000 to 200,000 species of eukaryotic organisms, about 25% of them found nowhere else, and most of these species still undiscovered. Only a few of them are known in any depth. The number of species of prokaryotic organisms -- bacteria and similar living forms -- in Taiwan and elsewhere is completely unknown and cannot be estimated with the data available.

(5) To style the 21st Century the "century of biology" is to assume that the rich diversity of organisms on Earth will continue to be available to build the sustainable systems that Taiwan and the rest of the world need for their continued prosperity. In this respect, Taiwan has the potential to become the "Green Silicon Island" envisioned by its President, a model for the world and a healthy and vibrant place for its inhabitants.

(6) Despite our need for them, both practically and spiritually, both the numbers of species present and their genetic diversity are being eroded very rapidly in Taiwan and throughout the world. Human population growth, increasing expectations and levels of consumption, and inappropriate technologies lie at the root of this trend, with the resulting destruction of natural habitats contributing fundamentally to the loss. Introduced alien species of plants, animals, and other organisms, a problem to which insufficient attention is being devoted in Taiwan, is the second most important factor in the erosion of biodiversity. Much more effort than currently should be devoted to the study and control of alien invasive organisms, both plants and animals, in Taiwan. Major problems also occur in the ocean surrounding Taiwan, where overharvesting is probably the greatest problem, but pollution and other destructive factors are growing in importance.

(7) Biodiversity constitutes an essential ingredient of sustainability for Taiwan, and must therefore be understood well, used wisely, and conserved for fundamentally important reasons. If lost, it can never be regained.
(8) Many institutions in Taiwan and abroad are studying aspects of Taiwanese biodiversity, and their collective efforts are of great importance in relation to the factors just reviewed.

(9) The Academia Sinica plays a leading role in science and technology in Taiwan, and because of the fundamental importance of this role, receives major government funding on a continuing basis.

(10) One of the leading research groups within Academia Sinica, with a very strong international reputation, was organized in January, 2004, as the Research Center for Biodiversity in the Academia Sinica (RCBAS); this Center now includes 19 principal investigators. Unlike many other scientific activities in the Academia Sinica and Taiwan generally, this is a unique center, already a world leader, and not an attempt to mirror or compete with activities carried on in many other parts of the world. It, and allied activities throughout Taiwan, constitute a national resource of the first order of magnitude that should be funded adequately for a leadership role even in times of scarce resources.

(11) The Research Center for Biodiversity differs from all other centers that have been formed within Academia Sinica in that principal investigators have been transferred to it from existing Institutes. Although it is called a center, it is de facto an institute, and part of the planned reorganization of the life sciences within Academia Sinica. For this reason, it will be very important to continue, and to the extent possible, increase the "internal funding" for the PI's who have been transferred out of the existing institutes, building in merit allocations to the extent that Academia Sinica tradition will permit.

(12) All other existing centers have been formed de novo, with a director who then recruits PIs. Their funding is theoretically all interdisciplinary, and in line with the goals of the particular center. If the "Research Center of Biodiversity" is actually to function as a center, it will need additional funding and additional positions, no matter how much goodwill exists among the staff that has been transferred. Loaded with 19 PIs who already have research agendas, it will probably find it difficult to function as a center in the traditional sense, and the maximum number of positions possible should be allocated when the new director is hired. Six positions would be traditional, but we recommend 12 if the unit is really to function as a center and not merely as an element in the organization of the life sciences in Academia Sinica.

(13) Biodiversity studies are highly dependent on collections, libraries, and data bases. Those existing in Academia Sinica should be maintained and housed properly. In the past, some of them have been rather marginally maintained as peripheral activities in the Institutes of Botany and Zoology, and some have not fared particularly well under these circumstances. Because of their central importance, these national collections should be managed in such a way as to provide models for the overall development and healthy growth of such important assets for the achievement of sustainability in Taiwan. They are research facilities, and should be well housed and curated as such.
(14) As a matter of practicality, the division of research programs into those concerned with marine, freshwater, and terrestrial ecosystems seems suitable. We believe that such a division would allow the maximum participation of those moved to the new center in its activities.

(15) Taiwan should maintain its strong tradition in taxonomy, using the best available modern approaches and taking full advantage of its excellent computing facilities and associated scientists. It cannot, however, support specialists for all groups of organisms; the new center should not grow principally according to taxonomic specialties. In order to deal with all such groups, international cooperation will be necessary. Baseline information about the biodiversity of Taiwan should be maintained, increased, and made available on line and in printed formats to the international community.

(16) Graduate and postdoctoral education, nationally and internationally, should become a feature of the academic life of the center, both for its internal and external importance.

(17) It is important that access to all institute facilities now being used by the members of the new center be unimpeded and, if necessary, subsidized centrally so that the research programs of the PIs who have been transferred to the new center will continue unimpeded. Fees should remain the same for the use of the same facilities. If the facilities are mostly used by members of RCBAS, they should be transferred to the new center.

(18) One or more internationally based workshops should be held to identify those aspects of the future sustainability of Taiwan to which the members of RCBAS could most usefully contribute, with suitable attention to the various forms of collaboration, internal and external, that will make success in those areas most feasible. Funds should then be provided or sought to encourage the development of these programs. Pertinent Academia Sinica and other governmental and private-sector entities should be involved in this selection process, since the problems involved go far beyond biodiversity studies into the social sciences generally, political sciences, economics, and many other areas. These programs should be selected and conducted in such a way as to promote sustainability in Taiwan, but as such they are likely to be of worldwide interest. Particularly important are the socio-economic aspects of such programs. There are many possibilities, with lowland forests, coral reefs, and inshore waters and estuaries being obvious among them.

