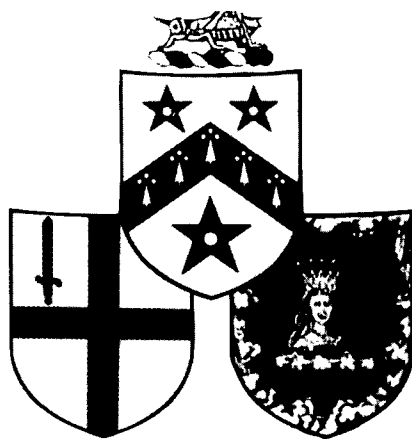


# *G R E S H A M* *COLLEGE*



## **HEALTH FOR ALL: EXPLODING THE MYTHS**

Three lectures by

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Lecture 1 - 7 March 1995  
**THE AIDS EPIDEMIC**

Lecture 2 - 14 March 1995  
**THE OVERPOPULATION PROBLEM**

Lecture 3 - 21 March 1995  
**CAN MONEY BUY HEALTH?**

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## The AIDS epidemic

### Introduction

In my previous series of lectures I discussed what I considered to be some of the outstanding problems facing biomedical scientists and also some of the ethical issues involved. I described the progress that had been made and some of the prospects for the future and, as we approach the beginning of the next century, we can look forward to a time in which everyone can expect to live longer and healthier lives; one in which preventative medicine will take the place of the medicine with which we are familiar today in which the majority of effort goes into curing infections or correcting things that have gone wrong. This is no pipe dream and the vast improvements in dentistry that have taken place over the last decade are good examples of the progress that can be made very cheaply and very quickly. Over the years, biomedical scientists have made vast contributions to the well-being of the human race but this has led to unreasonable expectations when scientists are suddenly faced with problems that they can not only not solve but really have no idea about how to proceed. It is then that those who are less informed come up with their own questions and solutions and nowhere is this more manifest than in the three areas I am going to discuss in this series of lectures, the AIDS epidemic, the population explosion and the financing of health. I shall begin by listing what I think are the ten most important myths about AIDS and, although I shall not try to comment on them one by one, I hope that by the end of the lecture you will agree that they really are all myths.

### Ten myths about AIDS

AIDS is the worst plague ever to have affected mankind

AIDS is not caused by a virus

AIDS did not originate in Africa

There is no AIDS epidemic

AIDS is a gay disease

There must be a cure for AIDS

Scientists are not interested in AIDS sufferers

Religion is not responsible for the spread of AIDS

It won't happen to me

There's no point in being tested for AIDS

### Is AIDS the most serious epidemic ever to threaten the human race?

This is not an unreasonable question and, to judge from the almost daily outpouring from the newspapers, AIDS is the most serious threat to human health that there has ever been and scientists are incapable of doing, or unwilling to do, anything about it. Nothing could be further from the truth but, in order to justify this statement, it is necessary to begin with some facts and to say something about AIDS, what it is, what causes it, what the size of the problem really is and how AIDS compares with other medical conditions. It is also only fair to point out that AIDS has generated a series of debates in which every claim and counter claim has been hotly contended and that everything I say has been disputed by someone somewhere.

Despite all the hype that surrounds this disease, AIDS is not the greatest threat from an infectious disease that mankind has ever faced and it is unlikely that it will be the last. We can only guess at the actual numbers affected by the Black Death which is estimated to have killed one third of the world's population which at that time stood at less than 500 million. More recently, the influenza epidemic of 1918-19 probably killed as many people as perished in the Black Death and the last plague pandemic at the end of the last century killed over six million people in India alone. To reach anything like the level of devastation inflicted by these epidemics, AIDS would have to kill about 2000 million people out of the current world population of over 5000 million. None of these diseases came anywhere near to wiping out the human race and nor will AIDS. The real problem with AIDS is that the epidemic has occurred at a time when everyone was led to believe that, following the introduction of antibiotics and the success of vaccines in the eradication of smallpox, infectious diseases would all pass into history in the same way.

### The origins of AIDS

Most scientists and clinicians believe that AIDS, Acquired Immunodeficiency Syndrome, is caused by infection with a virus, the Human Immunodeficiency Virus (HIV). Where the virus originally came from we shall never know for certain but all the evidence points to an origin in African monkeys which harbour similar viruses. Whereas it is taken for granted that infections such as yellow fever and malaria arose in this way there are those who contend that AIDS must have had some other origin. It is the way that the infection

is transmitted between humans, by sexual contact, that is the stumbling block here and those of a politically correct persuasion assume the unthinkable, that scientists believe that the transfer to humans must have occurred as a consequence of sexual contact with monkeys. This is absolute nonsense as the virus is easily transmitted with blood and the transfer could have occurred through a combination of eating infected animals and damage to the inside of the mouth. The virus does not seem to have been around in humans for very long and this is something else that has worried critics of the conventional story. Molecular studies suggest that the first human cases occurred between 100 and 200 years ago and simple mathematical models show that it would have taken many years before enough people became infected for it to be noticed and this would explain why AIDS was not perceived as a problem until recently.

There is, therefore, nothing unusual about the origins of AIDS and this contradicts the belief that many have that this disease is unique and is, for example, 'a punishment from the gods for the sins of mankind' or the displeasure of the gods for homosexual or promiscuous behaviour. I have dwelt on this particular point because it illustrates the kind of blind ignorance and non-scientific argument that characterises the so called 'AIDS debate'.

