

STEVE BRODNER

## WHAT MONEY CAN BUY

*Millions of Africans die needlessly of disease each year. Can Bill Gates change that?*

BY MICHAEL SPECTER

Each May, representatives from the hundred and ninety-two member nations of the World Health Organization travel to Geneva to set policies for the coming year. The assembly lasts a week, and the delegates often find themselves devoting as much of that time to politics as they do to matters of life or death. This year, on the opening day, Elena Salgado, the assembly's president, spoke bluntly about the growing chasm between the "rich world," where people live in health and comfort, and everywhere else. The mortality rate for infants in the developing world is sixteen times greater than it is for infants in the West, she told the delegates. And at least one woman dies every minute from avoidable complications of pregnancy. Half of these deaths occur in Africa, where hundreds of millions of children, and almost as many adults, suffer needlessly from illnesses that most people in the West have never heard of. The W.H.O.'s director general, Lee Jong-wook, warned that even the modest health goals that the United Nations has established for the new millennium are unlikely to be met. In fact, he said, in many places death rates are rising.

The most anticipated speech—and the least diplomatic—also came on the first day: Bill Gates addressed the assembly in his role as the founder of the world's most powerful charity, the Bill & Melinda Gates Foundation, which he and his wife started five years ago. The foundation's endowment is nearly twenty-nine billion dollars—more than the gross domestic product of Tanzania—and its principal goal is simple: to rid the world of disease, particularly the many illnesses that are essentially ignored because they affect the world's poorest people. "Global health

is our lifelong commitment," Gates told me that day. "Until we reduce the burden on the poor so that there is no real gap between us and them, that will always be our priority. I am not so foolish as to say that will happen. But that's our goal."

Gates had arrived from Seattle just after dawn, going directly to a breakfast with health ministers from ten African nations. It was a dismal day; rain pounded the gilt windows of the Palais des Nations, and the sky seemed heavy enough to touch the ground. The meeting was held in a room panelled in dark-green wood and filled with enormous mirrors. A buffet of coffee, tea, fruit, and doughnuts had been set out for the ministers. In front of Gates's seat, there was a Diet Coke and a plastic cup. When Gates entered, the ministers started to clap. Gates bowed his head, winced, and sat down. "I know your jobs are super, super important," he told them. "And I am excited about the progress that can be made for the health of your people." He looked tired, and seemed slight in a mauve shirt and gray business suit. One by one, the ministers told him their troubles. "In Nigeria, the health system simply doesn't work," Eytayo Lambo, the country's health minister, said. His counterpart from Botswana, Sheila Tlou, echoed those thoughts. "H.I.V. and malaria have dismantled our country," she said. "We need help just to get back to where we were." The other ministers told similar stories. Tuberculosis, H.I.V., and malaria were rampant, as were lymphatic filariasis, schistosomiasis, river blindness, and other, even less well-known diseases. Each person began and ended by thanking Gates; in January, the foundation had contributed seven hundred and fifty million dollars to the



*"This isn't about compassion. It's about results," Bono said of Gates's project. "When Bill walks into the room, we are not expecting to have a nice warm fuzzy feeling."*



*"Don't you just love that new cat smell?"*

U.N.'s Global Alliance for Vaccine and Immunization, to fight easily preventable diseases, like diphtheria, whooping cough, and measles. (Gates had also provided funds to vaccinate forty-two million children against hepatitis B.) The ministers thanked Gates for helping to promote a safe, cheap drug for visceral leishmaniasis (a malaria-like disease that affects nearly half a million people a year), for investing in the first seemingly effective new drug for sleeping sickness in fifty years, and for supporting research into a vaccine for pneumonia that could reduce African deaths by fifteen per cent.

Two days earlier, the *Tribune* of Geneva had run an article headlined "THE HEALTH OF THE WORLD DEPENDS MORE ON BILL GATES THAN ON THE WORLD HEALTH ORGANIZATION." Few of those at the assembly could disagree. The annual budget of the W.H.O. is \$1.65 billion. Since 2000, the Gates foundation has spent six billion dollars to address health issues in the Third World—more than nearly every contributing nation, and far more than any other charity. This time, Gates arrived

in Geneva with a check for two hundred and fifty million dollars, to help pay for the foundation's most ambitious venture yet: the Grand Challenges, a series of fourteen fundamental obstacles to scientific progress which, if solved, would lead to dramatic improvements in the health of the world. The challenges, which include goals like developing vaccines that require no needles or refrigeration, were first issued in 2003 (along with a two-hundred-million-dollar grant), and a thousand scientists from seventy-five countries responded with proposals.

It would be hard to overstate the impact that the Gates foundation has had: the research programs of entire countries have been restored, and fields that had languished for years, like tropical medicine, have once again burst to life. In a world where a fast reaction to the threat of disease is imperative, bureaucracies like the W.H.O.—which make decisions by consensus—are often too cumbersome to compete at the speed of a mutating virus. Gates and his wife need consensus only between themselves. At times, the foundation

appears as brazen as Gates has always been at Microsoft, which he started thirty years ago, and where his combative style has made him one of the most polarizing figures in the history of American business. "Bill and Melinda don't believe in half measures," Richard Klausner, the former head of the National Cancer Institute, who is the foundation's director of global health, told me. "Every time we get a grant proposal, we ask what fraction of the problem will be solved by this work. Always. And if there is no answer there is no grant." The rock star and anti-poverty evangelist Bono put it another way: "This isn't about compassion. It's about results. It's not some sort of well-meaning-hippie stuff. Bill Gates is not into nice sentimental efforts or whimsical support of hopeless causes. When Bill walks into the room, we are not expecting to have a nice warm fuzzy feeling."

Gates was scheduled to address the assembly at 3 P.M. First, however, there were some politics to endure. While he and I sat in a conference room on the second floor of the Palais, the delegates below were bogged down, for the eighth straight year, in hours of bickering over whether Taiwan could take part in the meeting. The country was not even seeking the right to vote—just to observe. Taiwan has always been a center of influenza—including the current epidemic of bird flu—and played a role in the rapid spread of SARS in 2003. It is not recognized by the United Nations, however, and there was never any chance that the request would be approved. Lofty goals are often set in Geneva—on H.I.V., polio (an effort now heavily underwritten by the Gates foundation), maternal health, and malaria, for example—but they are rarely met.

Malaria, the world's most prevalent parasitic disease, kills as many as three million people every year—almost all of whom are under five, desperately poor, and African. In most years, more than five hundred million cases of illness can be attributed to the disease, although exact numbers are difficult to assess because many people don't (or can't) seek care. It is not unusual for a family earning less than two hundred dollars a year to spend a quarter of its income on malaria treatment, and what they often get no longer works. In countries like Tan-

zania, Mozambique, and the Gambia, no family, village, hospital, or workplace can remain unaffected for long. Malaria governs their lives. "It just blows my mind how little money has been spent on malaria research," Gates told me as we were waiting for the Taiwan debate to end. "What has prevented the rich world from attempting this? I just keep asking myself, Do we really not care because it doesn't affect us? Is that what it is?" Gates looked grim but went on. "Human suffering as a result of malaria is incomparable. By many measures, it's easily the worst thing on the planet." When Gates gets animated, his voice starts to slide in unexpected directions, and so does he. By the end of our conversation, he was talking in bursts and rocking back and forth in his chair. "I refuse to accept it," he told me. "I refuse to sit there and say, O.K., next problem, this one doesn't bother me. It *does* bother me. Very much. And the only way for that to change is to stop malaria. So that is what we are going to have to do."

