4
The Temporal Dimension of Global Health

'If you knew Time as well as I do,' said the Hatter, 'you wouldn't talk about wasting it. It's him.*'*

'I don't know what you mean,' said Alice.

'Of course, you don't!' the Hatter said, tossing his head contemptuously. 'I daresay you never even spoke to Time!'

'Perhaps not,' Alice cautiously replied; 'but I know I have to beat time when I learn music.'

'Ah! That accounts for it,' said the Hatter. 'He won't stand beating.'

Lewis Carroll, *Alice's Adventures in Wonderland* (1865)

4.1 Introduction

The temporal dimension of global change concerns how we perceive and experience time. Globalization is changing the timeframe of many types of social interaction, changes that are closely linked to the spatial dimension described in the previous chapter. In many ways, the speed at which we live our lives is accelerating. We feel it in our daily work and in our personal lives – the constant pressures of limited time. Life seems increasingly like a race against the clock, with more and more people to see, more things to do. In other ways, time seems to be decelerating. Large bureaucracies have come to symbolize modern institutions, slowed by their sheer size and complexity. Our efforts to move from one place to another are prevented at times by traffic jams and the prospect of gridlock on the main roads of many large cities. Our ability to obtain information may only be a few keyboard taps away, but our ability to digest the mountains of information available remains essentially static.

This chapter explores how changes to our perceptions and experiences of time, as a consequence of global change, have implications for human health. In many ways, our capacity to promote and protect public health is affected by the time available to us. How long does it take for health risks and opportunities to manifest themselves? How quickly can we mobilize the appropriate decisions, resources and actions to respond to a health need? What 'window of opportunity' do we have to effectively control an infectious disease and stop it from raging like a forest fire out of control? How long do we have to produce effective health interventions, such as vaccines and antimicrobials, to meet the health needs of today and tomorrow? What does sustainability mean in the context of short and long-term health needs? Following a discussion of the temporal dimension of global change, these types of questions are explored in relation to selected health issues. As with previous chapters, the topics explored are illustrative rather than comprehensive, serving to demonstrate the complex links between globalization and health.

4.2 Speeding up, slowing down: the pace of global change

> *How we construct and use our time, in the end, defines the texture and quality of our existence.*
>
> Robert Levine, *A Geography of Time* (1997)

As described in Chapter 3, globalization is having unprecedented impacts on how we perceive and experience physical space, in some cases redefining the way we organize and interact within territorial boundaries, in other cases, rendering them irrelevant. Closely linked to these spatial changes are the timeframes in which human interaction takes place. In many ways, social interaction is a function of physical distance, with the greater the territorial distance, the longer the timeframe for interaction to take place. However, as Scholte (2000: 48–9) writes, 'the world has long been "shrinking", as territorial distances have been covered in progressively shorter time intervals'. The advent of progressively faster, higher-volume and cheaper communication and transportation technologies have been at the heart of this 'shrinkage'. If place is no longer territorially fixed, as a strict definition of globalization asserts, then 'territorial distance is covered in effectively no time … Hence globality in the sense of transworld simultaneity and instantaneity – in the sense of a single world space – refers to something distinctive'.

In other words, this delinking of time and space means that social interaction is no longer necessarily a function of territorial distance.

The cost of sending electronic mail (e-mail), for example, is not dependent on the geographical distance between the sender and receiver, but the technology used and the nature (size, graphics versus text) of the message itself. The growth in popularity of video conferencing, virtual reality and internet 'chat rooms' arises from people's ability to come together regardless of physical distance from the organizing venue. Thus, as the concept of distance is less tied to physical geography, the rate and speed of certain social interactions and their consequences are being altered.

