

**RIGHT NOW, MORE THAN 800 MILLION PEOPLE DON'T HAVE ENOUGH TO EAT. AND WITH THE WORLD'S POPULATION PROJECTED TO SOAR BY 50 PERCENT IN THE NEXT 35 YEARS, HOW CAN WE FEED ALL THOSE MOUTHS? THE ANSWERS ARE AS MUCH POLITICAL AS SCIENTIFIC.**

**BY DAN GORDON '85 • ILLUSTRATION BY THE HEADS OF STATE**

# WORLD HUNGRY

# W

**HEN HE WAS A COLLEGE STUDENT IN THE 1960S,** Bob Goldberg spent his free time tending to leaf collections. Four decades later and now a UCLA professor of molecular, cell and developmental biology, Goldberg is still hooked on plants. But today, flush with \$7.5 million in National Science Foundation funding, he is engaged in a far more momentous activity. Using some of the most powerful tools of modern science, Goldberg is creating what is in effect an atlas detailing the genetic activity of a seed throughout its development. Its application? Find new ways to feed a hungry planet — which is getting hungrier by the day.

"If we can understand how to make a seed genetically, we can make bigger, better, and more nutritious seeds," Goldberg explains. And we're going to need the help.

At any given time, more than 850 million people around the world don't have enough to eat. Given current population-growth statistics, Goldberg estimates that feeding the planet will require more food during the next 50 years than that





(Above left) When UCLA came to Westwood, shown here in 1930, there were 18,000 farms in Los Angeles — and the new university boasted an agricultural college and citrus/avocado orchard.  
(Above right) Today, the same view yields a picture of a densely populated, urban environment — and no orchard.



consumed in all of our cumulative history. What's worse, we are seeing a shrinking supply of arable land on which to grow food crops.

Any discussion about the status of the world's poorest nations is necessarily dominated by hunger and malnutrition. (Sub-Saharan Africa alone is home to more than 206 million chronically hungry people.) Children are hit hardest. The U.N. Food and Agricultural Organization (FAO), which tracks hunger, reports that 5 million children die of starvation each year — one every five seconds. Hundreds of millions of undernourished children have lower defenses against infectious diseases and fail to fulfill their physical and mental potential.

A bitter irony is that we have enough food to go around today. The FAO estimates that world agriculture produces 17 percent more calories per capita than it did in the 1970s — enough to provide every person on the planet with more than 2,700 calories a day. But too many people can't afford to purchase food and lack sufficient land on which to grow their own.

Tomorrow, though, production itself could be a problem. The world's population is projected to rise 50 percent between 1999 and 2042, from 6 billion to 9 billion. As countries are developed and income grows, so does demand for more expensive, protein-based foods. As demand for animal protein increases, so does the need for livestock feed. Global climate change introduces new concerns about the availability of sufficient farmlands. So researchers such as Goldberg are toiling long hours to push the science of plant genomics and biotechnology toward solutions that can increase the world's food supply. He and his colleagues hope their work, directed in ways that assist the people who need it most, can help to keep future granaries full.

But if science can help us meet the greater demand, it can't guarantee the food will make it to everyone's plate. That requires something that can't be addressed in a lab: a political fix.

### FIGHTING HUNGER: THE POLITICS

"Solutions of policymakers too often focus on production, not distribution," explains UCLA Professor of Geography Judith Carney, whose award-winning 2001 book, *Black Rice: The African Origins of Rice Cultivation in the Americas*, chronicles the grain's complex history.

Carney points out that the green revolution of the

1970s, which was supported by many well-intentioned scientists, improved yields of the major food grains but did little for hunger because the presumed beneficiaries couldn't afford to purchase the products. She believes that the same issues are informing biotechnology and the movement of transnational agribusiness corporations into new markets. "These technologies do not address the distribution issue — that is, how they will become available to the poor, which would mean pricing the food under market value," Carney says.