There has never been a time when malaria has not been a major global health problem; its symptoms have been reported for thousands of years. Only the plague—and, perhaps soon, H.I.V.—has influenced the demographic and geographical history of humans more. Malaria had become widely recognized in Greece by the fourth century B.C., and was responsible for the decline of many of the city-state populations that were then at the center of the world. Treatment and cures have been sought for millennia. The Chinese qing hao plant—which today is the source of the most promising anti-malarial drug, artemisinin—was first described, more than two thousand years ago, in a medical treatise called "Fifty-two Remedies," discovered in the Mawangdui tombs, in Hunan province. The Centers for Disease Control was founded in Atlanta, not Washington, at the end of the Second World War largely because its initial mission was to control malaria, which remained a significant problem in the southern United States and in Europe throughout the nineteen-forties; malaria was particularly severe in the Mediterranean. It was malarial infections, more

than war wounds or any other cause, that prevented Allied soldiers from fighting in the Italian campaign during 1943.

Malaria starts suddenly, with violent chills, which are soon followed by an intense fever and, often, disabling headaches, convulsions, and delirium. As the parasites multiply, they take over the entire body. Anemia is common, because malaria parasites live by eating the red blood cells they infect; they can also attach themselves to blood vessels in the brain. If it doesn't kill you, malaria can recur for years. The disease is transmitted to humans by female anopheles mosquitoes infected with one of four species of a parasite called plasmodium; by far the most dangerous of the four is *Plasmodium falciparum*. It is also the most prevalent. Together, the mosquito and falciparum are the most deadly couple in the history of the earth—and one of the most successful. A virus like measles, polio, or even H.I.V. consists of just a few genes. Malaria has five thousand genes, and its ability to mutate rapidly to defend itself and evade new drugs has made it nearly impossible to control. It wasn't until the eighteen-nineties that Ronald Ross, a British physician working in the Indian Medical Service in Hyderabad, discovered that malaria was transmitted by mosquitoes.

After the Second World War, malaria-control campaigns were initiated in many countries, and with the notable help of the insecticide DDT successes were striking. Malaria was eradicated from the United States in 1951; like measles, polio, and other illnesses that no longer threaten us, it is completely unknown to children and largely forgotten by adults. We tend to think of malaria, if at all, as something distant and exotic, like the British Raj, which suffered so badly from it—a malady that required a stiff upper lip and the quinine that comes in a gin-and-tonic. The World Health Organization sought to eliminate malaria even before it attempted to eradicate smallpox. The nineteen-fifties was an era of particular confidence in the power of medicine; a new polio vaccine had been discovered, and so had antibiotics. In

countries like South Africa, Sri Lanka, and Mozambique, after extensive spraying, malaria had almost vanished. India brought the number of cases down from seventy-five million in 1951 to around fifty thousand in 1961. Large swaths of the disease in Southeast Asia were also on the brink of eradication. Yet by the late nineteen-sixties the success had come to a halt. DDT was seen as devastating to wildlife, and mosquitoes had begun to grow resistant to it. (Many subsequent studies have shown, however, that the insecticide is not as dangerous to the environment when used sparingly.) The United States banned DDT in 1972, and other developed countries followed. In most of Africa and Asia, where malaria efforts have always been funded by the West, the pesticide became politically unacceptable. Six years after Sri Lanka stopped using it, the number of cases rose from seventeen to more than half a million. By that time, though, malaria had essentially been banished from the developed world, and with it any incentive for continued research.

Less than ten per cent of all investment in health research is devoted to the diseases that affect ninety per cent of the world. To address this imbalance, in 2002 the U.N. created the Global Fund to Fight AIDS, Tuberculosis, and Malaria. Richard Feachem, the fund's director, is a professor of public health at Berkeley; he founded the Institute for Global Health, and he once served as dean of the London School of Hygiene & Tropical Medicine, which has always been the world's most important center for malaria research. Feachem dresses in tweeds, and has graying hair and a thin, oval face; glasses dangle from a cord around his neck. Despite his current role, he retains the dispassionate manner of a scholar; he understands politics, but worries that too many people have begun to ignore history. "In the first year I had this job, malaria was never mentioned," he told me in Geneva. "In the origins of the fund, the momentum was entirely about H.I.V. Malaria was an afterthought."

At an annual cost of twelve billion



dollars, however, malaria is responsible for almost forty per cent of public-health spending in Africa. Poverty cannot be addressed unless malaria is, too. And the attempt to end poverty has gained great currency in the past two years. Last December, Gordon Brown, the British Chancellor of the Exchequer, promised that his country would purchase hundreds of millions of doses of any successful vaccine—thus providing incentive for investment which pharmaceutical companies had always lacked. In June, the Gates foundation, which had already donated more than a hundred and fifty million dollars for malaria research, announced a new round of global health grants, worth more than four hundred million dollars. A few days after the Gates announcement, President Bush pledged more than \$1.2 billion to fight malaria in Africa over the next five years, by expanding access to remedies that already exist and that are known to work: mosquito nets treated with long-lasting insecticide, indoor spraying, and the distribution of effective medicines, such as the therapies that include artemisinin. (Bush has announced such initiatives before—and then failed to fulfill them. Much of the money has simply been shifted from other commitments.)

“There have been great moments of optimism in the past, too,” Feachem told me, “but there has always been this sense of malaria fatalism. There has been the idea that this is just part of Africa and being African.” For much of the past twenty years, Feachem said, political leaders throughout the world have been waiting for a vaccine to appear as if by magic. “It is a moral outrage. This is an utterly preventable holocaust, and the numbers are far higher than the W.H.O. says. They have put the dead at one million for years, and now it is really three million in terms of deaths to which malaria might have contributed. So I don’t think it’s yet the time to break out the champagne. You have to remember we almost eradicated malaria before. And what has happened? Not only have we failed but by any reasonable measure more people have suffered from malaria in the past fifty years than in the history



of mankind. It has been a remarkable march backward.”

In most parts of the world, malaria parasites have become resistant to chloroquine, which had been the first-choice treatment in Africa for decades. Chloroquine, a synthetic chemical similar to quinine, costs only fifteen cents a dose, and is easy to make. Sulfadoxine-pyrimethamine, or SP—the second-choice treatment—has also failed widely. The only consistently successful alternatives are the artemisinin-based combination therapies—a mixture of drugs helps prevent resistance—but they have been

in short supply and are ten times as expensive as treatment with chloroquine. If those drugs should fail, nobody knows what would come next. “The problem is getting worse in many ways,” Feachem said. Studies consistently show that mosquitoes are transmitting the virus more frequently. There are also more breeding sites, denser populations in affected areas, and higher death rates owing to drug resistance. “We are seeing more urban outbreaks in countries like India,” Feachem continued. “We are seeing other, more ominous signs, too. Malaria has become endemic at altitudes where it never used to occur. Some of that may be because the mosquitoes are adapting, but most of it is simply a result of human population density—people living where they never used to live.” (Some of the disease’s spread, too, can be attributed to global warming, as mosquitoes migrate to newly temperate areas.)

Fifty per cent of the world’s population is regularly exposed to malaria—an increase of almost ten per cent in the past decade. When the parasite returns to a place where success had been dramatic, as was the case with Sri Lanka in the sixties, the consequences can be particularly devastating. In such populations, because they have never been exposed, most people simply lack the protective antibodies required to bolster their immune systems. It took the republics of the former Soviet Union fifty years to eradicate malaria, but only five years for the parasite to return in force. It will take many years to eradicate it again. Resistance to drugs and pesticides has become far more wide-

spread in the past decade, and many public-health systems in the Third World have broken down completely. African governments, faced with the staggering burden of H.I.V. (which not only increases susceptibility to malaria but places impossible demands on services and medical personnel) and often civil conflict as well, continue to grow poorer, and their people become sicker.