Our most immediate sense of the changing timeframe of social interaction in the globalizing world around us is that of increasing speed. To a certain extent, any social change generates certain feelings of nostalgia. Like the small town portrayed in the Frank Capra film, *It's a Wonderful Life*, successive generations can feel a sense of 'times past' when the pace of life was slower and seemingly more compatible with family and community life. Beyond nostalgia, life has objectively speeded up because of technological advances. In the workplace, the adoption of factory production lines, principles of 'scientific management' (Taylor 1911), and ever faster office machinery, such as the photocopier, and computing, has reduced the time taken to do a wide range of tasks. In the home, many so-called 'time-saving devices' have become mass consumer items (washing machines, dishwashers, microwave ovens) to free us (mainly women) from the drudgery of housework. Today, Gleick (1999) describes the contemporary world as filling up with fast-food drive-through restaurants, multi-tasking, speed dialling, instant credit and other time-saving features. Along with the capacity to live faster are pressures driving us to do so. The lives of many have become dominated by a constant race against the clock, some of it self-imposed by ambition and aspiration, but much of it integral to the pace and structure of postmodern society.

The technological capacity to live life at breakneck speed has been the enabling force for this acceleration of timeframes. Advances in transportation and communication technologies, in particular, have allowed us to interact at a far greater pace and intensity than ever before. Before mechanized transport, contact among population groups was regulated by the physical distance that people could travel by foot or animal. Natural barriers such as mountains and large bodies of water imposed certain limits to the geographical extent of such travel. The harnessing of new forms of energy by various modes of transport has permitted greater numbers of people to travel longer distances at a faster pace. The advent of the steam engine, for example, was a key development during the Industrial Revolution, opening up vast territories to European settlement and the establishment of intercontinental communication systems (for example postal services, telegraphy). Mass transportation in the twentieth century, via the burning of fossil fuels and the combustion engine – the automobile, jet aircraft – meant ever more people on the move. The availability of cheap commercial flights, in particular, has allowed ever-increasing numbers to travel frequently and more rapidly about the world.

Developments in communication and information technologies have had an equally dramatic impact on the speed and frequency of social interaction. Historically, the effective governing of any society has been strongly reliant on communication systems. Large empires, such as the Roman Empire, were highly dependent on reliable means of information flow from the centre to the farthest territories and back again. During the Industrial Revolution, the invention of telegraphy, radio and telephony during the nineteenth century allowed commerce and trade to flourish, as well as to facilitate the European colonization of far-flung territories. During the twentieth century, wire-based (telephone, fax, cable television) and radiowave-based (television, satellites, mobile telephones) modes of communication developed rapidly, progressively increasing the speed and reducing the cost of long-distance communication. By the last two decades of the century, the widespread use of personal computers, digital technology and ever-higher capacity microprocessors[1] (Table 4.1) began to lead to a merging of different media such as the Integrated Services Digital Network (ISDN). Such technologies have come to permeate so many aspects of everyday life. For example, any economic activities that require the acquisition of information, such as decisions about investment options, comparison shopping or sourcing inputs, can be done far quicker through the internet than traditional postal services, printed material or telephone (Butler et al. 1997).

It is important to recognize, however, that the temporal dimension of global change is not only about ever-increasing speed. The increasing scale and complexity of societies in a global age is a major social challenge because of larger populations, their geographical dispersal, and denser social networks among individuals and institutions. For example, members of a community have traditionally been defined by such factors as family name, birthplace, ethnicity or religion. Modern technologies enable us to become members of other types of communities, defined for instance by class, profession, gender, medical condition, political ideology or other special interest, that we can readily

Table 4.1 Developments in processing speeds of computers

Date	*Computer processor*	*Average speed*	*Average price*
1981	Intel 8086	4.77 MHz	US$5000
1982	Intel 80286	20 MHz	US$5000
1985	Intel 80386	40 MHz	US$5000
1989	Intel 80486	66 MHz	US$4000
1993	Pentium	166 MHz	US$3000
1995	Pentium Pro	200 MHz	US$3000
1997	Pentium II	450 MHz	US$3000
1998	Pentium III	1000 MHz	US$2000
2001	Pentium IV	2200+ MHz	US$2000

Source: Compiled from R. DeGrandpre (1999), *Ritalin Nation, Rapid-Fire Culture and the Transformation of Human Consciousness* (New York: W. W. Norton), p. 29; and Intel (2002), 'Processor Hall of Fame', <www.intel.com>

interact with across time and space. The proliferation of specialist websites and electronic 'listserves' embodies this proliferation of new 'virtual communities'. Depending on the intensity of the social interaction, members are bound together by shared goals, exchange of information and mutual support.