#### The spread of AIDS

There has been some reluctance among those concerned with racial matters to accept the fact that AIDS probably arose in Africa but the early origins of AIDS are largely irrelevant to studies on the prevention and cure of the disease. What is clear is that once in the human population the virus has thereafter been transmitted during sexual intercourse or through infected blood. There is no doubt that sexual transmission is facilitated by the presence of open genital sores and these are more common among the poorer and less developed peoples of the world than those living in more affluent situations. Although the first cases of AIDS have been traced to the 1950s, to all intents and purposes the AIDS epidemic began in the 1980s when the AIDS virus was introduced into new populations. There appear to be three distinct epicentres from which the virus has spread. In Africa, the growing population movements of migrant workers in search of work and the proliferation of prostitution contributed to the spread of the disease which is now endemic in the ordinary people in many communities particularly the major urban

conurbations. In Southeast Asia, the epidemic started in Thailand and Laos and spread with the cocaine traffic to Malaysia, Vietnam, Hong Kong and Brazil and from prostitutes to visitors to Bangkok and thence to all the major cities of Asia and Australia. In the United States and Europe, the intravenous use of drugs combined with promiscuous sexual behaviour were the precipitating factors. In all cases, the pattern of spread is similar. Particular sexually active individuals, usually men, acquire the infection from prostitutes or infected needles and transmit it to less sexually active wives or girl friends who then transmit it to their babies. The disease, which is at first confined to minority groups, then enters the general population particularly in Africa but also to a lesser extent elsewhere. Of those infected with the virus about half will develop full blown AIDS within ten years and thereafter the life expectancy is about two years. Although this is the general pattern, some individuals will develop AIDS more rapidly than this and some more slowly. This slow acquisition of AIDS is a statistical phenomenon but it has generated a number of false hopes.

#### The current AIDS situation

According to the most recent World Health Organization figures (December 1994) there are currently about 17 million individuals harbouring the AIDS virus and, as 6000 new infections are acquired every day, by the end of the decade this figure will have reached 30-40 million. The numbers with full blown AIDS are fewer (as would be expected with an infection that takes ten years to develop) about 350 000 but the worrying thing is that there has been a 60% increase since July 1993. Compared with a world population of over 5000 million, these figures may seem trivial but the real problems lie in the prevalence of the virus in particular groups. In Nairobi, for example, 60-80% of prostitutes, 20-40% of their clients and 5-10% of the general population are infected. More worrying is the fact that babies born to infected mothers are also infected. Intravenous drug use is rare in Africa but, elsewhere, the percentages of intravenous drug users infected are very high, 50% in Geneva and New York, 35% in Amsterdam and Edinburgh, 25% in Vienna and 5% in London. The foci of infections are, therefore, in the commercial sex and drug industries and spread from these into the general population. These overall patterns tend to conceal local details that are equally important in the maintenance and dissemination of the disease. For example, many African men prefer partners ten years younger than themselves

therefore sexually experienced males, who have been exposed to infection on a number of occasions, may acquire and pass the infection on to younger women of childbearing age. In some tribes it is the custom for a deceased husband's brother to take on his widow, a practice that has some genetic merit but one that can be devastating if the woman is harbouring the virus and there have been cases of up to five brothers becoming infected and dying in this way.

An understanding of the epidemiology of AIDS is a very important consideration in devising any method for the control of the disease as the methods must be appropriate to the needs of the particular communities at risk. This is something that has not been understood and I shall return to this point later.

#### The progress of the infection

As I said before, AIDS is caused by the HIV virus and, although there are those that are not convinced that this is the case, it is the perceived wisdom of the vast majority of scientists and clinicians. All viruses infect cells and HIV is no different except that it preferentially attacks lymphocytes known as CD4 cells. What is important about these cells is that they are central components of the immune system and exert total control over the direction that the immune response takes. Experimentally, animals without CD4 cells have great difficulty in overcoming infections as do humans born with a defect in these cells. AIDS infection usually takes a long time to develop. Early on, virus particles can be detected in the blood but as time goes by they become less easy to detect and are found only associated with CD4 lymphocytes. Throughout the incubation phase of the infection the level of circulating CD4 cells remains near normal but gradually begins to decline until there are so few of them that they are insufficient to drive an effective immune response against other invaders. The patient, therefore, succumbs to a variety of infections including tuberculosis or opportunistic infections such as pneumocystosis or cryptosporidiosis that have no adverse effects in healthy individuals. The hypothesis is that the virus gradually kills the infected CD4 cells but that the decline in their numbers does not occur until the multiplication of the virus outstrips that of the host cells. In essence, this represents a massive struggle between the virus and the host and one that the virus inevitably wins.