In 2000, all fifty-three African chiefs of state met in Abuja, Nigeria, and issued a document known as the Abuja Declaration, in which they pledged to halve malaria mortality and disability by 2010. Today, more people are sick and dying than before. “The mistake was not in putting out the targets,” Allan Schapira, a policy coordinator at Roll Back Malaria, which was created by the U.N. in 1998, told me. “The mistake was in not putting the hammer down to make it happen.” But that would have required about three billion dollars a year. “The economic conditions of the industrial world are better than at any other time in history,” Schapira said. “Affluence is much greater. People should have strong pangs of conscience.” New money has been committed—for drugs and research. Scientific prospects appear genuinely promising; but excessive confidence has derailed efforts to overcome malaria before. And some people feel that if there is no victory this time, the defeat will be even more difficult to overcome.

“There is one sad fact about the malaria community,” Kent Campbell, a former chief of the malaria branch at the Centers for Disease Control, told me. “We have always been so wedded to failure that we don’t even have the leadership necessary to risk the additional failure to get where we need to be. This would cost two or three dollars a person.” He was referring to treatment and prevention services for Africans. “It has gone on for too long. I would love to believe that in the United States this effort is being driven by a decent desire to help, but I don’t think most Americans give a rat’s ass about the death of millions of African kids each year. I don’t think they ever have.”

**T**uele Hospital sits on a low hill in the Muheza District of Tanzania, halfway between Mt. Kilimanjaro and Dar es Salaam. Much of the coastal

plain is given over to plantations of sisal and coconut. The roads are rutted and made of dirt, and along the sides women in brightly colored caftans gather to sell cashews, charcoal, bananas, cellular-phone cards, old tires, and bowls full of a small green fruit that looks like a lime and tastes like a mango. The rains were late this year, delaying the worst of the malaria season, but the dry weather hurt the crops. Everyone in this part of Tanzania raises some vegetable or fruit. Nobody could survive without them.

The day I arrived, this spring, the rain came down in torrents. Forests around Muheza have been cleared in many places in the past decade, which makes it an ideal breeding ground for the anopheles mosquito. Malaria is already Tanzania's leading communicable disease. The likelihood of getting sick is influenced by the number of infectious bites any person receives in a year, which is known as the entomological inoculation rate, or E.I.R.—the basic yardstick for transmission. Tanzania has a uniquely wide spread; E.I.R.s ranging from less than one to more than a thousand infectious bites per person have been documented. In the region near Tanga—Muheza lies just forty kilometres to the west—people are bitten by an infected mosquito an average of seven hundred times a year (about twice each night). That is among the highest rates of malarial exposure in the world.

At the Tuele hospital, which has two hundred and sixty-five beds and serves a district of three hundred thousand people, malaria accounts for more than half of all admissions. In the dry season, there are often two people in a single bed; when the rains get heavy, there are two to a bed and two or three lying on the floor between the beds. Tanzania spends four dollars per person on health care each year, and with that sum doctors confront an almost epic range of maladies: river blindness, rotavirus (the most common cause of diarrhea in children, responsible for more than six hundred thousand deaths a year), elephantiasis, and sleeping sickness are all relatively common. So are measles and pneumonia. But none of those diseases are as destructive as H.I.V. or malaria. The infant-mortality rate in Muheza is

a hundred and thirty-three per thousand births, far higher than the national average of slightly more than a hundred per thousand. (In Europe, the average figure is about five per thousand.) The malaria burden is harsh in terms of death, but it goes far beyond that. Sick people can't work or take care of their families. When one child is dying of malaria, a mother is often forced to ignore the others.

T. K. Mutabingwa, a gruff man in his fifties who holds a tenured position at the London School of Hygiene & Tropical Medicine, has watched children die nearly every day of his adult life. He is one of Africa's most prominent malaria researchers and has been working at Tuele for more than twenty-five years. "My Ph.D. was a study that showed chloroquine was doing nothing for pregnant women," he told me. "That was many years before the government tried to switch to other drugs. Perhaps they didn't read it." Since the early nineteen-eighties, Mutabingwa has been trying to find the most effective and least intrusive therapies for mothers and children. One of the genuine mysteries about malaria—and one of the greatest opportunities for researchers—is how people develop immunity. When a bite from a mosquito infected with falciparum doesn't make you sick, it acts like an inoculation; that's why

children who survive to the age of five are much less likely to die. Adults in Africa may get very sick, but the disease rarely kills them. Pregnant women, however, are an exception. The first time a woman becomes pregnant, she is highly susceptible to malaria; in subsequent pregnancies, the risk is lower. For years, epidemiologists had assumed that pregnancy simply weakened the immune system.

"That didn't make complete sense, of course," Mutabingwa told me. "Why would these same women do better in the second pregnancy? And even better in the third? Those weaken your immune system, too." Ten years ago, Patrick Duffy, of the Walter Reed Army Institute of Research, and Michal Fried, from the Seattle Biomedical Research Institute, both colleagues of Mutabingwa, discovered that a distinct form of the falciparum parasite binds to a specific receptor on the placenta. The first time a woman becomes pregnant, if the parasite latches onto those receptors, she has no defenses. After that, however, her immune system learns to recognize the parasite and makes antibodies that provide at least some protection. The discovery has immense implications both for drug treatment and for the development of a vaccine: if those antibodies can be reproduced successfully, they may be able



to protect women even before they become pregnant.

Mutabingwa offered to show me around the hospital. Women dressed in robes, their heads obscured by flowing scarves, lined a long, low breezeway connecting the main wards. Each woman had at least one child, bundled in swaddling, sitting by her feet, or nursing. None of them cried; the children seemed like statues while their mothers waited wordlessly to see a nurse. Nearly half of the adults in the hospital have H.I.V., Mutabingwa said, and almost all the children have malaria. A considerable number have both. We entered the women's ward, where electric-blue mosquito nets hung in cones over every bed. The hospital is often the only place in which a woman will have the use of a net. One mother had just arrived from a village nearby, after a ten-kilometre bus ride over a series of craters that serve as a road. She was covered in dust and wrapped like a mummy. In her arms she cradled a seemingly lifeless child; malaria had made the baby severely anemic. Two feet away, a three-year-old boy with an I.V. tube in his hand lay on a gurney, screaming over and over, "*Mkono wangu! Mkono wangu!*" ("My hand! My hand!") "At times, you get to a clinic and they don't have cups for water," Mutabingwa said. The boy was one of the lucky children who had made it to the hospital before lapsing into a coma.

"You know, if you do this for a while the danger is not to care," Mutabingwa said. We walked over to the combined H.I.V. and chronic-tuberculosis ward (there is neither space nor money to separate them). A single fluorescent bulb cast an eerie glow across the room. Every bed was occupied, some by more than one person. H.I.V., tuberculosis, and malaria (which together kill five million people a year) fuel each other. Anybody with one is far more likely to fall prey to either of the others. "These women are here because of acute malaria," Mutabingwa said. "After five or seven days, they are usually released. There is not that much we can do for them after that." We headed back toward the women's ward. A young woman, about sixteen, was sharing a bed with another woman, a few years older. A baby with malaria lay between



*A Tanzanian girl, sick with malaria. "It just blows my mind how little money has been spent*



on malaria research," Gates said. "Do we really not care because it doesn't affect us? Is that what it is?" Photograph by Samantha Appleton.

them. The two women were sisters, and the older one was visiting. She had tuberculosis. Mutabingwa could not conceal his irritation. "This is not infection control!" he cried out to nobody in particular. "It is really very dangerous for her to be here." The older woman shrugged, got out of bed, and left.