Our ability to wear multiple 'hats', however, can be restricted by our capacity to sufficiently sustain so many social identities. Being 'spread too thin' so that we have insufficient time to devote 'quality time' to each social identity is a common experience. Research on child development finds that parent–child relationships demand a certain amount of 'quality time' for healthy relationships to form. For instance, a study by Carlson et al. (1995) concludes that the imposition of a parent's timeframe on their baby's activities, rather than parental adaptation to the baby's pace, predicts distractability as an early precursor of later hyperactivity in middle childhood. Similarly, Whitelegg (1993) cites a novel by Michael Ende entitled *Momo* (1984) which depicts a small community persuaded by 'time thieves' to stop wasting time on idle conversations, care of the elderly and other communal activities. The result is not more available time but the mysterious vanishing of time: 'no matter how much time he saved, he never had any to spare; in some mysterious way, it simply vanished. Imperceptibly at first, but then quite unmistakably, his days grew shorter and shorter.' The novel refers to the breakdown of community as a result of our hurried lives, and the need for a greater investment of time to maintain appropriate relationships with families and friends. Whitelegg coins the concept of 'social speed' to describe the paradox that people feel they have *less* time despite the availability of faster modes of transport. This is because we use speed to travel further and more often, rather than saving time to spend elsewhere. Hence, we end up spending the same amount of time travelling overall, and perhaps even more, as congestion becomes a problem.

There are also aspects of human cognition that are resistant to time pressures. The greater availability of information, for instance, is not met by an equivalent capacity of the human brain to absorb and process this information. Faced with too much information, we experience 'information overload' which can slow our ability to act. This may be especially so in the health field. Health-related activities are the second most common use of the Internet, mostly by patients seeking information on conditions relevant to them. Indeed, health is a knowledge-intense industry, with doctors in the UK spending almost as long dealing with information (25 per cent of their time) as they do patient contact (Lister 2000: 182). Coiera (1996: 3) points to a potential problem in 'the mismatch in the speed with which new scientific results can be disseminated and the length of time required for careful peer review'. Similarly, the increased size and complexity of organizations of global reach can mean a slowing down of decision making and action. The term 'bureaucracy' in the late twentieth century has come to be synonymous with ponderousness, a reflection of the inverse relationship that can develop between the size of an organization and its capacity to act quickly.

Hence, there are dual forces impacting on our perception and experience of time amid globalization. In many ways, the technological capacity to live life in the 'fast lane' has led to social and cultural changes to our aspirations and lifestyles. In other ways, we are resistant to such pressures biologically, culturally and socially. Initially perhaps, it might be argued that the hyperactive, caffeine-addicted lifestyles of the so-called 'Type A personality' are limited to the world of big business and high finance of the industrialized world. In his study of the pace of life in different cultures, Levine (1997) argues that the concept of time is culture-specific. Switzerland, Ireland, Germany and Japan are judged as having the fastest pace of life,[2] Mexico, Indonesia and Brazil the slowest. It is argued here, however, that globalization is spreading the culture of speed to other countries, social classes and population groups. The result is that more and more of us feel like Charlie Chaplin in the 1936 film *Modern Times*, disoriented about the purpose of all of this frenetic modernity. For human health, there is a diverse range of consequences.

