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HOME

Tanzania: Young Chemist Seeks Answers in Traditional Medicine

Julie Frederikse 6 July 2011

Johannesburg — When Justin Omolo was growing up in Tanzania, he preferred Western medical clinics to African traditional healers. "I was the only one in my family who didn't believe in all the traditional cures," he said. "I guess I wanted proof."

Now this young African organic chemist is looking for that proof as he conducts research for his PhD on plants used by Tanzanian traditional healers to treat HIV.

Omolo's research is supported by the Science Initiative Group (SIG), which aims to foster science in developing countries. Based at the Institute for Advanced Study in Princeton, New Jersey, SIG is governed by a board that includes scientists from developing countries, leading U.S. scientists and an entrepreneur, and is supported by the Carnegie Corporation and the Mellon and Packard foundations. SIG's chief focus is an initiative supporting PhD and MSc-level students in sub-Saharan Africa called the Regional Initiative in Science and Education (RISE).

It is through RISE that Omolo has been able to study potential drugs to combat HIV/Aids. His PhD research was inspired by reports from Tanzania's northeastern Tanga region that HIV-positive people who consulted traditional healers responded well to treatment with indigenous plants.

"People said that you drink just one cup of this medicine (made from local plants) and your condition improved," Omolo said. "Doctors at the local hospitals heard about it, too. They said that these people were living as much as 10 years longer than expected."

The Tanzanian government sent researchers to probe these reports and test the plants for toxicity. Once they proved non-toxic, the Tanga Aids Working Group (TAWG) was founded to investigate the effect of these indigenous plants on HIV. Medical doctors and scientists from the National Institute of Medical Research and the Institute of Traditional Medicine at the University of Muhimbili have joined forces with Dutch and Indian research organizations.

As part of this international effort, Omolo has travelled from the University of Dar es Salaam to South Africa, where he is conducting further research on these plants for his PhD in organic chemistry. The RISE program links graduate students such as Omolo into various networks relating to their specific fields of science.

Omolo is part of the RISE network known as SABINA, Southern African Biochemistry and Informatics for Natural Products, which aims to harness the power of southern Africa's biodiversity to increase capacity in natural products research. This kind of innovative networking in chemistry and biochemistry among universities in the Southern African Development Community (SADC) aims to contribute to development goals around food security, public health and value-added exports.

Two major South African universities, Witwatersrand and Pretoria, and South Africa's Council for Scientific and Industrial Research (CSIR) are SABINA partner institutions. Omolo is conducting his PhD research at Johannesburg's "Wits" University, with support from CSIR. These institutions act as a back-stop to his home university in Tanzania, which has far less resources and expertise.

"In order to do my research, I prepare the plants the way the traditional healers do, boiling the stems, bark, leaves and tubers," Omolo said enthusiastically. His studies have found chemical compounds in the plants that act against HIV, which targets the T4 cells that are vital to the body's immune system. The hope is that a drug made from these plants can stop HIV from binding with the T4 cells, thus allowing them to do their job of fighting infections.

Why synthesise a drug in a lab when the plants in their natural environment have been shown to do the job of fighting HIV? Omolo's supervisor, University of the Witwatersrand chemistry professor Charles de Konig, said that if the plants were to be harvested in Tanzania, it could require a ton of plant material to produce a few milligrams of the active ingredient.

On the other hand, the laboratory can replicate the required climate and soil conditions and make synthetic versions of the plants far more efficiently. Another issue is that SABINA doesn't endorse the pillaging of a natural healer's source, which is something that pharmaceutical companies had been accused of doing.

The names of these plants are not being publicly revealed because Omolo's efforts to identify and synthesise the active anti-HIV compounds could eventually lead to the patenting of an anti-HIV drug. But that's all in the future - his immediate goal is to finish writing up his research findings by the end of this year, so that he can return to teach at his university in Tanzania as Dr. Justin Omolo.

South Africa: Building With the Molecules of Medicine

Julie Frederikse 2 August 2011

For South African organic chemistry student Adushan Pillay, conducting research for his PhD is like building with Lego children's blocks.

"That's what we do at a molecular level," he said. "You can't predict what will work - you build and build, and it's trial and error to figure out what works."

