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THE DIPLOMATIC IMPLICATIONS OF EMERGING DISEASES

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SINCE THE DISCOVERY OF ANTIBIOTICS in the forties, complacency in medicine has walked hand-in-hand with public credulity in the mistaken belief that all infection can be conquered by science. In 1967, the U.S. Surgeon General, William H. Stewart, was able to announce to a White House gathering that infectious illness was all but history and that health resources should now be diverted to "the new dimensions" of health, the chronic degenerative and neoplastic diseases.[1] That such optimism was not without foundation seemed surely vindicated with the announcement by the World Health Organization (WHO) a decade later that one of the vilest of infectious diseases, smallpox, had been eradicated from the world.[2] This optimism might be said to have reached its zenith in 1978 when the Member States of the United Nations signed the Alma Alta "Health for All, 2000" accord. In this scientifically naive and misleading (albeit it well-intentioned) declaration, all humanity would be immunized against most contagious disease, and basic health care would be provided to every man, woman, and child regardless of class, race, religion, or place of birth.

Why, half a century later, has the threat of a contagious plague, the very demon that science was to have banished from the globe, become an international issue of such magnitude as to merit inclusion under the title of "Preventive Diplomacy"? Why is it that medical science has

had to warn the politicians of the world that mankind is faced with the greatest threat ever to its existence, and why is it that the politicians of the world have been so reluctant to heed these dire predictions?

The issue is one that cannot be handled by doctors and scientists alone, nor by the political leaders of the world indulging in scientific isolation in expedient and ineffective measures. Rather there is an urgent need for medical science and the international body politic to join together in devising strategies that will permit man to come to terms with the microbe that now threatens his existence. Not alone must doctors and politicians work in harmony as never before, but there is also need for politicians to bring the nations of the globe together in a bond of international brotherhood the likes of which has hitherto been voiced only by idealists and philosophers.

Is the Threat of Global Plague a Reality?

There is a belief among politicians that doctors and scientists have been unduly alarmist about the threat of an imminent plague. In the euphoria of the 1940s and 1950s, the architects of national public health policies in the developed world seriously miscalculated by ignoring three factors that were to decimate their ambitions. First, they did not anticipate how modern travel would open up a reservoir of microbial infection with even greater potential than that which they hoped to conquer. Second, medical science was unaware of the microbe's potential to adapt and mutate in the face of the antibiotic assault. Last, and most important, they failed to anticipate how, paradoxically, the new bounty of developed society would lead to a change in sexual mores and to drug abuse, thereby facilitating the microbe to launch an offensive far more devastating than the threat antibiotics and vaccines had briefly presented to its existence.

If we view the microbe/human relationship as being symbiotic, as indeed it is for the greater part, but one that may be disturbed by a variety of factors from time to time, the balance that swung in mankind's favor in the decade or so after World War II, has now reverted dramatically in favor of the microbe. There is an urgent need, therefore, to prevent an irrevocable upset to the delicate balance between man and microbe. That this has occurred is evidenced by three disturbing changes in microbial behavior. First, diseases that were considered conquered only a few decades ago are reemerging.[3] Tuberculosis is the prime example with ninety million

new cases forecasted to occur during this decade alone.[4] Second, hitherto unknown illnesses are appearing at an alarming rate. Since 1973, twenty-nine previously unknown diseases have been identified; that is over one new disease every year! The most striking example of the new order is the AIDS epidemic, which has infected thirty million people and become endemic in every country in the world with an estimated global cost to humanity of $500 billion by the year 2000 according to the Global AIDS Policy Coalition at Harvard University.[5] Horrific though the AIDS epidemic is, it could have been very much worse.

Had HIV been transmitted by droplet in the air rather than being dependent on transmission in bodily fluids, the devastation would be incalculable. And there are much nastier microbes than HIV, Ebola being an example, waiting for the subtle mutation that will permit a global pandemic so speedily that international health services as they exist would be readily overwhelmed. The third feature of microbial behavior to cause concern, and the one that causes greatest human misery and suffering, is the acquired facility of one microbe to thrive on the circumstances created by another, as has happened, for example, with tuberculosis and AIDS. The global tragedy of this symbiotic relationship is reflected in the economic impact of removing, not the infant or the elder (and fiscally unproductive forces of society) but the youthful work force on which nations, particularly those in the underdeveloped world, are dependent for survival.

These disturbing developments prompted the Institute of Medicine in 1991 to bring scientists together to discuss the threat of a contagious pandemic. The outcome was a carefully reasoned treatise entitled *Emerging Infections: Microbial Threats to Health in the United States.*[6] The scientific conclusions were, first, that the threat of a global pandemic was real, and, second, that existing facilities were not equipped to anticipate or manage such an eventuality. Five years later the threat is all the greater and those improvements in our defense strategies, although significant, fall far short of what is needed to protect mankind from a virulent pandemic.

What Preventive Strategies Can We Devise?

How then can we apply "preventive diplomacy" to cope with the epidemics of emerging diseases that now grasp the headlines? That the topic deserves inclusion in such discussion should go without

saying, but there has been global political reluctance to even acknowledge the reality of the microbial threat let alone prepare means for overcoming it. If the world was now poised on the brink of World War III, or if nuclear war was to become a reality, frenzied and intense political and diplomatic activity would quite rightly be initiated across the world. Yet, as we speak, the forces with the potential for devastating mankind are growing in strength, deriving that strength ironically from the very practices that mankind has devised to improve his lot. If preventive diplomacy is to be effective, it must be acknowledged at the outset that its success will be dependent on an unprecedented level of international accord and cooperation simply because these illnesses that threaten us, though local in origin, are already global in potential. In short, the terms in which we consider the human condition, at least insofar as international diplomacy is concerned, need to be rethought.

