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Marine Scientists Embark on Global Project to Save Coral Reefs

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Dr. Edgardo Gomez is not your typical doctor. The clinic he runs has no walls, no beds, and no white-robed staff. For a roof, it has the clear blue sky. His patients are fragile underwater animals that cannot move. His fellow doctors conduct checkups underwater with scuba tanks strapped to their backs. His nursing staff is made up of researchers, local government officials, and community leaders involved in management efforts to address the effects of human activities and climate change on what is referred to as the ocean's rainforests.

The world-renowned marine scientist co-chairs the coral reef Restoration and Remediation Working Group (RRWG), one of the six working groups of the Coral Reef Targeted Research and Capacity Building Management Project (CRTR&CBM), which aims to accelerate and refine a global response to the crises faced by coral reefs worldwide. The project is a high priority global initiative under the Global Environmental Facility (GEF), an independent financial organization that provides grants to developing countries for projects that benefit

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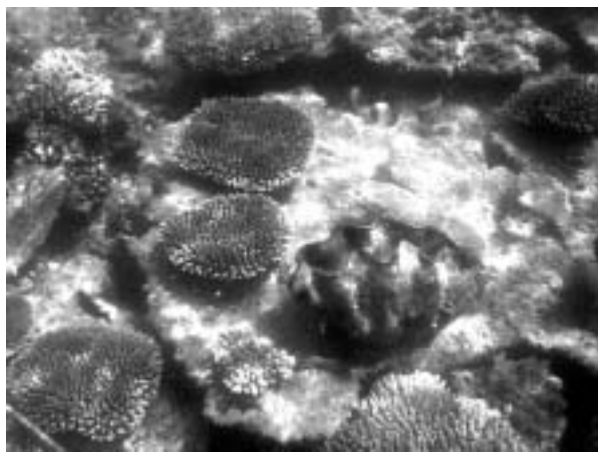

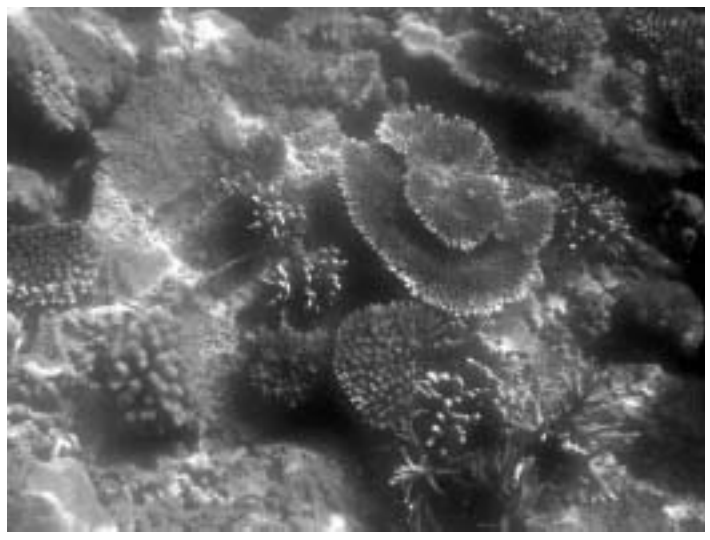

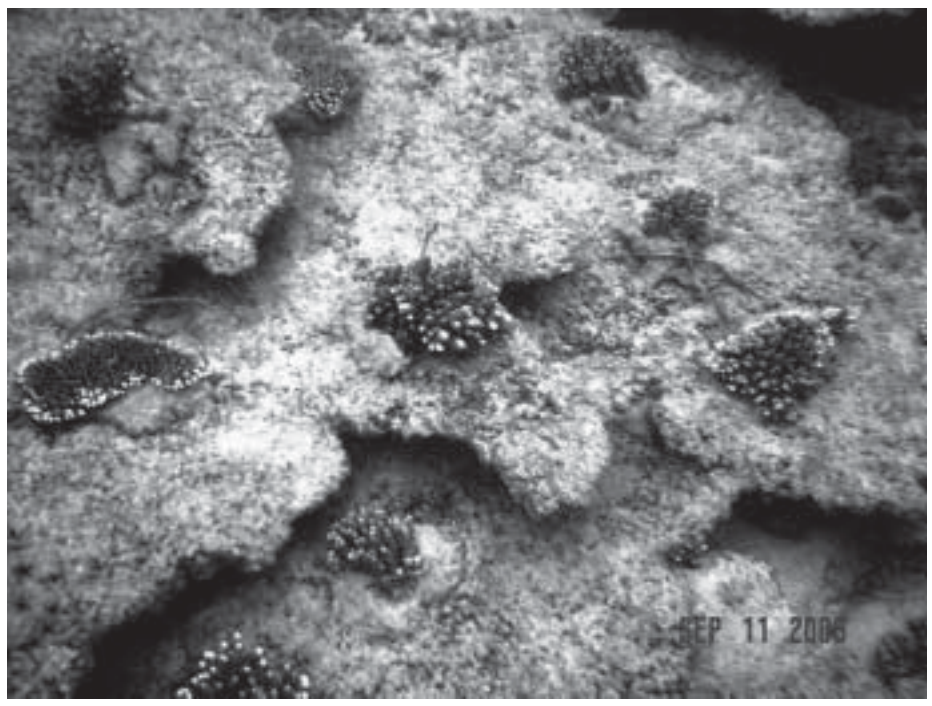

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the global environment and promote sustainable livelihoods in local communities. It is funded by, among others, the World Bank and the Australian government, and involves about eighty of the world's leading experts from at least fifty institutions.

Gomez also coordinates the CRTR&CBM's Philippines/Southeast Asia Center of Excellence (CoE), the University of the Philippines Marine Science Institute. UPMSI was selected together with three other international CoEs in key coral regions of the world—the University of Queensland Heron Island Research Station for Australasia, the Instituto de Ciencias del Mar y Limnología of the Universidad Nacional Autónoma de México for the Western Carribean, and the University of Dar Es Salaam Institute of Marine Science in Tanzania for Eastern Africa—to serve as focal points of exchanges among the CRTR&CBM scientists. Each of the six CRTR&CBM working groups will conduct core elements of their investigations in at least two of the four regional nodes during the first five years of the project. The working groups focus their investigations on the following themes: Coral Bleaching and Local Ecological Effects, Connectivity and Large-Scale Ecological Processes, Coral Disease, Restoration and Remediation, Remote Sensing and Modelling and Decision Support Tools. Faculty members of the UPMSI are involved in several CRTR&CBM working groups and conduct local research under the project.

"The CRTR&CBM aims to do several things—build capacity, finance scholarships and training, and improve the infrastructure of the CoEs—so that its scientists can do research that addresses local coral reef-related problems, provide training, and, eventually, help other working groups in their research," Dr. Gomez explains. Ultimately, the goal is to come up with new knowledge, tools, and techniques to help managers of coral reefs, especially in developing countries. "Armed with this knowledge and these tools and techniques, local government officials and planning officers can then come up with informed decisions in the day to day management of their reef areas," he adds.

Addressing information gaps

The CRTR&CBM project does not simply aim to increase the level of knowledge among scientists about coral reef ecosystems, from how they respond to pressures from human stress and climate change, to what interventions may help strengthen their resilience. More importantly, it hopes to address the severe lack of knowledge regarding such ecosystems at the level of the local stakeholders. "For instance, how many are aware of the simple fact that corals are animals, not plants or non-living things, like rocks?" Gomez's executive assistant, Rene Abesamis, asks. "How many people actually know that climatic occurrences, like the El Niño, can have dramatic effects on the coral reef ecosystem?"

Reef-building corals are colonies of tiny individual animals called 'polyp.' Each polyp secretes a calcium carbonate exoskeleton (corallite) which protects the soft, sack-like body inside. Over thousands of years, these animals form reefs on top of the cemented exoskeletons of their ancestors and dead family or community members. Coral reefs are confined to the tropical and subtropical regions of the planet and mostly in depths that span less than twenty-five meters. In other words, they occupy only a tiny portion of the ocean's surface. But they are the world's richest repository of marine biodiversity and harbor many other animals, such as fishes. Millions of people and thousands of communities all over the world literally depend on coral reefs for food, protection, and livelihood.

In the Philippines, where an estimated ten to fifteen percent of the total fish yield comes from coral reefs, these ecosystems are threatened by extinction. "Many coral reefs are in really bad shape, primarily because of reckless coastal land use, pollution, siltation due to deforestation, and increasing numbers of fishermen, many of whom have already resorted to destructive fishing methods," Abesamis laments.

A 2004 Global Coral Reef Monitoring Network study, *Status of Coral Reefs of the World*, found that Philippine reefs are experiencing a steady decline in coral cover of three to five percent annually. According to the study, this trend of degradation is confirmed by the rapid increase in the range of reefs classified in the 'poor' category, from a third in the 1980s to nearly half two decades later.

"Some reefs are already gone and will never come back. Some reefs are dying," says Gomez. "The best that we can do now is slow down the degradation in the near future until we can solve or stabilize it."

Reef restoration projects involve transplanting living corals to dead or dying reefs, sometimes also restocking them with giant clams. Local communities are taught the process of restoration and educated in the care of these creatures.

A mistake people make in the effort to rehabilitate the reefs is the transfer of corals to an area they want repopulated at the expense of the area from which these were extracted. They go about extracting corals or coral portions not knowing they are actually killing the reef in the process. The CRTR&CBM hopes to eliminate this problem. "We are looking into several methods, like cropping in which healthy coral branches are used. We are currently trying to determine the ideal size for transplanting so that we can do it without killing the donor corals and maximize the survivorship of the transplanted ones," says Gomez.

Although the despicable conditions of Philippine reefs may easily leave one disheartened, Gomez chooses to focus on the great strides that have been made to restore these natural resources. He takes pride in the fact that the CRTR&CBM project is addressing issues that had not been tackled until recently. As an example, he mentions disease-related damage of coral reefs, which has been well-documented in the Caribbean, but has only begun to be observed in other regions of the world, such as the Philippines. Some experts believe that stress caused by human activities, pollution, and environmental perturbations have pushed corals to the breaking point, making them unable to fend off diseases which they used to fight off in the past. Gomez also calls attention to the efforts of the CRTR&CBM Modeling and Decision Support Working Group to educate decision makers and reef users in the biophysical and socio-economic aspects of the coral reef ecosystem, by coming out with predictive models, maps and simulations.

Fortunately, technology is facilitating and speeding up the process of rehabilitation. "Computers did not even exist when we were doing the coral surveys in the 70s and 80s. Molecular genetic tools, DNA analysis and other methods used to demonstrate linkages among marine populations did not exist then. They are entirely new," he notes.

Man-made mayhem

Destructive human activities remain the largest contributor to reef degradation in the Philippines. "A lot of our coastal villagers depend on the reefs for their livelihood. The paradox is that they are also often the very people who destroy the reefs out of desperation," says Gomez. The growing demand for fish, not only as a basic food supply but also as a collectible for home aquaria and as exotic offerings by high-end restaurants, has taken a heavy toll on the country's reef system.

Destructive fishing methods, ranging from the use of explosives to cyanide, are destroying vast areas of reef. Fishermen blast reefs with dynamite to kill fish, which float to the surface and can easily be scooped up in large quantities. What they fail to realize is that these blasted reefs yield only 2.7 to 5 metric tons per square kilometer per year compared to 30 metric tons for healthy reefs, according to an August 2002 *People and Planet* article by Henrylito Tacio. After a blast, algae growth quickly smothers the coral because the shoals of grazing fish that would normally keep it under control have been decimated.