4.3 The global spectre of infectious disease: the quick and the dead

> *Moving such an infection across the Atlantic in the early sixteenth century must have involved a certain measure of chance, for the voyage was generally longer than a month, the average length of an active smallpox infection. Unless the passage were unusually fast, more than one previously unexposed person would have to be on board for the disease to be sustained across the Atlantic and thus passed to the Americans.*
>
> (Hays, 1998: 75)

> *The increase in international air travel, trade, and tourism will dramatically increase the prospects that infectious disease pathogens such as influenza – and vectors such as mosquitoes and rodents – will spread quickly around the globe, often in less time than the incubation period of most diseases.*
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> U.S. National Intelligence Council, *The Global Infectious Disease Threat and Its Implications for the US* (2000)

Time is central to the spread of infections. All infectious agents must spread to new hosts at a certain rate to reproduce. The course of an epidemic, for example, depends on the rate of contact between susceptible and infectious individuals. In the field of mathematical epidemiology, this is known as the 'mass action principle' which holds that 'the net rate of spread of infection is assumed to be proportional to the product of the density of susceptible people times the density of infectious individuals' (Anderson and May 1991). Also important is the interplay between the individual and the social/natural environment, along with the nature of the viral or bacterial agent itself. Some infections, such as influenza and measles, need to pass quickly to new populations or die out. In other cases, such as variant Creutzfeldt-Jakob disease (vCJD) and HIV/AIDS, there is a long incubation period before illness appears, during which the virus can be passed on to others. Still others have an ability to survive for long periods outside of living tissue (e.g. anthrax) or in animal reservoirs (e.g. plague). The complex interaction between infection and environment is well illustrated by cholera. Classical *Vibrio cholerae,* the strain of cholera of the great pandemics of the nineteenth century, was gradually replaced by the milder El Tor strain during the twentieth century. The former could kill within days, and even hours, from severe dehydration. As water and sanitation systems improved in Europe, such a rapid rate of mortality did not allow sufficient time for the organism to spread and infect others. El Tor cholera produced a milder and longer illness, as well as a higher number of asymptomatic cases. This enabled it to become the dominant form of cholera throughout the world (Lee 2001b).

The potential impact of globalization on the epidemiology of infectious diseases has been the subject of much high-level attention. From the late nineteenth century, improvements in sanitation, water supplies, nutrition and housing in many industrialized countries, along with advances in health care such as the availability of antibiotics and vaccines, led to a remarkable decline in infectious diseases such as tuberculosis, cholera, typhoid and smallpox. Life expectancy at birth increased from 25–30 years in 1700 to 70–75 years by 1970, largely achieved by a decline in deaths from directly transmittable viral and bacterial infections (Anderson and May 1991: 3). While infectious diseases continue to afflict many in the developing world, those living in high-income countries came to feel relatively safe and even complacent. Much was made of the 'demographic–epidemiological transition' defined as 'the process by which falling fertility and mortality produce markedly rapid declines in communicable disease among the young, leading to ageing populations with a rising proportion of older members among whom chronic disorders predominate' (Gwatkin et al. 1999). It was assumed to be only a matter of time before economic development, and thus the benefits of modern health care, would spread to poor countries.

Yet, even as the global eradication of smallpox was being celebrated in the late 1970s, an unprecedented achievement of medical science and international cooperation, dark clouds were on the horizon. Malaria, the target of eradication efforts for decades, was proving a resilient and even growing problem. Tuberculosis, quietly forgotten despite killing around one million people annually (primarily in the developing world), was declared a 'global emergency' by WHO in 1993. Twenty diseases that had been in decline have re-emerged or spread geographically between 1973 and 1999 including multi-drug-resistant forms of TB, malaria and cholera. And new challenges loomed. Twenty-nine new diseases were identified during the same period, of which HIV/AIDS is perhaps the most prominent. Worldwide infectious diseases are a leading cause of death, accounting for up to one-third of all deaths in 1998. By 2001, total deaths to date from AIDS surpassed 20 million (UNAIDS 2001a), thus exceeding deaths from the bubonic plague during the Middle Ages and influenza in 1918–19 (estimated 20 million each). Even in a wealthy country like the United States, there has been a doubling of deaths from infectious diseases since the late 1990s (US National Intelligence Council 2000).