I propose to consider, first, the *preventive strategies* that global diplomacy might achieve, and then the *diplomatic implications* of implementing such strategies, under the following broad headings:

- Strengthening international disease surveillance
- Establishing international public health stations and strike forces
- Preventing biowarfare
- Preventing disease transmission
- Improving medical practice
- Studying microbial behavior
- Modifying sexual behavior and intravenous drug abuse

Strengthening international disease surveillance

The most pressing need and the most effective first line of defense against the microbe is the acquirement and dissemination of scientific information on infectious organisms. As Jonathan Mann, of the Harvard AIDS Institute, has put it: "A worldwide 'early-warning system' is needed to detect quickly the eruption of new diseases or the unusual spread of old diseases. Without such a system, operating at a truly global level, we are essentially defenseless, relying on good luck to protect us."[7] Relying on luck could well be the downfall of *Homo sapiens*.

The technology for the establishment of a global surveillance system is available, the scientific will and skills are at hand, international

boundaries need no longer be barriers to communication, and yet, the question that has to be asked is simply, has man the wisdom to utilize these advantages to secure survival? The answer is in the affirmative, but, disturbingly perhaps, the provision of the need arose from an individual's vision rather than from the collective deliberations of international diplomacy.

In 1986, at a peace conference in Budapest, Dr. Bernard Lown first introduced the concept of "space for health." With the Reagan Administration aggressively pursuing its "Star Wars" defense policy, Dr. Lown, who had previously mobilized medical opinion into an effective force against nuclear weapons when he founded International Physicians for the Prevention of Nuclear War (which was awarded the Nobel Prize for Peace in 1985), offered a more enlightened vision: "When people gaze at the heavens," he said, "they should do so with hope not with dread."[8] This philosophy spawned SatelLife, which has developed into one of the most significant forces against the threat of microbial plague.

Lown's vision of the heavens was rooted in pragmatic reality. He realized that impoverished though the developing world might be according to the more readily identifiable economic factors, the greatest impoverishment was "information poverty."[9] He realized, moreover, that any efforts to satisfy this need would have to be affordable and easily implemented in the poor countries of the world.[10] Though telecommunication systems are improving across the world, a telephone line is a luxury in many of the poorer countries and will remain so for years to come. In Zimbabwe, for example, the average waiting time for a telephone line is 5.3 years, in Tanzania it is 10.9 years, and in Nepal, 48 years. Thus, whereas telecommunication technology is revolutionizing life in the developed world, most of the world's population has never even made a telephone call. Nor are they ever likely to be able to afford to do so even if the technology was available. A three-minute phone call from Burundi to Botswana at about $23 is twice the annual per capita expenditure on health.[11]

These considerations were to be the cornerstones of a philosophy that led to the formation of SatelLife in 1987. The first step was to purchase two LEO (low earth orbit) satellites at a cost of about $3 million (paid for by private donations), which were launched from Arianspas, the European space agency, in 1991 and 1993. Each satellite, which is roughly the size and shape of a small refrigerator, orbits

the earth at an altitude of 800 kilometers, every 100 minutes, passing over every point of the earth at least three times each day when contact can be established with strategically placed ground stations. These ground stations, which cost about $10,000, can also serve as nodes linking many individuals, institutions, and hospitals to the satellite via modem if the telephonic infrastructure permits. SatelLife's computer-based network, known as Healthnet, is administered from SatelLife's Boston headquarters and now connects some 4,500 health care workers in twenty-five countries. The poorer countries of Botswana, Cameroon, Congo, Ethiopia, Gambia, Ghana, Kenya, Mali, Malawi, Mozambique, Tanzania, Sudan, Uganda, Zimbabwe, Brazil, and Cuba can obtain information and advice from centers of expertise in Canada, America, Britain and Australia and in turn the information they provide swells the Healthnet database. SatelLife is now poised to extend its reach to forty countries.[12]

SatelLife has given physicians and health care workers in poorer countries the unique opportunity to seek the help and expert advise of their colleagues in the affluent world as soon as they are confronted with an unusual disease. This system provides, for the first time in human history, a means for doctors to communicate directly with each other from the remotest parts of the world. Moreover, and most importantly, a doctor in a poor tropical country faced with a bewildering illness, such as tomorrow's Ebola, can communicate his fears to his colleagues without the restrictions that he would formerly have had to face using a communication system subject to official government clearance.

Having established an economical and efficient system of international communication, the next objective of SatelLife was to provide information and knowledge to those countries so deprived of the essential ingredient for medical advancement. As Lown has stressed, the information gap between the rich and poor countries is enormous. Kenya's leading medical center in Nairobi can afford to subscribe to only 15 medical journals, whereas Harvard Medical School receives more than 6,000.[13] Healthnet users, apart from seeking information, are also the beneficiaries of a variety of educational services. A weekly electronic publication, *HealthNet News,* provides current abstracts from leading peer-reviewed medical journals that are considered relevant to the needs of the developing world. Professionally moderated electronic conferences are organized to provide

the latest information on emerging diseases, AIDS, and essential drugs. The National Library of Medicine has provided the necessary software facilities to permit researchers to conduct electronic researches of over one hundred databases and to receive the full text of articles. Healthnet has also begun to link its users with Internet but cautiously, not alone because of the considerable costs in developing countries but because the information on the Internet is excessive and often inappropriate for the needs of the developing world. "In short, it isn't enough, at least as far as health care is concerned, to lay down the communication lines. The quality of the information that transits those lines must be assured."[14]