Pillay's building materials are molecular compounds known as naphthoquinones found in a parasitic fungus that causes blight on potato plants. These compounds kill the host plant by producing toxins, but what's interesting to Pillay is whether they could combat human diseases.

The 26-year-old from Pietermaritzburg in South Africa's KwaZulu Natal province is probing the potential of these compounds to fight cancer. He has identified a specific molecule, known as marticin, which shows great promise as an anti-cancer drug, according to Pillay and his supervisor.

Pillay is studying under a program to support science in developing countries, the Science Initiative Group (SIG) of the U.S. Institute for Advanced Study. He is one of the PhD students from sub-Saharan Africa in SIG's Regional Initiative in Science and Education (RISE) and is studying at Johannesburg's Witwatersrand (Wits) University.

RISE has grouped scientists into networks relating to their research areas. Pillay's work falls under SABINA, the Southern African Biochemistry and Informatics for Natural Products.

"We're lucky to have 10 percent of the world's biodiversity in plants here in Africa," said Pillay. The goal of SABINA is to use this biodiversity to increase capacity in natural products research in southern Africa.

In addition to Wits, where Pillay is conducting his research, the University of Malawi, the University of Namibia, and the Tea Research Foundation of Central Africa (TRFCA) are SABINA partner institutions, along with Pretoria University and the South African Council for Scientific and Industrial Research (CSIR).

Given SABINA's emphasis on natural products, it might seem that the focus would be on plants in nature rather than on synthesizing compounds in a lab. However, the fungus makes the key compound in very small amounts, so if its anti-cancer properties are proven, this medicinal plant will be worth a lot of money, which could lead to over-harvesting.

This is why Pillay is working so hard to make a molecule in the lab which is identical to the one found in nature - a challenge in that it is structurally complex. Such a "synthetically identical natural product" could be produced in large quantities.

To this end Pillay aims to develop a novel methodology, for the synthesis of a model tricyclic system, but he has been finding it hard to introduce the final ring to make it a naphthoquinone.

"It's only about 30 percent of the time that you get what you want, so you get used to being disappointed," he mused. "But if you go into something knowing that the outcome will be uncertain, then when it does work you're on a high for three days."

Pillay's supervisor, Charles de Koning, professor of Organic Chemistry at the University of the Witwatersrand, harks back to that Lego analogy. "You build and build, and then if the next block doesn't fit, you have to kick whole house down and start over."

De Koning describes his student as "a very creative organic chemist". "He's in my office just about every day with new ideas on how to synthesize the complex quinones we have set as targets for his PhD. Then by the end of the week, as if by magic, he has already obtained some interesting results."

Pillay is aware that for all his hard work his research could produce an unexpected outcome, that marticin might not be the anti-cancer drug he hopes it is.

"So I'm doing other things on the side," he said. "I know I can't put all my eggs in one basket." He aims to test the compound for anti-malarial and anti fungal properties as well.

Pillay said he receives support from fellow chemistry students, especially his Tanzanian colleague in the SABINA-RISE program, Justin Omolo. Omolo in turn says he appreciates Pillay.

"I also get depressed when my research isn't going well," said Omolo, who is investigating the anti-HIV properties of an indigenous Tanzanian plant. "Adushan and I support each other, we tell each other that things are going to work out."

Pillay said that one of the aspects of the RISE program that he values is the interaction with students from other African countries, who he sees as "the cream of the crop".

AllAfrica - All the Time

Engineers get to grips with materials science

Munyaradzi Makoni

August 29, 2011

Engineering postgraduates will be immersed in materials science – sometimes described at the ‘‘science of stuff’’ – at next month’s Pan-African School of Materials (PASMAT).

The school will be held in Nigeria for the first time. It will run for two weeks in September on the campus of the African University of Science and Technology (AUST), located in Abuja.

Wole Soboyejo, who serves on the AUST scientific advisory board, said the school would take in about 20 students from African universities. The deadline for applications has been extended until tomorrow.

Soboyejo, who is a lecturer at Princeton University in the USA, will present the first week of lessons, focusing on structural fatigue and fracture.

“These are two key topics at the heart of materials science and engineering,” he told Research Africa.