Fishermen also stun fish by squirting water mixed with sodium cyanide into reef areas where the fish seek refuge. Some even rip the corals apart with tools such as crowbars to capture the disoriented fish. The lingering cyanide in the water also kills coral and the algae on which the fish feed.

Although *muro-ami*—an extremely damaging technique involving hundreds of swimmers repeatedly banging metal or stone weights attached to scarelines on corals to drive fish out into a waiting net—was outlawed in 1986, its alternative, *pa-aling*, has recently been found to be as ecologically devastating. Pa-aling fishing involves divers using hoses attached to a surface air compressor to form a virtual bubble curtain which forces fish out into the nets. While the practice is less damaging to reefs, its efficiency is currently raising concerns about overfishing. Studies by the UPMSI suggest that pa-aling is depleting fish stocks, resulting in a decreasing trend in catch-per-unit in many areas, including offshore reefs.

Reefs have also suffered from; coral mining (with the country supplying a third of an estimated 1.5 million kilograms of coral harvested annually as part of the international trade in reef products in the past); increasing siltation as a result of inland deforestation and the destruction of mangroves; from industrial pollution; and from nutrient pollution contributed by sewage, fertilizers, and urban runoff.

Recently, according to Gomez, new and emerging threats to coral reefs have caught the attention of scientists. An example is bleaching, which is caused by changes in the earth's climate.

Unlike most animals, corals, which feed on microscopic zooplankton that swim in the water, are also capable of producing their own food. Their living tissue contains symbiotic algae, microscopic single-celled organisms called *zooxanthellae*, which are like little plants growing inside their skin. It is these same algae which give the corals their calendar-photo colors.

If corals are stressed from high water temperature and bright light or for any other reason, what breaks down is this symbiotic association with the food-producing algae. Unfortunately, unlike most animals, corals cannot run away from stress. Instead, they become what scientists refer to as bleached—they literally turn chalk white and starve to death.

Incidentally, newer global threats to coral reefs such as bleaching are rapidly increasing in frequency and severity, accelerated by direct human disturbances.

Marine protected areas

Gomez, however, is not suggesting that people should stop fishing. "What I am saying is that they should fish sustainably."

While there have been many good initiatives and practices in coral reef management in the Philippines, efforts have not been maximized due to poor management and the lack of a unifying vision and framework. For Gomez, this is where governance should come in. "We have plenty of programs for people who live close to coral reefs and use them. We have conservation mandates. What we need now is for local government officials to initiate community-based management strategies to tie these acts together."

He believes that the coral reef crisis can be addressed through the creation of marine protected areas (MPAs), a concept which is already at the heart of marine management issues in developing countries. The idea here "is simply to reduce this pressure of degradation until you get to that level where the reefs can sustain a certain level of damage and are able to recover." The approach holds true for practically all damaged ecosystems.

The trick is to preserve the MPA as a breeding ground for species. Thus, even though some fish may be caught in non-protected areas, others will have a chance of surviving and reproducing within the MPA to seed other areas.

For mobile organisms that are site-based, such as coral reef fishes, MPAs

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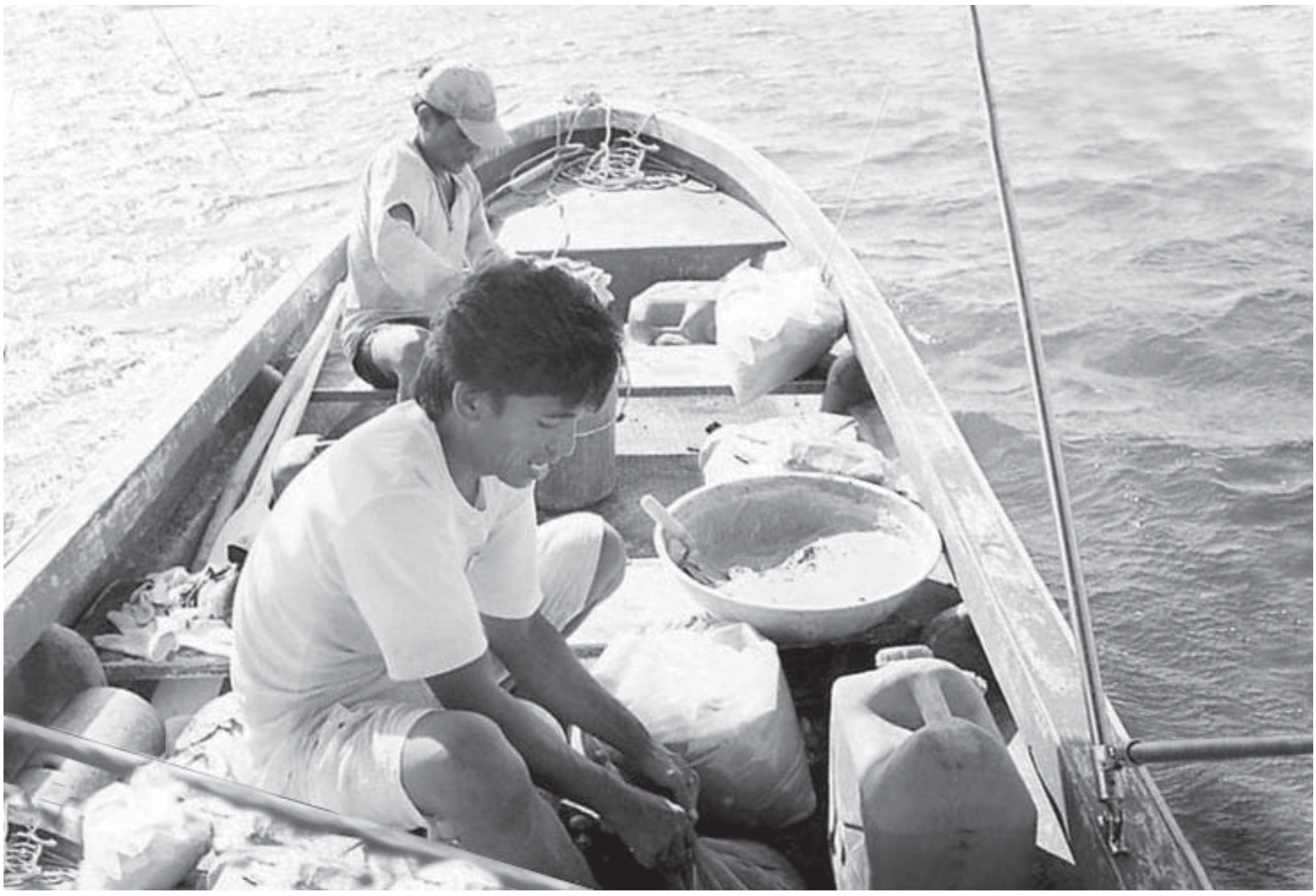

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work to protect them in their home range. When reef fishes reproduce, they release their eggs and sperm in the water. The fertilized eggs that eventually develop into larvae are then carried away by currents. With oceanographic conditions varying from place to place, there is no fixed size for an MPA. However, it should be large enough to achieve the objective of sustaining the fish stock.

Marine ecologists consider the establishment of MPAs one of the most promising strategies for biodiversity conservation and fisheries manage-ment. Also known as marine reserves, these are areas within a coastal zone where resource extraction is banned. An MPA may be a part of a single or a combination of any of the major coastal ecosystems—coral reefs, mangroves, seagrasses, soft-bottom communities. Resource utilization within and adjacent to these areas is strictly managed; hence, resources are protected.

In developed countries, this is usually accomplished by assigning the task of guarding a particular marine area to the coastal police. The government typically allocates subsidies to fishermen to compensate them for the reduced catch. In the Philippines, on the other hand, this is mostly accomplished with local government or NGO support. But being direct-users, fishermen become the day-to-day managers in the use of marine resources in these areas. This becomes problematic in the absence of strong government support and enabling local legislation to make protective management actions binding.

According to the Summary Field Report of the Coral Reef Monitoring Surveys conducted by the Department of Environment and Natural Resources' Coastal Resource Management Project and the Coastal Conservation and Education Foundation in 2002, MPAs are either too small to be very effective or in grave need of proper routines of monitoring and surveillance to stem entry of fishers. Most marine reserves need to improve their visitor management and to start collecting user fees from scuba divers and others to finance long term protection, the report suggested.

But there are some success stories. Apo Island in Negros Oriental is one of the earliest community-based marine reserves and a textbook example of a successful reef management approach. Reef protection began informally when Silliman University initiated the Marine Conservation and Development Program in 1982. A few years later, the island community and the local council formally agreed to manage the entire fringing coral reef of the island and establish a smaller 'no take' fish sanctuary. Eventually, the community prospered with fish yields improving considerably despite the reduced fishing area.

The role of marine scientists

Greater effectiveness can be achieved by complementing the efforts of NGOs and local government units with technical inputs from members of the academe and research institutions. This is one of the rationales behind the CRTR&CBM project, according to Gomez. He believes that improved participation and informed decisions can only take place if research findings are effectively communicated to key stakeholders.

But as a research initiative, of course, the project in the meantime will involve mainly the scientists. One of the challenges is to come up with a mechanism for methodologies and interventions, if and when they are needed, and on the level at which they are needed. Additionally, research should be able to address policy issues and fill the gaps in legislation.

"Although this was not the original intent of the CRTR&CBM, there was a lot of pressure from the GEF Council to do exactly that—to relate, not later but sooner, all the research to management," Gomez says.

Last year, a consultation with municipal agricultural officers and local planning officers in Bolinao, Pangasinan, was conducted to jumpstart the CRTR&CBM project. The observations gathered from the meeting were then reported to the scientists in the synthesis panel so that research by working groups could be tailored to real world needs. Annual interactions with managers and stakeholders are planned. Other workshops and trainings are slated for technical people to interact with or to train other scientists and students from different parts of the country. These and other channels are expected to provide a venue for exchanging information between scientists, cause-oriented groups and local government officials.

"For now, it is just Bolinao. But eventually we will do the whole country, and then the whole of Southeast Asia," says Gomez. "If you noticed we started with middle level managers. But eventually we will get to the mayors."

But Gomez feels it is no longer the task of the UP marine scientists to address the other dimensions of the problem.

"I cannot spend my time talking to these coral fishermen because I should be doing my coral restoration research to determine which species can be transferred, how fast they grow, where to put them and in what combination, and eventually come up with solid scientific input to management." He feels that social scientists also need to be involved in the process and share the burden with the natural scientists.

"As scientists, we can only do so much. The rest is for the other stakeholders to accomplish."

Going Alternative: A look at some alternative fuels

by: Celeste Llaneta

The news of an energy crisis has been touted so often in the media that it has practically lost its edge. As the New Year ushered in another surge in world oil prices, from a previous high of 59.1 dollars per barrel in September 1, 2005 to a record high of 69.20 dollars in January of 2006, the news was received by an exhausted public accustomed to the fact of a perennial energy crisis. Unfortunately, resignation and indifference do not diminish the gravity of the problem, and the rising cost of fuel is a harsh reality that needs to be faced.