While I was in Tanzania, I stopped at villages near Tanga, on the eastern coast, and, with the help of my driver, spoke to people there. When the subject turned to malaria, the sense of futility was pervasive. "We don't have the kind of money you need for nets," one mother told me. Nets, which are remarkably effective, cost about four dollars and must be treated regularly with insecticide. "My husband doesn't think it's worth the expense," the woman said. Mosquitoes almost always feed at night, yet only two per cent of the children and women in Tanzania sleep under nets or live in homes that have been sprayed with insecticide. At Tuele, I asked several women if they had bed nets—and all said no.

Later that day, I went to visit Stephen Magesa, an entomologist with Tanzania's National Institute for Medical Research. Magesa has spent most of his career assessing the effectiveness of

bed nets that have been impregnated with insecticide. "In 1991, we showed that even in very intense areas of transmission we could reduce the burden," he said. Magesa is a quiet, donnish man. He spoke deliberately but without emotion. "The study was not big enough to show an impact on mortality. But we did show very clearly that the mosquitoes did not survive." More important, the researchers found benefits even for those people who did become infected: they had fewer parasites in their blood and less severe fevers. "We know the nets work. We have known it for almost twenty years," Magesa said.

Actually, people have been using nets to protect themselves from mosquitoes for more than two thousand years. Herodotus described Egyptians living in marshy areas who would wrap themselves in fishing nets. In the nineteenth century, British colonists in India routinely slept under nets to stave off bites. (At that time, nobody knew what caused malaria.) It turns out that you don't even have to sleep under a net for it to protect you. In one study, in Ghana, child mortality increased by seven per cent for every hundred metres that children were away from nets; other research, in Kenya, has demonstrated that death rates, the incidence of anemia,

and even the level of parasites in the bloodstream were lowered in children who lived within three hundred metres of houses that had nets.

Bed nets do require attention. They must be properly installed, used regularly, and treated with insecticide every six to twelve months. And although the four dollars they cost would be money well spent for even the poorest family, African governments have never made much of an effort to help. In 2003, fewer than five per cent of children living in sub-Saharan Africa slept under nets. New technology should change that. Several companies have begun to manufacture nets that have insecticide embedded within their fibres. They don't need to be sprayed and they last for nearly five years—the years that are crucial for infants and young children.

Magesa's arguments have long been ignored. "I am sitting here watching my hair go gray and waiting for those nets," he told me as we sipped iced tea in his cramped office. "Every year, a million more kids die. A decade ago, they were saying, 'Let people die; there is nothing we can do.' Then Gates came along and he said this is not acceptable. That was more important than his money. He put malaria back on the world's stage. But will he be able to keep it there?"

"We are watching children die—our children—and they die every day," Magesa said. "You could save between thirty and fifty per cent of them with nets alone. If you added improved hospital services and proper medicine, you could save eighty per cent. But we already know how much eight hundred thousand African children are worth to the rich world. We have known it for a long time."

One afternoon, early in August, I met Bill and Melinda Gates for dinner at the home of the foundation's president and co-chair, Patty Stonesifer, who lives with her husband, the journalist Michael Kinsley, on the prosperous shores of Lake Washington. Their house sits directly across from the technological Xanadu occupied by Gates, Melinda, and their three children. As I stood on the dock staring at the sailboats dotting the water, I noticed a small motorboat heading our

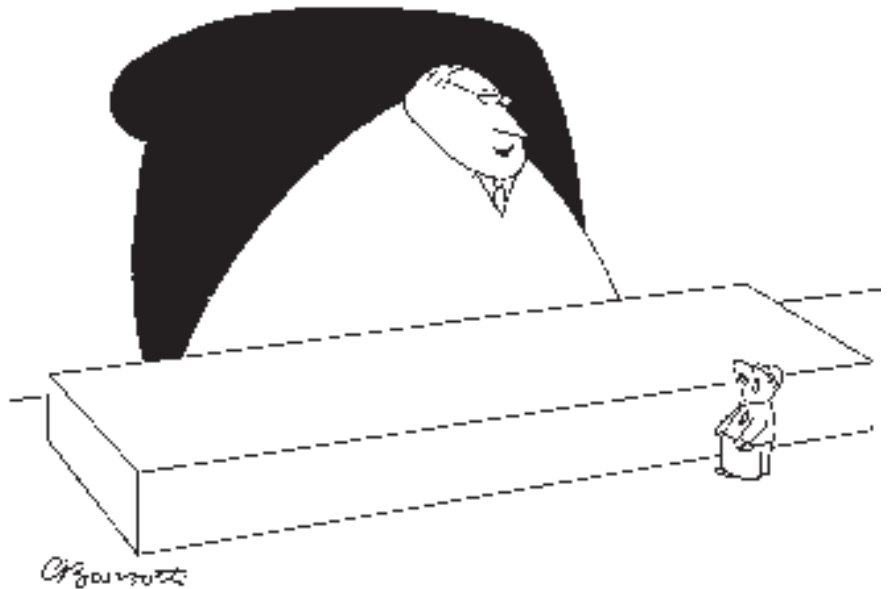


*"That was great, Howard. The perfect antidote to mindless summer fare."*

way. Bill Gates was behind the wheel, with Melinda acting as navigator. When it seemed as though they were going to glide into the dock, they cut the engine, drifted in, and tied up. Gates was dressed in a T-shirt, a Polartec sweater, and khakis. He looked as if his most recent haircut had been performed with blunt scissors and a soup bowl. Melinda was dressed casually in a sweater set and black pants. She is athletic, and one could not help contrasting her tan with the definitive pastiness of her husband.

The Gates foundation—while run by Stonesifer, chaired by Gates's father, and founded by both Bill and Melinda Gates—has been portrayed largely as the expression of one man's obsession. That turns out to be untrue. Stonesifer is close to both founders, and she has been with the philanthropy since the planning stages. Gates and his wife sign off on all grants larger than ten million dollars, but Stonesifer is responsible for hiring staff and managing the foundation. After working at Microsoft for nine years, becoming its highest-ranking female executive, she retired in 1996. She had become very wealthy, and takes no salary from the foundation. Stonesifer is not particularly fond of publicity; she is utterly frank, but prefers to work behind the scenes. At times, her lack of pretense leads her to be underestimated. But not by Gates. "If this foundation works, it's because of Patty," he told me. "She is one of the best managers I have ever known."

In addition to its work on public health, the foundation has chosen to support libraries, education, and the underprivileged. By most measures, the grants and the commitment in those areas are enormous: so far, the foundation has made nearly \$2.5 billion worth of educational awards; eight hundred million dollars more has been allocated to programs in the Pacific Northwest, where Gates has spent his life. They are each dwarfed, however, by the investment in public health. The Gates foundation has more than vast wealth: it has the power of a government without actually being bound by a nation's political or economic constraints. "We are in this unusual position where we can spend one hundred million dollars on something we think might work and it



*"You understand, Wilkens, I have yachts, cars, planes, and women, so I'm not firing you just for the fun of it."*

can fail and nobody gets fired" was the way Gates described it to me. "Political institutions just can't handle risks like that." The foundation has drawn liberally from America's leading medical institutions: in addition to Klausner, who will leave next month to pursue a private venture, Regina Rabinovitch, who was hired from the Malaria Vaccine Initiative, directs the infectious-disease program; Helene Gayle, who is in charge of the foundation's H.I.V., TB, and reproductive-health programs, is one of the most visible black women in American science. There are at least a dozen other similarly experienced and sought-after scientists on the staff.