These and other developments presently being incorporated in the Healthnet system offer the poorer countries of the world information from which they have been too long deprived, and, in the long term, they will mean much more than the often misplaced fiscal aid directed from the affluent to poorer countries of the world. Ironically, the success of SatelLife might well be threatened by the fiscal might of the telecommunications industry, which will endeavor to expand to the developing world without regard for the needs of impoverished regions nor for their means to sustain expensive technology. The lessons of providing expensive medical technology that was both inappropriate and unsustainable should not be ignored by the World Bank when it comes to investing in telecommunications. WHO estimates, for example, that 20 to 40 percent of all medical equipment in developing countries is now unusable, either because the facilities necessary for use were unaffordable or because the costs of maintenance could not be sustained.[15]

The most ambitious surveillance system ever devised was known as the Program for Monitoring Emerging Diseases (ProMED), sponsored by the Federation of American Scientists. It was to rely on a vast international network of monitoring systems that would detect diseases emerging in hospitals and clinics, agricultural crops, livestock, animals, and water supplies. The system was also to have capabilities to act as a watchdog on the development of biological weapons. Such an elaborate system could only operate with the full support of the United Nations, but many of the scientists involved in its design were skeptical of giving control to WHO or the Center for Disease Control and Prevention (CDC) in Atlanta. So, at the end of much scientific deliberation, the scientists had no option but to return to their political masters for the necessary finances to imple-

ment their programs with the predictable inevitability that the politicians went on debating while continuing to bolster so-called defense issues at the expense of basic health care.[16] The CDC, which, allowing for many criticisms and indictments of its policies, emerges nonetheless as the corporate hero in many battles against the microbe, recognizes the danger of an imminent pandemic and is aware also of the vulnerability of global defenses against such an occurrence. In 1994 the CDC requested $125 million from Congress to augment what it perceived to be its paltry system of surveillance and response; it received $10.95 million![17]

However, ProMED is now functioning economically using SatelLife's Healthnet. Inaugurated in 1993 at a Geneva conference co-sponsored by sixty prominent experts in human, animal, and plant health, a steering committee comprising representatives from WHO, CDC, the National Institutes of Health, and the International Epizootic Organization, was established.[18] This remarkable network of expertise and the educational facilities it can provide enhances greatly the reach and capability of Healthnet, making it a system, in my view, worthy of whatever assistance we can muster under the title of *Preventive Diplomacy.* For example, the sooner SatelLife is extended to Asia and South America and linked to the remaining countries of the developing world, the sooner scientists will be able to augment the knowledge already lodged in the database and provide an increasingly wider range of reference information. The imperative for such expansion should be a priority for international diplomacy. If the developed world recognizes the importance of disease surveillance then it should be possible to impress the need for surveillance on the developing world and, as importantly, to provide the necessary funding for this. International cooperation will be an essential ingredient of a successful disease surveillance system. As has been dealt with by other contributors to this symposium, the need to be able to identify potential areas of conflict and disaster before the simmering pot boils over would be of considerable assistance to worldwide health-surveillance systems, because such information would permit a preventive health policy to be drawn up for an area of potential conflict. Therefore, any international system for disease surveillance must be capable of integration with other early-warning networks, such as those outlined by Professor Gurr (chapter 8).

Developments in computer technology are such that it is now

possible to establish an international laboratory providing the means of instantly classifying microbes, of studying their behavior, and of determining their genetic potential. With the establishment of genetic databases, such as the GenBank at Los Alamos National Laboratory in New Mexico, and GenInfo at the U.S. National Library of Medicine, doctors and scientists in developing countries will be able to screen and match viruses and bacteria in their patients with those in the genetic data banks. Moreover, the exchange will not be one-sided with the information on microbial characteristics and behavior from the corners of the earth creating in time a database of comprehensive magnitude that would not have been possible before the age of the microchip. This may ultimately prove to be man's greatest weapon against the microbe.

Establishing International Public Health Stations and Strike Forces

However comprehensive global surveillance systems may be, their ultimate efficacy is dependent on how they are used, and this requires skilled workers in the field at the likely locations of disease emergence. Whereas the developed countries have public health systems of varying efficiency, many developing countries have nonexistent or inefficient public health services. But even in the rich developed nations, public health services need to be bolstered in preparation for the microbial assault. Americans, and indeed the rest of the world, like to believe that the United States has an efficient public health service, but what may once have been the case is now far from the truth. Horton has stated the reality bluntly: "The U.S. public health system is falling apart."[19] Of the many glaring inefficiencies of the U.S. public health service, suffice it to state that each year almost seventy thousand adults die from diseases that are largely preventable by vaccination—influenza, hepatitis B, and pneumococcal infection. The inconsistency of the U.S. administration in investing resources in public health, whatever the shortcomings for its own health policies, has provided the experimental model to demonstrate clearly that control and prevention programs for infectious diseases simply cannot succeed without a health service capable of their implementation. Put another way this means that when a government is shortsighted enough to deprive its public health services of funding, it pays dearly for such parsimony in hav-

ing to provide the health care facilities to cope with the resultant resurgence of diseases.

If this is the state of affairs in the United States, the situation in the developing world is far worse, and there is an imperative for the developing world to select key areas in which to establish field stations of public health by improving whatever services already exist, such as in missionary hospitals. The affluent countries of the world must develop a more altruistic attitude to the public health requirements of their less well-to-do neighbors so that the provision of essential health services is seen as being in the interests of global survival, rather than as merely the granting of aid to be repaid at a later date.

Even with adequate computer-linked international surveillance, as provided by Healthnet, in place and a network of field public health stations in the areas of the world most at risk, there will be a remaining requirement to augment the local public health stations in the time of national epidemics carrying the potential for pandemic spread. This can be best achieved through the dispatch of trained strike forces from centers of excellence and expertise in the developed world.

The Office of Emergency Preparedness and the National Disaster Medical system has a panel of some 4,200 private-sector doctors and nurses who are committed to rapid mobilization in cases of emergency.[20] This system should be expanded, perhaps through international cooperation, and financing might be shared to provide the necessary forces to contain major epidemics threatening not only the United States but the world at large.