The government has proposed an intervention program aimed at cutting back on power and oil consumption and developing alternative and renewable energy resources. The past years have seen the emergence of some choices of alternative fuel, and words like biodiesel, bio-ethanol, coco biodiesel, and biogas are slowly creeping into common usage. These alternatives may very well pave the way out of a seemingly insurmountable problem.

Vegetarian fuel

Biodiesel, as defined in the Iowa State University Office of Biorenewables Program website, is any biodegradable fuel "produced through a process in which organically derived oils are combined with alcohol to form ethyl or methyl ester." In contrast to petrol-based fuel, whose adverse impact on the environment is well known, biodiesel is a natural hydrocarbon with very little sulfur content, which when blended with petrol-based fuel even in little amounts, translates to less toxic emissions. Moreover, while the specter of an ultimately limited supply hangs over fossil fuels, biodiesel comes from a renewable source—plant or animal oil. Most car engines today can run well on a blend of biodiesel and petrol-based diesel.

Biodiesel, which includes coco diesel, ethanol, and methanol, comes under the heading 'biomass,' which simply means fuel sourced from biological materials. The use of biomass, one source of alternative energy, is far more widespread than one would think. Statistics presented by Teresita M. Borra, director of the Energy Utilization Management Bureau of the Department of Energy during last year's Klima Clean Transport Forum and Workshop, show that while a good thirty-nine percent of our country's energy supply comes from oil, energy from alternative sources, primarily biomass and some solar and wind power, account for close to thirty-one percent.

Not-so-virgin coconut oil

Coco biodiesel has received a definite go-signal from the government. In 2004, President Arroyo signed Memorandum Circular No. 55, mandating all government departments, bureaus and offices to add a one percent blend of coco biodiesel to their diesel requirements. Coco biodiesel, or Coconut Methyl Ester (CME), which is derived from coconut oil, has been endorsed by the DoE as offering "excellent lubricity, solvency and detergency." Moreover, coco-biodiesel can be used in any diesel engine with little or no modification to the engine or fuel system.

"A liter of coconut oil is about forty pesos... It is simply not cost effective for government vehicles to use coco biodiesel at the moment.

A team from the UP Diliman Department of Mechanical Engineering has been doing test productions of coco-biodiesel through a process formulated by a Japanese company, which also provided the equipment. The group, headed by Dr. Edwin M. Quiros, associate professor of the department, used different blends of coco biodiesel and petrol-based diesel, ranging from one to five percent coco biodiesel. They recorded data on fuel economy on a road test covering 100 km per fuel blend, as well as emissions in terms of smoke capacity. "With these small percentages of biodiesel, emissions were reduced compared to straight diesel," Quiros reports, citing a ten to fifteen percent reduction in emission. "As for fuel economy, there was not much of a difference between it and straight diesel. So it seems if you're going to use biodiesel as a fuel additive to straight diesel, the main benefit would be reduction in smoke emissions."

It wouldn't represent a reduction in expense, though. One reason why MC No. 55 has not exactly drummed up enthusiastic compliance is the relatively high cost of the raw material. "A liter of coconut oil is about forty pesos," Quiros explains. "If you're going to blend it with diesel, it will boost up the cost of fuel."

It is simply not cost effective for government vehicles to use coco biodiesel at the moment.

Dr. Karl N. Vergel, associate professor of the UP Diliman Department of Civil Engineering and head of the Transportation and the Environment Group of the National Center for Transportation Studies, narrows it down to an issue of supply. Even a one percent blend would put too much pressure on the supply of coconuts. After all, coconuts are the main ingredient in a whole range of other products, including food, cooking oil, and the very popular virgin coconut oil. "The bulk of our coconut oil is

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the FORUM ROUNDTABLE ON SCIENCE

Q What are the controversial questions attending science as a discipline? What could be its greatest challenge to teachers of science and scientists today?

Saloma: A scientific inquiry becomes controversial when it polarizes public opinion. Human cloning, which is concerned with creating genetically identical copies of humans, is the quintessential example. Another contentious issue deals with the possible presence or absence of life forms in other planets. Nuclear energy, genetically modified organisms, etc. also tend to divide public opinion, depending on the prevailing socio-economic condition.

The debate about human cloning is no longer confined among harmless academics, geeks, and Hollywood producers. The challenges surrounding the issue have grown and now have legal and political implications. The debate is beginning to capture the serious attention of legislators, national supreme courts, and government executives because continuing advances in science and technology are steadily improving the capability of scientists to perform the process successfully.

Human stem cell research is important because of its immense therapeutic potential. Stem cells can be used to produce replacement organs (e.g., kidney, liver, heart, etc) with almost null possibility of rejection during transplant. Many lives, including our own and those of our loved ones, can be saved or prolonged if humankind is able to acquire the said capability.

However, the ability to produce and harvest human stem cells reliably and efficiently is a precursor technology to human cloning. As a scientific technique, human cloning is neither good nor bad. It becomes terrifying when utilized to prolong human cruelty or sustain oppression. But what if it is used to create a real *Superman* who does not have any of the weaknesses that make us human? Perhaps even the promise of unfailing benevolence would not make cloning widely acceptable—human societies have difficulty embracing changes that happen much faster than the perceived evolutionary rates.

Understandably, the presence of life forms outside the Earth is worrying and even threatening because extraterrestrials may not believe in the same norms and values that humans naturally consider basic and universal. But are we going to stop space explorations out of the fear that returning space vehicles might bring back ferocious organisms that could decimate human civilization? On the other hand, the menacing existence of extraterrestrials could provide the missing catalyst for unifying mankind.

Difficult issues should not deter scientists from advancing our understanding of the physical world. Scientific knowledge empowers humans to defeat ignorance and intolerance. It liberates us from the debilitating fear of the unknown.

— Saloma

Difficult issues should not deter scientists from advancing our understanding of the physical world. Scientific knowledge empowers humans to defeat ignorance and intolerance. It liberates us from the debilitating fear of the unknown. Scientific knowledge emboldens people to anticipate the future with optimism and hope. Ignorance and intolerance have already cost millions of lives.

It is quite tempting for unsuccessful researchers to engage themselves in endless philosophizing that often contradicts the inherent impermanence of scientific knowledge. While it is doubly difficult to succeed in scientific research in the Philippines, Filipino scientists, especially those who are still young, should not stop learning from past failures in order to improve themselves professionally. They must not waste precious time rationalizing mediocrity and trivializing scientific excellence.

Hilomen: The greatest questions in science vary depending on the interests of the scientist. The questions asked by fisheries scientists and marine biologists would be entirely different from those asked by physicists. For example, how to sustain fisheries production (particularly capture fisheries production) in our country is a problem Filipino marine biologists, fisheries scientists, and even social scientists and economists must address. Currently, the rate at which fishers harvest fish is faster than the rate at which fish naturally replenish their populations. This condition is exacerbated by the use

of destructive fishing methods which destroy habitats and larvae of fish. A holistic approach is necessary to solve this problem. If fisheries production is effectively managed in other parts of the world, why shouldn't we be able to do the same in our own country?

The greatest challenge to teachers of science and scientists is how to train students to think critically. If we teach students how to think, then we will help create a society of discerning men and women. We need people who can think outside the box.

Rapanut: There is a general perception that the solutions to some of the world's toughest problems are likely to be found, at least in part, in scientific discoveries. These discoveries have a great impact on our quality of life. They include achievements like sanitary sewers and safe drinking water, which fundamentally changed the way people lived; computers and telephones, which significantly altered the way people worked; and automobiles, airplanes, and spaceships, which redefined the way people traveled. Moreover, we have conveniences that range from a vast electric power grid and agricultural mechanization, to the widespread use of airconditioning, refrigeration, and household appliances.

Although controversy is antithetical to the practice of calm and studied observation in science, it has enabled scientific progress in various ways. Controversies in research have pushed forward the process of scientific investigation by highlighting the absence of information in particular areas. One example is the overuse of antibiotics which has caused the spread of antibiotic resistance among bacteria. It has been alleged that scientists have the tendency to assume causality when only a causal association has been demonstrated. Poorly supported arguments have supposedly been used to fill in the gaps in the data connecting antibiotics, resistant bacteria, animals, and humans. This has sparked further research that could improve our understanding of such connections.

Decisional controversies arise because of action (or perhaps inaction, which is a decision in itself) taken on the basis of insufficient information. Global warming has been identified as such an issue. The observational approach of traditional science cannot yet reliably predict the impact of human behavior on our climate. For example, we cannot tell with finality that an alteration of the rate of fossil-fuel consumption will resolve the issue.

There are also moral and ethical questions surrounding some scientific issues, like information technology and biotechnology. Science has built engineering systems whose complexity is such that it is impossible to predict all of their behaviors. In software engineering, "errors" happen not because the software does something it wasn't intended to do, but because it does what it was specified to do. It is just that the consequences of such specifications were not understood or anticipated by its creators.

The great challenge posed by such controversies to teachers of science and scientists is how to touch the students' imaginations and bring the subjects to life. Learning activities that allow students to interact with each other should be utilized. A learning activity can involve breaking the class into small groups (of two or three students) with the teacher posing a question and instructing each group to discuss a possible answer. In considering genetically modified foods, for example, several questions arise: How does the presence of large multinational agrobusiness corporations affect the dynamics of innovation in this industry? What stands between the development of "golden" rice and the release of that strain to subsistence farmers? Is a tomato expressing an animal transgene still be acceptable to a vegetarian?

Students may also be encouraged to take a position on a given issue and to investigate the pros and cons of their position through guided activities and web research. The websites may be designed to include research scientists so that students have the opportunity to see controversy unfold as scientists discuss their research. Moreover, a realistic presentation of how controversy plays out in science provides students with a clearer understanding of what a career in science might entail. Recognizing the dynamic nature of the field, students will realize that scientists rarely have the benefit of simple answers and 20/20 hindsight.

Marita Reyes: The objectivity of science is being questioned. How unbiased are scientists when they interpret empirical data? Do intuition, personal beliefs, and culture play a role in science and its applications? I think these questions underlie the present debates on global warming, the skepticism of some scientists regarding the import of human activities on the ozone layer in the atmosphere, and the stand of creationists on human development.

The challenge to science teachers and scientists today is to demonstrate science as an attitude and approach to problem solving and to the development of technological innovations rather than a difficult discipline of equations and formulas. There is a need to humanize science.

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— Marita Reyes

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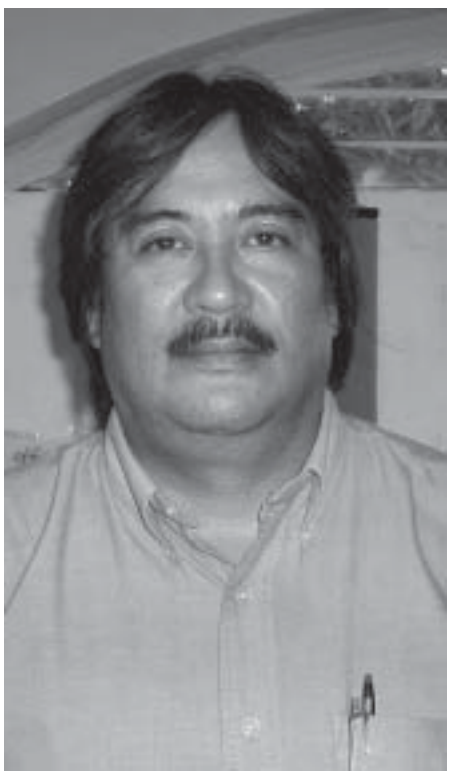

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Q *Can Filipino scientists working in the Philippines compete with the rest of the world? What are the advantages and disadvantages of doing scientific research in the Philippines?*

Saloma: Filipino scientists are competing globally if and when they are solving problems that are considered meritorious and interesting to the international scientific community. A generally accepted indicator of high quality is the publication of a research finding in a scientific journal that is read not only by specialists in one's own field but also by those from other fields. Publication in a widely read journal increases and widens the possible impact of new scientific results. However, the competition for space in high impact journals is intense and acceptance is extremely difficult, especially for authors who are still building their own scientific reputation.