Bill Gates has always had an interest in science. Yet it was Melinda who first suggested that they concentrate on global health. Gates didn't get it: he was interested in population control and thought that improving the world's health might even run counter to that goal. ("It was only when I dug into it a bit that I came to understand that better health leads to lower populations with more resources," he said.) Melinda French grew up in Dallas. She studied economics and computer science at Duke and stayed to earn an M.B.A. She joined Microsoft in 1987, helping to develop such products as Encarta, Expedia, and Cinemania, and

she ran a division that produced several hundred million dollars in annual sales. The two were married in 1994, and Melinda left the company two years later, when their first child was born. Gates owns more than a billion shares of Microsoft, which at times have been worth as much as a hundred billion dollars. Today, after his contributions to the foundation, his net worth stands at roughly half that amount. "We knew that we wanted to give virtually all of it away instead of having it go to our kids," he said. "But we certainly thought that it would happen when I wasn't working full time at Microsoft."

On the eve of their wedding, Gates's mother wrote a letter to Melinda in which she stressed the great opportunities the two would have as a couple to improve the world—and the unique responsibilities that came with immense wealth. "It was really quite beautiful," Melinda said. "And that was what got us going." Their interest in population control led them to look more deeply into public health, and the realization that diarrhea, respiratory diseases, and other syndromes were killing millions of people every year. "The whole thing was stunning to us," Gates said. "We couldn't even believe it. You think in philanthropy that your dollars will just be marginal, because the really juicy ob-

vious things will all have been taken. So you look at this stuff and we are, like, *wow!* When somebody is saying to you we can save many lives for hundreds of dollars each, the answer has to be no, no, no. That would already have been done.” Gates’s voice rose as he talked. In the background, a seaplane swooped down onto the lake. “We go to events where people are raising money for various illnesses where lives are being treated as if they were worth many millions of dollars. And here we were learning that you can save even more lives for a few hundred each. We really did think it was too shocking to be true.”

Gates began to approach scientists for advice. One of them, William Foege, is a former director of the C.D.C. and one of the country’s most experienced public-health officials. I ran into Foege not long ago and asked him about his first encounters with Gates. He laughed and said, “The guy came to me and said he wanted to learn about public health and he wanted to help. Do you know how many times before I have heard those sorts of things? Rich people say that all the time. I gave him a list of eighty-two books. I saw him a couple of months after that and I asked, ‘How are you doing on those books?’ And he said, ‘Well, I have been so damn busy I have read only nineteen of them.’ I still didn’t know whether to believe him, so I asked, ‘Which was your favorite?’ He didn’t hesitate for a second. ‘That 1993 World Bank report was just super,’ he told me. ‘I read it twice.’” By then, Foege had signed on as an adviser to the foundation. He now splits his time between Seattle and Atlanta.

The 1993 World Bank Development Report helped change the way public-health officials calculate the relationship between disability and the value of life. In the report, for the first time, bank economists focussed on the concept of the “disability-adjusted life year” (DALY), which has come to serve as the standard measure of how to assess the burden of a disease. In the past, the impact of any illness—cancer, the common cold, and everything in between—was usually evaluated on the basis of how likely it was to kill you. But life without good health also carries enormous costs for individuals, families, and

societies. The disability-adjusted life year combines years of potential life lost owing to premature death with years of productive life lost to disability. Blindness is an example of a health problem that, while not causing death, can dramatically reduce one’s quality of life or ability to function within society. Alzheimer’s disease is another.

Even so, the World Bank report, at three hundred and twenty-nine pages, makes for some dry reading. When I asked Gates if he had indeed read it twice, he replied, “I’ve read it more than twice. It’s really a nice piece of work.” The DALY concept led Gates and his wife to their first large grant, a hundred and twenty-five million dollars, for the Children’s Vaccine Program. They refer to that grant as “the 125.” “That led to the 750,” Melinda added, an initial seven-hundred-and-fifty-million-dollar donation to the Global Alliance for Vaccines and Immunization, which they matched this year. “After the 125, we had a dinner for about a dozen scientists at the house,” Melinda went on. “We were both extraordinarily impressed with their knowledge, their expertise, their desire to solve problems. And toward the end of the dinner Bill posed the question: ‘If you had more money, what would you do?’ and the room came alive. Just to hear what their ideas were was so exciting for us. It was a revelation. And we both walked away from that dinner thrilled, because we had been surrounded by people that were so brilliant at Microsoft. And we saw immediately that these were the same type of people.”

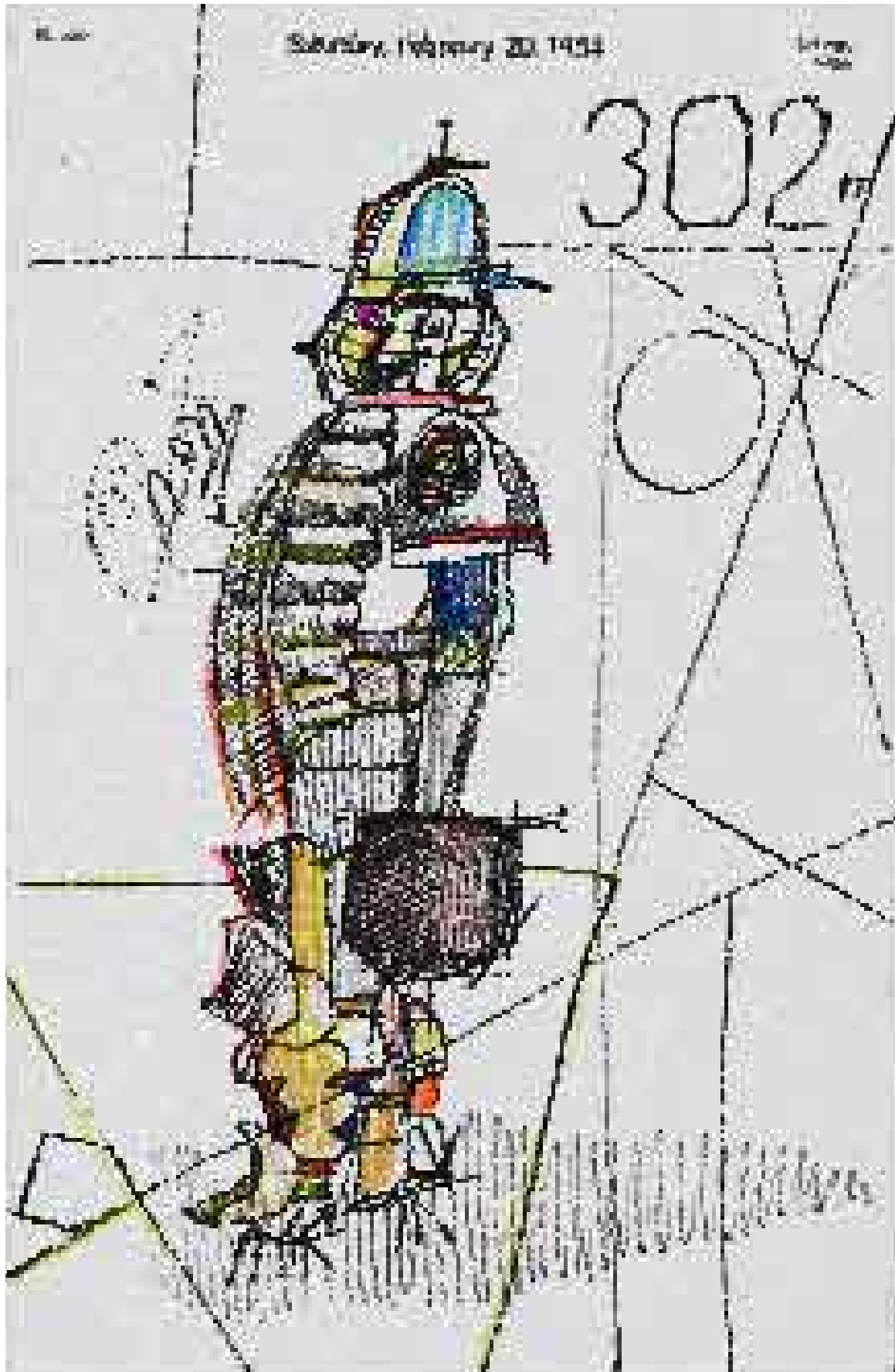
The National Institutes of Health helps pay for most of the basic biomedical research carried out in the United States, but it does not produce drugs or vaccines. That has always been a job for pharmaceutical companies, which, like any business, concentrate on creating products that people will buy. There is almost no financial incentive to make a vaccine for malaria; the West doesn’t need it. African children don’t lobby Congress; they have no money, and neither do the countries they live in. Philanthropy has not filled the gap. “I always say to people with a lot of money, ‘Do you want a disease?’” Gates said. “We can give you this whole disease, or a whole region or a country. Whatever