WHO, recognizing that "national health has become an international challenge," established a new division in Geneva in 1995 named The Division of Emerging, Viral, and Bacterial Diseases Surveillance and Control (EMC). The objectives of the EMC are "to strengthen global surveillance of infectious diseases, to rebuild the international infrastructure necessary to recognize, report, and respond to emerging and resurgent infectious diseases, to foster applied research, and to enhance the international capacity for infectious disease prevention."[21]

The European Union has initiated the European Programme for Intervention Epidemiology (EPIET) with the stated objective of "raising the level of expertise on outbreak and intervention epidemiology and to establish a network of people to meet the external obligations

and the internal demands of an increasingly borderless continent."[22] The EMC can mobilize specialist strike forces within twenty-four hours to arrive at the site of an outbreak to begin control and containment measures. At the same time, WHO can put into effect the international health regulations appropriate for the outbreak.[23] The rapid response by the EMC and CDC to the recent outbreaks of Ebola in Kikwit and Gabon demonstrated clearly how effective strike forces can be.[24]

The question as to who should control public health strategies and surveillance networks is crucial to their success and is one that international diplomacy should address. The Secretary-General of the United Nations, Boutros Boutros-Ghali, once said, "The lesson I learned in Cairo still applies. The only way to deal with bureaucrats is with stealth and sudden violence."[25] Perusal of the literature on recent epidemics of reemerging and new disease epidemics would urge one to take this philosophy a step further and to recommend removing the bureaucrats from any part in the overall decision making of international disease surveillance processes, while recognizing their essential role in the infrastructure of any such system. In particular military influences should be kept to a minimum. There are sound practical reasons for ensuring that any surveillance system has international independence. By charter, the United Nations has to respect national sovereignty, which in effect means that any of its agencies, including WHO, cannot intervene in a disease crisis without an official invitation of the government.

That there is urgent need to establish an efficient controlling body is apparent from an examination of the international public health facilities for studying and researching new and reemerging contagious diseases. In a survey conducted by WHO in 1995, only six laboratories in the world met security and safety standards that would make them suitable sites for research on the world's deadliest microbes. Two of these laboratories in Russia are compromised by political instability and financial priorities, and two in the United States and one in Britain are likely to be compromised by budgetary reductions. In another exercise WHO assessed the ability of thirty-five international disease-monitoring laboratories to identify a variety of organisms. Only one, the National Center for Infectious Diseases at the CDC correctly identified all the microbes; most were correct in fewer than half.[26] What these and other similar surveys indicate is that despite the undoubted advances in medical science and technol-

ogy and the availability of excellence in some laboratories, no single agency—the CDC, WHO, the military, or nongovernmental agencies—currently has the resources, staff, or equipment to act swiftly and effectively to deal with an outbreak of a virulent contagious disease.[27]

Examples about our vulnerability, which is a measure of our state of unpreparedness and incapacity to coordinate our not inconsiderable defenses abound, not least among them was the outbreak of Ebola Zaire among laboratory monkeys at the Reston Primate Quarantine Unit in Virginia, a few miles from the nation's capital. The handling of this event, which had much potential for the doomsday epidemic now being popularized in fiction, has drawn strong criticism from at least one quarter: "... the single occasion of a potentially species-threatening event in the United States produced a disquieting response which exposed remarkable passivity and arrogance among the American research community. Little has happened since to suggest that this same mistake would not be repeated. The rule that secrecy equals safety still holds in the government's public health service."[28] The startling peregrinations of the Ebola virus from Zaire to Reston should serve to illustrate how humanity is now poised continuously on the brink of catastrophe. We know not what microbial mutation is about to emerge with the capabilities of sweeping inexorably through the world. The Reston experience, subsequent confirmation that Ebola can be transmitted by aerosol in the laboratory,[29] and the recent outbreaks of Ebola fever in Gabon[30] and yet again in northern Zaire,[31] should serve to warn us how vulnerable we are and how very inefficient (and lucky) international health agencies have been in the face of an impending pandemic. This tale indicates the need for close cooperation between the politicians and their agencies, such as the military and defense, on the one hand, and an *independent* knowledgeable public health service on the other. I stress the word *independent*. Doctors and scientists must be allowed to voice their opinions and recommendations for action openly; military scientists and doctors for the most part are behoven to their political masters and cannot freely voice their concerns.

Preventing Biowarfare

An effective global surveillance system must also have the facility to detect the perversion of microbial biology for use in warfare. It seems perhaps inconceivable that any nation could countenance harnessing

microbial life as a weapon of war, but that the threat of biowarfare is real is evident from, for example, the outbreak of plague in India, where disturbing reports have indicted genetic engineering of *Yersina pestis* for biowarfare as the cause of the epidemic. There was then the threat that Saddam Hussain would use biological weapons in the Persian Gulf war and the alarming specter of the Aum Shinrikyo cult in Japan, which was prepared not only to release toxic sarin gas in a Tokyo subway, but also to prepare vast quantities of *Clostridium difficile* bacterial spores for terrorist use.[32] This example illustrates a rather frightening aspect of contemporary existence. It is no longer necessary for the mad scientist of fiction to have vast resources of wealth, technology, and labor to threaten the world. With modest equipment and relatively modest skills, he can manufacture a deadly cocktail in a homemade laboratory. One hundred kilograms of a lethal sporulating organism, such as anthrax, spread over Washington by a crop duster could cause well over two million deaths.[33] Even worse to contemplate is the prospect that a scientist acting in misguided isolation or as part of a team in a backward country could utilize genetic engineering to produce a lethal germ capable of decimating the population of a hostile country. In short, man has the capability of literally joining sides with the microbe to facilitate its ultimate supremacy.