According to the World Bank, more than a billion people in developing countries live on \$1 a day or less, and most of them suffer from chronic hunger. It's the most vicious of circles: Hunger is a consequence of poverty — and a cause. "We have shown that economic growth is extremely important for hunger reduction," says Kostas Stamoulis, a UC Berkeley graduate who is now in Rome as chief of the FAO's Agricultural Sector in Economic Development Service. "However, you can't expect growth when 35 percent of the people are chronically undernourished, because that's going to make them sicker and less productive."

The most recent FAO report, which Stamoulis co-authored, recommends a two-track approach that includes direct-assistance programs to help the neediest populations break the cycle of poverty. For the long term, the report urges initiatives to enhance productive potential, particularly emphasizing agriculture and rural development, along with ensuring access by the poor to productive assets — physical, human and financial.

### FIGHTING HUNGER: A CLOSER LOOK

In four Peace Corps stints that took her to some of the world's poorest regions, Theresa Elders M.S.W. '78 saw firsthand the visible effects of childhood malnutrition. But Elders, a psychiatric social worker who has championed healthy environments in leadership roles with the Arkansas Department of Health and the Los Angeles County Department of Public Social Services, was equally troubled by what was not as readily apparent.

"Right away you would see what's called *kwashiorkor* — the distended bellies and the reddish hue of the hair," Elders says. "But the thing that people rarely talk about is how malnutrition affects long-term cognitive functioning. You would see adults having cognitive difficulties, and it would make you wonder: When children grow



to adulthood and can't catch up intellectually, what are we doing?"

Charlotte Neumann, a pediatrician on UCLA's School of Public Health faculty, has conducted seminal studies with collaborators in Kenya, documenting the high proportion of the nation's schoolchildren lacking the nutrients they need for adequate functioning, learning and growth. Ultimately, they showed that adding a small amount of meat to the diet dramatically increased the children's school performance, physical activity, muscle mass and ability to ward off infection.

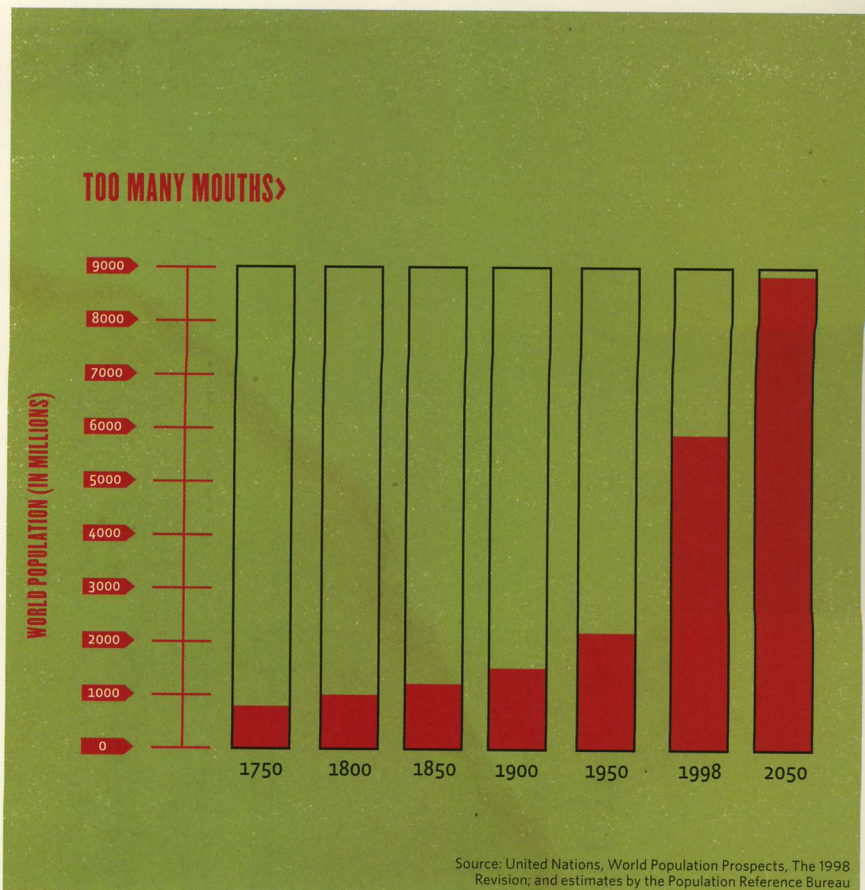
For policymakers, malnutrition is among the most challenging public health problems to address. Gail Harrison, a professor in the School of Public Health who specializes in international nutrition issues, notes that, unlike a disease that focuses on a defined segment of the population or one that could be prevented for life with a single vaccine, "with malnutrition, 100 percent of the population is at risk from birth to death."