you want.” He went on, “We heard again and again this recitation of places where all this great work had occurred and then it would just get stalled. There was just nobody to push it to the next level. It’s all the greater crime that something like malaria never got more attention. We gave a small grant at first, like thirty million dollars, and everybody said, ‘Wow! That is the greatest increase in nongovernment spending in the history of malaria research!’ And I thought, Oh, you are *kidding*.”

The Gates foundation offices, in Seattle, are aggressively nondescript. There is no name on any building or door, and no architectural grandeur. The foundation receives thousands of grant proposals every year. (Program officers appraise them first, and then rely on outside committees of experts for guidance before deciding whom to fund and how much to award.) The criteria are straightforward. “We look at three things,” Richard Klausner told me one day in his office. “The burden, the inequity of that burden, and the inequity of attention.” Diabetes, for example, is a big problem in the developing world, but it gets a lot of attention and also affects the rich part of the world, so neither pharmaceutical companies nor Western scientists need Gates money.

Gates sends a constant stream of e-mail to Stonesifer, Klausner, and the other top scientists at the foundation. Although he remains the chairman of Microsoft and seems no less consumed by its affairs, he still finds time to pore over every major grant that the foundation makes, and he asks dozens of highly technical questions about each of them. “Bill is a guy who enjoys spending his free time reading and rereading immunology textbooks and learning a bit more about molecular biology,” Klausner said. Bob Dylan’s “Chronicles: Volume 1” sat prominently on Klausner’s desk, next to a fat book filled with N.I.H. budget projections. “Guess which one I would rather read?” he said. “Well, Bill would choose the other.” Once, when I asked Gates if he watched television, he said, “Not really.” Then he conceded that he liked to watch while he was on his treadmill, particularly the show “24.” “Although a little less after

SKETCHBOOK BY SAUL STEINBERG



Kim left," he said, referring to the role played by the actress Elisha Cuthbert. When I started to mention something about a recent episode, Gates jumped in before I could finish the first sentence. "No!" he shouted. "Don't say one word until December the sixth. That's when the last season comes out on DVD. I'll be able to discuss it the next day—well, it might take me two days."

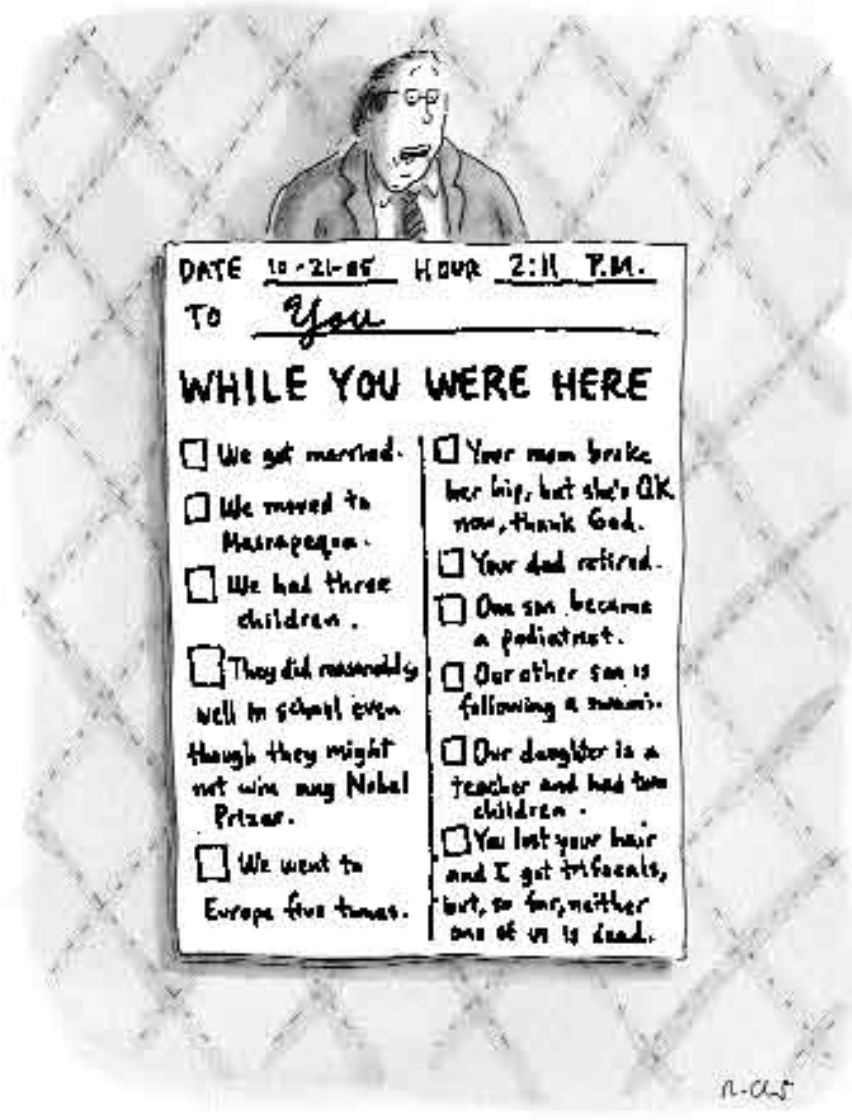
Nothing animates Gates more than the attempt to find vaccines for AIDS and malaria. He has been the International AIDS Vaccine Initiative's most prominent and consistent supporter. He told me that he hoped to live to see vaccines for both diseases used widely. When he is criticized in the public-health world, it is usually because he has focussed so prominently on cutting-edge, next-generation

vaccine research, rather than on the use of more conventional technology that could have immediate effects. "Genomic data, of course, is the future," he told me. "We are really down to a rational-design approach to drugs. We can even sort immune cells and see what proteins come out where." Gates is right: at some point in the next generation, our understanding of genetics will undoubtedly help produce fundamental advances in medicine. For now, though, many wonder if an emphasis on simpler solutions would save more lives. "The Gates approach is highly scientific," Allan Schapira, of Roll Back Malaria, told me when I was in Geneva. Schapira spends most of his time figuring out how to best deploy bed nets and to stave off drug resistance in Africa. "I don't want to say it's wrong," he said of Gates's approach.

"There can be valuable questions." But he personally found it hard to concentrate on the future when so many people are dying now. Even Klausner, on more than one occasion, has discussed with me the pitfalls in counting on high-tech solutions when other answers already exist.