Scientific reputation is not built overnight. It is established over years of dedicated work that relies on careful planning, uncanny foresight, and more often than not, serendipity. Pedigree also helps—if your mentor is a highly successful scientist, then you are likely to do research on a fascinating topic (although it may not be clear to you immediately that it is so) for your PhD dissertation.

In the Philippines, the number of PhDs in the natural sciences, mathematics, and engineering, is very small. According to a 2004 report in the journal *Nature*, the number of PhDs per one hundred of the

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population is 8, 17, and 18 in Japan, the US, and the European Union, respectively. The Philippines, with its (extrapolated) population of about 85.5 million, would need to have 6.8 million PhDs if it were to aspire to the current scientific muscle of Japan. The number of PhDs in the Philippines today is not likely to exceed even ten thousand.

A young PhD in the Philippines who is able to publish consistently in ISI journals will be recognized more quickly than if he were in Japan, the US, or Europe. In a country where scientific tradition is not yet firmly established, public's expectation of a scientist is less harsh and more forgiving. Appreciation and recognition are powerful motivators for a scientist to work even harder. In the Philippines, it is easier for a scientist to be conservatively eclectic and to try different interdisciplinary topics because there is practically no resistance from well-entrenched communities, unlike in Japan, the US, or Europe where changing research topics means dealing with a new set of researchers with established hierarchies and a different perspective.

Because I started my professional career in the Philippines, I was able to work independently at an early stage. I did not have to toil as an underling or a lieutenant of a senior professor and was blessed to be able to work with a steady stream of bright and highly motivated undergraduate and graduate students. It becomes more fulfilling when you do science not only for yourself or your family but also for your own country.

The difficulties encountered by Filipino researchers are consequences of a weak scientific tradition and a low public appreciation of the contributions of science. The nonscientists in our country, from the elected politicians to civil servants to the illegal settlers, have not yet adequately comprehended the vital role of science in sustaining economic growth and promoting a fair and just society that is based on merits.

The rules and regulations that were formulated to slow down, if not eradicate, graft and corruption also make the development of scientific infrastructure and the acquisition of research equipment and materials agonizingly slow and unnecessarily costly and even wasteful. Despite the impediments, however, a number of initiatives can still be pursued locally by the University leadership to improve the lot of researchers in UP. Many of the miseries that torment our researchers continue to exist due to our misplaced sense of helplessness or lack of sufficient attention. It perplexes me why we still continue to find people inside UP Diliman who care little for or have nothing to do with the academic enterprise.

Given the Internet, the lack of journals in our libraries and the lack of funding to attend scientific meetings are no longer excuses for not being able to publish in important journals... The Internet has leveled the playing field.

— Noli Reyes

Campos: Filipino scientists working in the Philippines can both compete and excel in the international arena, as proven by international awards given to some institutions in the country, such as the National Institute of Physics in UP Diliman. The playing field may not be even, in terms of (1) the cost and availability of equipment, (2) the accessibility of related updated information (from extensive library holdings), and (3) opportunities for critical discussions with colleagues, but these are workable challenges. These limitations may be less surmountable in some than in other fields, but they can be addressed.

There are relatively few research institutions/facilities in the country. Hence, there is a wealth of topics to do research on (in other words, there should be enough ideas for everyone). Our more progressive Asian neighbors have invested considerably in research and development, and this has been a major contributor to their present economies. It would certainly help motivate more scientists to increase and improve scientific research in the country if administrative (government) support were to take on more challenges rather than accept and be content with limitations.

Hilomen: Despite limited resources, Filipino scientists are among the best in the world. Time and again, we are reminded that given ample resources, we can produce world-class results, as in the case of marine biologists like Drs. Edgardo D. Gomez and Angel Alcala, who are based in the country, and Dr. Baldomero Olivera in the US. It is difficult to pursue research interests in the Philippines if we depend only on the resources of the government. Although the competition is tough, international research grants must be pursued.

Marita Reyes: Good and "competitive" scientific activity has many requirements. These include the personal attributes of individuals involved (e.g., intellectual capacity, creativity, resourcefulness, passion and commitment, discipline, etc.), a facilitative social and political environment (including harmonized and consistent policies), and an adequately maintained scientific infrastructure. I have listed the requirements in the order of decreasing availability to our scientists. Our best asset is the presence of individuals who heroically make do with very deficient infrastructure and still produce world-class research. But this situation cannot be sustained and cannot last long.

Be that as it may, I am not comfortable with "can compete" as synonymous to good scientific work. "Competitiveness" is often used to mean the ability to get ahead of someone or even the capacity to put one over somebody. This direction usually leads to prideful behavior and to unethical conduct as was evident in the recent fiasco in South Korea's stem cell research. Unethical conduct leads to loss of trust and public support for science.

Science is collaborative work. One can no longer work alone or in isolation and position oneself to "compete" with others. Materialism is anathema to collegiality and collaboration, very important values in science and the academe.

Noli Reyes: I can only speak for the mathematical sciences.

First of all, given the Internet, the lack of journals in our libraries and the lack of funding to attend scientific meetings are no longer excuses for not being able to publish in important journals. Before the Internet, mathematicians in poor countries were in a truly unfair and helpless situation because they had limited or no access to unaffordable journals. But the Internet has leveled the playing field of math research. Scientific results can be communicated as easily in developing countries as in developed countries. Scientific papers, even before they appear in journals, are often available in the author's website. The table of contents of many journals are accessible electronically for free, and getting hold of a paper can be done quickly with a simple email to the author.

Doing math research definitely requires some mathematical talent. I believe that many Filipinos have the potential to develop this talent. What seems lacking is the passion and drive to go deeper and pursue math and science research as a profession. I feel it is only this passion that can instill the discipline to systematically devote hours each week to study.

One nice thing about doing mathematics research is that formulating a problem or contemplating it can be done practically anywhere and anytime: in the *ikot* jeep, on the beach, while jogging, while waiting in the bank, etc. But like any other intellectual pursuit, the most conducive to mathematical contemplation is a quiet place. One disadvantage of doing mathematics in the Philippines is the noisy environment. (I'm not sure whether we Filipinos have a high tolerance for noise or we simply feel uncomfortable in a quiet environment.) It is difficult to think clearly when your neighbors are playing their sound system full blast or when vehicles can honk anywhere.

Another disadvantage of doing math research in the Philippines is the lack of a research culture. Honestly, sometimes I feel odd spending hours, days, weeks, and months working on a problem on my own, when everybody else is partying. (But actually, I might be having much more fun.)

I think mathematics and science will always be relevant for as long as we want to improve our quality of life. What abound are challenges to the attractiveness of math and science as a profession. I think the quickie approaches to solving our problems and the get-rich-fast mentalities are the greatest of these challenges. Figuring out a math problem is like learning how to make the violin produce a certain quality of sound. It takes time and a lot of discipline.

Villoso: The dominance of foreign educational and research institutions in science is undisputed. The best research and teaching institutions in the world are science-oriented; they are pioneers of new technology which possess an international outlook and a global reputation among academics, students, and employers. Universities abroad leading the information technology revolution are now getting involved in the next wave of technological advances in areas like robotics. Some foreign research institutions have sizable war chests for their expansion because of donations from grateful alumni who have profited from the wave of high technology. The international orientation of leading science institutions abroad is shown by the high percentage of their international staff and foreign students.

The Philippines has ordinarily depended on other countries for knowledge generation. In some disciplines, our country has the required critical mass of human resources capable of competing with the rest of the world in advancing the frontier of knowledge. Lack of general appreciation, however, coupled with an apparent failure of local funding institutions to recognize the potential benefit of high-impact research on the general welfare of the nation, reduces

the ability of our scientists to compete with their foreign counterparts in the development of science and technology. While some foreign countries devote at least three percent of their gross domestic product to research, there is reluctance on the part of Philippine agencies to fully support research. It is unfortunate that most instructional grants to local universities are geared toward informal training and extension programs and not to the development of new knowledge. This approach turns local universities into project implementers instead of knowledge generators. The Filipino scientific community must apply pressure on the government to spend more on research. Scientists must also find ways around government policies that delay rather than facilitate their research endeavors.

Local research agencies must address areas of weakness like the low production of high-impact research. Incentives can be provided by research foundations and private companies to generate more cutting-edge research.

In the present era of scientific research in the life sciences, the emphasis is on interdisciplinary programs and the search for broad, unifying generalizations. Successful foreign research institutions have encouraged collaboration across disciplines by introducing multi-disciplinary programs in the sciences. Given steep international competition, capability-building through cooperation with local and international institutions is desirable and necessary. Local scientists should not stay in their cocoons; life is too short to be spent inside a capsule without reaching out to other scientists.

Filipino scientists and research institutes have a bright future. There is optimism that the science and technology community will expand in Asia and in the Philippines as more significant centers of development are built, and more high-technology products are designed and manufactured. The importance of Filipino and Asian scientific communities as suppliers of research output and experts is bound to grow. There are few high-profile institutions for medical research in Southeast Asia, and biomedical-research centers in the country are fertile grounds for a new breed of Filipino scientists. One trend is for science-oriented institutions to attract and fund significant research groups. This might take off in the Philippines in the near future.

Q *Has science or its outcomes figured in important decisions of our courts?*

Saloma: As far as I know, no one in the Philippines is seriously engaged in human stem cell research or space exploration; thus, the difficult issues that are encountered in such research fields do not grip the minds of our decision makers or stir the emotions of the public. At this point in time, the immediate challenge is for the government to invest more in scientific research and development and for legislators to formulate laws that are wise and applicable to our society, fully realizing that our situation is quite different from that of the US or the European Union. There seems to be a wide gap between enactment and enforcement of laws and regulations. Enforcement is difficult when the rules and regulations are not backed up by technical competence and professionalism among the concerned implementing agencies of government.

Marita Reyes: I cannot cite specific cases where science has helped in important decisions of our courts. However, I am aware that medical and social scientists have been sharing scientific data in medical forensics with judges and lawyers regarding rape and child abuse in order to correct long-standing misconceptions about virginity and the physical and psychological elements of domestic violence. Court decisions that continue to ignore appropriate scientific information have been cause for much frustration and anguish.

I also know that a DNA analysis laboratory has been established in UP Diliman to assist the judicial system in crime investigations, in the identification of victims in disasters, and the resolution of paternity questions.

Q *What are the challenges to the continued relevance of science?*

Saloma: The local science community has remained small and therefore its productivity continues to be low in terms of sheer number of publications in widely read scientific journals of the world. However, our understanding of scientific excellence has become more mature. When I was a graduate student more than twenty years ago, it was already a cause of great celebration and reverence if someone in NIP published in an ISI journal. Now the challenge is to publish consistently in high impact journals like *Physical Review Letters*, *Nature*, or *Science* and to get featured in science magazines. Definitely, current expectations are a lot higher, which is a definite sign of genuine progress.

