IN OUR Gilded Age, the poorest of the poor are nearly invisible. Seven hundred million people live in the 42 so-called Highly Indebted Poor Countries (HIPC s), where a combination of extreme poverty and financial insolvency marks them for a special kind of despair and economic isolation. They escape our notice almost entirely, unless war or an exotic disease breaks out, or yet another programme with the International Monetary Fund (IMF) is signed. The Cologne Summit of the G8 in June was a welcome exception to this neglect. The summiteers acknowledged the plight of these countries, offered further debt relief and stressed the need for a greater emphasis by the international community on social programmes to help alleviate human suffering.

The G8 proposals should be seen as a beginning: inadequate to the problem, but at least a good-faith prod to something more useful. We urgently need new creativity and a new partnership between rich and poor if these 700m people (projected to rise to 1.5 billion by 2030), as well as the extremely poor in other parts of the world (especially South Asia), are to enjoy a chance for human betterment. Even outright debt forgiveness, far beyond the G8’s stingy offer, is only a step in the right direction. Even the call to the IMF and World Bank to be more sensitive to social conditions is merely an indicative nod.

A much more important challenge, as yet mainly unrecognised, is that of mobilising global science and technology to address the crises of public health, agricultural productivity, environmental degradation and demographic stress confronting these countries. In part this will require that the wealthy governments enable the grossly underfinanced and underempowered United Nations institutions to become vibrant and active partners of human development. The failure of the United States to pay its UN dues is surely the world’s most significant default on international obligations, far more egregious than any defaults by impoverished HIPC s. The broader American neglect of the UN agencies that assist impoverished countries in public health, science, agriculture and the environment must surely rank as another amazingly misguided aspect of current American development policies.

The conditions in many HIPC s are worsening dramatically, even as global science and technology create new surges of wealth and well-being in the richer countries. The problem is that, for myriad reasons, the technological gains in wealthy countries do not readily diffuse to the poorest ones. Some barriers are political and economic. New technologies will not take hold in poor societies if investors fear for their property rights, or even for their lives, in corrupt or conflict-ridden societies. The Economist’s response to the Cologne Summit (“Helping the Third World”, June 26th) is right to stress that aid without policy reform is easily wasted. But the barriers to development are often more subtle than the current emphasis on “good governance” in debtor countries suggests.

Research and development of new technologies are overwhelmingly directed at rich-country problems. To the extent that the poor face distinctive challenges, science and technology must be directed purposefully towards them. In today’s global set-up, that rarely happens. Advances in science and technology not only lie at the core of long-term economic growth, but flourish on an intricate mix of social institutions—public and private, national and international. Currently, the international system fails to meet the scientific and technological needs of the
world’s poorest. Even when the right institutions exist—say, the World Health Organisation to deal with pressing public health disasters facing the poorest countries—they are generally starved for funds, authority and even access to the key negotiations between poor-country governments and the Fund at which important development strategies get hammered out.

The ecology of underdevelopment

If it were true that the poor were just like the rich but with less money, the global situation would be vastly easier than it is. As it happens, the poor live in different ecological zones, face different health conditions and must overcome agronomic limitations that are very different from those of rich countries. Those differences, indeed, are often a fundamental cause of persisting poverty. Let us compare the 30 highest-income countries in the world with the 42 HIPC 

Not only life but also death differs between temperate and tropical zones. Individuals in temperate zones almost everywhere enjoy a life expectancy of 70 years or more. In the tropics, however, life expectancy is generally much shorter. One big reason is that populations are burdened by diseases such as malaria, hookworm, sleeping sickness and schistosomiasis, whose transmission generally depends on a warm climate. (Winter may be the greatest public-health intervention in the world.) Life expectancy in the HIPC’s averages just 51 years, reflecting the interacting effects of tropical disease and poverty. The economic evidence strongly suggests that short life expectancy is not just a result of poverty, but is also a powerful cause of impoverishment.

All the rich-country research on rich-country ailments, such as cardiovascular diseases and cancer, will not solve the problems of malaria. Nor will the biotechnology advances for temperate-zone crops easily transfer to the conditions of tropical agriculture. To address the special conditions of the HIPC’s, we must first understand their unique problems, and then use
our ingenuity and co-operative spirit to create new methods of overcoming them. Modern society and prosperity rest on the foundation of modern science. Global capitalism is, of course, a set of social institutions—of property rights, legal and political systems, international agreements, transnational corporations, educational establishments, and public and private research institutions—but the prosperity that results from these institutions has its roots in the development and applications of new science-based technologies. In the past 50 years, these have included technologies built on solid-state physics, which gave rise to the information-technology revolution, and on genetics, which have fostered breakthroughs in health and agricultural productivity.