Appeals for low-tech solutions by public-health leaders and by African scientists like Stephen Magesa were traditionally ignored, because they cost too much. In places where the government spends less than ten dollars a year on each citizen's health, bed nets, drugs, and the use of various pesticides (which has kept the United States malaria-free) are out of the question. In Zambia, malaria kills one child out of five. This May, the Gates foundation decided to award thirty-five million dollars to MACEPA, the Malaria Control and Evaluation Partnership in Africa, to help Zambia. The program will be administered by Kent Campbell, who spent many years at the C.D.C. The immediate target is to cut deaths by seventy-five per cent within three years. But the greater goal is to create a model of what is possible in a poor African nation. The government of Zambia will purchase hundreds of thousands of insecticide-treated mosquito nets, thousands of doses of artemisinin combination therapy, and enough insecticide to spray every house in the country. "We need to prove that children don't have to die," Brian Chituwo, the Zambian health minister, told me. "And with this money I think we can."

There is almost universal acknowledgment that the research pipeline for new malaria drugs has never seemed better. There are also techniques that lessen the likelihood that the parasite will become resistant. One of the most promising of these techniques is the use of intermittent preventive treatment for infants. In recent studies, scientists gave babies three doses of medicine during the first year of their lives, whether or not they had malaria, when they received routine immunizations to other diseases. Such preventive therapy has already been shown to help protect pregnant women; and in early studies the children's risk of contracting malaria was cut by more



than half. So was the incidence of severe anemia. Still, drugs require money (lots of it), vigilance, and a functioning health-care system, and the emergence of resistant strains will always pose a threat.

A malaria vaccine, on the other hand, would save many more lives, and at a far lower cost. "There is a huge distinction you have to make between a chronic treatment and something you take once in your life," Gates said. "Mumps is complicated. Rubella is complicated. So is polio. But a onetime treatment and boom"—he clapped his hands together. "There you go."

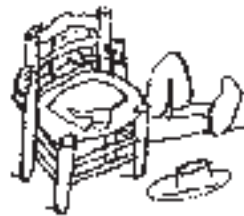
Nobody has ever made a vaccine that works against a parasite, but scientists have spent decades trying. The organism itself is stupefyingly complex; but the relationship of a mosquito, the falciparum parasite, and a human is far more so. Anopheles mosquitoes require a meal of blood in order to lay their eggs—and they almost always feed at night. Malaria begins when a female mosquito bites somebody who has already been infected. The mosquito becomes infected, too, then passes that infection to its next victim in a form of the parasite called sporozoite. Once sporozoites enter the body, they glide into the bloodstream and travel to the liver, where they divide repeatedly. Two days later, about the time that the parasites leave the liver, ten original sporozoites have created millions of progeny. They then invade red blood cells and begin to feed on them, and within two weeks they will number more than thirty billion.

Last year, for the first time, a vaccine offered partial protection against infection. In a study on more than two thousand children in Mozambique, the risk of developing severe malaria was reduced by fifty-eight per cent. The vaccine attempts to stimulate immunity by using one of the proteins on the surface of the malaria parasite when it invades the liver. It was produced by GlaxoSmithKline and, along with more than a dozen other experimental vaccines, was supported by the Malaria Vaccine Initiative. Most of the funding came from the Gates foundation. Although this vaccine is not a miracle cure, even partial protection against a

disease that kills millions would help. Nonetheless, the foundation is intent on finding a vaccine that works better. Regina Rabinovitch said, "We would like to take a vaccine and have it be ninety-nine per cent effective—a mosquito bites you, it takes a blood meal, shoots some parasites into you, and within five minutes those parasites are dead." The problem is that such a response would require a high level of the right kind of antibodies. It would have to work early, in the blood or just as the sporozoites enter the liver—before they destroy billions of red blood cells. "That is the holy grail for you and me and the United States military," Rabinovitch said. Malaria has always had a profound effect on the military. During the war in Vietnam, for example, there were places in which the number of malaria cases reported by G.I.s each year equalled—and even exceeded—the number of U.S. troops.

"But this is where it gets a bit messy," Rabinovitch continued. "Let's say we got that immunity and it waned after five years. You would then be immunologically naïve." For an American soldier, she said, it wouldn't matter, because "you're only there for two years or less." But, she went on, "if you are a child who is living in Africa, who is dying at the highest rates, what would happen if that immunity wore off? All of a sudden, you would be like an infant again—the people who are at greatest risk. So if we had a vaccine and its effects didn't last, children would be at risk once again beginning when they are about five years old. So we really want something that provides protection from severe disease, and death, so that if you still get infected you will generate an immune response, and the likelihood that you will die or become severely sick is lower.

"The goal is to turn a six-month-old into a ten-year-old, so that he has protective immunity. This is called the 'leaky-bed-net model.' We know that it doesn't decrease all exposure. It acts as a baited trap with a human inside and the mosquito touches the net and neurologically becomes a little nutso and dies."



The parasite's greatest weapon is its ability to avoid the immune system by continually changing both its surface proteins and its location: every time it moves from a mosquito's gut to its salivary gland and from there to our liver and red blood cells, it changes form. The tools of molecular genetics are finally letting scientists attack each different stage of the infection—and there are now many vaccines in development. Some work at the blood stage and some at the liver stage. I asked Rabinovitch how she chooses which to fund. She smiled. "We are supporting all of them," she said. "This foundation is agnostic when it comes to malaria religion. We just want something that works."

The Seattle Biomedical Research Institute is more than twenty-five years old, and the scientists there work solely on eliminating infectious disease. Last year, the institute moved into a new building a couple of miles from the Gates foundation, with laboratories equipped with gene-sequencing machines, microchip arrays, and powerful new computers. It's a Bill Gates kind of place. Institute scientists are working on several malaria vaccines. One of them is based on research by Michal Fried and Patrick Duffy, who is on loan from the Army. Their discovery of a distinct form of falciparum which adheres only to the placenta suggests that they might be able to create a vaccine for pregnant women. Their goal is to prevent sickness, not necessarily to prevent infection.

Stefan Kappe, a young German parasitologist at the institute, takes an entirely different approach. He has been studying the mosquito itself. Since the parasite moves from a human into a mosquito, as well as in the other direction, Kappe is trying to find a way to prevent infection by disabling falciparum before it can make it to the liver. Exposure to radiation weakens the sporozoites that mosquitoes carry in their salivary glands. When those sporozoites are injected into a person, they stimulate immune activity and protect him from malaria. That is how most basic vaccines work. A measles vaccine, for example, is a live strain of the virus that has been

weakened to the point where it can do no harm; yet it tricks the immune system into creating antibodies to defend itself against genuine measles viruses.

Until sequencing technology made it possible to manipulate genes in the parasite, this approach never seemed worth pursuing. The parasite has to be alive to spark the immune system, and it would have been unethical to inoculate people with live parasites—even weak ones. Nor would it ever be possible to X-ray enough mosquitoes to protect the world from them. So Kappe is using genomics to destroy only those genes which are essential for the parasite to grow in the liver. He, too, is supported by a grant from the Gates foundation. “I would never have received funding for this particular project—any classical review mechanism at N.I.H. would have come back and said no, too far-out,” he said. “The Gates people know it’s far-out. But sometimes far-out works.”

Kappe wondered what would happen if he could weaken the falciparum parasite enough to stimulate the human immune system without endangering it. It’s a tricky prospect, because the parasite needs to do at least part of its job. Weaken the parasite too much and it would not be capable of inducing a useful immune response; but, if it isn’t weakened enough, the inoculation would simply give people malaria. Relying on the full spectrum of modern genetic tools (as well as on educated guesses), Kappe was able to identify several genes that help falciparum to grow and to survive. He then started deleting individual genes, to see what effect that caused. “We were lucky to find two genes that when we delete them the parasite really gets stuck in its development,” Kappe told me. “What matters the most here is that these deletions don’t affect other parts of the life cycle.” Without these genes, the falciparum parasite cannot cause infections in red blood cells, because it never makes it out of the liver.