Surely one of the major objectives of international diplomacy must be to ensure that an effective ban on biowarfare is instituted without delay and seen to be effective. One-hundred and twenty-five nations have signed the Biological Weapons Convention but that agreement has many weaknesses.[34] For example, the U.S. Department of Energy suspects that the Russian and Ukrainian governments are not complying with the Convention but has little power to enforce restrictions.[35] The ambivalence of attitude and the apathy of expression of the military leaders and body politic of the developed world to the global proliferation and use of land mines must not be allowed to influence international accord in urgently enforcing a strict embargo an all forms of biological warfare.

Preventing disease transmission

Three developments of modern society are greatly enhancing the microbe's ability to transmit disease, namely, airplane travel, overcrowding in cities, and, in times of disaster, refugee camps and modern agricultural practices.

Disease transmission by airplane: When man walked the earth his ability to infect others with whatever disease he had acquired was limited to the distance he could cover on foot during his lifetime. When he took to the seas he extended the range of infectivity and brought diseases endemic in his homeland to populations with no immunity, often with devastating consequences for the virgin community. Smallpox and measles were brought to the New World with disastrous results for the indigenous population, which wilted under the relentless spread of disease while the invader pressed on, protected by immunity acquired over generations.

The jet airplane is the modern equivalent of the ship of the past. The number of passengers traveling by international flights soared from 2 to 280 million between 1950 and 1990, and it is anticipated that 600 million passengers will travel on international flights by the year 2000.[36] The entire world has become accessible to the modern traveler who can bring a multiplicity of diseases with him from continent to continent. It is estimated that one million people cross an international border every day of the year, and that one million people travel between the industrial and developing worlds every week of the year. Yet the microbe had the potential to traverse the globe long before the age of air travel. The virus responsible for the 1918–1919 influenza epidemic managed to circumnavigate the planet five times in 18 months, killing 22 million people. Should such a virus reappear in 1996 when some half a billion passengers will board airline flights, the death toll could be devastating.[37]

Not only is the modern jet traveler transported swiftly as the vector of illness, but the jet plane also permits the transport of microbes in many other ways. Infected insect vectors, such as mosquitoes, for example, have ready access to airplanes and the transport of live infected animals is proving a most serious threat. There is a large and lucrative airborne trade in exotic animals as pets and perhaps, more important, in the provision of animals for laboratory research, mostly monkeys. The 1989 Reston outbreak of Ebola-type virus in laboratory monkeys was an example of how potentially threatening this form of transmission can be.

One of the major problems with air travel as distinct from sea travel is the speed with which a journey is accomplished. Animals and people travel within the incubation period of most infectious illnesses when the carrier is asymptomatic but highly infectious. Thus many people may become infected and have mingled with and

infected many hundreds more in the crowded environment of a city before the illness is diagnosed.

The airplane also serves as a means of disease transmission by virtue of its enclosed atmosphere, which utilizes recirculated air laden with microbes. With increasing financial competitiveness, the expensive circulation of fresh air in airplanes has been reduced, thereby facilitating the spread of infection among passengers. Though the risk of airborne transmission of infection in airplanes from one passenger to another is thought to be small, there has been a recent disturbing report of transmission of drug-resistant tuberculosis from an infected woman to other passengers.[38]

What then can be done from a preventive viewpoint to minimize the international dissemination of disease by air travel? Restrictive quarantine measures for airline passengers are not practical, and there is probably no effective way of reducing the transmission of disease by passengers or the crew of airplanes, other than by ensuring that patients suspected of having contagious disease are not allowed travel and by reducing the frequency of air recirculation on airplanes. Surveillance systems at airports have proved inadequate and very costly, simply because the incubation periods for many incurable contagious disease exceeds 21 days.[39] However, the transport of animals by air is another matter. Following the Reston monkey scare, much stricter quarantine and importation regulations are now in force in the U.S., but these need to be applied to the rest of the world. The transport of diseased animals, whether in the pet, laboratory, or agricultural industries must be recognized urgently for what it is, a massive pool of potential infectivity that the airplane can transport from one part of the world to another. Only by enforcing strict internationally accepted quarantine regulations at both the countries of exportation and of importation can this vast microbial traffic be halted. Constant international vigilance will be required because the pet and laboratory animal trade often originates in poor countries where such regulations are more likely to be flouted.

Disease transmission with overcrowding: The refugee camp is a phenomenon of modern civilization, which can present itself in affluent Europe as readily as in impoverished Africa. The combination of overcrowding, poor sanitation, and inadequate public health services provide an ideal environment for a variety of microbes to thrive and mutate. Diseases, such as cholera and dysen-

tery, are predictable in such circumstances, but the resurgence of drug-resistant illnesses, such as tuberculosis, and the spread of newer diseases, such as AIDS, are serious developments that will have repercussions extending far beyond the refugee camp. Should a new disease, such as Ebola, emerge in the setting of a refugee camp, the conditions would be perfectly in place for a global plague. Refugee camps must be recognized as one of the most dangerous phenomena of contemporary society, and the prevention of human disasters that create the homeless refugee must become a priority of modern diplomacy.