These developments have shaken the confidence of the health community, and complacency has been replaced by fears that contagion is back with a vengeance. The element of time is central to these contemporary fears about the resurgence of infectious disease. As well as the changing spatial distribution of disease, there is growing evidence that current forms of globalization provide fertile conditions for the more rapid spread of certain infections. The movement of people via modern transportation systems, rapid urbanization without adequate water, sanitation and public health facilities, human-induced environmental changes (see Chapter 3), and the intensified exchange of goods and services may be contributing to the increased speed with which infectious agents can arise and spread worldwide. A new sense of vulnerability to infectious diseases, in short, has accompanied the present era of accelerating globalization (Kassalow 2001; Barks-Ruggles 2001). In this context, lethal diseases that are fastest to spread have captured popular imaginations. The dreaded Ebola virus has become mythologized as embodying the worst of nightmares among infectious diseases – the quick and the deadly.

The increase and spread of antimicrobial resistance (AMR) is another example of the importance of the temporal dimension of globalization to infectious disease. There are several links between globalization and growing AMR that require further study. Current evidence suggests that the overuse and misuse of antimicrobials, for human and veterinary use (such as for intensive rearing of animals for food production) are the key factors. By the 1970s more than 100 antibiotics were available but extensive misuse has one by one led to resistance. It is estimated that 20–50 per cent of the 145 million prescriptions given each year to outpatients in high-income countries are unnecessary (Stolberg 1998: 45), and up to 75 per cent of antibiotic use is of questionable therapeutic value (Wise et al. 1998: 609). Seventy per cent of all antibiotics are used for growth promoters in livestock. The above, coupled with the decline in public health systems that ensure appropriate use of such drugs, have directly contributed to the emergence of so-called 'superbugs'. These are microbes that are resistant to one or more of the arsenal of drugs that medical practitioners have come to rely on since the introduction of penicillin in 1943, to treat bacterial infections. The list of drug-resistant microbes grows steadily – *Streptococcus pneumoniae*, *Mycobacterium tuberculosis*, *Neisseria gonorrhoeae* and, perhaps most worryingly, methicillin resistant *Staphylococcus aureas* (MRSA) and

Vancomycin Intermediate-Resistant *Staphylococcus aureas* (VISA). More than 90 per cent of *Staphylococcus aureas* strains are now resistant to penicillin and a wide range of other antibiotics including methicillin, considered the penultimate line of defence before vancomycin.

The potential for these 'superbugs' to spread worldwide in a short time is already known. As Alexander Tomasz, Chief of Microbiology at Rockefeller University (as quoted in Stolberg 1998: 45), warns, 'These are international problems. The next wave of bugs is just a few days away.' For instance, a multidrug resistant strain of *Streptococcus pneumoniae* originating in Spain spread throughout the world in a matter of weeks during the early 1990s (US National Intelligence Council 2000: 10). The first case of VISA was detected in Japan in December 1996, and was followed by cases in the US from 1998 onwards. AMR has thus led to an intense race to develop new drugs before the effectiveness of existing ones, notably vancomycin, is undermined. A new generation of antimicrobials will take several years to develop and, if not achieved faster than the development and spread of AMR (bacteria divide once every twenty minutes), will mean a return to the pre-penicillin era when familiar infections could become fatal, routine surgery could become high risk, and new microbes could spread unchecked.

By their very nature, therefore, infectious diseases evoke within us an almost primeval fear, intensified by the prospect that globalization will 'level the playing field' in terms of susceptibility once again. While humanitarian concerns toward the afflictions of the developing world remain, there has been a certain degree of over-confidence that diseases such as TB, cholera and malaria remain 'over there'. Globalization changes this. Equally important, however, is the prospect that conditions in high-income countries are also leading to the emergence of new infections and threatening our ability to effectively treat infections through antimicrobials. In this sense, responsibility for addressing the changing nature of infectious diseases is global.