This theory has not been accepted by a minority of individuals of whom the most qualified to comment is Dr Peter Duesberg of Berkeley in California who has argued that AIDS is not caused by the HIV virus but results from other factors such as socioeconomic factors, drug abuse and some forms of medication. Duesberg's arguments have been taken up by certain elements of the press including the *Sunday Times* and this has resulted in acrimonious discussions between this newspaper and the widely respected scientific journal, *Nature*. The *Sunday Times* has also espoused the views of others who do not believe that AIDS is caused by a virus but that deaths attributed to AIDS, particularly in Africa, are actually due to malaria and tuberculosis. Unfortunately, this kind of analysis comes either from unqualified individuals or results from misunderstanding or misquoting those who do understand the situation. At the end of last year I had dinner with a Jesuit priest who runs an AIDS hospice in Nairobi and who had been quoted as saying that 'AIDS victims required tender loving care and good food.' In fact, this is what he did say but this was interpreted as meaning that tender loving care and good nutrition would prevent AIDS! Virtually all qualified scientists and clinicians now agree that AIDS is caused by the HIV virus and a number of gaps in our knowledge have now been cleared up and the valid scientific arguments articulated by people such as Duesberg have now been resolved. Briefly, the theory that the HIV virus gradually kills off all the infected CD4 cells has been replaced by one that maintains that the infection generates a population of 'killer cells' that kill the infected CD4 cells. The scientific arguments are difficult to summarise briefly but the new theory makes much more sense than the earlier one. However, the net result is the same, the depletion of CD4 cells to such a level that the integrity of the protective immune system is compromised.

Other arguments have also been put forward in attempts to discredit the concept that AIDS is caused by infection with the HIV virus. One such argument is that the increase in the numbers of those infected with AIDS has not been as rapid as would have been expected if the cause had been a virus but the fact is that, although the speed of the epidemic appears to have slowed down, the present figures are still within the predicted estimates for a disease with a viral cause. It has also been stated that haemophiliacs infected with contaminated blood products are less likely to develop AIDS than intravenous drug users thus the virus could not be the cause of the disease.



Again, sadly, this is not true and there is no evidence to suggest that infected haemophiliacs do not eventually die from AIDS.

#### The prevention of AIDS

In order to conquer any disease it is necessary to know the enemy and all current research is based on the assumption that AIDS is caused by a virus and that tried and tested methods of controlling viral diseases are the appropriate ones. Viral infections are not easy to cure with drugs and the best method of controlling them is by the use of vaccines which have been very successful. In this context, it is interesting to note that there are no drugs against smallpox or poliomyelitis yet these diseases have been eliminated or are about to be eliminated through the use of vaccines. Vaccines against AIDS are, therefore, our best hope for intervention. A number of conventional vaccines are being considered but the HIV virus does not seem to be susceptible to any of those currently being considered except possibly a genetically engineered one known as gp120. This has led to a major row between those who would like to see a really effective vaccine developed before it is tried and those who feel that any vaccine, no matter how effective or ineffective, should be released for general use. The vaccine in contention is gp120 which has been given the go-ahead by the World Health Organization for clinical trials in Africa despite the fact that the National Institutes of Health have not approved its use in the United States. Opponents of this vaccine are now torn between the argument that what is not good enough for Americans should not be foisted on Africans and those in America who feel that they are being deprived of a possible weapon against the disease.

Scientists are very cautious about the prospects for a vaccine. The AIDS virus is very variable and there are a number of types in different parts of the world. Types A and D predominate in Africa, type B in drug users in Bangkok and Type E in heterosexuals in the rest of Thailand. Even within these types there are further variants and, as vaccines rely on absolute specificity, these variations could prove to be a major constraint on any mass vaccination programme. The general feeling among scientists is that any vaccine against AIDS is unlikely to be 100% effective, most guess is that it might be 50% effective at best while a few argue that it would not have any effect at all. Recent observations suggesting that, during the final stages

of the infection, the immune response may actually turn against the body itself and that a vaccine might enhance the progression of the disease have left even the most optimistic more cautious.

However, there are some grounds for some optimism and mathematical models indicate that a vaccine with 30-50% efficacy would save a considerable number of lives. On the other hand, the major problem is who to vaccinate and when. Blanket coverage would be very expensive and targeting particular high risk groups would probably have only a minimal effect on the spread of AIDS.

A drug against the HIV virus would be desirable but the virus seems to have an in-built anti-drug defence mechanism. It is well known that most bacteria and parasites eventually develop resistance to the drugs used against them and the AIDS virus seems to be particularly adept at doing the same by a simple change in the sequence of its nucleic acids. Drugs can be effective and have been shown to clear 100 to 1000 million virus particles each day. However, this is only sufficient to match the reproductive rate of the virus itself and, at best, merely keeps the infection in check. The current drug Zidovudine (AZT) can, therefore, curtail the progress of the infection but cannot cure it. The costs of administering AZT for life with no prospect of an eventual cure presents both ethical and financial problems.

#### Prospects for the future

We now know enough about the virus to be able to move towards the developing of a vaccine and/or effective drugs but we also know that progress will not be easy nor likely to be 100% effective. We also know a lot about the epidemiology of the disease and how it is spread and this knowledge provides a sound basis for the design of any control programme. AIDS spreads in predictable waves and the infection passes from high risk to low risk groups. In western countries, the peak of infection in homosexual males seems to have been reached, the second wave among intravenous drug users has not yet peaked and the third wave among heterosexuals is only just beginning. In Africa, the peak among prostitutes has now been overtaken by that in heterosexuals. In Thailand, the first wave among intravenous drug users has been overtaken by the second wave in prostitutes and the wave in heterosexuals is only just beginning. There are also other major differences between different countries that we do not understand. In Africa, 40% of babies born to

infected mothers are themselves infected whereas in the developed world this figure is about 20%.