“The tools that postgraduates acquire at PASMAT will prepare them for materials research, as well as future efforts to develop new materials,” the mechanical and aerospace engineer said.

The entire event runs from 5 to 17 September 2011. Interested master’s and PhD students should send their curriculum vitae and a one-page description of their thesis research to Tracey Odigie at tracey@aust.edu.ng by 31 August 2011.

Lesley Cornish, assistant dean of research at South Africa’s University of the Witwatersrand (Wits), will present the second week of training.

“I am hoping that the students will be able to bring their research problems to the course and we can discuss them in class to make it a learning experience for all,” Cornish told Research Africa.

At Wits, Cornish also directs the Centre of Excellence in Strong Materials, another collaborative effort begun in 2004 and funded by the government’s department of science and technology and the National Research Foundation.

She is also the director of African Materials Science and Engineering Network (AMSEN), established in 2008, which is one of the partners organising PASMAT.

The network, which focuses on increasing skills in materials science and engineering in order to add value to Africa’s extensive mineral deposits, has branches at Wits; the University of Botswana; the University of Namibia; the University of Nairobi, Kenya; and the Federal University of Technology, Nigeria.

AMSEN itself is one of five networks established by the Regional Initiative in Science and Education (RISE).

RISE is implemented by the Science Initiative Group (SIG), whose board includes Sudanese-born physicist Mohammed Hassan, the former president of the African Academy of Sciences.

SIG is located at the 70-year-old Institute for Advanced Study – once home to Albert Einstein - in Princeton, USA.

allAfrica.com

Africa: Stuff is Cool, If You're a Materials Scientist

Julie Frederikse 11 September 2011

If postgraduate students at the Pan-African School of Materials (Pasmat) are asked what they're studying this month, they aren't being flippant if their answer is "stuff". That's because the field of materials science is often referred to as "the science of stuff".

Calling it "stuff", however, doesn't mean it's easily - or briefly - defined. An educational kid's site - StrangeMatter puts it this way: "Understanding how [everything you use every day] is put together, how it can be used, how it can be changed and made better to do more amazing things - even creating completely new kinds of stuff: that's what materials science is all about."

Nearly two dozen masters and doctoral students in science and engineering are attending the Pasmat course at the African University of Science and Technology (AUST) in Abuja, Nigeria, through mid-September.

Aerospace engineer Wole Soboyejo, who teaches at Princeton University in the United States, is an AUST advisor and this week's course lecturer. The topic: structural fatigue and fracture - or, in lay terms, what happens to matter when stressed.

To a non-scientist, it might sound esoteric, or even boring. But think of it like this; if you're in an airplane that hits an air pocket, you'd want the engineers who built the fuselage to have paid attention in that part of the course! "The tools that postgraduates acquire at Pasmat will prepare them for materials research, as well as future efforts to develop new materials," Soboyejo told Research Africa, a professional body for African government and institutional policymakers, researchers and research managers.

The second week of training is being presented by Professor Lesley Cornish, assistant dean of - get ready for this - Research of the Faculty of Engineering and the Built Environment at South Africa's University of the Witwatersrand (Wits), who will cover basic materials concepts required for the calculation of phase diagrams in materials science and engineering. If you're not a scientist and want to be even further confused, take a look at this YouTube video.

On the other hand, you could just think of the airplane again. You really do want the builders to be able to calculate how complex mixtures of metals will respond under varying conditions. And wouldn't it be nice if African scientists come up with innovative uses of materials to solve old or emerging problems of contemporary life?

When she's not fully occupied with being dean of a university department whose name you can't remember, Cornish is also the director of one of the Pasmat partner groups, the African Materials Science and Engineering Network (Amsen), which aims to improve skills in materials science and engineering. One of the potential results of that work is to add value to Africa's extensive mineral deposits. And that matters - a lot - to Africa's future.

Oxford economist Paul Collier, in his recent book 'The Plundered Planet', writes that "the failure to harness natural capital is the single-most important missed opportunity in economic development". In an interview with AllAfrica, Collier added that the "resource discoveries which are now happening in Africa are the biggest opportunity for good that Africa has ever had and is likely to have in our lifetimes". If Amsen-related faculty and students help increase the utility of the continent's natural resources - retaining more of the value - the investment in science education would be enormous.