4.4 Fast food and slow death: diet and nutrition in a world hooked on speed

> *Prepared, precooked, prepackaged meals – all the descendants of the TV Dinner – now take up more supermarket space than fresh fruits and vegetables. They threaten to surpass the rest of the traditional stock: the mere ingredients of meals.*
>
> James Gleick, *Faster, the Acceleration of Just About Everything* (1999)

> *The reunification of Germany took place on October 3rd, 1990 … Two months later, eastern Germany had its first McDonalds.*
>
> Eric Schlosser, *Fast-Food Nation* (2002)

In traditional societies, food production and consumption occupy a substantial proportion of daily life. The industrialization of food has dramatically changed our relationship with food over time with trends towards larger economies of scale, mass production, highly specialized supply chains, widespread mechanization and the use of a variety of processing methods to add value. All of these changes have contributed to a reduction in time needed by most people to meet this basic human need. Yet these changes have important implications for our health.

On the production side, there has been a wide range of developments to meet the dual pressures of increasing demand for food by growing populations, and reducing costs in an increasingly competitive global market. Producers have sought greater yields through more intense farming methods such as battery farms for chickens, feedlots for cattle, and monocropping of single species and/or varieties of plants. This has been accompanied by selective breeding to produce fast-growing animals and plants with desirable qualities, and the increased use of fertilizers, antibiotics, growth hormones and increasingly genetic modification to speed production. The result has been a remarkable change in the rate of food production. Engel (2001a) notes, for example, that twenty years ago, broiler chickens were raised in 84 days. Today they are ready for slaughter in half the time. This has been achieved through selective breeding of chickens capable of turning feed into flesh quickly. Up to the 1940s, more than 90 per cent of American cattle were grass-fed, roaming cattle ranches and eating native grasses or hay. Grass-fed beef then needed to be hung for a few weeks before being sold and consumed. From the 1950s, cattle began to be penned into feedlots, fed cheap grains and later processed plant and animal by-products, and sold for consumption days after slaughter. Following such practices, the US company Monfort Inc. expanded its annual production capacity from 20,000 head of cattle in the 1940s to almost one million cattle per year today (Schlosser 2002)

As well as increasing yields, producers have added value to basic food products through greater processing. There are now at least 3000 different additives used in food processing, ranging from sugar and salt to artificial colours and preservatives. Additives are used for four main reasons: to enhance the appeal of foods; to improve nutritional value;

to facilitate processing (including stabilizers, thickeners); and to preserve freshness and prevent spoilage. The latter includes food irradiation, a method used to extend the shelf life of perishable foods (for example long-life milk) and thus increase their marketability.

Accompanying developments in food production have been corresponding changes in patterns of food consumption. In populations around the world, there is a clear trend towards food that takes less time to prepare and consume. High 'time intensity' staple dishes, even in low-income countries, are giving way to 'the selection of foods that require less time and skill to prepare and consume' (Drewnoski and Popkin 1997: 37). In the US, where changes in food practices are most prominent, three-quarters of meals a generation ago were made at home. Today, most meals are prepared outside of the home, mainly at fast-food restaurants. Roughly one-quarter of Americans buy fast foods each day. Between 1960 and 1997, the amount of ready chips that the average American ate increased from three and a half pounds each year to 30 pounds per year (Schlosser 2002). Along with highly processed foods, there has been a greater use of microwave ovens to cook and reheat food in a fraction of the time of convection ovens. Other inventions include foods that 'boil in a bag', toast and cook instantly by adding hot water.