So what is to be done? Firstly, it must be recognised and accepted that AIDS is a viral infection and one that just happens to be less susceptible to vaccination or drugs than most others. Secondly, it must also be recognised that AIDS is essentially a sexually transmitted disease. This is not merely to justify the scientific position but to draw attention to the possible damage that can result from believing any other propaganda, for example, raising false hopes and disregarding preventative measures such as 'safe sex,' and clean needles. This also means that responsibility for the spread of AIDS lies with the individual. The lessons that should have been learned from correlations between tobacco and health, alcohol and health and alcohol and road safety have not been assimilated and there are always those who, in ill-informed opposition to what they believe is censorship, will always take a contrary view from everybody else. To quote from Julius Caesar, 'such men are very dangerous.'

Nevertheless, some action is necessary, and very quickly, a point taken up by the Paris AIDS Summit attended by forty-two Heads of Government or their representatives. The Summit began with strong words from Dr Hiroshi Nakajima, the Director General of the World Health Organization who said "The suffering, anxiety and courage of people infected, the extent of the threat of HIV/AIDS to all our societies, make it essential that we dare to be honest. Honest about figures, honest in words and in action" but ended with the Paris declaration that lists seven resolutions to combat AIDS:

- Support for a greater involvement of people living with HIV/AIDS at all levels.

- Promotion of global collaboration for research on HIV/AIDS.

- Strengthening international collaboration for blood safety.

- Encouragement of global care initiatives.

- Mobilization of organizations at all levels for a movement for the world's children.

- Support for initiatives to reduce the vulnerability of women.

- Strengthening the national and international mechanisms concerning human rights and biomedical ethics with reference to HIV/AIDS.

Unfortunately, it is obvious from the bland words of these declarations that honesty is somewhat lacking and that politeness and politics are more important than health. What is required is for governments of all kinds to take off the kid gloves and to educate people to the methods of transmission and dangers of AIDS even if it means changing whole ways of life. Another possibility might even be to consider writing off a whole generation in order to protect further generations, a policy partly adopted during two world wars. Those who are cynical might even think that the current AIDS epidemic is something that is welcomed by some governments who see the AIDS problem as being less important than that of overpopulation. Currently AIDS is reducing the population growth rates in many parts of Africa from increases of over 3% per year to negative values and this is something I shall discuss in my next lecture.

## The overpopulation problem

### Introduction

In my previous lectures I discussed with some enthusiasm the recent advances that have been made in the field of biomedical research with the ultimate aim of enabling people everywhere to live longer and healthier lives. This might seem to be a straightforward and laudable enterprise but the question that is always asked, and must always be in the background, is whether the successes achieved might actually make things worse for many other people by contributing to what has been called 'the overpopulation problem' and all that this entails in terms of crowding, pollution and even starvation. The use of the word 'problem' in this context is loaded and already embraces the assumption that there really is a problem. There are parallels elsewhere, for example the Irish problem, the refugee problem and so forth. Such phrases imply that the problem, if there is one, can be categorised as being due to the growing population, the Irish or the refugees. If one considers the so-called problems of overpopulation, the Irish or refugees it should be clear that the focus of the last two is incorrect and that the actual problem lies elsewhere. The same is true for problems associated with populations or, more emotively, overpopulation. In this lecture, I am going to suggest that there is really no overpopulation problem, at least at present, and that changes in culture and attitudes, rather than a reduction or slowing down in biomedical advances, could well prevent there being one in the future.

### Ten myths about overpopulation

There are a number of widely held ideas about overpopulation that have almost achieved the status of absolute truths but, when examined more closely, are actually myths. These can be summarised as follows:

1. The world population is increasing at an unstoppable rate.
2. The planet is unable to sustain this population growth.
3. There is no alternative to renewable resources.
4. Global warming will make things worse.
5. The real problem is in the developing world.
6. Decisions must be made by men and not by women.
7. Authoritarian measures do not work.
8. World religions have no part to play.

9. The problem is so bad that it is too late to do anything.
10. Scientists are behaving irresponsibly.

I do not intend to discuss these one by one but what I shall do is to try to discuss the growth in the world population in a rational way and to return to these ten myths at the end.

### The biology of animal populations

It is an established fact that all animal populations fluctuate with time. Population growth is characterised by first a slow and then a rapid rate of increase which reaches a plateau and then declines. The overall population size is controlled by the availability of resources the most important of which are food and space. Typically, an animal population grows until it uses all its food resources and then declines giving the food resource time to recover and for the pattern to be repeated. This is clearly seen in virtually all predator-prey interactions. Similarly, the growth of the population may be limited by physical space. In these two examples, food and space are the limiting factors but these do not operate independently, for example a population may run out of space before it runs out of food and *vice versa*. Thus there may be enough food but not enough space or enough space but not enough food. In order to survive, the members of the population must obtain for themselves sufficient of whatever resource they require for themselves and their offspring and this leads to two completely different situations, competition, in which some get all the resources they need while others get nothing, or scramble, in which all members of the population get something but none gets enough. From the point of view of any particular species, competition is more advantageous than scramble because at the end of the day some members will survive whereas in a scramble situation none will. It follows from this that selfishness is more advantageous than altruism.

Humans are animals and must, therefore, be subject to the laws of population growth. As pointed out above, the limiting factors are resources, chiefly food and space, and parallels with animal populations can be seen daily in the context of human societies. Examples include the inhabitants of the streets of big cities, refugees and the events that occur after natural disasters and it is those that can get the most that survive whereas those that cannot get enough perish. Throughout history, humans have found many ways to ensure

that the strong survive at the expense of the weak. In the past, colonisation has ensured the continual provision of resources for a privileged few, trade agreements between the powerful have formalised the exploitation of the weak and wars have further ensured that only the most powerful of the powerful have got and kept what they wanted. Wars have also served to keep populations in check. However, these situations, distressing as they may be, really only have any effect at a local level and contribute little to a reduction in the overall global population. What does control human populations on a potentially global scale is disease and I have discussed some of the effects of disease on the population of the world in my last lecture.