The world is in greater state of flux than at any time in its history and nowhere is this more manifest than in the migration to cities. According to the UN High Commissioner for Refugees and the Worldwatch Institute, 30 million people moved from rural to urban areas within their own country in 1994, and an additional 23 million were displaced by war or social unrest.[40] It has been estimated that in 1993 more than 21 million people on earth were living in circumstances ideal for the emergence of microbial diseases.[41] The rural exodus to the cities has swollen the urban population of the world from 275 million in 1985 to 750 million in 1995, and it is estimated that the figure will rise to 1.3 billion by the end of the century.[42] At present 45 percent of the world's population live in cities. Cities have been likened to "huge human sponges" soaking up sixty-one million new people each year.[43] The first city to reach a population of one million was Peking in 1750, and by the start of the twentieth century eleven cities had achieved this status. In 1994, the ten most populated cities of the world ranged from Tokyo with 26.5 million to Seoul with 11.5 million. Cities with populations of more that 8 million are classified by the United Nations as mega-cities. They are growing faster in the poorer parts of the world where shanty slumlands become, in effect, urban refugee camps, providing an ideal habitat for the adventurous microbe—the so-called "microbial metropolis,"[44] examples being São Paulo, Calcutta, Bombay, Istanbul, Bangkok, Teheran, Jakarta, Cairo, Mexico City, and Karachi.[45]

The mega-city provides the ideal environment for microbial propagation. Here human deprivation and disadvantage afford also the greatest opportunities for avarice and exploitation and the expression of human nature in the extremes of behavior. Hedonism and depravity go hand-in-hand with virtue and piety. Man's sexual proclivities, the quest for nefarious pleasures, thriving black markets

in legitimate drugs, such as antibiotics, and in drugs for intravenous abuse guarantee the microbe ready transmission as well as the ideal circumstances for mutation. From these teeming metropolises those with further-reaching ambition, those who are successful in business and trade, those who have thrived in the burgeoning underworld that the mega-city supports so readily, and the opportunist aspire to expand their horizons and inevitably reach the developed countries of Europe, America, and Australia accompanied, of course, by a coterie of ubiquitous microbes, like their human vectors, in search of opportunity. A message of preventive diplomacy to the governments of the world should be, therefore, to recognize that the creation of mega-cities is not desirable. Whereas it might be argued that little can be done to alter the mega-cities in existence, national policies should in future be directed toward developing modest cities throughout a nation rather than concentrating growth in the capital city.

Changing agricultural practices: The emergence of another new disease, initially in cattle as bovine spongiform encephalopathy (BSE) and, possibly, in humans as Creutzfeldt-Jakob disease, is the most daunting example of how modern agricultural practices can facilitate the spread of disease from animals to humans.[46–47]

The BSE epidemic in cattle and the potential association Creutzfeldt-Jakob disease in humans demonstrates the need for international preventive diplomacy to ensure that those with a vested interest in societal practices, such as farmers, are not permitted to obstruct the implementation of national policy, as was the case with feeding specified offals to cattle in Britain. However, the basic lesson should be to correct the practice of feeding farm animals specified offals and, on a broader scale, to anticipate how modern agricultural techniques aimed at providing rapid profits will alter microbial behavior so as to facilitate the transmission of disease in animal food to man.

Improving Medical Practice

Hand in hand with every progressive step made by civilization is the inevitable companion of reaction, the adjustment that can be so costly; nowhere is this better illustrated than in the remarkable therapeutic, interventional, and technological advances that have taken place in medicine in the last half-century. Not only has organ trans-

plantation become an everyday procedure, but life-support mechanisms dependent on the placement of interventional lines from the outside environment into the innermost recesses of the human body are commonplace. These procedures result in the creation of an artificial body milieu, with ready microbial access to the internal organs which is often facilitated by prolonged debility, metabolic imbalance, and deliberate suppression of the immune defense mechanisms. The startling advances in surgery and trauma management owe their success in large part to efficient and safe blood transfusion services. Initially the problems with transfusion were simply those of donor/host incompatibility, which was solved by cross-matching blood for incompatibility. A far greater form of incompatibility was around the corner, that of transfusion-transmitted viral disease, which has caused such enormous illness and suffering. This tragic and unique form of disease transmission has been facilitated by human sexual behavior and intravenous drug abuse.

Advances in medicine have also been dependent on the abolition of infection, which, in the pre-antibiotic era, claimed so many lives from infectious illnesses, such as pneumonia, but also limited greatly the success of surgery that more often than not culminated in death from sepsis. Again medical scientists failed to appreciate that in overcoming so many infections they had upset the delicate microbe/human symbiosis and that inevitably there would be a reaction. The microbe responded with frightening speed by adapting to antibiotics and producing lethal antibiotic-resistant strains.

Another benefit of medical advance has been the extension of man's life span with the creation of a state of existence not hitherto possible. Infants are now born in a state of prematurity, which even two decades ago was not possible. At the other extreme of life the elderly are living longer and longer. The microbe is able to take advantage of a premature developing immune system at the one extreme and of a failing one at the other. Moreover, the use of drugs and other mechanisms to combat infection has to be modified in the face of inadequate degrading and clearing systems at the extremes of life.

Can preventive diplomacy be applied to the discipline from which the term derives? Most certainly it can. Indeed preventive medicine walking hand in hand with preventive diplomacy possesses an immense potential for improving the lot of disadvantaged man. Medical science usually reacts with reasonable haste in identifying

the problems it has created, but medicine, as practiced in the day-to-day life of the hospitals and surgeries of the world, is remarkably slow in responding to the demands of changed circumstances. From a preventive viewpoint, there is a need to improve the international education of health care workers as soon as it becomes evident that a particular medical intervention has created a disease hazard. International standards should be drawn up and implemented, as, for example, in the blood transfusion services. Likewise, international standards for the detection and effective treatment of infectious diseases, such as tuberculosis, should be established. Regrettably, failure to implement such policies in developing countries with a high level of illiteracy is resulting in the emergence of the drug-resistant microbe.

Studying Microbial Behavior

Man will never be truly victorious in the battle against the microbe, but if a truce is to be declared—a restoration of the ecobalance between man and microbe—it will be brought about only by carefully planned and globally coordinated strategies. If man is to come to terms with the microbe, it will be because of his ingenuity in learning more about microbial diversity and behavior and his ability to develop newer drugs and vaccines to neutralize the illness caused by microbes.