There are a variety of reasons for the popularity of 'convenience' foods – the rise in the number of women in the workforce, gradual adaptation of palates to processed foods and, not least, the intense marketing of such products (see Chapter 5). Speeding the time needed for food production and consumption offers tangible benefits. There are clear pressures in some countries to increase yields to meet the needs of growing populations. The ability to store food for longer periods, without the risk of deterioration or contamination by harmful microorganisms, has been a major contribution of modern food production methods. Up to one-half of the world's food supply is lost after harvesting as a result of spoilage, infestation, and bacterial and fungal attack (Craft 1994). Methods such as canning, drying, freezing, pasteurization, heat treatment, use of preservatives and irradiation have extended the 'shelf life' of many foods. The risks from foodborne diseases are serious. Up to 70 per cent of diarrhoeal diseases, which cause about a quarter of all deaths in low-income countries, are due to infected food. The preservation of food also enables it to be consumed at different times of the year, or to be traded more widely, enabling a diversification of the nutritional content of human diets.

However, the adverse effects of the industrialization of food are also increasingly recognized. As described in Chapter 3, the globalization of the food industry has placed a strong emphasis on economies of scale and mass production, sometimes at the expense of quality, the environment and biodiversity. Furthermore, there are close links between the way food is produced and our health. One major concern is the rising incidence of obesity in many industrialized countries, and among the relatively affluent populations of middle and low-income countries. As a result of what Lang (1999b) calls the 'burgerization' of our diets, coupled with more sedentary lifestyles, the number of obese and overweight people has dramatically risen. The people of most high-income countries have been getting bigger, both in height and weight, over several centuries. Between 1750 and 1950, average British male heights increased by about 20 centimetres, and working-class 14-year-old boys by 31 centimetres (Appleby 1997). In Scandinavian countries, for example, the average increment is about 1.5 centimetres per generation (20 years) or 7.5 centimetres per century. This earlier growth is largely attributable to improvements in nutrition, such as postwar milk consumption, and predates the advent of fast food (Boseley 2001b). The size-gains in recent decades, however, need to be seen in a different light. While gains in average height are slowing, rapid increases in average weight have continued. During the 1990s, the prevalence of overweight adults increased by 50 per cent in the US (Strauss et al. 2001), with most US adults (56.4 per cent) being overweight (Mokdad et al. 2001). The number of obese adults[3] increased by 61 per cent between 1991 and 2000, accounting for one in five adults (Mokdad et al. 2001). Half of Europeans and 61 per cent of Americans are now overweight (Josefson 2001). Worryingly, similar trends are being observed among younger people (13–18-year-olds) and children (4–12-year-olds). Targeted by the marketing of fast food, these two cohorts are now described as undergoing an epidemic of obesity in the US, Europe and other high-income countries (Dietz 1998). Among American children, between 1986 and 1998 overweight prevalence increased by more than 120 per cent among African Americans and Hispanics, and 50 per cent among whites. By 1998, 21.5 per cent of African American, 21.8 per cent of Hispanic and 12.3 per cent of white children were overweight (Strauss and Pollack 2001).

Despite variations in definition and measurement, making it impossible to give an overview of the global prevalence of obesity, studies worldwide consistently report high prevalence and increasing rates in other countries (Frühbeck 2000; WHO 1997a). In a growing number of low and middle-income countries, these trends are most notable among the relatively affluent that can afford, and have chosen, to adopt Western diets and lifestyles (WHO 2001a). As markets in the developed world are saturated, fast food companies expand abroad, using the appeal of 'Americana and the promise of modernization' (Schlosser 2002) to attract new consumers, notably young children aged two to eight. Just as working-class parents during the 1950s aspired to eating in restaurants, people in the developing world accord themselves a certain status and self-esteem by eating in fast-food restaurants. The so-called 'nutrition transition' by which western diets are being adopted in lower and middle-income countries (Popkin 1994) is underpinned by a cognitive transition.