#### Human population growth

One thing that is agreed is that the population of the world is increasing. The following approximate figures give some idea of the magnitude of the situation.

<u>Date (AD)</u>	<u>Estimated world population</u>
500	100 million
1000	200 million
1500	500 million
1800	1000 million
1930	2000 million
1990	5000 million
2050	10000 million

The most significant feature of these figures is the trend which shows that the population of the world increased ten fold in the thousand years between the tenth and twentieth centuries whereas it is estimated that it will have increased another ten fold in only 250 years. There is, therefore, no doubt that the world population is increasing at a potentially alarming rate but this does not necessarily mean that there is a real problem at the present time and that nothing can be done about it.

#### The growth and stability of populations

The size of any animal population is governed by two elements, gain, represented by immigration and birth, and loss, represented by emigration and death. Where gain and loss are approximately the same, the population size

remains more or less constant but if one predominates the population will either grow or decline accordingly. This also applies to human populations and one can see examples of this every day at local, for example village, and national levels. On a world scale, however, the situation is even simpler and the only elements in the equation are birth and death as there is no immigration or emigration from this planet (except for the odd astronaut). Advances in medical science have altered the natural balance between birth and death by effectively increasing the number of births while at the same time decreasing the number of deaths. This has not been achieved by any major changes to the normal patterns of birth and death but by increasing the number of live births while at the same time prolonging lives. The net result is that more individuals enter the population while those that are already there remain in it for longer. The current rate of population increase can be calculated from an estimate of the numbers of individuals in a population at any one point in time and comparing these with the numbers at a point some time before, usually a year. World-wide the current rate of population increase is 1-3%, 1% in developed countries and 3% in developing countries. These figures might seem to be alarming but, compared with the past, are largely insignificant. For example, the rate of population increase in England and Wales in 1750 was 7%, in 1800 it was 11% and in 1817 it was 18%. When trying to put these figures into context it might be useful to compare them with inflation, 1-3% is tolerable whereas 18% is not. The point here is that the population of the world is increasing but not at an inexorable rate and the crisis, if there ever was one has either passed or has not arrived. If the crisis has passed then no action needs to be taken and if it is yet to come it is not too late to do something now. Discussions of population problems are not new and Tertullian in the second century AD wondered 'if pestilence and famine and wars and earthquakes have to be a remedy for pruning the luxuriance of the human race' while Malthus, in his *Essay on the Principle of Population* questioned whether we had the resource base required to feed the population of England.

#### The resource base

For any animal or human population the essential resources are food, space, water, air and energy and any one of the first four of these these can be a limiting factor on the growth of the population even if the others are abundant. Space presents no immediate problem on a global scale for humans



occupy only a tiny fraction of the habitable parts of the surface of the earth and, for all their disadvantages, cities are remarkably efficient at conserving space. Even within national boundaries new space can always be created as has been demonstrated in many parts of the Middle East particularly Israel. Neither Tertullian nor Malthus was concerned with water or air which should not be resource problems provided that they are not contaminated. It is gradually being realised, at least in the developed countries, that such contamination would be a waste of precious resources so, for the time being, shortages of water or air do not present insuperable resource problems. Food is the real resource problem not because there is not enough to go around but because of the inequality of its distribution and use. Those living in the developing world use about four times as much food per head as those in the developed world. However, there is also another problem and this is that much of the food produced, particularly in the developing world, is lost before it can be used because of disease. If food could be shared more equitably and more disease resistant food crops produced then there should be plenty of food for everybody.

It is rare to consider energy in the context of the human population problem but it is, nevertheless, essential for the maintenance of the kinds of developed societies that will be the norm in the world of the future. Most of the sources of energy currently available will run out and, in any case, the use of coal and oil causes vast amounts of contamination which affect the growth of food crops and the quality of air and water. The sun has the potential to provide limitless amounts of energy and the challenge facing scientists is how to trap, use and distribute this energy. Once again, this should not be an insuperable problem. However, there is a requirement for some form of energy to tide us over the period between the disappearance of conventional energy sources and the availability of entirely novel ones and this is nuclear energy. Nuclear energy is inexhaustible and the main problems at the present time are not the dangers inherent in any relatively new technology but the uninformed prejudices aroused by the discussion of its use. In passing, it might be worth mentioning that the accident at Chernobyl killed and adversely affected fewer people than have been affected during the normal working lifetime of any coal mine of a comparable size.