At present scientific knowledge is paltry. It has been estimated that of some 5,000 species of viruses known to exist in the world, less than 4 percent have been characterized. The world population of bacteria is thought to be between 300,000 and one million, of which only 2,000 have been characterized.[48] This vast population is as mobile as the vectors in which they ride. Animal disturbance and human migration have caused massive shifts in the microbial population, most of which has been uncharted. We can anticipate, therefore, the appearance of many frightening diseases as man upsets the ecobalance more and more, and it can only be a matter of a short time before all the requirements for a pandemic spread of disease will be in place.

The success of the microbe is mostly attributable to its genetic ingenuity, and one of the main thrusts of scientific research should be toward genetic mapping of microbes. The nucleotide sequence

has been established for almost 50 percent of the *Mycobacterium leprae* genome, and it is anticipated that the complete sequence will be known within the next three years. Ironically, much less research has been directed at the genome of *Mycobacterium tuberculosis*, despite the fact that it causes much greater human suffering.[49] It is necessary for our politicians and diplomats to realize that for mankind to even achieve a truce in the battle with the microbe, mighty resources will have to be provided for scientific research and development.

Yet, the omens for more rational use of research resources are not auspicious. Tuberculosis kills more people than any other infection and has earned the distinction of being the only illness ever declared by WHO as a "global emergency." Yet of WHO's $1 billion budget, only about 14 percent has been allocated to tuberculosis research, and no new antituberculous drugs have been developed by the pharmaceutical industry since 1966.[50] The pharmaceutical industry is unlikely to invest, of course, in antituberculous drug development when 95 percent of cases occur in the poor developing countries unless such research is subsidized.[51]

With the Healthnet surveillance network in place, the potential for studying microbial behavior at the national level and then making that information available on an international database is feasible and should be of major relevance in combating infectious disease. But such an initiative requires the provision of scientists in remote and developing countries so that such information can be gathered.

Modifying sexual behavior and intravenous drug abuse

Mankind is unique among mammals (with the possible exception of the dolphin) in having no restricted season for sexual intercourse.[52] Moreover the inventiveness of man in devising unique ways of eroticizing copulation for pleasure rather than procreation has facilitated the transmission of sexually transmitted diseases that are increasing in variety at an alarming rate. These include genital herpes, gonorrhea, syphilis, human papilloma virus, viral hepatitis, and the human immunodeficiency virus. The proliferation of sexually transmitted disease has been facilitated by a general acceptance of promiscuity, gay liberation, travel and migration, a growing sex industry, increasing prostitution, deprivation, and overpopulation driving

women and children to earn a living from sex, and the phenomenon of intravenous drug abuse.

Perhaps if one had to single out one factor that will pave the way for a doomsday pandemic of illness it would be the increasing worldwide phenomenon of intravenous drug abuse. For most infectious diseases, infectivity is dependent on transmission of the microbe by intimate contact or by a vector such as a mosquito. The microbe in search of a host must truly have been surprised to find its potential victims providing a means of direct transmission by needle and syringe. Not alone did this new practice permit transmission from one host to another, but also by infected blood donors' contaminated blood for transfusion, thereby spreading illness to vast numbers in one fell swoop. The microbe was now free to diversify, and new or rare diseases became commonplace—AIDS, Kaposi's sarcoma, *Pneumocystis carinii* pneumonia, adult T-cell leukemia, hairy-cell leukemia, hepatitis B—and old diseases, such as tuberculosis, which had once been under control, became rampant.

Intravenous drug abuse, prostitution, and promiscuous sexual practices are partners of poverty and deprivation where illiteracy renders futile any educational efforts to avoid needle contamination or to practice safe sex. The imperative for modifying human behavior toward the betterment of mankind's general lot has been a feature of the human condition since the beginning of time and will no doubt be always thus. Space only permits its mention here, which is not to denigrate the importance of continuing campaigns to encourage safe sex practices and to reduce the transmission of infectious disease through contaminated needles and syringes. One of the paradoxes of human behavior is an inability to modify that behavior to cope with man's ever changing proclivities. For example, legalization and licensing of brothels and prostitution and the provision of clean syringes and needles for intravenous drug users may be far more effective ways of coping with the diseases consequent on such activities than declaring them criminal. However, the admission of such a reality is unacceptable to many for reasons that have no basis in rational thought. As to which measure may or may not be successful will always be a matter for debate but let the plea be for reasoned debate based on scientific and medical fact rather than devising ineffective solutions that have been influenced by religious and quasi-moral issues.

The Ultimate Aspiration—The Global Village

The preventive approaches discussed so far are capable of implementation immediately and those that are functioning are in need of urgent funding so that they can be developed and expanded into effective strategies. For this to happen the prescient concept of preventive diplomacy will have to be translated from discussion and recommendation into policy. There is also, however, a longer-term imperative that calls for a far-reaching view of the needs of humanity in the face of limited resources.

Since the industrial age, man's ability to modify his environment often has been a cause for wonderment, but the advances of the technological age have been such that man now has the ability to improve his environment out of existence. The consequence of this has been a reaction from ecologists and environmentalists calling for environmental awareness, or, if you like to use the medical analogy, calling for environmental health. Unfortunately, successful though the movement has been in certain instances, the forces of mendacity, founded on fiscal avarice, railed against it are such that any significant lasting influence may at best bring about isolated successes that are spurious in the overall context of global destruction. The fiscal interests of industry are so powerful, and the expediency of short-term gain so primordial when the scant time afforded to human existence is balanced against that of the universe, that the future success of controlling environmental threats like global warming, deforestation, urbanization, wet farming, pollution, and the extinction of animals may be an unrealizable ideal. Of the many insults wreaked by man on the globe, two are of particular importance in terms of emerging diseases, namely, overpopulation and overcrowding, both of which should be priorities for longer-term strategies of prevention.