The only place you can keep enough mosquitoes to do this kind of research is an insectary—which is a cross between a zoo for insects and a laboratory. There are just a few in the world;

they require constant oversight, lots of space, and a perfect climate. The insectary at the institute is a very humid room, and, as we entered, several of Kappe’s colleagues, working with dissecting microscopes, were removing parasites from the glands of mosquitoes. Behind the researchers lay long pans with hundreds of tiny eggs about to hatch. A female anopheles will lay a raft of about a hundred eggs at a time. The males live for sex, last about a week, and then die. Kappe’s vaccine has worked in mice, stranding the parasite in the liver and preventing further infection. But he has a long way to go before he can test it on humans. “This association between the parasite and the mosquito is millions of years old,” he said. “It’s absolutely a brilliant example of evolution. But if we want to succeed we will have to reproduce this intricate relationship exactly. We have to create that environment and then manipulate it. I come from genetics and from the world of parasite biology. I believe that with modern technology we can make live vaccines that are protective. I don’t think that is in the future. I think it’s now.”

David Schellenberg, a clinical epidemiologist from the London School of Hygiene & Tropical Medicine, has spent much of the past decade in Africa, and he sees the struggle in a less exalted way. On the day of my visit, he was standing in the middle of his office at the Ifakara Health Research and Development Centre, on the northern edge of Dar es Salaam, along with a young Tanzanian man who works for him. Schellenberg was excited. A rough wooden box sat on a table in front of them. Jumper cables snaked out of one end of the box,

and a car’s cigarette lighter was at the other end. Schellenberg thanked the man profusely. “This could be as important and valuable as anything we have ever done for malaria,” he told me as I entered the room. He was not entirely joking. Schellenberg is running some of the most important malaria drug trials in Africa—testing whether a few doses of preventive medicine will

help protect infants from the disease. The contraption on the table had been rigged to charge the batteries of computers in the many study villages where electricity is often absent. “We need computers to work out there if we are to collect data and store them properly. But, with the electricity so bad, the computers are completely unreliable.” Schellenberg is a soft-spoken, studious-looking man with close-cropped hair, blue eyes, and gold wire-rimmed glasses. Like any doctor who has worked both in the lab and in the village, he is well aware of the difference between efficacy and effectiveness. When researchers announce that they know how to do something because they have the scientific data to back it up, those data are based on efficacy—not effectiveness. “The difference between what you see in the clinical world and what you find in the real world can be enormous,” Schellenberg said. “And in the real world sometimes you don’t feel you can afford the fine print.” Some of the earliest trials involving preventive treatment of pregnant women and of children were conducted at Ifakara. “Often a clinical trial proves something can work—the use of bed nets, for example, or a new regimen of drugs,” Schellenberg said. “But does that mean that everyone in every village or city in Africa will accept the results?”

Schellenberg and his wife, Joanna, who is also a malaria researcher, have two sons, eleven and seven. They moved back to Africa from England last year. Their first posting lasted six years, but their older son contracted drug-resistant malaria and almost died. “He was airlifted to Nairobi, and he had chest surgery,” Schellenberg told me. “Then he had pneumonia and that led to abscesses. We very nearly lost him. He is fine now, but it was scary. You can imagine after that there was a lot of soul-searching about whether or not to return. But we are here because this is where we really belong.” He said this with no remorse. “Look, we are lucky. We were able to call a plane and get him out of there. So he lived. That is not the way it is for the other children who get this disease. There are no planes. No drugs. No doctors. And no real hope of surviving. So when we asked ourselves, ‘What are



## A MIRROR FOR A QUESTION

I asked, and they said: the branch  
swathed in flame is a sparrow.  
They said: my face  
was the waves, the world's face a pile of mirrors,  
a lighthouse, and the sailor's sorrow.

I arrived and the world in my way  
was ink, each gesture a phrase.  
I did not know that between it and me  
there was a bridge named Brotherhood  
made of steps, prophecy, and fire.

I did not know that my face  
was a ship that sails inside a spark.

—Adonis

(Translated, from the Arabic, by Khaled Mattawa.)

we doing by coming back,' we had to think about that."

The Gates foundation supports much of Schellenberg's work—and other studies of intermittent therapy as well. He is grateful. But Schellenberg, like many of his colleagues, is concerned about what he sees as a growing preoccupation with futuristic technology. "Ten years ago, we were saying that a vaccine would not be available for at least ten years. Now we seem to be saying the same thing. I think we need not put our hopes in magic bullets when we have the arsenal to make such an impact now. What we need are magic guns, not magic bullets," he said. "We need to be able to deliver what we already have." Schellenberg admits that while he is attracted to the "shiny, scientifically exciting stuff, a lot of what we are doing in southern Tanzania now is not scientifically challenging. It's like that wooden box with the cigarette lighter. We are making simple things. And the questions we are asking are not very exciting in scientific ways. But they are urgent. This is what we need to do now. We need to make things work. Not just work under ideal conditions."

**B**ill Gates approaches life as if it were a problem that needed to be solved. At times, he appears as if he had stepped out of a Henry James

novel: a confounding mixture of innocence, arrogance, and belief in what is right—the American Man. Gates's eager, energetic view of the world is stamped on everything he does: from his house, where guests can program their rooms to reflect their taste, to the software company he founded. Microsoft, whatever else it is or has become, began as a collection of smart people who realized that technology, when driven by the right kind of intelligence, rules the world. Gates feels the same way about improving public health. His faith in progress is absolute. "The complexity of biology and how it works is so interesting," he told me one day. "And, in terms of human welfare, the idea of getting rid of these diseases—which could be in our lifetime—is just very exciting." That final sentiment makes many public-health officials nervous. "The eradication of disease and the alleviation of suffering depends more on developing the skills of talented people than on technology," a generally favorable editorial about the foundation recently declared in the British scientific journal *The Lancet*. Gates has put aside more than a billion dollars to help disadvantaged American students earn college degrees. The *Lancet* editorial suggests that a similar educational investment in developing countries might do more good than many pro-

grams that emphasize science alone. Both historical and contemporary studies have shown that the public health of a nation only improves through a combination of social and political measures. Medicine matters, of course, but it is far from the only thing that does. (The United States is the richest country in the world and the most technologically advanced, yet it ranks twenty-ninth among world nations in life expectancy and thirty-eighth in infant mortality.) "In calling on the world's researchers to develop innovative solutions targeted to 'the most critical scientific challenges in global health,' the Gates Foundation has turned to a narrowly conceived understanding of health as a product of technical interventions divorced from economic, social, and political contexts," the Canadian health economist Anne-Emanuelle Birn wrote recently.

Gates has heard these criticisms, and the foundation's recent commitment to a full-scale attack on malaria in Zambia illustrates that. It is impossible to doubt the sincerity of Bill or Melinda Gates, or to question the impact they have had, and will have, on the world. Yet it would be hard to expect the iconic American technologist, a man who has made one of the world's great fortunes by harnessing the flow of information, to abdicate the future. "I do believe in progress," he told me in Seattle. "Capitalism is an unusual system, in that somebody can have so much wealth. But then again it's an unusual system because money can actually flow from the luckiest to the unluckiest and hopefully in clever ways so that it's not just writing checks.

"We do not measure ourselves at all by the amount given," he continued. "We have taken on the top twenty killers, and for everything we do we look at the cost per life saved and real outcomes in terms of how things get improved. It's fun, and it is also an enormous responsibility. But having my job at Microsoft is also fun and a huge responsibility. That is true for being a parent. Many of the most important things in life are like that. Why else would you want to get up in the morning?" ♦