### Looking ahead

Summarising what I have already said, I suggest that the problem component of the so-called population problem is not the population but the availability of resources, and distribution of these resources, required to maintain the predicted growth. However, this is not to say that eventually the population will not outpace availability of resources and it would be irresponsible not to propose some ways in which a balance between population and resources could be achieved. We have already seen that the size of a population is determined by a balance between birth and death. Given that advances in medical science have prolonged the life spans of many people in the world, and everything is in place to extend this progress to the entire population, there can be no going back. The only solution is, therefore, to control the input into the population and this can only be achieved by a concerted effort directed towards birth control. This is not something that modern medical research can or should provide. What medical science can offer is the prospect of a long and healthy life and this means that the need for large families as an insurance for the future should no longer be necessary. In many parts of the world, particularly in the more developed countries, the rate of population growth is now less than 1% per year. In China, draconian State-imposed methods of reducing the size of families is beginning to have some impact; in India, the State is beginning to take action, through education, to stem the growth of population which is rapidly approaching 1000 million while in Latin America increasing prosperity has reduced the population growth to 1-2%, levels approaching those in the more developed world. In Africa, however, the rate of population growth is still above 3%. This means that the greatest increases in population growth are occurring in the poorest countries which are not only least able to cope but also have inadequate available resources to sustain the growing populations.

The challenges now are to try to understand why the population of Africa is increasing so rapidly and to educate people, particularly women, to accept the prospects of smaller but healthier families than they have ever done in the past. The only acceptable answer is some form of birth control.

At the beginning of this lecture, I listed ten myths about overpopulation and indirectly I have attempted to show why I consider these to be myths. In conclusion, I should like to return to these points and state precisely why

I think that they are myths

1. The world population is increasing at an unstoppable rate. The truth is that although the population is increasing it is not increasing at an unstoppable rate. There is still plenty of time to do something about it before it does become a problem.
2. The planet is unable to sustain this population growth. Again, this is not true, the planet does have adequate resources and the real problem is their conservation and equitable distribution.
3. There is no alternative to renewable resources. Eventually the sun should be able to provide all the energy required but in the meantime nuclear energy should not be neglected. This energy could be channelled into production of food crops and, coupled with the application of the technologies of molecular biology, should produce disease-free food crops that develop more rapidly and more efficiently.
4. Global warming will make things worse. I have not touched on this point but it should be possible to take advantage of the effects of global warming to enhance crop production.
5. The real problem is in the developing world. This is only partly true. Admittedly, population growth is more rapid in Africa than elsewhere but in other parts of the developing world this growth has been brought under control. Although the problem might seem to be located in the developing world, it is accentuated by the demands from the developed world and the inequitable distribution of resources.
6. Decisions must be made by men and not by women. This attitude is changing but still prevails in many parts of the world where population growth is greatest particularly among the poor and illiterate. Education and involvement of more women in lives outside the home and as equal partners in the economy and government of their countries should ensure that they do not assume that their sole role must be the rearing of children.
7. Authoritarian measures do not work. Authoritarian methods have worked

in China and it would be wrong to apply Western concepts of freedom elsewhere where the circumstances and requirements are entirely different.

8. World religions have no part to play. This is certainly not true and the Roman Catholic Church has much to answer for in this respect. There is no likelihood of any change in the attitude of the Catholic Church in the near future but widespread disregard of the church's teaching seems to be the rule in much of the developed world and in Latin America. The problem here is that it is now only among the poor and illiterate that the Church's teaching on birth control is most influential but with increasing prosperity and some of the other changes such as the perception of improving health and the changing role of women, things will probably change.

9. The problem is so bad that it is too late to do anything. This is something I repudiate. The problem is not out of hand and there is plenty that can be done. All that is lacking is the will.

10. Scientists are behaving irresponsibly. I do not believe that this is a myth (but I would say that, wouldn't I?). I maintain that scientists have contributed to the increase in the population of the world by reducing infant mortality and increasing longevity. However, the longer lives are also healthier and more productive ones and scientists have also provided the means of ensuring that population growth does not get out of hand.

In summary, I should like to make three points that cover the main topics I have covered this evening.

1. The first problem concerns not so much the population but the resources.
2. The second problem concerns not the availability of resources but their distribution.
3. The third problem concerns the will to do anything about the current inequalities.

Unfortunately, all three of these are outside the scope of biomedical research.

Can money buy health?

To begin at the beginning

This is my last lecture as Gresham Professor of Physic and it gives me an opportunity to take stock of some of the things I have covered in the six series of lectures during which I have outlined some of what I consider to be the major problems facing those involved in biomedical research. I have also offered some solutions and I have discussed a number of the social and ethical problems that have arisen. Throughout, my emphasis has been not so much on what biomedical scientists are doing but why they are doing what they are. In many ways this has been a kind of exploration and, in the words of T.S. Eliot,

'We shall not cease from exploration  
And at the end of all our exploring  
Will be to arrive where we started  
And to know the place for the first time.'

Here we are at the end of my exploring and I still believe what I believed at the beginning (1) that the control of infectious diseases is the key to world health, (2) that this aim is still worth pursuing and (3) that biomedical scientists have provided, and will continue to provide, means whereby everybody can expect a long and healthy life.

What is health?

The concept of health is, like many other concepts, easier to understand than to define but is best encapsulated by the World Health Organization's 1981 *Health for All* mission statement as 'a state of physical and mental well being'. The original ideal was health for all by the year 2000 and, although there has been some slippage, a vast amount of progress has been made and the possibility of a generally healthy world sometime in the foreseeable future is not unrealistic. However, there is now a widespread assumption that all that is necessary to achieve this end is the provision of more and more money. In each of my last two lectures I listed ten myths about AIDS and ten about the overpopulation problem but in this lecture I am only going to list one myth and this is: 'Money can buy health'.

I had not expected that, in a week that should have been dominated by reports on the World Summit on Social Development in Copenhagen, the main new items would be about a ten year old girl who had been refused expensive medical treatment and a 79 year old man who had not. Nor had I considered discussing individual cases, particularly as neither of these really has anything to do with health as I perceive it, but they do serve to focus attention on broader issues.