In the past ten years or so, UP has introduced merit-based programs (e.g., international publication awards, creative grants, etc) that have improved the lives of its productive scientists and researchers. The challenge is to keep these incentives responsive to changing economic realities.

Scientific research in UP will continue to improve in terms of productivity, quality, and impact. In NIP and the College of Science, I place high hope in the ability of our young PhDs and graduate students to build upon the accomplishments of their mentors and predecessors and push scientific research to the next level. I am confident that the younger generation can respond to the challenge brilliantly. Scientific tradition is established by the efforts of several generations across time.

Campos: Analytical thinking is perhaps the major contribution of science to society, although the "discoveries" are equally important. This doesn't mean that non-scientific fields do not develop critical thinking. But the scientific process which involves focusing on a question, formulating the appropriate systematic methodology or approach, extensive referencing, and objective thinking, rigorously develops analytical thinking in addressing problems. It would be a big boost to the country if more people in government approached issues in a similar manner.

Marita Reyes: The relevance of science is best demonstrated by the use of its applications by people and for people. However, its utilization depends on how it is understood and ap-preciated. The challenge for scientists is to make their work understood and better appreciated by policy makers and program implementers—people who are in the best position to disseminate scientific information or technology which should be available to the general public. For example, how can medical scientists make people choose to believe what they advise over the declarations of charlatans on quick recovery from the use of strange concoctions that have not been tested scientifically?

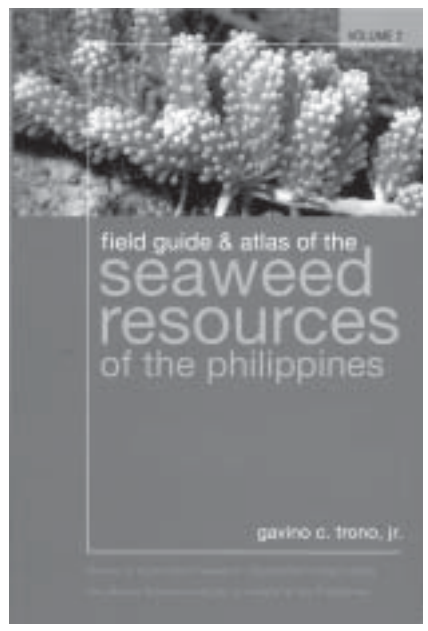
Villoso: Science embodies a systematized body of knowledge based on facts and the nature of

ROUNDTABLE, *p. 10*

Field Guide and Atlas of the Seaweed Resources of the Philippines

Gavino C. Troño, Jr.

Publishers: Bureau of Agricultural Research, Department of Agriculture and Marine Environment and Resources Foundation, Marine Science Institute, UP Diliman, 2004



Seaweed is one of the most important marine resources. Its production through culture is one of the most productive forms of livelihood for thousands of coastal inhabitants in the Philippines today.

While the seaweed industry is the third ranking fishery industry in the country at present, its further development is constrained by the lack of basic information about kinds/species, distribution and availability, natural products, and uses.

This book collates all available information necessary for the faster development of seaweed resources under one cover, to serve the needs of a diverse group of users.

ROUNDTABLE, *from p. 9*

things. The advancement of the frontier of science has changed, deepened, and intensified our realization of the nature of life and our knowledge of its processes, throwing new light upon our judgments, suggesting fresh methods of human cooperation, imposing novel concepts of service, and opening up new possibilities to us.

Scientific materials are predominantly imperfectly accessible to ordinary busy people. The information is embodied in highly specialized publications and books; it is expressed in technical terms that have yet to be translated into ordinary language; it is circulated alongside masses of controversial matter and, in some cases, questionable literature tainted with prejudices and superstitions. Much scientific information remains unprocessed, merely accumulated in a pile of reports. Consequently, the ordinary person is unavoidably ignorant of such information and draws far less confidently from the resources of science than he or she might do under better circumstances.

To significantly enhance the positive contribution, usefulness, and impact of science on human life, teachers of science and scientists today must help clear up and simplify science for the ordinary person. Scientists must not simply be obsessed with their search for facts but should strive to draw and effectively communicate the practical wisdom arising from their endeavors.

— Villoso

To significantly enhance the positive contribution, usefulness, and impact of science on human life, teachers of science and scientists today must help clear up and simplify science for the ordinary person. Scientists must not simply be obsessed with their search for facts but should strive to draw out and effectively communicate the practical wisdom arising from their endeavors.

ENHANCEMENT OF THE PROTECTION AND UTILIZATION OF SCIENTIFIC AND TECHNOLOGICAL INTELLECTUAL PROPERTIES (IPs): Intangible Wealth Transformable to Tangible Treasure

by: Rhodora V. Azanza

Rhodora V. Azanza, Ph.D.
Dean, College of Science
UP Diliman

Knowledge generated by students and professors should be properly managed. This should go beyond individual management, for collective management of knowledge creates more knowledge and innovations. Moreover, intellectual property protection and management is not the business of lawyers nor the Intellectual Property Office (IPO) alone. It is an interdisciplinary / multidisciplinary (WIPO, 2006) field that involves primarily the generators or creators (who are in the Universities and research institutions) of these intangible wealth called Intellectual Property or IP. Technology transfer of knowledge from source areas is the process that enables these intangible assets (of universities and research institutes) to be converted to products and services.

The intellectual property of the faculty researchers and graduate students of the College of Science for the past few years consists mainly of scientific publication (in ISI-covered journals). Original contributions in the fields of mathematics, physics, chemistry, biology, molecular biology and biotechnology, geology, marine science, material science and environmental science have been increasing, particularly during the last five years, thus making the College the highest contributor of international publication in the University. The College of Science (and the College of Engineering) like their counterparts in the UP System and other Universities in the country however, still lags in contributing to and benefiting from the gains of the so-called "Innovation Cycle," i.e. "Research and Development (R & D) to IP Protection to Commercialization to Research and Development". The usual route in Philippine Universities and research institutions is Research or R&D to Publication, because results should become part of the public domain specially in government-funded researches. This publication route, however should not be considered less vital since they build up or refine existing knowledge.

Universities and research agencies in developing countries tend to export "raw materials" (i.e., unprotected intellectual properties and/or human capital), unlike in developed countries where the gains from the cycle of research (R) to development (D) to commercialization (C) is completed, with the material gains plowed back to the faculty/researchers/university to be used partly or wholly for another round of innovation generation. Such a scheme is of course successfully being used in Stanford University and Oxford University, to name a few.

To cite an example in the region, the National University of Singapore (NUS) aims "to promote NUS-generated knowledge and technology for the benefit of the society and the economic development of the nation." Among others, they have the NUS Venture Support Fund for "start-ups" and "spin-offs" to take care of knowledge and technologies generated by students and faculty members with the highest potential for commercialization. It is also noteworthy to cite two other universities in the ASEAN—the University of Technology of Malaysia (UTM)—and the Hanoi University of Technology (HUT) which have come up with detailed provisions for IP protection and technology transfer. These Universities have also considered/started IP education for S&T students and researchers and initiated the build-up of IP database in their universities.

In the Philippines, support for protection and commercialization of IP's are not taken care of directly by Universities but by two separate agencies, i.e. by a branch of the Department of Science and Technology, the Technology Assistance and Promotion Institute (TAPI) and the National IPO. It is difficult for the creators of knowledge and innovators to be active participants in the protection and management of their IP's although some Universities like UP have just started to have an Intellectual Property Office and Technology Incubators.

National Strategies

1. In collaboration with the National IPO, *review and enhance Philippine IP legislation* to enable public universities and research institutions to protect and manage their IPs for the benefit of the nation.

2. *Review and if needed make amendments to the charters*/other pertinent documents of public Universities and research institutions to empower them to protect and manage efficiently and effectively their IPs.

3. *Support for Enhancement of Technology Transfer and Commercialization for Selected Universities and Research Institutes* to vigorously appraise commercial viability and to seed capital fund for selected technologies and innovations for added value and reduced risk.

4. *Conduct IP Education in appropriate academic levels* on the nature and powers of Intellectual Properties (IPs) and their proper management and utilization.

5. *Encourage and support small and medium scale entrepreneurs and venture capitalists* (with the participation of innovations inventor/author) to develop commercialization of these products and services. This would encourage responsible partnership between universities and industries emphasizing protections of IPRs and non-disclosure agreements, thus creating a harmonious Science-Technology-Enterprises relationship.

Target Areas Aside from ICT and Biotechnology

Intellectual assets which should be effectively and efficiently managed to derive economic benefits are not limited to the fields of ICT and biotechnology. According to the World Intellectual Property Organization in Geneva, new areas where IP's should be generated, protected and managed are the following:

1. environment,
2. energy: extraction, natural gas, conversion of biomass, alternative source,

INTANGIBLE, *p. 15*

LETTER, *from p. 16*

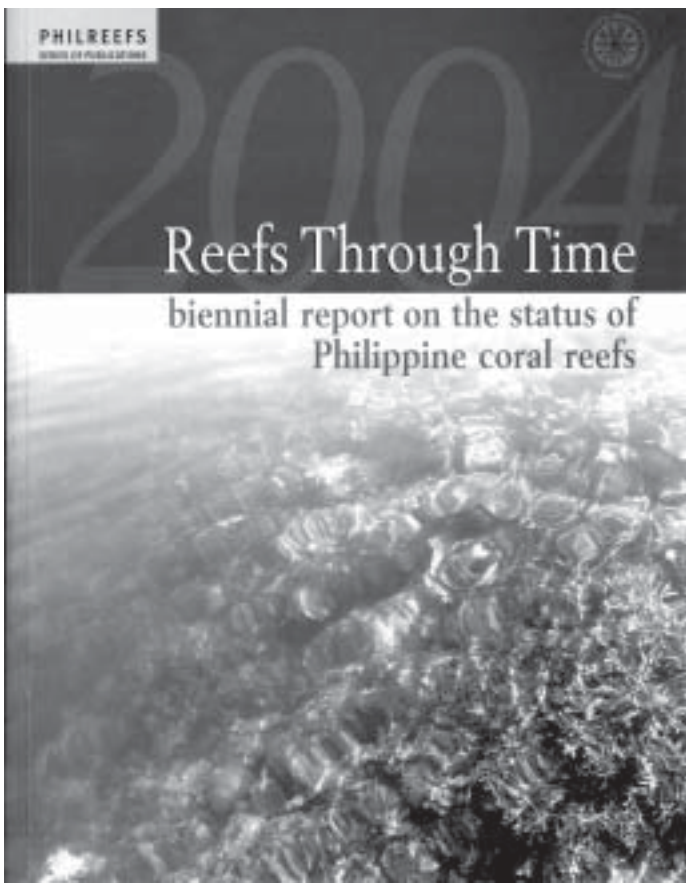
On December 26, 2005, Luchie Galang handed over to me her check in the amount of $15,000 to support the establishment of a Faculty Grant at the College of Engineering. On January 2, we received in my office Dr. Benito Kalaw of the UPAA Greater Chicago who handed over to us a check for $10,000 for the UP Diliman Infirmary project. This is the $10,000 announced by Olive Rocha Aliga during the San Diego affair as the contribution of UPAA Greater Chicago for the Infirmary project. Mr. Felix Padlan, who joined us during Benito Kalaw's visit added his own contribution of $2000 for the same project. Felix has made it almost a habit to donate to UP every time he visits and as of January 23, his contribution had reached $8000. Benito and Felix were accompanied by Dr. Ray Torralba and Dr. Oscar Lopez. On January 5, Ted Aquino, newly elected President of the UPAA in America, came over to check on the progress of the Infirmary project which they started over a year ago. In the afternoon of the same day, Dr. Mario and Mrs. Perla Andres of UPAA Toronto gave a check for CDN$25,000 for scholarships. Dr. Jun Abrajano, Professor at Rensselaer Polytechnic Institute also visited on January 17 to renew his pledge to help with UP's fundraising. On January 24, I received email from Dors Maligalig of UPAA Greater Los Angeles to say that the Vet Med group that pledged $4000 during the induction/dinner-dance last October 15 has already put up the amount, thanks to Agustin (Ago) Romero, who made sure the group lived up to its promise. (Ago is one of UPAAGLA's very energetic members, and is one of the best dancers I have seen. He and his wife, Eva, make very good dancing partners.) On January 25, Dr. Bayani and Mrs. Ursula Manalo of UPAA Washington DC, Maryland and Virginia also came over to see what we have done with their chapter's $7000 donation for the Infirmary. Dr Manalo was very pleased with what our Health Service Director Dr. Olga Formoso has done to the two VIP rooms which have been renovated and furnished with the chapter's donation. Francisco (Toti) Juan of the Friends of UP Foundation in America (FUPFA) and his wife, Isabel also visited. Toti and I talked about FUPFA and its activities. Revitalizing FUPFA is our concern and I hope to be able to meet with the other people behind the foundation soon.

