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GLOBAL WARMING

U.N. Conference Puts Spotlight on Reducing Impact of Climate Change

NAIROBI—For the past 6 years, Louis Verchot has had a ringside seat for Lake Victoria's ecological decline. Intense rainstorms pounding down on degraded land have swept in millions of tons of phosphorus-laden sediments from the Nyando River, transforming the lake from a nutrient-limited ecosystem into one with a gross excess of nutrients. On a visit last spring, says Verchot, a soil specialist at the World Agroforestry Centre in Nairobi, the water was so choked with an algal bloom that a glass of it "looked like spinach soup."

Verchot can't do anything about the torrential rains. But to help communities in western Kenya's Lake Victoria Basin mitigate the damage, he's spearheading a project with the Kenyan Agricultural Research Institute, funded by the Global Environment Facility (GEF), to reforest denuded land with acacias and other indigenous trees and to help farmers switch to sustainable agricultural practices. It will be a long haul, says Verchot, "but we think we will be able to help them out."

Victoria's downward spiral is a stark example of how climate change—shifting patterns of rainfall in this case—and poor resource management have conspired to create an ecological nightmare. The countries most vulnerable to these effects are also those least able to adapt to the changes, U.N. Secretary-General Kofi Annan told the U.N. Climate Change Conference in Nairobi last week. "Innumerable African communities have suffered climate-related disasters in recent years," he said. "For them, adaptation is a matter of sheer survival."

One clear message from the Nairobi meeting is that the need to adapt to climate change is finally being taken seriously on the world stage. Until now, the debate on climate change has been dominated by the epic dispute over how to stem greenhouse gas emissions, says Jon Barnett, an environmental sociologist at the University of Melbourne, Australia. "But we know that even if we completely stopped emissions tomorrow, there are already enough [greenhouse gases] in the atmosphere that more global warming is inevitable," he says.

Adapt or perish. Unusually heavy rainfall and unsustainable resource management are accelerating erosion around Lake Victoria (*above*). Poor countries are least able to adapt, says Kofi Annan (*top*).

Here at the annual U.N. conference of nations that have ratified the landmark 1990 Kyoto Protocol, which binds parties to sharp limits on greenhouse gas emissions, delegates fleshed out an Adaptation Fund that will funnel assistance—eventually amounting to hundreds of millions of dollars—to developing countries that bear the brunt of climate change. But disagreement over who will control the money—GEF or the countries that the fund is designed to help—will delay implementation until next year's meeting at the earliest. "This will be one of the most important debates that the next conference will have," says Ian Noble of the World Bank.

The fund could be a huge boost to nascent efforts to adapt to climate change. Emerging problems run the gamut from shifting disease patterns and droughts to coastal erosion from rising sea levels. Without adaptation, the World Bank forecasts that climate-change impacts in vulnerable developing countries could cost up to $100 billion per year over the coming decades.

One new initiative described at the meeting aims to build climate adaptation into global public health. The World Health Organization (WHO) estimates that climate change is already causing at least 150,000 excess deaths per year. One major killer is malaria. Here in Kenya, some 20 million people are at risk as warmer average temperatures allow the mosquito that transmits malaria to spread into the highlands, says Solomon Nzioka of Kenya's Ministry of Health. "We've established that we have something to be concerned about," says WHO's Diarmid Campbell-Lendrum. "Now we're at the critical point: telling people what to do about it." For malaria spread, measures could include more aggressive mosquito control at higher altitudes and stepped-up vaccine R&D.

WHO and the U.N. Development Programme have launched a pilot project in seven countries—Barbados, Bhutan, China, Fiji, Jordan, Kenya, and Uzbekistan—with different health vulnerabilities to climate change. Last month, for example, Chinese officials agreed to explore ways to reduce fatalities from heat waves, which are estimated to cause between 225,000 and 890,000 excess deaths per year from strokes and heart attacks in China, says Jin Yinlong, director general of the National Institute for Environmental Health and Engineering in Beijing. "We will be judged on how well we protect people's lives as climate change evolves," says Campbell-Lendrum.

Scores of other projects are getting off

CREDITS (LEFT TO RIGHT): ANTONY NJUGUNA (KENYA)/REUTERS; LOUIS V. VERCHOT

the ground. The World Bank is spending about $50 million on adaptation projects, and bilateral programs have committed $110 million to more than 50 projects in 29 countries. Even the United States, which has not ratified the Kyoto Protocol, is getting in on the adaptation action: The U.S. Agency for International Development has promised $2 million for such projects over the next 5 years. Still, "we are orders of magnitude underfunded," says Alf Wills, South Africa's chief climate negotiator at the conference.