### The art of the possible

Nobody has better understood the working of a scientist's mind than Peter Medawar who, in his review of Arthur Koestler's *The Act of Creation* (*New Statesman* June 19th 1964), wrote that 'No scientist is admired for failing in the attempt to solve problems that lie beyond his competence'. If one applies the scientific approach to purely medical problems the only thing that really matters is the probability of success. Success can be measured in terms of years of healthy life that the procedure produces, quality adjusted life years in the jargon of the subject. There is, however, a third parameter - cost. It is possible to measure each of these three elements, the probability of success, the results in quality adjusted life years and the cost very accurately but, from a medical viewpoint, cost should not enter the equation. However, in all areas of modern medical care cost is considered and this distorts the emphasis on the other elements. Let us consider a procedure with a 100% probability of success at a cost of £100 and two patients aged 10 and 80. Which one should be treated? The obvious answer is both. However, if the cost is £100 000 the answer will almost certainly be different although the medical principles remain the same. Let us now assume that if the decision taken is to treat the 10 year old and not the 80 year old it follows logically that there must be a precise age between 10 and 80 at which the cut-off should apply. Extending this absurd logic, this point could be defined so precisely that one twin might be treated and one born five minutes later not. The introduction of a cost element into medicine has made a nonsense of the scientific approach to medical treatment.

Cost has entered the equation largely because the current provider/purchaser concept gives a distorted view of what medicine is really about and has directed attention towards treatment instead of prevention simply because it is easier to quantify immediate results than those that might not become

apparent for many years. Medicine had its origins in healing and the current focus is wrong and misdirected simply because it pays too much attention to the origins of medicine, in other words healing, and not enough to the world of the future and the aims of the World Health Organization's *Health for All* enterprise which, in order to succeed, must be based on prevention.

In terms of healing, resources will never be able to match demand, that is, the purchaser will never be able to afford everything that the provider can offer. Currently, antibiotics, new limb joints, transplanted kidneys and hearts and dialysis are all standard procedures unthought of a few years ago and it would be naive to think that there will not be many more procedures beyond our conception within a very few years. The real problem is that every advance is incrementally more expensive than the previous one and the purchaser is always looking out for improved products. At the same time patients are more informed and are making more and more demands on the safety and efficacy of procedures than ever before. Biomedical progress is now so rapid that the implementation of the whole of its provision will inevitably outstrip the ability of the purchaser to pay for it. Money will never be able to buy health in terms of healing. What is possible is that some money will be available to buy some form of healing but even then problems will arise. The invention of novel antibiotics for the treatment of common bacterial infections is an obvious area in which new research can and should be concentrated but what about an antibiotic specifically for use against a rare disease such as Lassa fever or for the treatment of a disease which has a very low chance of success? Currently biomedical scientists are free to pursue all of these aims. However, the inevitable consequence of unrestrained progress will be that available treatments will sooner or later have to be withheld on grounds of cost and that scientists will become disillusioned with what they are doing and will be forced to concentrate only on the main areas of research with the inevitable loss of new ideas and concepts.

#### Prevention is better than cure

Sir Thomas Gresham is best remembered for his 'law' that bad money drives out good and this applies to more than money for poor medicine also drives out

good as does poor medical practice. The concentration of effort on healing is bad medicine because prevention is a real and cheaper alternative to treatment for many diseases. Money can buy research and research can lead to new ways of preventing disease thus money spent on research into prevention is better than money spent on treatment. There is no doubt that prevention can work and examples in this country include the reduction in dental decay among young people, a reduction in the prevalence of cervical cancer as a result of intensive screening campaigns, a reduction in deaths and an increase in quality adjusted life years associated with giving up smoking and a decrease in industrial disorders following well focused legislation.

In the future, preventative medicine will replace much of the traditional healing medicine which is really only applicable when things have gone wrong. The ideal is to stop things going wrong or to deal with them before they get out of hand. None of us lets our car deteriorate to such an extent that it can only be put on the road as a result of extensive repairs yet our approach to preventative medicine is years behind our approach to vehicle maintenance. This need not be the case. In my previous lectures, I discussed a number of examples of the sorts of things that are occupying the minds of biomedical scientists. Research into the genetic bases of many diseases, including an understanding of the predisposition to diseases and the use of pre-natal screening to identify the more serious disorders, has already begun to show promise. New vaccines that can be given orally and only once are being developed and the underlying causes of disorders such as arthritis and those associated with old age are being investigated. The prospects for the future are very good and at the recent Human Genome Conference in San Francisco it was predicted that by the year 2020 it would be possible to develop a microchip capable of analyzing the whole of an individual's genome for about \$50. This analysis should be able to predict susceptibility to many diseases including cancers of various kinds that could be prevented by avoiding particular predisposing factors. It is already possible to predict the occurrence of cancer of the colon and in the United States individuals who know that they are at risk now regularly submit themselves for tests knowing that early diagnosis and treatment will prevent the disease from progressing to an untreatable stage. There is no doubt that breast cancers will soon be amenable to the same kind of approach.