(19) All future activities concerning the achievement of sustainability in Taiwan should be carried out in suitable national and international contexts. National funds should be made available to facilitate such arrangements, and the role of Taiwanese scientists and institutions in training international students and helping to build their institutions is of critical importance. Sustainability for Taiwan ultimately means sustainability for all of its trading partners, and for the world at large. Present connections through ASIANET and other similar networks should be nurtured and developed because of all that Taiwan has to give its partners.

(20) The increase of taxonomic information should be a consistent feature of all integrated ecosystem-level projects, since they are by definition suitable sites for such efforts. Learning about poorly known groups of organisms, such as fungi, nematodes, mites, and bacteria at such
sites will not only inform that particular ecosystem studies but ultimately help to build up a picture of the diversity of such groups for Taiwan and beyond.

(21) Academia Sinica should develop appropriate ways of fostering long-term and applied research and rewarding those who engage in it. Although Academia Sinica was formed to address the basic problems of science and technology, the application of the results of that basic science and technology to the problems of society is of fundamental importance today, and the mechanisms for applying it are not obvious in Taiwan. There is no institution comparable to the National Research Council in the United States, which provides advice on matters of science and technology to the government on a continuing basis, and mechanisms for providing such authoritative advice to proper levels of government must be found. Meanwhile, Academia Sinica should function to do this as a function of its leadership role in science and technology generally. In this connection, the strict application of SCI indices and related means of evaluating individual scientists is often inappropriate for biodiversity scientists and those concerned with fundamentally important problems of national sustainability. Such unimaginative approaches should be abandoned when appropriate for more flexible means of evaluation, or Taiwan will simply be unable to carry out research that is of critical importance to its own sustainability and for human welfare generally.

(22) The results derived from comprehensive projects of national importance should be presented in forms that are immediately useful to the end-users, and can be applied to the actual problems that they face. Such end-users would be involved from the initiation of the programs, and would inform them as they proceed. The immediate applications could be in fields such as sustainable agriculture, forestry, and fisheries; the restoration of depleted areas and particularly watersheds; and the conservation of individual species and communities. Marine and fresh-water habitats should be given special attention in this context.

(23) The system of protected areas in Taiwan was created only recently, with the first national park having been established in 1984. We recommend that the RCBAS become active in the re-evaluation and delimitation of existing protected areas and the prioritization of additional areas to be designated for protected status. The development of a protocol for the inventory of both native and non-native biota in these areas would assist greatly in efforts to preserve them. The recognition and creation of well-selected marine protected areas deserves attention as an important part of the strategy for preserving Taiwan’s remarkable biodiversity.

(24) The development of appropriate means of communicating the principles of sustainability and the findings of new studies in this area to the general public should properly be a matter of urgent national concern, and the RCBAS should participate actively, with appropriate rewards for those involved, in the development of such means. They would logically include schools as well as public displays, botanical gardens, museums, and similar facilities. An appropriate program should be developed for Academia Sinica itself, and that program might include the installation of public museums and other facilities on the Academia Sinica campus or elsewhere. More promising, perhaps, would be Academia Sinica partnerships with institutions already engaged in such activities.
(25) An outstanding director should be recruited for the Center as soon as this can be accomplished properly. This director should be given adequate funds to implement the necessary research, coordination, and communication to achieve the desired results. As mentioned above, since the RCBAS is a sort of hybrid center that already has 19 PIs before the director is recruited, we recommend the allocation of 12 additional PI positions to accomplish the aims of the group as a true center. It is also hoped that coordination with other parts of Academia Sinica and other agencies will result in the involvement of other "virtual PIs" in the center, who will be involved in realizing its objectives. The director must have the necessary communication skills to make Taiwan-wide and international coordination and cooperation a regular feature of the Center's activities, and to render Taiwan and the world audiences for its findings to the extent that may be appropriate. If not Chinese, or particularly familiar with Taiwan's special conditions, the director should definitely have experience in communicating with governmental and private agencies and in directing major interinstitutional programs. Communication and administrative skills are of fundamental importance.

(26) Only after a director has been recruited and some of the new directions have been established should the additional PI positions be filled. New support staff and others on the technological track should be added in relation to the new programs once they have been formed.

(27) It is likely that a new form of guidance committee, either general or in relation to the individual projects, should be formed by the Center. The involvement of individuals and institutions from throughout Taiwan who are involved in sustainable development is essential if the findings by scientists associated with the Center are to be implemented efficiently. As outlined earlier, such individuals and institutions should definitely be involved in the selection of major integrated projects and then follow them as they unfold. Otherwise, there is danger that such projects might be selected on theoretical scientific grounds alone, might not be the most useful ones, and their findings might not easily be implemented.

(28) We wish to commend Dr. Kwang-Tsao Shao for his excellent leadership of the RCBAS in this interim period. Since it is unlikely that a permanent director can be recruited within this fiscal year, it will be of special importance to provide staff and adequate space for Dr. Shao to function properly in this role and in developing the budget for the next fiscal year.