DEVELOPING WORLD

The New Groove in Science Aid: South-South Initiatives

MEXICO CITY—When 42 elite scientists from the developing world founded their own academy 25 years ago, they aimed to help close the divide between the research capabilities of the northern and southern hemispheres. Today, that community, the 871-member Academy of Sciences for the Developing World (known as TWAS after its original name, the Third World Academy of Sciences), is also focused on another divide: the widening gap between the South's scientific haves and have-nots.

While research in about 80 struggling countries in Africa and elsewhere has lagged, it has advanced dramatically in several of the South's largest nations—led by China, India, and Brazil. That gap sparked a lively debate at TWAS's 25th anniversary meeting here about the academy's programs and the responsibilities of the top developing countries.

"The growth of science and technology in the developing world has been as uneven as it is impressive," says mathematician Jacob Palis, president of TWAS and the Brazilian Academy of Sciences. He wants TWAS to expand its grants and fellowship programs and bolster initiatives to help young scientists.

Others contend that big science projects are also needed. Physicist Mambillikalathil G. K. Menon, a TWAS founder who advises India's Space Research Organization, is calling for projects funded by developing nations that might parallel Europe-wide ventures such as the European Space Agency and CERN. He also suggested that the South's prosperous countries should mentor far more scientists in Africa and other less-developed countries. "We should undertake some major scientific activities," Menon says.

One such regional effort seems likely to succeed, says Moneef R. Zou'bi, director general of the Islamic World Academy of Sciences: the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME). It brings together scientists from 10 Middle Eastern countries to conduct experiments at a relocated German synchrotron that will start operating next year in Jordan. Other researchers, arguing that big science is not yet feasible in most of Africa, want to build better research networks to link scientists from poorer nations to strong labs in the emerging South economies.

C. N. R. Rao, a past TWAS president who led the Jawaharlal Nehru Center for Advanced Scientific Research in Bangalore, India, says small African nations need basic assistance to build their research capacity. It's the kind of support India received a quarter-century ago, Rao says, and is now giving back. India, China, and Brazil have joined with TWAS to run a South-South fellowship program for 250 Ph.D. students and postdocs.

Tieniu Tan, deputy secretary general of the Chinese Academy of Sciences (CAS) and director of China's National Laboratory of Pattern Recognition, says China is expanding fellowship programs and sharing technology and data in the developing world. "We feel obliged to do this because we are the largest developing country," he says.

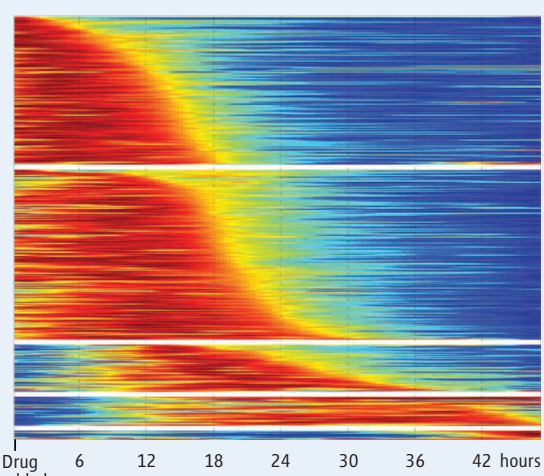
African postdocs praise the Chinese fellowship program but say that returning to their home countries—with expertise but limited equipment and grant money—can be a shock. "It is great to train at a good institute, but the training and equipment I had in China was not matched when I returned home," says S. Idowu Ola, a Nigerian reproductive

SYSTEMS BIOLOGY

Cast of 1000 Proteins Shines in Movies of Cancer Cells

Like the instruments of an orchestra, the thousands of proteins inside a living cell sometimes individually surge into prominence, blend in with each other, or fade to a whisper. Biologists have not had an effective way to eavesdrop on this full protein symphony—but now they're a step closer. Systems biologists led by Uri Alon of the Weizmann Institute of Science in Rehovot, Israel, describe online in *Science* this week (www.sciencemag.org/cgi/content/abstract/1160165) how fluorescent markers and a time-lapse microscope have allowed them an unprecedented view of the fluctuating locations and levels of about 1000 proteins in individual human cancer cells.

Leroy Hood, president and co-founder of the Institute for Systems Biology in Seattle, Washington, calls the new work "pioneering," pointing to the number of proteins Alon's group followed and how precisely their abundance and whereabouts were tracked. "I think it will be a milestone paper," he says. The new technique should help drug developers as well as basic cell biologists, notes Alon. In their study, for example, his group fingered two proteins that may help explain why some lung tumors resist a well-known cancer drug.



Protein symphony. Each horizontal line shows the level of a specific protein (redder is higher, bluer is lower) as cells respond to a cancer drug.

CREDIT: A. A. COHEN *ET AL.*, *SCIENCE*

Existing ways to monitor multiple proteins in a cell include gene expression arrays, which detect RNA from transcribed genes, and mass spectrometry, which measures protein levels. But both methods entail crushing large numbers of cells, collecting the cytoplasmic juice, and analyzing it. Results reflect an average across many cells.