I have already mentioned the progress that has been made in the prevention of



tooth decay and lung cancer, however, much of the good done is negated by commercial activities such as the advertising of sweets, cigarettes and diesel cars. I have also discussed the possible adverse roles of insurance companies in inhibiting individuals from obtaining their genetic profiles. Already, some people fear taking an HIV test because of the possibility of adverse discrimination. These fears may not be wholly justified and there is evidence that in the United States insurance companies are taking a positive attitude to genetic profiling because overall it should enhance the health of the nation. Those who find that they have a predisposition for some disorder and take medical advice would not be penalised but the real problem relates to those who do not take the advice proffered and might end up without insurance or pension rights for their dependents.

Here it is worth noting that the United States is investing millions of dollars in research into various aspects of genetic profiling whereas the United Kingdom is investing virtually nothing. This means that in the future, unless there is a fundamental change in attitude, British medicine will still be in the healing era whereas much of the rest of the developed world can look forward to an era of better health at much lower cost.

#### Health in the developing world

The World Health Organization's 1981 *Health for All* initiative was based on sound principles, namely to enable the third world countries to stand on their own feet. This initiative was based on three assumptions, that the economic growth rate in the third world, which was very encouraging at that time, would continue, that third world governments would be able to provide the necessary resources and that developed countries would provide aid. Unfortunately, the growth rate could not be sustained, the various governments were unable to provide resources and the recession in the developed world not only decreased the amount of aid provided but also reduced the demand for goods from developing countries thus contributing to the decline in their growth rate. Third world governments attempted to buy their way out of their crisis by heavy borrowing and, within a few years of the start of the *Health for All* initiative, African countries were spending a quarter of their productivity on debt repayments while in Latin America this figure was nearly half. In addition, loans used to finance massive capital projects required vast amounts of money simply to keep them going. Inevitably, third world governments

tried to balance their books and reduced their spending and education and health dropped to the bottom of the pile. Among the capital building programmes were hospitals and very quickly it became almost impossible to provide the equipment required and to repair broken equipment. Cut backs in education and a reduction in the numbers of people sent abroad to train (partly because of the increase in fees charged in Britain) reduced the numbers of skilled personnel available and foreign medical staff left because they could not do their jobs properly. The crisis is still not over and recently there has been serious criticism of the role of the World Bank which has been accused of burdening third world countries with debts that they cannot afford to repay instead of providing the funds that would enable them to become self-sufficient. Even as recently as the end of 1994 there has been another turn of the screw, resulting from the devaluation of the CFA franc by 50% and a disproportionate increase in the cost of imported medical supplies, which has affected fourteen countries and over 80 million people.

There are a number of lessons to be learned from the events that have taken place in the developing world over the past fifteen years and all of these suggest that health cannot be bought. For example, investments in capital projects such as hospitals do not necessarily bring improvements in health, it is unrealistic to aspire to the standards of developed world medicine without the infrastructure to sustain it and, in any case, developed world technology is not always appropriate to the needs and aspirations of developing countries. Faith in what money can buy has resulted in grandiose enterprises and has diverted attention away from cheaper, more realistic and more appropriate schemes.

### The legacy

The belief that money can buy health is seriously flawed as far as the developing world is concerned and idealistic schemes, such as north-south cooperative projects, the establishment of international research institutes and third world capability strengthening, have been counterproductive as they have encouraged the development of, and reliance on, inappropriate technologies.

### The solutions

It is easy to suggest solutions if one does not have to implement them but I

should like to make a few suggestions about ways in which the third world could begin to recover from the health crisis that it is presently in. First of all, the crippling debts should be written off. After this, the individual countries should begin again, this time with a more modest resource base, and set in train some basic plans for improvements in health such as the provision of clean water, local clinics, education and selective preventative health care. In Africa, each country should be encouraged to develop its own strategy to achieve minimally acceptable programmes of health care and to build on these. Developing these strategies should be the task of some of the many gifted African biomedical scientists who should be encouraged to apply their skills in such fields as epidemiology and operational research. These important areas use sophisticated but low cost technology and the scientists employed on such tasks need not feel that they have been relegated to the fringe of international science. Eventually, it should be possible for African countries with common interests to cooperate for common purposes, something that has been achieved elsewhere, for example the Central Coordinating Board for Tropical Medicine and Public Health Education of the Southeast Asia Ministers of Education Organisation (SEAMEO). Although money cannot buy health, the money that is available can be better spent.

#### In conclusion

I should like to end this lecture with three quotations. The first comes from Malaysia where there used to be a panel in the Institute of Medical Research in Kuala Lumpur which read:

'Modern medicine, , may it be curative or preventive, cannot be practised without adequate laboratory support and sustained medical research in the country'

The others come from the Heidelberg Appeal signed by 425 members of the scientific and intellectual community at the end of the Rio Summit in 1992:

'We draw everybody's attention to the absolute necessity of helping poor countries attain a level of sustainable development which matches that of the rest of the planet, protecting them from troubles and dangers stemming from developed nations, and avoiding their entanglement in a web of unrealistic obligations which would compromise both their independence and dignity.'

'The greatest evils which stalk our Earth are ignorance and oppression,

and not Science, technology and Industry whose instruments, when adequately managed, are indispensable tools of a future shaped by Humanity, by itself and for itself, overcoming major problems like overpopulation, starvation and worldwide disease.'

This leads me to the conclusion of this lecture in which I hope I have shown that money cannot buy health . What is left? The only thing that can ensure health for all is education and in no other field is the cliché 'If you think that education is expensive - try ignorance' more true. Money cannot buy health but it can buy education and education can indirectly buy health for all.