Amsen has branches at the universities of Botswana, Namibia and Kenya, as well as Nigeria's Federal University of Technology in Akore (FUTA) as well as at Cornish's university, Wits in Johannesburg. Amsen is one of five networks in sub-Saharan Africa funded by the Carnegie-IAS Regional Initiative in Science and Education (RISE). The goal is to strengthen higher education in sub-Saharan Africa by preparing new faculty to teach in African universities and upgrading the qualifications of current faculty.

Professor Cornish is pleased that three of her students from the Amsen network will be taking part in the Pasmat course, which is a collaboration between AUST-Abuja and RISE-Amsen. Cornish's students are Nigerian Adenike Olaseinde, winner of the Tata Africa Scholarship for women scientists, who was a lecturer at FUTA before coming to Wits; another Nigerian materials scientist, Apata Ayodeji, who taught at the Department of Metallurgical & Materials Engineering at the Federal Polytechnic of Idah in Nigeria's Kogi State; and Kenyan Bernard Odera, who lectured at the University of Nairobi. All the Amsen postgraduate students will return to their home institutions when they have completed their PhDs.

The rationale for the workshop is to provide training that will allow students to undertake research, with topics chosen so as to be applicable for many research topics, such as alloy development, corrosion, materials development and beneficiation - or enhancing the value -

of local resources, said Cornish. She said the research is important not only as the basis for local industries, but also to make existing products last longer.

"Some places in southern Africa, which by tradition have simply exported raw minerals with no value added, are finally developing truly advanced technologies and applications for these minerals," said Alan H. Anderson, a consultant for the Science Initiative Group based at the Institute for Advanced Study in Princeton, New Jersey, which implements the RISE program. "The Amsen program at Wits is one of the best examples of this."

Professor Cornish says she encouraged her students to use the opportunity of attending the Pasmat course to discuss their research problems with other materials scientists. "I'm developing alloys that have high strength in aggressive environments," Cornish said. "I've got students working on steels and cermets (materials used for machining tools) on research which will contribute to the mining sector and other areas where high temperature alloys are used, like in turbine engines, and also in the petrochemical industry."

She says an alloy she and her students are working on can withstand high temperatures more effectively than materials currently used, e.g. those that are nickel-based. What's more, she says that because less fuel will be needed, the result is not only cost savings but less pollution.

Arlen Hastings/RISE

Apata Ayodeji, Adenike Olaseinde, Bernard Odera and other Amsen students at Wits.

Professor Cornish is also director of the Centre of Excellence in Strong Materials, funded by the South African government's Department of Science and Technology and the National Research Foundation. But for all her scientific cred, while listening to the "scientists of stuff" as they chat about their mentor, they can be overheard referring to her in a more typically African tribute to a strong woman - as "Mama Cornish".

Tami Hultman contributed to this article.

twas

8

Okavango Research Institute

MAUN, BOTSWANA

ORI

EXCELLENCE IN SCIENCE

Profiles of Research Institutions in Developing Countries

PUBLISHED IN COLLABORATION WITH

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Profiles of Research Institutions in Developing Countries

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The Okavango Research Institute (ORI) is a unit of the University of Botswana (UB) located on the fringe of the Kalahari Desert in southern Africa, some 1,000 kilometres northwest of UB's main campus in the capital city of Gaborone. It is dedicated to the study and conservation of one of the world's largest and most intact inland wetland ecosystems: the Okavango Delta. In 2010, ORI's area of concern expanded to the entire Okavango Basin in which the delta resides. That area adjoins Zimbabwe to the east, Zambia and Angola to the north, and a sliver of Namibia along the northern frontier. The institute, which was not fully staffed until the mid-1990s, has grown rapidly in the past several years.

Additional growth is anticipated with the opening of a second UB campus adjacent to the site of ORI. Construction is scheduled to take place no later than 2015. The entire complex is about 15 kilometres up the Thamalakane River from the sprawling, dusty town of Maun, the destination for most tourists who travel from around the world to see the Okavango's rich wildlife.