**Science at the ecological divide**

In this context, it is worth noting that the inequalities of income across the globe are actually exceeded by the inequalities of scientific output and technological innovation. The chart below shows the remarkable dominance of rich countries in scientific publications and, even more notably, in patents filed in Europe and the United States.

![Different resources](chart)

The role of the developing world in one sense is much greater than the chart indicates. Many of the scientific and technological breakthroughs are made by poor-country scientists working in rich-country laboratories. Indian and Chinese engineers account for a significant proportion of Silicon Valley’s workforce, for example. The basic point, then, holds even more strongly: global science is directed by the rich countries and for the rich-country markets, even to the extent of mobilising much of the scientific potential of the poorer countries.

The imbalance of global science reflects several forces. First, of course, science follows the market. This is especially true in an age when technological leaps require expensive scientific equipment and well-provisioned research laboratories. Second, scientific advance tends to have increasing returns to scale: adding more scientists to a community does not diminish individual marginal productivity but tends to increase it. Therein lies the origin of university science departments, regional agglomerations such as Silicon Valley and Route 128, and mega-laboratories at leading high-technology firms including Merck, Microsoft and Monsanto. And third, science requires a partnership between the public and private sectors. Free-market ideologues notwithstanding, there is scarcely one technology of significance that was not nurtured through public as well as private care.
If technologies easily crossed the ecological divide, the implications would be less dramatic than they are. Some technologies, certainly those involving the computer and other ways of managing information, do indeed cross over, and give great hopes of spurring technological capacity in the poorest countries. Others—especially in the life sciences but also in the use of energy, building techniques, new materials and the like—are prone to “ecological specificity”. The result is a profound imbalance in the global production of knowledge: probably the most powerful engine of divergence in global well-being between the rich and the poor.

Consider malaria. The disease kills more than 1m people a year, and perhaps as many as 2.5m. The disease is so heavily concentrated in the poorest tropical countries, and overwhelmingly in sub-Saharan Africa, that nobody even bothers to keep an accurate count of clinical cases or deaths. Those who remember that richer places such as Spain, Italy, Greece and the southern United States once harboured the disease may be misled into thinking that the problem is one of social institutions to control its transmission. In fact, the sporadic transmission of malaria in the sub-tropical regions of the rich countries was vastly easier to control than is its chronic transmission in the heart of the tropics. Tropical countries are plagued by ecological conditions that produce hundreds of infective bites per year per person. Mosquito control does not work well, if at all, in such circumstances. It is in any event expensive.

Recent advances in biotechnology, including mapping the genome of the malaria parasite, point to a possible malaria vaccine. One would think that this would be high on the agendas of both the international community and private pharmaceutical firms. It is not. A Wellcome Trust study a few years ago found that only around $80m a year was spent on malaria research, and only a small fraction of that on vaccines.

The big vaccine producers, such as Merck, Rhône-Poulenc’s Pasteur-MérieuxConnaught and SmithKline Beecham, have much of the in-house science but not the bottom-line motivation. They strongly believe that there is no market in malaria. Even if they spend the hundreds of millions, or perhaps billions, of dollars to do the R&D and come up with an effective vaccine, they believe, with reason, that their product would just be grabbed by international agencies or private-sector copycats. The hijackers will argue, plausibly, that the poor deserve to have the vaccine at low prices—enough to cover production costs but not the preceding R&D expenditures.

The malaria problem reflects, in microcosm, a vast range of problems facing the HIPCs in health, agriculture and environmental management. They are profound, accessible to science and utterly neglected. A hundred IMF missions or World Bank health-sector loans cannot produce a malaria vaccine. No individual country borrowing from the Fund or the World Bank will ever have the means or incentive to produce the global public good of a malaria vaccine. The root of the problem is a much more complex market failure: private investors and scientists doubt that malaria research will be rewarded financially. Creativity is needed to bridge the huge gulfs between human needs, scientific effort and market returns.

**Promise a market**

The following approach might work. Rich countries would make a firm pledge to purchase an effective malaria vaccine for Africa’s 25m newborn children each year if such a vaccine is
developed. They would even state, based on appropriate and clear scientific standards, that they would guarantee a minimum purchase price—say, $10 per dose—for a vaccine that meets minimum conditions of efficacy, and perhaps raise the price for a better one. The recipient countries might also be asked to pledge a part of the cost, depending on their incomes. But nothing need be spent by any government until the vaccine actually exists.