And just before the month ended, I received email from Dr. Patricio Reyes. Pat is Director, Alzheimer's Disease and Cognitive Disorders Program of the Barrow Neurological Institute (Arizona). Responding to our call for assistance for the faculty, Pat and his wife immediately agreed to fund a faculty grant to be known as the Patricio and Ligaya Chavez Faculty Grant for the College of Home Economics. Ligaya is an alumna of the College.

What is also heartwarming is the response we have been getting from our younger alumni. Maricris Bitong, BSBAA Batch 1996 came home for the holidays and presented to Dean Ned Echanis ten postdated checks (at $200 each check) as her contribution for a Professorial Chair in Business Administration. It was Maricris who suggested to us during our visit to the US that we tap our young alumni abroad as they are likely to have disposable income to share with UP. She made good her promise by handing those checks over to us before going back to California. And last January 20, Dean Raul Fabella of the School of Economics and I joined representatives of School of Economics Batches 1979 and 1980 for lunch and to receive their donation of P1 Million to the UPECON Foundation for the Endowment Fund for the School of Economics. Vince Perez, former Secretary of Energy, who is part of the group, presented the check to Dean Fabella. What really touched me was their genuine desire to help. They promised to continue helping. How I wish others would follow their example!

Indeed, our fund-raising program is off to a good start. Thanks to our dear alumni and friends who believe in our faculty and in UP.

Reefs Through Time
Biennial Report on the Status of Philippine Coral Reefs



Porfirio M. Aliño
Series Editor

Publisher: UP Diliman Marine Science Institute through the UNEP-GEF South China Sea Project, 2005

This book continues the efforts to document reef monitoring undertaken by the Coral Reef Information Network of the Philippines (Philreefs) partners. Presented here are 36 monitoring reports from five major marine bio-geographic regions in the country. In terms of hard coral cover trends, 44% are increasing, 36% decreasing, and the rest in stable/variable condition.

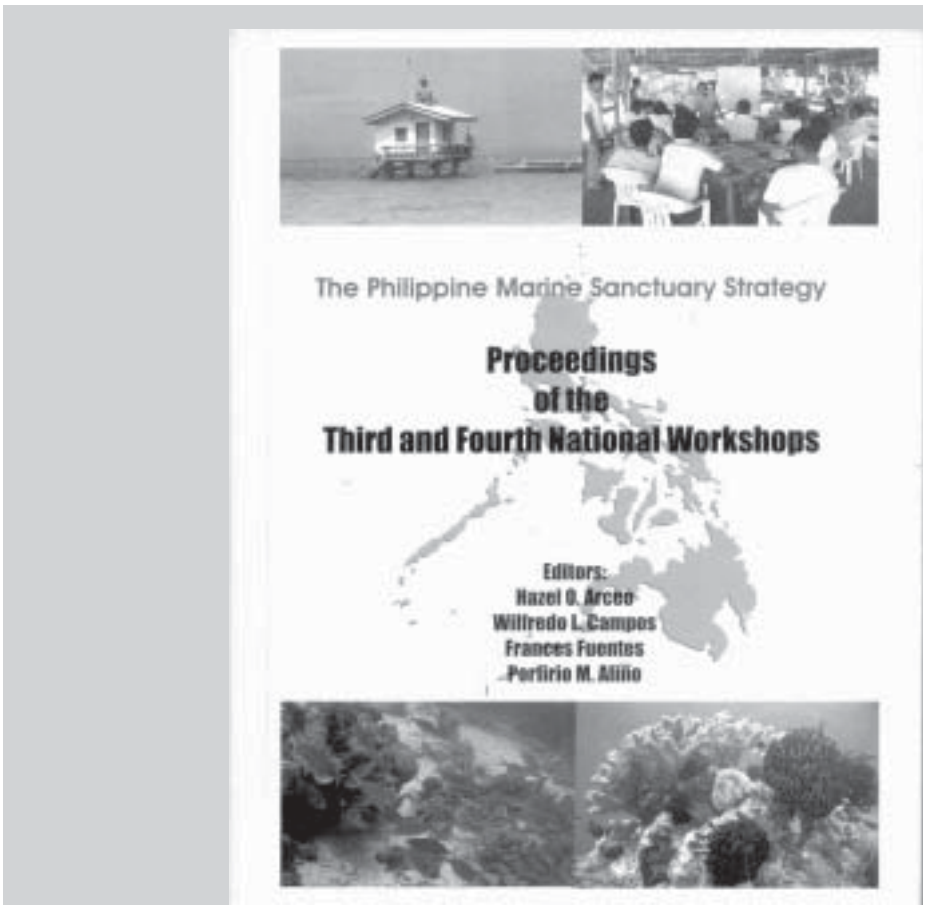
This compilation serves as a testament to the tremendous efforts of local communities, people's organizations, non-government organizations (NGOs), local government units (LGUs), national government agencies (NGAs), and academic institutions in the management of coral reefs.

Proceedings of the Workshops Towards the Formulation of the Philippine Marine Sanctuary Strategy

Hazel O. Arceo, Wilfredo L. Campos, Frances Fuentes, and Porfirio M. Aliño
Editors

Publisher: UP Diliman Marine Science Institute with Funding Support from the UP Center for Integrative Development Studies (CIDS), 2004

This book compiles the Proceedings of the 3rd and 4th Workshops to formulate a response strategy to the twin problems of resource depletion and sustainable resource use by our people. The findings and practical experiences presented in this volume will help in pursuing coastal and resource management to ensure a better life for our coastal communities.



POLLINATORS POWER PRODUCTIVITY OF STAPLE CROPS

by jo. florendo b. lontoc

FOOD GROWERS *Corn producers inspect the demonstration farm for IPB's newest variety pf white corn, the Los Baños White Gold.*

Planted everywhere in the Philippines, corn, cassava, and sweet potato are energy sources many Filipinos cannot live without. Without white corn, for example, roughly a fifth of the country's population would be deprived of a staple food. Cassava, sweet potato, and the industrial variety of corn known as yellow corn are essential in the production of flour, starch, alcohol, and oil. These rich sources of low-cost carbohydrates for humans are also crucial in the manufacture of feeds for the livestock industry.

National statistics show that these staple crops are the backbone of the country's agriculture. In 2003, the quantity of corn produced came second only to rice. Two years earlier, according to the Department of Agriculture, 1.6 million hectares were planted to white corn, and 980 thousand hectares were planted to yellow corn or the varieties used for livestock feeds and industrial purposes. Among the nineteen major Philippine crops, statistics show that cassava is next only to sugarcane, coconut, and banana, in terms of quantity produced, while camote or sweet potato ranks seventh.

Despite efforts at industrialization, the Philippines is still largely an agricultural country and the production of vital crops is a relatively stable source of livelihood for many Filipinos. Corn raising, for example, provides livelihood to a third of Filipino farmers. Unfortunately, more farmers are paying less attention to the staple crops in favor of "higher-value crops," such as fruits and vegetables, which can fetch higher prices. In fact, the country has reached a point where it has to import its staples, particularly rice and corn, because local production no longer meets the country's needs.

Since staple food will always have a market, it is important for the country to maintain and nurture such a resource. The secret to its continued viability lies in the adoption of improved varieties by farmers. This translates into not only an increase in yield, but also greater value for the same yield. For example, the starch contents of sweet potato should be increased. More prolific varieties also allow farmers to devote a smaller area to the crops and to diversify; that is, if a farmer can get the same amount of crops for less land area, then he is free to plant other crops in the area left over.

The IBP is the lead agency for crop biotechnology research. Its endeavors in the conventional breeding of new variants of corn, cassava, and sweet potato are stellar examples of UPLB's initiatives in line with the University's twin thrusts of research excellence and service to the country.

In the quest for improved varieties, biotechnology in the Philippines has yet to take off despite its potential and proven advantages over more conventional means of breeding. It has yet to produce a hybrid. Even if it were to produce one right now, it needs to overcome the health, environmental, and ethical controversies involved. Bt corn, for example, although available in the country from abroad, has not had a warm reception, to say the least.

In the meantime, research on more conventional breeding technologies continues to flourish in the University, which plays a great role in the pursuit of improved varieties. The traditional variety or technology does manage to address contemporary needs, providing ways to achieve self-sufficiency in the production of corn, cassava, and sweet potato.

Fields of dreams

For their efforts and accomplishments in generating improved varieties for the Filipino farmer, the researchers of the Institute of Plant Breeding (IPB) are a source of pride for the University of the Philippines-Los Baños (UPLB)—the main arm of the University for food security. By virtue of the Seed Industry Development Act of 1992, the IBP has been identified as the lead agency for crop biotechnology research. Its endeavors in the conventional breeding of new variants of corn, cassava, and sweet potato are stellar examples of UPLB's initiatives in line with the University's twin thrusts of research excellence and service to the country.

In the latter part of 2005, research efforts led by Dr. Azucena L. Carpena and Dr. Artemio Salazar came to fruition upon the release of new varieties of white corn, cassava, and sweet potato, adding to over a hundred different crop varieties developed by the institute since 1975. The corn variant goes by the name Los Baños White Gold; the cassava, Datu 2 and Raja 1; the sweet potato, UPL Sp-7 and UPL Sp-9. As the latest hybrids, they exceed the qualities of all the previous varieties, especially in terms of yield.