ORI remains physically small. There's only one main building for offices and laboratories, plus a handful of outlying, mostly temporary structures for graduate students, visitors and staff. It also has a tented camp to accommodate visiting students and researchers, a refurbished library, a new herbarium and a modern geographic information systems (GIS) laboratory, which produces maps and charts and maintains geospatial data on the Okavango Basin.

THE OKAVANGO RESEARCH INSTITUTE (ORI)

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With 33 academic staff and 45 support staff, ORI is involved in more than 25 research projects, many in collaboration with international partners. The institute's mandate extends beyond hydrology and natural resource management to issues related to ecosystems, tourism, livelihoods and governance.

ORI's educational functions are new and growing. The first graduate students arrived in 2009. Currently, 15 students are enrolled, five of whom are supported by the Regional Initiative in Science and Education (RISE), a programme funded by Carnegie Corporation of New York and administered by the Science Initiative Group (SIG) based at the Institute for Advanced Study in Princeton, New Jersey, USA.

About 20 undergraduates attend a course in research methods that takes place during the main campus's summer break. They work with mentors on small, basic research projects. A master degree's programme in development practice will begin in 2011 to train students from around the world on strategies for establishing businesses in developing countries. This programme has received funding from the MacArthur Foundation and grants from the University of Florida in the US. In the near future, however, ORI plans to continue to focus largely on research, with grants from external funding agencies providing much of its income.

With 33 academic staff and 45 support staff, ORI is involved in more than 25 research projects, many in collaboration with international partners.

TOMORROW'S RISING RESEARCH STARS

• ***Siziba Nqobizitha***, *who was born and raised in Zimbabwe, earned his master's degree at the National University of Science and Technology in Bulawayo. He specializes in aquatic ecology. While working as a research assistant at Lake Kariba Research Station, he met the director, Moses Chimbari, who soon left for ORI and invited him to come along. With the help of RISE, Siziba completed his PhD, which showed the integrity of the delta's ecosystem had been placed at risk by climate change and increasing demand for water. He plans to continue exploring how climate change will affect both the quantity and quality of water resources in the region.*

• ***Gaolathe Tsheboeng***, *who hails from Gaborone, Botswana's capital, learned about RISE just as he was completing his bachelor's degree at the University of Botswana. His research at ORI focuses on the intricate relationship between annual flooding, vegetation and animals in the delta. Flooding is necessary to preserve the natural richness of the delta and its biota, Tsheboeng says. He fears that major hydrologic changes designed to reduce flooding – most notably, the construction of dams upstream, which Angola has long contemplated – would reduce the ecosystem's rich plant and animal biodiversity.*

SNAPSHOT

• ***Kelebogile "Kelly" Cole*** *has always wondered how different forms of life could survive in southern Africa's harsh, dry climate. Since earning a degree in ecological studies from the University of Botswana in her home town Gaborone, Kelly, with RISE support, has worked at ORI, studying the effects of the flooding on soil nutrients. In the near future, she hopes to secure additional support to pursue a doctorate degree that she will need for a career in academia.*

• ***Kondja Amutenya*** *came to ORI as a master's degree student from the National Marine Institute Research Center, in Swakopmund, Namibia, where he learned about fisheries. His research, supported by RISE, sought to shed light on a puzzling size difference between tilapias of the same age from the northern and southern delta. His hypothesis: Southern fish, which depend on the temporary seasonal flood water to grow and mature, must do so rapidly, whereas northern fish, which live in permanent flood channels, have more time to mature. In the future, Kondja hopes to study the effects of diamond mining on groundwater quality in his native Namibia.*

SNAPSHOT

We can offer an exciting work environment for young researchers.

SCIENCE INITIATIVE GROUP (SIG)

The Science Initiative Group (SIG) is an international team of scientific leaders and supporters dedicated to fostering science in developing countries.

Formed in 1999 to provide scientific and administrative oversight for the Millennium Science Initiative (MSI), SIG is currently governed by a six-member board consisting of three scientists from developing countries, two US scientists and an entrepreneur. SIG is administered by a small staff based at the Institute for Advanced Study in Princeton, New Jersey, USA. The group's informal structure allows it to take advantage of opportunities quickly and with minimal bureaucracy.