Globe-spanning adaptation efforts are necessary, says Barnett, but there are also immediate priorities on a very local scale. Take the Pacific island nation of Niue, the smallest in the world. Intensification of tropical cyclones and rising sea levels "could wipe the nation off the map within decades in the worst-case scenario," Barnett says. Luckily, he says, some quick-fix adaptations could make a big difference. "For a start, half the population needs to be relocated to higher ground," he says. That, along with improvements in infrastructure to help islanders cope with climate-related problems, "comes to a ballpark figure of $60 million." Considering that what is at stake is an entire nation with its own unique language and culture, says Barnett, "this is incredibly cheap."

–RICHARD STONE AND JOHN BOHANNON

The reporting of Stone and Bohannon was supported in part by the Reuters Foundation.

DEVELOPMENTAL BIOLOGY

Teams Identify Cardiac 'Stem Cell'

Like many organs, the heart is a patchwork of cell types, from smooth muscle that pulses blood through arteries to endothelial cells lining vessels. These pieces, varied as they are, were long considered distant cousins born of different parent cells. But two new studies have uncovered a primitive type of heart cell in mice that can give rise to the heart's main cell lineages. If the finding holds up, it will make the heart one of very few organs, along with the blood, known to grow largely out of a single type of cell; it may also ease the introduction of embryonic stem cell treatments in cardiac patients.

"It's surprising that so much can come from" just one type of heart cell, says Timothy Kamp, who studies cardiovascular regenerative medicine at the University of Wisconsin, Madison. "You have essentially a type of cardiac stem cell."

Although they took different approaches, the two groups that found the heart progenitor cells both identified overlapping genetic markers to define their progenitor population, and both found that the cells could differentiate into cardiac muscle and blood vessel cells, the principal building blocks of the heart. The first paper, led by Gordon Keller, a stem cell biologist at Mount Sinai School of Medicine in New York City, was published earlier this month in *Developmental Cell*; the second appeared this week in *Cell*. That work was led by a husband-and-wife team, Karl-Ludwig Laugwitz and Alessandra Moretti, at the Technical University of Munich in Germany, and Kenneth Chien at Massachusetts General Hospital in Boston.

The Chien team found that mouse embryonic stem cells developing into heart cells first entered an intermediate state that could be monitored by tracking expression of three different genes. Those intermediates, which the scientists called "triple positive cells," gave rise only to heart cells. To confirm that these triple positive progenitor cells, grown under artificial conditions, exist in an animal, the researchers examined mouse embryos at different points in their development. Around day 8, they detected them.

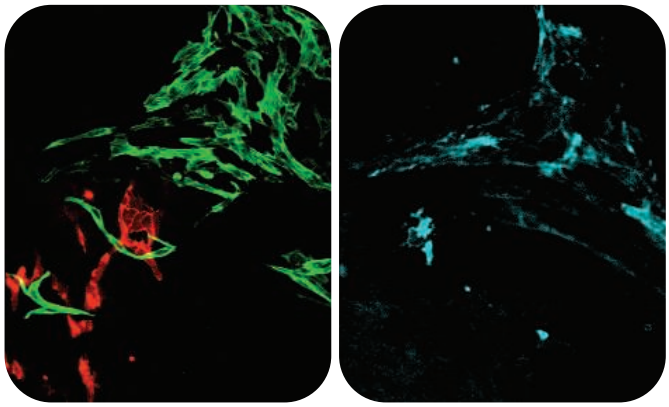
Although Keller's team did not use all the same markers as Chien's to characterize the cells it found, both groups found that their cells could differentiate into the same cardiovascular cell types. "We're arriving at a similar progenitor," says Keller, also adding that "it's still pretty early days."

To prove that these progenitor cells can become functioning, specialized heart cells, the scientists need to inject them back into an animal to see whether they give rise to the different cardiac tissue types, Moretti notes. That is also a key experiment to determine whether these master ancestor cells can repair a damaged heart. Keller's group has begun precisely this experiment, inserting the progenitor cells it identified into mice whose hearts resemble those of humans following a heart attack.

Chien notes that "we have not formally proven that that cell can make a whole heart." Still, says Kamp, the work could ease one of the most worrying concerns about using embryonic stem cells in patients: that, left alone to form whatever cell type they fancy, they'll develop into tumors. "If you can have a more committed cell population that can only give rise to limited progeny," Kamp says, "that's going to dramatically reduce the risk." And the cells might still be flexible enough to form, say, a coronary artery, which includes different cell types. Still, admits Laugwitz, that "remains to be proven." Both groups, in the United States and Germany, are working with human embryonic stem cells to see whether the mouse patterns will hold.

–JENNIFER COUZIN

With reporting by Gretchen Vogel.



CREDIT: MORETTI *ET AL.*, *CELL* (2006)

Versatile. The same cells from an early mouse embryo give rise to the heart's endothelial cells (red) in blood vessels, contracting heart muscle cells (green), and smooth muscle cells (blue, *right image*).