Even without a vast public-sector effort, such a pledge could galvanise the world of private-sector pharmaceutical and biotechnology firms. Malaria vaccine research would suddenly become hot. Within a few years, a breakthrough of profound benefit to the poorest countries would be likely. The costs in foreign aid would be small: a few hundred million dollars a year to tame a killer of millions of children. Such a vaccine would rank among the most effective public-health interventions conceivable. And, if science did not deliver, rich countries would end up paying nothing at all.

Malaria imposes a fearsome burden on poor countries, the AIDS epidemic an even weightier load. Two-thirds of the world’s 33m individuals infected with the HIV virus are sub-Saharan Africans, according to a UN estimate in 1998, and the figure is rising. About 95% of worldwide HIV cases are in the developing world. Once again, science is stopping at the ecological divide. Rich countries are controlling the epidemic through novel drug treatments that are too expensive, by orders of magnitude, for the poorest countries. Vaccine research, which could provide a cost-effective method of prevention, is dramatically under-funded. The vaccine research that is being done focuses on the specific viral strains prevalent in the United States and Europe, not on those which bedevil Africa and Asia. As in the case of malaria, the potential developers of vaccines consider the poor-country market to be no market at all. The same, one should note, is true for a third worldwide killer. Tuberculosis is still taking the lives of more than 2m poor people a year and, like malaria and AIDS, would probably be susceptible to a vaccine, if anyone cared to invest in the effort.

The poorer countries are not necessarily sitting still as their citizenry dies of AIDS. South Africa is on the verge of authorising the manufacture of AIDS medicines by South African pharmaceutical companies, despite patents held by American and European firms. The South African government says that, if rich-country firms will not supply the drugs to the South African market at affordable prices (ones that are high enough to meet marginal production costs but do not include the patent-generated monopoly profits that the drug companies claim as their return for R&D), then it will simply allow its own firms to manufacture the drugs, patent or no. In a world in which science is a rich-country prerogative while the poor continue to die, the niceties of intellectual property rights are likely to prove less compelling than social realities.

There is no shortage of complexities ahead. The world needs to reconsider the question of property rights before patent rights allow rich-country multinationals in effect to own the genetic codes of the very foodstuffs on which the world depends, and even the human genome itself. The world also needs to reconsider the role of institutions such as the World Health Organisation and the Food and Agriculture Organisation. These UN bodies should play a vital role in identifying global priorities in health and agriculture, and also in mobilising private-sector R&D towards globally desired goals. There is no escape from such public-private
collaboration. It is notable, for example, that Monsanto, a life-sciences multinational based in St Louis, Missouri, has a research and development budget that is more than twice the R&D budget of the entire worldwide network of public-sector tropical research institutes. Monsanto’s research, of course, is overwhelmingly directed towards temperate-zone agriculture.

People, food and the environment

Public health is one of the two distinctive crises of the tropics. The other is the production of food. Poor tropical countries are already incapable of securing an adequate level of nutrition, or paying for necessary food imports out of their own export earnings. The HIPC population is expected to more than double by 2030. Around one-third of all children under the age of five in these countries are malnourished and physically stunted, with profound consequences throughout their lives.

As with malaria, poor food productivity in the tropics is not merely a problem of poor social organisation (for example, exploiting farmers through controls on food prices). Using current technologies and seed types, the tropics are inherently less productive in annual food crops such as wheat (essentially a temperate-zone crop), rice and maize. Most agriculture in the equatorial tropics is of very low productivity, reflecting the fragility of most tropical soils at high temperatures combined with heavy rainfall. High productivity in the rainforest ecozone is possible only in small parts of the tropics, generally on volcanic soils (on the island of Java, in Indonesia, for example). In the wet-dry tropics, such as the vast savannahs of Africa, agriculture is hindered by the terrible burdens of unpredictable and highly variable water supplies. Drought and resulting famine have killed millions of peasant families in the past generation alone.

Scientific advances again offer great hope. Biotechnology could mobilise genetic engineering to breed hardier plants that are more resistant to drought and less sensitive to pests. Such genetic engineering is stymied at every point, however. It is met with doubts in the rich countries (where people do not have to worry about their next meal); it requires a new scientific and policy framework in the poor countries; and it must somehow generate market incentives for the big life-sciences firms to turn their research towards tropical foodstuffs, in co-operation with tropical research centres. Calestous Juma, one of the world’s authorities on biotechnology in Africa, stresses that there are dozens, or perhaps hundreds, of underused foodstuffs that are well adapted to the tropics and could be improved through directed biotechnology research. Such R&D is now all but lacking in the poorest countries.