Thanks to strategic partnerships with other organizations and careful stewardship of grant monies, over the last 12 years SIG has parlayed some $15 million in foundation grants into more than $100 million in project support, consisting primarily of financing from the World Bank and governments.

Since 2008, SIG's main project has been the Regional Initiative in Science and Education (RISE), funded by Carnegie Corporation of New York. RISE prepares PhD and MSc-level scientists and engineers in sub-Saharan Africa through university-based research and training networks in selected disciplines. Its primary emphases are on training new faculty to teach in African universities and on upgrading the qualifications of current faculty.

For additional information, see **www.ias.edu/sig**.

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Institute of Marine Sciences

ZANZIBAR, TANZANIA

EXCELLENCE IN SCIENCE

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Physically, the aging structure of the Institute of Marine Sciences (IMS) in Zanzibar, Tanzania, is not imposing. The building is wedged between the gently lapping waves of Zanzibar Harbour and the bustling byways of Mizingani Road, where surging crowds of traders and hagglers have little notion of the mindful activity inside. The paint on the small, white harbour-side building is faded and chipped after more than half a century of the Indian Ocean's damp air and seasonal downpours. Aside from the occasional departure and return of the SUVs that ferry students and faculty to their study sites, there are few hints that this is home to East Africa's leading research institute of marine sciences.

Zanzibar, since ancient times an exotic way station for explorers seeking a sea route to the Far East or the source of the Nile River, has always beckoned to the ambitious and the powerful. A few steps away from the IMS building is the heart of Zanzibar Town, or Stone Town, which hums with activity today much as it has for centuries, a maze of alleys, bazaars, mosques and once-grand townhouses built by Arab traders.

Many buildings are distinguished by their famous hand-carved, brass-studded 'Zanzibar doors', imported from India to signify the wealth of the owners. Some of the grandest houses are now attractive hotels, signs of the island's growing stream of tourists who have discovered the white beaches, blue waters and intriguing historical past of the 'Spice Islands'.

Driven by a rising tide of Western visitors, the archipelago is moving quickly to catch the rhythms of the 21st century, some of which can be heard literally next door to IMS at Mercury's restaurant and bar. Mercury's is named after Freddie Mercury, a Zanzibar native who gained international fame as the lead singer and songwriter for the rock band Queen.

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Like the archipelago itself, IMS has not ignored the changing needs of Zanzibar, most of whose people are among the world's poorest. Despite the institute's low local profile, in the past decade, its small but close-knit academic community has leapt ahead not only in its professional capacities, but also in the concern for its neighbours who can benefit from science in many ways. At the level of academic research, IMS has no peer in the region, claiming expertise across the spectrum of geology, oceanography, chemistry, biology and information technologies. Equally important, it has made a strategic decision not to be satisfied with scientific knowledge, but to share its insights and expertise with the community and local partners in Zanzibar, on the mainland of Tanzania, and throughout the Western Indian Ocean community.

A telling mark of maturity for IMS is that the parent University of Dar es Salaam (UDSM) has given the institute approval to award most postgraduate degrees on its own. As of 2010, IMS has been able to offer MSc and PhD degrees by virtue of students having successfully completed a thesis, and as of 2011 it has gained the right to award an MSc through the successful completion of coursework and a thesis. IMS faculty will now be able to train the next generation of researchers more effectively, awaiting only the ability to award PhD degrees by coursework and thesis.

In fact, the progress of IMS faithfully reflects the motto of UDSM as it celebrates its 50th anniversary in 2011: *Advancing knowledge, creating futures*. The academic staff of IMS, most of whom arrived on the island within a few years of one another in the late 1980s, seem equally motivated to pursue their own research careers and to create better futures for others. Indeed some of the staff and students are familiar figures in the most remote villages of Zanzibar and the mainland coast, where they enlist local residents as partners in developing new forms of aquaculture that provide both food and livelihoods for more people.