To make these hybrids for the country, researchers of the IPB worked under the elements in the fields sprawled across the valley beside Mt. Makiling. They cross-pollinated male and female flowers of the best variants from the institute's germplasm bank, a facility that conserves genetic resources of important and potentially useful agricultural crops. They selected the best parent varieties, grew them, waited for them to flower, cross-pollinated the varieties, grew the fruit, collected the seeds, grew the new varieties, propagated them "clonally" (through cuttings), then subjected them to several tests to see if the breeds contained the desired qualities of the parent varieties.

Cross-pollination is tricky, but it facilitates the natural processes of hybridization. Before the flower buds open, each is encased in a bag. A male flower is bagged to contain the "pollen burst" so that pollen collected from the flower is pure. If not covered before the flower opens, other pollen can contaminate it. The female flower, on the other hand, is bagged to protect it from being fertilized by any wayward pollen floating in the air. In the case of corn, researchers rub the male flowers on the female flowers in the morning, when the female flower's receptivity for fertilization is at its peak. In the case of cassava, this takes place from noon until two in the afternoon. These pollinators are remarkably dedicated field hands, braving the scorching heat to do their job.

EXCELLENT SEEDS. *The IPB lobby exhibits different IPB-bred varieties of corn and beans*

Fruits of evolution

The release of the new varieties is an important means to increase productivity. Eighty percent of white corn planted in the Philippines consists of the old varieties, exemplified by the *tiniguib* variety, which is good for only one ton of corn per hectare. Los Baños White Gold has a yield of almost 6.5 tons per hectare. In addition, it is moderately resistant to the corn borer, rust, stalk rot, and earworm. According to Proceso H. Manguiat, university researcher and spokesperson for IPB's cereal team, even without fertilizers, their hybrid white corn would still produce higher yields.

The latest breeds of cassava also have higher value than other varieties. Datu 2, recommended for industrial use, excels in all areas of value measurement compared to the Lakan varieties, products of the IPB, which are currently being used by San Miguel Corporation. These parameters are: root yield or the amount of cassava roots harvested; dry matter content or what remains of the cassava after being peeled and dried; and starch content. While a Lakan variety can yield as high as 30.9 tons per hectare, with 35.9 percent root dry matter and 26.9 percent starch content, Datu 2 surpasses it on all counts, yielding 37.2 tons per hectare, with a dry matter content of 39.1 percent and starch content of 27.1 percent.

With a yield of 27.7 tons per hectare, dry matter content of 36.5 percent, and starch content of 25.1 percent, Rajah 1 registers a lower yield and starch content than Datu 2 and Lakan. However, it belongs to another league of cassava—the all-purpose kind that is edible by simple cooking and most useful for the backyard food industry. Rajah 1 scores higher within those parameters than other varieties, according to Edwin E. del Rosario, university researcher and spokesperson for IPB's root crops team. Datu 2 and Rajah 1 are adaptable in all regions of the country and moderately resistant to scale insects, spider mites, leafspot, and bacterial blight.

The new sweet potatoes are also excellent varieties recommended by government for cultivation. UPL Sp-7 yields 11.1 tons of creamy-white camote per hectare, with 35.5 percent dry matter and 21.1 percent starch. UPL Sp-9 yields 12 tons per hectare of purple- or red-skinned camote with creamy-white flesh with 32.5 percent dry matter and 21.1 per cent starch. Both varieties are resistant to scab and weevil, in varying degrees. Aside from the white color of their flesh, which does not have to be bleached during starch extraction, the two new sweet potato varieties beat the old varieties in terms of dry matter content.

ROOTS OF SUCCESS. *Three of the IPB's varieties of sweet potato or camote.*

Because of these new varieties, the Feed and Industrial Crops Division was named Outstanding Research Team during the celebration of IPB's thirtieth anniversary last year. More importantly, the new varieties, the results of the hard work on hybrids begun by IPB teams in the mid-1990s, ensure better harvests for farmers, as proven by standard testing procedures of the National Seed Industry Council, the recommendatory arm of the Department of Agriculture.

These procedures—which involve trial cultivations in the different regions and different seasons of the country—took three years for the rootcrop varieties and two years for the white corn. After running the gauntlet, the new varieties are guaranteed to deliver on their promise.

A record of bounty-sharing

According to Del Rosario, a number of farmers have already taken some cuttings of the rootcrops, good for a few square meters. Manguiat also says seed growers in Cagayan de Oro and Cotabato have already planted the new variety of corn. The IPB has yet to receive feedback from them but it is confident that more farmers will soon realize the benefits of planting the hybrids. After all, the institute has a record of providing varieties of cereals and rootcrops which have proven most beneficial both to individuals and industry. Aside from San Miguel Corporation, starch mills and farmers in the provinces of Bohol and Lanao del Sur—top cassava starch-producing provinces in the country—have also adopted the IPB's Lakan varieties.

It was also the IPB's cereal group that jumpstarted the hybrid yellow corn production in the country in line with the government's Grain Productivity Enhancement Program (GPEP). This was the first time that a hybrid corn variety (IPB 911) was utilized for a nationwide agricultural program. Private entities were enlisted to produce seeds of the IPB variety so that they would be more available nationwide. Del Rosario and Manguiat estimate that yellow corn production in the Philippines today mostly consists of hybrid varieties, covering eighty percent of all yellow corn cultivated.

White corn production now appears ready to take off with the introduction of hybrid varieties, similar to what happened in the mid-1990s with the landmark introduction of hybrids of yellow corn.

The seed industry

The phenomenon of the yellow corn hybrid industry showed that for new varieties to create a significant impact, their seeds had to be produced in commercial quantities. The IPB does not have this capacity. Functioning mainly as a research center, the IPB can only raise enough to accommodate inquiries and get farmers and commercial seed producers started on the new varieties. It cannot distribute to all farmers in the Philippines needing new seeds. Thus, private seed producers play a significant role in the promulgation of the new varieties. As in the case of the GPEP program, they can multiply the seeds of the new IPB varieties to amounts sufficient for distribution nationwide. Although private

POLLINATORS, *p. 14*

CASUY-BASED CREAM AS SKIN CANCER CURE?

YES! say inventor, PGH doctors

By Chat Jemena

Who would have thought that the lowly casuy nut, a favorite snack of Pinoys, would prove to be a cure for basal skin carcinoma (BCC)? Yet that's exactly what a Filipino inventor and his partners, a team of PGH doctors, proved to the world.

Taking the oil extract from the pericarp of the cashew nut and mixing it with various Philippine herbs, Mr. Rolando dela Cruz came up with DeBCC, the wonder skin cream which can beat basal skin carcinoma. (The prefix "De" means "to remove"; hence, the name DeBCC.

BCC is the most common type of skin cancer in the world. It arises from the basal cells, which are at the bottom of the epidermis (the outer skin layer). It affects mostly those who have a history of chronic or frequent exposure to sunlight (either due to work or leisure). However, there are a few cases wherein contact with arsenic, exposure to radiation, and complications of burns, scars, vaccinations, or even tattoos, are contributing factors.

It has been estimated that the annual incidence of BCC is one million in the USA, over 500,000 in Europe, and 190,000 in Australia. The numbers are rising. When left unchecked, especially if it develops on the middle third of the face, it can cause horrible disfigurement as well as loss of the functions of the eyes and nose. Unfortunately, the usual treatments, which involve extirpative surgeries, also result in disfigurement since a wide margin of normal tissue must be removed with the cancer.

The DeBCC treatment may very well ensure that the cancer and the surgery it entails are no more.

With the help of PGH surgeons Drs. Eric Talens, Daniel de la Paz, and Orlando Ocampo, DeBCC was field tested two years ago on fourteen patients whose cancer developed on the very delicate middle third of the face. Their cases were considered hopeless by some doctors and rejected by most plastic surgeons.

For weeks the cream was patiently administered and the patients were buoyed up by the steady improvement in their illness. On the sixteenth week of trial, the cancer was cautiously declared cured. And it really was—no recurrences were noted after a follow-up of more than two years.

Rolando dela Cruz

For his invention, Mr. Dela Cruz garnered two top prizes—a gold medal from the Archimedes Inventors' Forum of 2004 in Moscow, Russia, and another gold medal from the International Inventors' Forum held at Nuremburg, Germany in November 2005. There were fifteen gold medal winners at the last forum, but Mr. Dela Cruz ranked highest. He received the award accompanied by his family and the doctors.

Mr. Dela Cruz was also the recipient of several top awards from his earlier inventions of DeWart and DeMole—herbal preparations which can safely remove warts and moles without surgery. Not bad for a commerce graduate and former barber, and a dedicated volunteer of the Ugnayan ng Pahinungod-Manila.

POLLINATORS, *from p. 13*

institutions have started their own hybrid programs in recent years, the IPB remains the top source of expertise for the breeding industry, both in con-ventional breeding technology and biotechnology.

In the absence of a government program such as the GPEP that makes government varieties available to farmers all over the country, the IPB is unable to promote its products on a large scale. It can only put up demo areas in the vicinity of Los Baños for each planting season and join trade fairs and exhibits, when funds allow. IPB experts also provide training and technical and advisory assistance to government and industry.

Although it stimulates the growth of private seed producers by providing the latter with the latest varieties which they can sell to the farmers, the IPB does not lose sight of its main objective. This is to be of service to the Filipino farmer. Business agreements with seed producers notwithstanding, the IPB makes available to the farmers stocks of seeds and parent varieties at much lower prices, through its National Seed Foundation. This helps to keep the pricing of the private seed producers in check. The difference between the prices of seeds of the private producers and IPB seeds can be startling. In 2005, a hybrid of white corn in an amount sufficient to cover a hectare sold for P2,800. The same variety sold at P1,500 at the IPB. Seeds from the multinationals are the most expensive. Bt hybrid corn, a product of these multinationals, can go higher than P5,000.

There is indeed money in hybrids. Recently, many IPB experts transferred to the private sector, where more funding for their research and higher compensation for their expertise are available. In spite of this, the IPB retains the advantage of a germplasm bank, consisting of plant genetic materials collected from its thirty years of research. The majority of its experts also remain committed to the service goals of the institute. Del Rosario has worked for the IPB since 1980 while Manguiat has remained loyal to the institute since 1977. They maintain that the IPB is still home to the most number of breeding experts in the Philippines. It also has linkages with international breeding research centers.

Toward stable staples

A premier research and service center for Philippine agriculture, the IPB continues to create new varieties to answer the ever-increasing demand of human, animals, and machines for energy and growth. Los Baños White Gold, Datu 2, Rajah 1, UPL Sp-7 and Sp-9 will not be the last ones of their kind. The wheels of research work at the IPB continue to grind.

ALTERNATIVE, *from p. 5*

exported," Quiros explains. "When you sell it abroad, you naturally earn more from it."

New meaning to 'sugar-rush'

Fuel ethanol, defined in the DoE website as "a high-octane, water-free alcohol produced from the fermentation of sugar or converted starch," is one of the world's most popular alternatives to petrol-based fuel. Pure ethanol burns far more cleanly than other fuels, with end products consisting of carbon dioxide and water, making it an environmentalist's favorite fuel. Most cars today can handle up to a ten percent blend of ethanol; anything higher will require a few engine modifications. Many countries have successfully campaigned for greater use of fuel ethanol, including Brazil, the European Union, the US, Australia, China, India, Japan, and Thailand.

In the Philippines, the National Bioethanol Program was launched only last May 2005. A House Bill and Senate Bill have also been authored, seeking to establish a bioethanol industry in the country. The Philippine Fuel Ethanol Alliance (PFEA) is actively campaigning for the passage of the bills.