The situation of much of the tropical world is, in fact, deteriorating, not only because of increased population but also because of long-term trends in climate. As the rich countries fill the atmosphere with increasing concentrations of carbon, it looks ever more likely that the poor tropical countries will bear much of the resulting burden. Anthropogenic global warming, caused by the growth in atmospheric carbon, may actually benefit agriculture in high-latitude zones, such as Canada, Russia and the northern United States, by extending the growing season and improving photosynthesis through a process known as carbon fertilisation. It is likely to lower tropical food productivity, however, both
because of increased heat stress on plants and because the carbon fertilisation effect appears to be smaller in tropical ecozones. Global warming is also contributing to the increased severity of tropical climatic disturbances, such as the “one-in-a-century” El Niño that hit the tropical world in 1997-98, and the “one-in-a-century” Hurricane Mitch that devastated Honduras and Nicaragua a year ago. Once-in-a-century weather events seem to be arriving with disturbing frequency.

The United States feels aggrieved that poor countries are not signing the convention on climatic change. The truth is that these poor tropical countries should be calling for outright compensation from America and other rich countries for the climatic damages that are being imposed on them. The global climate-change debate will be stalled until it is acknowledged in the United States and Europe that the temperate-zone economies are likely to impose heavy burdens on the already impoverished tropics.

New hope in a new millennium

The situation of the HIPC s has become intolerable, especially at a time when the rich countries are bursting with new wealth and scientific prowess. The time has arrived for a fundamental re-thinking of the strategy for co-operation between rich and poor, with the avowed aim of helping the poorest of the poor back on to their own feet to join the race for human betterment. Four steps could change the shape of our global community.

First, rich and poor need to learn to talk together. As a start, the world’s democracies, rich and poor, should join in a quest for common action. Once again the rich G8 met in 1999 without the presence of the developing world. This rich-country summit should be the last of its kind. A G16 for the new millennium should include old and new democracies such as Brazil, India, South Korea, Nigeria, Poland and South Africa.

Second, rich and poor countries should direct their urgent attention to the mobilisation of science and technology for poor-country problems. The rich countries should understand that the IMF and World Bank are by themselves not equipped for that challenge. The specialised UN agencies have a great role to play, especially if they also act as a bridge between the activities of advanced- country and developing- country scientific centres. They will be able to play that role, however, only after the United States pays its debts to the UN and ends its unthinking hostility to the UN system.

We will also need new and creative institutional alliances. A Millennium Vaccine Fund, which guaranteed future markets for malaria, tuberculosis and AIDS vaccines, would be the right place to start. The vaccine-fund approach is administratively straightforward, desperately needed and within our technological reach. Similar efforts to merge public and private science activities will be needed in agricultural biotechnology.

Third, just as knowledge is becoming the undisputed centrepiece of global prosperity (and lack of it, the core of human impoverishment), the global regime on intellectual property rights requires a new look. The United States prevailed upon the world to toughen patent codes and cut down on intellectual piracy. But now transnational corporations and rich-country
institutions are patenting everything from the human genome to rainforest biodiversity. The poor will be ripped off unless some sense and equity are introduced into this runaway process. Moreover, the system of intellectual property rights must balance the need to provide incentives for innovation against the need of poor countries to get the results of innovation. The current struggle over AIDS medicines in South Africa is but an early warning shot in a much larger struggle over access to the fruits of human knowledge. The issue of setting global rules for the uses and development of new technologies—especially the controversial biotechnologies—will again require global co-operation, not the strong-arming of the few rich countries.

Fourth, and perhaps toughest of all, we need a serious discussion about long-term finance for the international public goods necessary for HIPC countries to break through to prosperity. The rich countries are willing to talk about every aspect except money: money to develop new malaria, tuberculosis and AIDS vaccines; money to spur biotechnology research in food-scarce regions; money to help tropical countries adjust to climate changes imposed on them by the richer countries. The World Bank makes mostly loans, and loans to individual countries at that. It does not finance global public goods. America has systematically squeezed the budgets of UN agencies, including such vital ones as the World Health Organisation. We will need, in the end, to put real resources in support of our hopes. A global tax on carbon-emitting fossil fuels might be the way to begin. Even a very small tax, less than that which is needed to correct humanity’s climate-deforming overuse of fossile fuels, would finance a greatly enhanced supply of global public goods. No better time to start than as the new millennium begins.

*Jeffrey Sachs is director of the Centre for International Development and professor of international trade at Harvard University. A prolific writer, he has also advised governments of many developing and East European countries*