Complicating matters is the so-called Nutrition Transition: the dramatic rise in the developing world of obesity, portending an epidemic of chronic adult conditions such as diabetes, hypertension, cancer and heart disease in countries still wracked by malnutrition. "It's a terrific policy dilemma," says Harrison, who has consulted with the World Health Organization, UNICEF and other key organizations and governments on nutrition-related matters.

### FIGHTING HUNGER: LAB RESULTS

The Web site of Ceres, the Thousand Oaks, Calif.-based plant genomics company that Goldberg co-founded in 1997, touts the words of Philip H. Abelson, the late former editor of the journal *Science*, who said of the nascent genomics revolution: "Thus far, the pharmacological potential of genomics has been emphasized, but the greatest ultimate global impact of genomics will result from the manipulation of the DNA of plants. Ultimately the world will obtain most of its food ... from genetically altered vegetation and trees."

Worldwide, more than 1 billion acres of genetically engineered crops have been planted in the last decade. Opponents, particularly in Europe, have been vocal over such issues as how much control big business has over food supply and the potential lack of genetic diversity in foods, but Ceres president and CEO Richard Hamilton argues that biotechnology simply turns up the power on breeding methods that have been practiced for thousands of years. "Agriculture itself is a human invention," he says. "Corn didn't just spring forth from some mythical garden of Eden."



Plant biotechnology selects for desired genetic traits just as conventional breeding does, Hamilton argues, replacing the traditional trial-and-error process with the ability to knowingly manipulate specific genes. Improving agriculture through technology can pay substantial dividends. The adoption of modern genetics practices in breeding has tripled corn yield since 1940. And the green revolution — a movement launched in the 1970s to raise yields through the use of hybrid seeds, fertilizers, pesticides and irrigation — tripled wheat production and turned India from a net importer to a net exporter.

When UCLA's Westwood campus opened in 1929, it was part of a rural county with 14,000 farms, and the university's College of Agriculture was a major resource for the area's farmers. When Goldberg shares that information with his surprised students, it's to make a larger point: The transformation of Los Angeles into an urban center after World War II is emblematic of what is happening everywhere — and as a result, it's going to become increasingly important to find ways to produce food for a growing population on diminishing agricultural land.

Soon, Goldberg and his scientific colleagues around the world will have identified and defined the functions of all of the genes necessary to program the entire life cycle of crop plants, enabling better yield even under less-than-ideal conditions. Will that result in a better-nourished population?

Says Stamoulis: "The issue is to what extent this increased food supply is translated into increased food consumption for those who don't have enough to eat." ■

**WORLD AGRICULTURE  
PRODUCES 17 PERCENT MORE  
CALORIES PER CAPITA THAN  
IT DID IN THE 1970S—  
ENOUGH TO PROVIDE EVERY  
PERSON ON THE PLANET  
WITH MORE THAN 2,700  
CALORIES A DAY. BUT TOO  
MANY PEOPLE CAN'T AFFORD  
TO PURCHASE FOOD AND LACK  
SUFFICIENT LAND ON WHICH  
TO GROW THEIR OWN.**