Main sources of ethanol are corn, cassava, sugarcane, and other starchy materials. Dr. Reynaldo I. Acda, former dean of the UP Los Baños College of Engineering and Agro-Industrial Technology and technical consultant of the PFEA, favors ethanol obtained from sugarcane. Corn is heavily utilized by the livestock industry for feeds and by people as a major food source. If supplies were further divvied up for ethanol production, it might become necessary to import corn in the short run. "Sugarcane [in contrast] is widespread, with developed areas and areas for development lying idle," Acda says. "Besides, Filipinos are more familiar with sugarcane agronomy, particularly in the Visayas. We know how to raise *tubo* quite well."

Another advantage to ethanol, Acda says, is that "it is relatively inexpensive to produce ethanol, compared to diesel, at fifteen to twenty pesos a liter, using modern technology, not the old technology."

Acda is careful to emphasize the use of modern technology because it addresses one of the major misgivings about ethanol production: the treatment of slops. Ethanol, which is also used in alcoholic beverages, is obtained through distillation; and in the past, environmental groups have taken issue with the industry's method of dealing with distillery waste. Acda is quick to point out that the modern technology for waste treatment was not available then. Acquiring it would entail additional cost, of course, and may in turn drive up the price of ethanol.

There are other challenges the Philippine bioethanol industry has to face, says Acda. One is the lack of distilleries. "According to our approximations, we would need at least eleven distilleries with a 160,000-liter capacity a day just to supply enough ethanol to meet a ten percent-blend requirement." There is also a need to develop the local sugarcane industry further. Fuel stations to handle blending and pumping are also required. As for the added cost of waste treatment, Acda believes that full government support—in the form of a temporary relaxation of environmental laws and tax credit—would further help make the Philippine bioethanol industry comparable to the rest of the world's.

Anaerobic exercise

Perhaps the nascent bioethanol industry can take a page out of Dr. Wilfredo I. Jose's project proposal.

Challenged by MMDA Chair Bayani Fernando's suggestion to Metro Manila residents to simply flush their household wastes down the toilet, Dr. Jose, professor of biochemical engineering at the UP Diliman Department of Chemical Engineering, devised a way of dealing with wet household wastes, while at the same time discovering a solution to the roaring, smoke-belching tricycles present in every subdivision. The result is an ingenious melding of waste treatment through anaerobic digestion and a quieter, less noxious alternative to diesel-run engines.

The country is in dire need of a cure for its dependency on imported fossil fuel. How can the gap between the scientific principles behind alternative fuels and the day-to-day realities of the common people be bridged?

In Jose's project proposal, wet biodegradable wastes are separated from dry wastes, ground finely, and sent through anaerobic digesters, wherein bacteria work to break the wastes down without the presence of oxygen. This process produces methane, or biogas, which is then stripped of hydrogen sulfide and carbon dioxide before going into a storage tank. The biogas is used to power the engine of an electric generator, which will in turn charge lead-acid batteries needed to run an electric tricycle. Besides green e-tricycles, Jose adds, the biogas acquired in this manner can also be used by a household for cooking, or to power a boiler or run an electric generator.

A problem could crop up in the area of maintenance, however. "If you don't understand the processes involved, there will be difficulties," says Jose. "The system could get blocked, or air could get in, killing the bacteria…you need proper maintenance."

Jose also mentions the importance of selecting the kind of waste that produces enough methane. Human waste, for instance, produces less biogas. "However, this is an economic way of creating the pollutant," he says. He refers to the biological oxygen demand (BOD) of the materials, or the amount of oxygen that will disappear from the water when aerobic bacteria set about breaking down organic material, a measure of the level of water pollution. "The higher the BOD, the higher the level of pollution," Jose points out. "If your organic material has a BOD of less than 500 mg/L, you won't be able to get enough biogas from it. Above 1,000 mg/L, sufficient methane is produced. Good sources of biogas are swine and cattle manure, with a BOD of 20,000 mg/L. The best source is alcohol distillery slops, with a BOD reading of 60,000 to 80,000 mg/L. In fact, Jose says, the biogas one can acquire from distillery slops is adequate to the needs of one small subdivision.

Alternative Engineering

It is common knowledge that the country is in dire need of a cure for its dependency on imported fossil fuel. How can the gap between the scientific principles behind alternative fuels and the day-to-day realities of the common people be bridged? "Engineers are needed to make the principle practical," Jose explains. "The ideas already exist; they work in the laboratory. So how do you transform them into something practical, even commercially useful?"

The urgency is there, Acda insists. Thus far, the country has been trapped in a cycle. An energy crisis induces the government to launch into feverish campaigns and studies on alternative fuel, only to lose interest when the crisis has passed. The scientific knowledge that could help the country is already there. All that is needed is the ability to focus on the long-term and the will to do what is necessary to get there.

(Left photo) Dr. Jose beside an experimental setup for biogas production. (Right) Dr. Jose with a digester for the pilot study.

INTANGIBLE, *from p. 10*

3. water—irrigation, desalination,
4. disaster management,
5. climate change, and
6. Transportation—fuel efficient transportation technologies.

Universities and Research Institutions should be supported by government and private institutions in order to achieve the following objectives in line with science and technology (S&T) Intellectual Property (IP) protection and management:

1. start or enhance existing IP offices to facilitate protection for and ownership of research and development results;

2. develop educational materials to effectively teach students, teachers and researchers on the multidisciplinary/interdisciplinary nature of intellectual property protection, utilization and management;

3. rigorously select the IPs/ innovations of these institutions for transfer to industry or commercialization with non disclosure arrangements in place;

4. add value to and reduce risk involved in selected innovations or new technologies; and

5. develop well-planned IP strategy/ies for each selected innovation to obtain the desirable outcome for the university and industry.

In conclusion, I would like to cite his Excellency Pres. APJ Abdul Kalam of India who very aptly stated the role of the university in societal transformation and economic growth. He said this rule is to "develop and enhance the potential of its human resource progressively transform it (i.e., the society) into a knowledge society: A knowledge society will be producing products and services that are rich in both explicit and tacit knowledge, thus creating value added products (and services)."

LETTER FROM THE PRESIDENT

Strengthening S & T in UP

Emerlinda R. Roman

Dear Colleagues,

Our administration has identified the strengthening of science and technology (S&T) programs in all UP campuses as one among the ten points in the agenda we are pursuing in the next five years. This is because we want to continue to help the country build up its scientific manpower base which is crucial to progress and development. Many countries have achieved economic prosperity because they have invested heavily in science and technology. In the Philippines UP should contribute by training students to further strengthen our country's science capacity and by creating knowledge through research for domestic production and for public sector policy formulation and implementation.

Our thrust in S&T is evident in the number of our students enrolled in science and engineering programs. In AY 2005-2006, 42.3% of our students, both undergraduate and graduate, were enrolled in S&T courses (at the undergraduate level, science and engineering were easily the most popular programs, while at the graduate level, management courses were only slightly ahead, by 0.03%, of science and engineering.) This has been the profile of our students in the past several years and it is one that we would like to sustain or improve during our term. Our enrollment profile is unlike the national enrollment profile in which about 40% of the country's college students are enrolled in education and teacher training and business courses. Surely UP would not want to further aggravate the oversupply of teachers and business or commerce graduates. It should instead do its share to build up the country's scientific and technology knowledge and expertise.

We will not only strengthen our existing science and technology programs, we will also develop initiatives in emerging fields in science and technology. A committee has been formed to help us identify what these emerging fields are. Chaired by Vice-President Amelia Guevara, the committee is composed of representatives from the various UP campuses: Dr. Victor Ella of UP Los Baños, Dr. Alvin Marcelo from UP Manila and Dr. Caesar Saloma (Physics), Dr. Titos Quibuyen (Chemistry) and Dr. Joel Marciano (Electrical and Electronics Engineering) from UP Diliman. The committee has identified four technologies, namely: (1) **Materials** (bio-materials, pharmaceuticals, nano materials, and molecular medicines and drug delivery); (2) **Biotechnology** (bio-materials, bio-informatics, nano, disease characterization and diagnosis, vaccine development, food sufficiency, robust crops and yield enhancement, biodiversity, drug discovery, bio-monitoring); 3) **Pervasive com-puting** (cost-effective rural con-nectivity and distance learning, disaster mitigation and early warning systems management, telemedicine, environmental and habitat protection and monitoring, advanced micro-electronics and "systems on a chip", 4th generation networks and internet, distributed computing, optical com-munications in wired networks; and 4) **Instrumentation** (nano, photonics, separation science, and robotics.) The committee's next step is to discuss its recommendations with our colleagues in the constituents universities before finalizing them. Should any one of our colleagues find it interesting enough to participate in the discussion, they should please feel free to contact any committee member or Vice-President Guevara.

Update on the Centennial Fund Raising

In my report on the US trip, I shared with you the good news about our alumni's commitment to help raise funds for the University. I brought home some checks with me and a list of those who have pledged to contribute to the Centennial Fund Campaign. The months of December and January have been especially lucky months, for UP Alumni from abroad have come home not just to celebrate the holidays with their families but also to make good their promise to help.

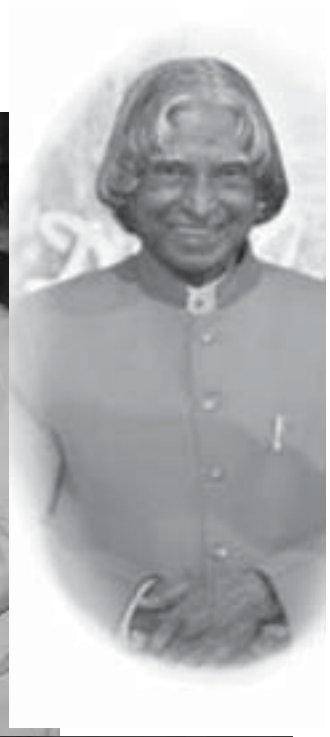
LETTER, *p. 11*

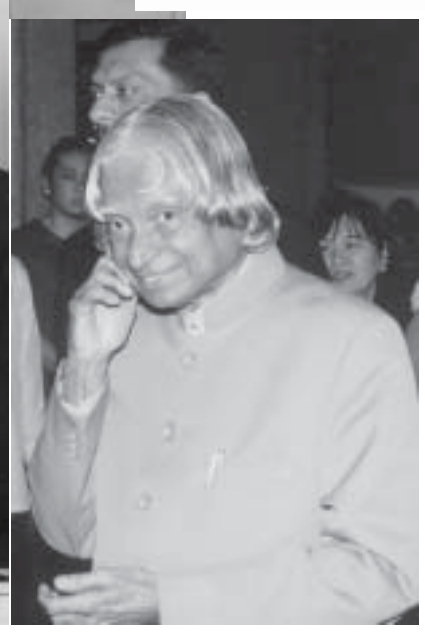
The Role of Science and Technology in Development

Indian President's visit to UP

"The whole purpose of education in a country is to develop and enhance the potential of its human resource and transform it into a knowledge society."

–Abdul Kalam
President of India





President Kalam stressed this in a lecture on "The Role of Science and Technology in Development" at the NISMED Auditorium, University of the Philippines Diliman on February 6. The lecture was part of a four-day state visit that also resulted in four agreements between the Philippines and India in the fields of defense, agriculture, tourism, and medicine.

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