Like any abode, the earth has a finite capacity to sustain its inhabitants. The difficulty is determining what exactly this capacity is. Many predictions have been attempted and in 1992, the Royal Society of London and the U.S. National Academy of Sciences warned that if population forecasts were correct, "science and technology will not be able to prevent either irreversible degradation of the environment or continued poverty for much of the world."[53] This is not in itself a doomsday statement, but it predicts perhaps a dooms-

day existence if viewed from the comfort of contemporary life in affluent societies.

When World War II ended, the world population was about 2.5 billion, and since then it has doubled. At present rates of reproduction world population is forecast to quadruple by the year 2050 and most of this growth will take place in developing countries that are least prepared to sustain an increase in population.[54] Demographic forecasts cannot anticipate, of course, the occurrence of calamities such as war, famine, and disease. With the threat of major war lessening, albeit it never to entirely disappear, the major global threat now is devastating plague. This eventuality is being facilitated by the inevitable epidemics that are now so much a part of global strife. The pitiful conditions endured in the population shifts of Europe and Africa bring into existence the refugee camps that provide an ideal environment for the microbe to thrive and mutate. It may be that nature has controlling mechanisms not yet identified, which become operative when fecundity poses a threat to survival, and when this occurs a natural culling is instigated.

It may not be unreasonable to take this train of thought one step further and to forecast that the recent microbial resurgence of new or exotic diseases and the reemergence of diseases that had been formerly contained heralds nature's solution to the problem of overpopulation, which the statesmen of the world's nations have been unable to contain globally. In fairness the furtherance of this resolve by many nations has been greatly hampered by the powerful influences of religion, encouraging procreation on the basis of a morality that is flawed in its inherent amorality. There remains, therefore, a universal challenge—that of reducing the population of the world while retaining a balance between races, between the underprivileged and the privileged, between the educated and the uneducated so that no one sector can proliferate to the extinction of the other. Perhaps the inherent atavism of the human condition is such that civilization can never aspire to such an ideal.

In the long term the survival of *Homo sapiens* will be reliant on the maturation of civilization as a whole developing to a stage where the world is seen not as a conglomeration of nations each vying with the other for largess but rather as a global home that must sustain us all. Such a universality of thought would permit the adoption of global policies on population control, eradication of extreme poverty and deprivation, the control of migration, and avoidance of the creation of

mega-cities with international policies directed toward preserving the environment from pollution, global warming, and the like. However unwelcome such a concept may be to some, it is likely that mankind will only guarantee survival by this means. Man and microbe are jostling for survival in a world that may not be able to sustain both. As man combats man, so microbes devour each other in a world as chaotic as ours. Yet when that world is under threat, as happened briefly in the antibiotic era, the microbes pooled their armaments—their genetic material—to stave off the enemy with a ruthless efficiency, which, happily for man, has not quite been perfected—yet!

The ideal of civilization, that of man living in global harmony with his neighbor, providing sustenance for ailing fellow man, banishing the evil weaponry of war, ensuring fair food for all and an equitable quality of life, and of protecting the environment in its huge totality as a priority, was seen as the preserve of the philosopher in former times and not a subject for common debate. Endowing the subject of our existence with an intellectual mien may have done a grave disservice to the advancement of civilization. Placing the responsibility for the interpretation of ecological science in the hands of our political masters was undoubtedly an even greater impediment to the development of civilized thought. Because common man has become aware of the relevance of ecology not so much for himself but for his successors, the ideals of an integrated caring global village have been moved forward. For once the aspiration of global harmony is being debated by common man and movements for nuclear disarmament and global protection, to mention but two examples, have forced politicians into actions that would not have resulted in the absence of such pressures.

Moreover, there have been pockets of notable success in the process of civilization, among which might be cited the enlightened social policies of some countries and the attempts to dismantle the boundaries of former strife in Europe. Which is not to say that civilization remains far removed from the dream of a strife-free world without boundaries. All of which leads to the consideration that if civilization is poised to take one massive stride forward, albeit a stride forced upon it by the threat of annihilation, this step must surely be to dismantle the boundaries of communication so as to permit free dissemination of information. If the legions of microbes arraigned against man recognize no national boundaries, it is

extreme folly for man to erect such boundaries, which restrict his ability to come to terms with the enemy. If mankind's global intellectual development has not reached a maturity sufficient to appreciate that survival almost assuredly depends on acting without delay, then Armageddon is nigh. If, on the other hand, the will to act, and to act immediately, is seized, the technology, the science, and, with thoughtful global husbandry, the resources are available to permit a restoration of balance between man and microbe.

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Chapter 15: The Diplomatic Implications of Emerging Diseases

In writing this paper I have relied for much detail on the comprehensive, if somewhat difficult-to-read (undoubtedly one of the worst-indexed books I have come across) study of the subject by Laurie Garret–*The Coming Plague. Newly Emerging Diseases in a World Out of Balance (*London: Virago Press, 1995), p. 750. The more readable and yet well-researched work by Arno Karlen–*Plague's Progress. A Social History of Man and Disease* (London: Victor Gollancz, 1995), p. 266, was also of great assistance and the thoughtful essays by Richard Horton, who is editor of the *Lancet,* have served to keep in focus the issues of a subject always in danger of becoming immersed in an apparent wealth of fact. Finally, I am indebted to John Mullaney, Executive Director of SatelLife, 1360 Soldiers Field Road, Boston, Mass. 02135, USA; tel.: (617) 789–5455; fax: (617) 789–4771; E-mail: hnet@usa.healthnet.org., who provided me with the latest developments in SatelLife and its computer network, Healthnet.

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EDITED BY KEVIN M. CAHILL, M.D.

A Joint Publication of BasicBooks and
The Center for International Health and Cooperation

BasicBooks
A Division of HarperCollins*Publishers*

1996