> *Zanzibar has always beckoned to the ambitious and the powerful.*

RISE STUDENTS RISE

Grace Mutia *of Kenya, a member of the first round of students in the WIO-RISE network, studies Zanzibar's coastal seaweeds as well as the seaweed industry that has helped increase the standard of living for thousands of women and their families. She learned early in her investigations that coastal fishermen, many married to women who sold seaweed to the food and pharmaceutical industries, did not cultivate seaweed as a crop but used it as bait to catch fish. The fisherman discovered that the crushed leaves lured the common parrotfish and they developed techniques for placing the leaves in hand-woven fish traps. Mutia is currently determining which species the fishermen use, why they use them, and how they can be cultured. As she comes to know the species better, her next step will be to do additional chemical analysis of the leaves, identifying the proteins, amino acids, minerals and other nutritional qualities that may lead to additional applications. She also hopes to explore new techniques of aquaculture and mariculture that may provide larger and more reliable harvests.*

As a master's student at the University of Dar es Salaam from 2004 to 2008, ***Siajali Pamba*** *was interested in preventing marine pollution, specifically through the ability of mangrove trees to filter and clean wastewater before it returns to the ocean. His focus was on the large tourist hotels near the shore that emit a steady discharge of sewage water. He proposed the use of settling ponds inhabited by mangroves, which can take up suspended particulate matter in a self-sustaining system of water purification. For his PhD studies, he has expanded his range considerably, investigating one of the major water systems of Tanzania, the Pangani River and its estuary. His goals include monitoring and measuring sediments suspended in the water, as well as the river flow, tides, waves and salinity. More than 70% of the flow of the five major rivers is pumped out for irrigation before it reaches the ocean. As the economy grows, more water will be needed for industry and power generation. "A lot of water is extracted without considering the impact on the estuary", he says. "If the river flow is too low when it reaches the coast, it does not supply the necessary nutrients and sediment that make the estuary productive. This affects many different fisheries, most notably the prawn fishery. It also impacts navigation." Pamba's goal is to construct a scientific basis for the strategic management of the nation's few large estuaries.*

Pramod Chumun *came to IMS to work on a question of urgent concern to both Zanzibar and his native Mauritius: the survival of coral reefs. He has focused on the symbiotic relationship between the coral animals and the micro-algae that produce food by photo-*

synthesis. This symbiosis of corals and zooxanthellae, as the algae are called, is vital for the survival and ecology of reef-building coral. Chumun has found, using polymerase chain reaction (PCR) techniques, that some zooxanthellae are more common in Mauritius than Zanzibar. The difference in populations may be due to varying environmental factors, such as temperature and light, or to stress from abrupt climatic changes resulting in coral bleaching. His findings could pave the way for a better understanding of zooxanthellae shuffling among corals in the region and thus contribute to the long-term management of coral reefs.

Joseph Ravina, like his compatriot Chumun, is working on reef-building corals that are threatened by an increase in the frequency and severity of coral bleaching caused by such environmental stresses as more intense light and higher temperatures. A current concern is whether the reef-building corals will be able to adapt to the environmental changes over the next century that are being forecast by sea surface temperature models. His studies have examined the responses to temperature and light stress of four coral species common to the Changuu Reefs in Tanzania and the Trou au Biches Reefs in Mauritius. Corals in each area have shown a significant drop in photosynthetic efficiency in response to both stresses, with some species reacting more strongly than others. Understanding these responses is essential in predicting the occurrence, frequency and severity of bleaching among different coral species.

Mozambique Channel is the name given to the section of the Indian Ocean between the island of Madagascar and Mozambique on the mainland. The huge eddies swirling throughout the channel have received extensive study because of their importance to ocean circulation and the production of phytoplankton, the primary source of the ocean food chain. While most studies have focused on the channel's southern and central segments, ***Avelino Langa***, a native of Mozambique, has chosen to investigate the northern parts of the channel, which have received little scientific attention. Using both satellite measurements of net primary production (NPP) and measurements of the eddies' kinetic energy (EKE) or rate of flow, Langa has found a close correlation between the two for eddies flowing in both cyclonic and anti-cyclonic directions. He has also found that ocean water rises to the surface in the center of cyclonic eddies and at the edges of anti-cyclonic eddies. Because the eddies help determine the dispersion of phytoplankton, Langa's study is providing some key information for the future management of living marine resources in the Mozambique Channel.