To develop a new way to gauge protein dynamics, Alon's group relied on fluorescent proteins plucked from jellyfish and other organisms that biologists commonly use these days to tag proteins in cells. Researchers typically fuse the gene for a fluorescent protein to the gene for a single protein of interest and add the construct back into a cell's DNA.

Instead of creating tagged proteins one by one, however, Alon's team took a more global approach. They infected lung cancer

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Lab boost. Expansion of South-South scientific cooperation might help research at labs across Africa, like this one in Tunisia.

physiologist who was a postdoc at the CAS Institute of Zoology in Beijing. Eventually, with some help from TWAS and the International Foundation for Science, he set up an animal reproduction lab at Obafemi Awolowo University in Ile-Ife, Nigeria.

Both South Africa and Nigeria, two of the continent's strongest nations, now offer programs to train other African students and young scientists. "We are fully committed to South-South cooperation in S&T," says South Africa's science minister, Mosibudi Mangena, noting that his country already hosts three "flagship centers" to train African students in advanced math, biosciences, and laser technology. "But political support is absolutely crucial for South-South cooperation."

–ROBERT KOENIG

cells with a retrovirus ferrying the DNA for a yellow fluorescent protein. In each cell, the retrovirus integrated its payload at a random place, often within one of the cell's 20,000 or so genes that encode a protein. Voilà: a cell with a fluorescently marked protein. The researchers ultimately isolated individual cells with 1020 different, randomly tagged proteins.

Then it was time to make movies. Working with an automated microscope that could record the fluorescence of 12 cell colonies at a time, each one with a different protein tagged, the researchers gave each group of cells a dose of the common cancer drug camptothecin and watched what happened over the next 48 hours. The drug kills cancer cells by gumming up an enzyme called topoisomerase-1 (TOP1) that the cells need to unwind DNA and copy it or transcribe it into the RNA instructions for making proteins.

Not surprisingly, in TOP1-tagged cells, levels of the enzyme dropped soon after the drug was introduced. In cells tagged for other proteins, sometimes a protein's level rose, but more often it fell after the drug treatment. Some tagged proteins faded from the cell's nucleus and appeared in the cytoplasm or made another translocation that could further explain camptothecin's mechanism of action.

The big surprise was the fate of cells tagged with two particular proteins. After exposure to the cancer drug, these cell colonies each split into two sets of cells with differing characteristics. In one, the concentration of the tagged protein rose, and the cells survived. In the remaining cells of the colony, the protein's level slumped, and the cells later self-destructed. Understanding the role these two proteins play in cell survival could suggest a new strategy for overcoming a tumor's resistance to camptothecin, Hood says.

The technique developed by Alon's team could be "an amazing tool for working out drug mechanisms," says computational biologist Joseph Lehár of CombinatoRx, a company in Boston that tests pairs of known drugs to see if they work better than one alone.

Alon acknowledges that with 5000 to 10,000 proteins being produced by cells at any one time, his team is far from observing a complete picture of protein dynamics. Still, "1000 is pretty impressive," says Boston University systems biologist James Collins.

–JOCELYN KAISER

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INSERM in Flux?

The French government plans to adopt proposals for a major overhaul of the life sciences, presented last week by a panel led by the U.S. National Institutes of Health's former director Elias Zerhouni. The group recommends ending the current fragmentation of biomedical research by setting up a strong, unified agency to fund biomedical research.

In its review of the French National Institute for Health and Medical Research (INSERM), it takes aim at the entire life sciences effort. The report said that "striking" fragmentation has led to "unnecessary turf battles" and "inordinate amounts of time" being spent on paperwork. Recommendations include rewarding good researchers better and streamlining peer review. Unions are expected to object to deep reforms, but French Prime Minister François Fillon has asked research minister Valérie Pécresse to set up a panel to implement the recommendations.

–MARTIN ENSERINK

Stretching Out LHC Repairs

Repairs to the Large Hadron Collider (LHC) at CERN near Geneva, Switzerland, could take longer than anticipated. LHC project director Lyn Evans told *Science* last week that the work, costing an estimated $13 million or more, could extend beyond the previously announced target of May 2009. At least 20 of the facility's 10,000 superconducting magnets suffered electrical damage 9 days after the 27-kilometer collider was unveiled on 10 September. Repairs began 2 weeks ago.

–YUDHIJIT BHATTACHARJEE

Gene Tests Under Scrutiny

Australia may soon get its own direct-to-consumer genetic testing business, but the company is heading into choppy waters. Lumigenix, based in Sydney, aims for a commercial launch early next year. But it could run afoul of the national Therapeutic Goods Administration (TGA), which a spokesperson says could ban the test kits with legislation being drafted now. CEO Romain Bonjean says Lumigenix is taking a cautious approach to wording on promotional material for the service: "We've been communicating at length [with TGA] to understand what we can and can't do." But Ron Trent, chair of the Human Genetics Advisory Committee of Australia's National Health and Medical Research Council, says "it's hard to make sense of some of these tests unless you're a statistician. … When it comes to genes for serious medical conditions, direct-to-consumer testing shouldn't be allowed."

–ELIZABETH FINKEL

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