The health consequences of excess weight are well documented. There are an estimated 300,000 deaths from obesity-related diseases in the US annually, second only to tobacco (Allison et al. 1999). Coronary heart disease, gallbladder disease, colorectal cancer, metabolic diseases, infertility, hypoventilation, arrhythmia, raised blood pressure, sleep apnoea and depression are all associated with being overweight. For people with a body mass index above 35 (obese), there is a 93-fold increase in risk for women and 43-fold increase for men of diabetes mellitis. Obesity is an important determinant of cardiovascular disease (CVD), notably as a consequence of hypertension, and a major contributor in the 33 per cent rise in diagnosed diabetes between 1990 and 1998 (Mokdad et al. 2000a), accounting for up to 10 per cent of US adults. It is clear that genes related to obesity are not responsible because the US gene pool did not change significantly during this period (Mokdad et al. 2000b). Children that grow quickly during the first three years of life (higher-than-average increase in BMI), because they are allowed to eat as much as they want, are more at risk of becoming diabetic during childhood. Childhood type 1 diabetes is becoming more common in affluent countries because of the abundance of food. In Britain, the incidence of child diabetes has doubled in the past five years, with 1200 children diagnosed each year (EURODIAB ACE Study Group 2000). Worldwide, diabetes mellitus affects 100 million people and accounts for 8 per cent of total health budgets in high-income countries (WHO 1996a).

There are other health concerns raised by changes in food production and consumption patterns. There is growing evidence, marked by high-profile outbreaks, that the ways in which food production methods have changed have also contributed to the increased spread of foodborne diseases such as *Salmonella* serotype *enteritidis* (SE), *Escherichia coli* and vCJD (Lee and Patel 2002). For example, the intense farming methods, accompanied by high speed and volume production at slaughterhouses, raises the risk of contamination (Schlosser 2002). These risks, in turn, can be rapidly dispersed through the global food trade. Farm imports into the US increased 65 per cent between 1991 and 1999 (Barks-Ruggles 2001). Other concerns have been raised over the potential link between the greater use of additives in processed foods and the increased incidence of hyperactivity (see below) and allergies in children. There are also disputed concerns over the safety of microwave ovens and food irradiation (Public Citizen 2000).

In summary, changes to how food is produced and consumed has been part of the acceleration of lifestyles, and the globalization of such lifestyles. Food is now a global industry, one that shapes the quality of the food available to us and the ways we consume it. Given real and perceived constraints on our time, our focus is increasingly on speed. As well as losing the social benefits of preparing and eating meals communally, the eating habits of modern societies are creating serious health risks far beyond indigestion.

4.5 The mental health effects of temporal change

> *… both the pace of life and the intensity of the stimulus world around us continue to intensify, largely because of ongoing transformations taking place in the modes of human experience … As they do, they're also radically transforming time, space, and the fabric of human consciousness. Rapid-fire culture gives rise to rapid-fire consciousness, an unsettling temporal disturbance of the self that then motivates an escape from slowness …*
>
> Richard DeGrandpre, *Ritalin Nation* (1999:22)

There are growing signs that the accelerating pace of life is having adverse impacts on mental health. Historically, mental health has been the Cinderella of public health practice. Yet about 500 million people worldwide suffer from mental disorders, and the trend is upwards. The total burden of disease from mental illness is expected to grow from 12 per cent in 2001 to 15 per cent in 2020. Mental disorders represent four of the ten leading causes of disability worldwide, with depressive disorders due to rise from the fourth to second leading cause of death and disability (WHO 2001: 3). An analysis of studies on major depression from North America, Western Europe, Middle East, Asia and the Pacific Rim finds the condition increasing over time and occurring earlier for successively younger age cohorts in many different locations. The age of onset of manic depression has declined from 32 years in the mid 1960s to 19 years by the late 1990s (Cross-National Collaborative Group 1992).

WHO cites three main factors behind these trends – increased poverty, ageing populations, and the pace of modern living. As WHO Director-General Gro Harlem Brundtland (2001a) describes,

> We are living in a world of rapid change. This is experienced by people living in the calmest and most prosperous corners of the world. They encounter newness at a breath-taking pace: from new technology to new jobs to new fashions in entertainment and culture. They are being swirled along in the rapidity of global transformation.

The most commonly cited mental health manifestation of such rapid change is stress. As Bonn and Bonn (2000) write, '[s]tress, in essence, is a feeling of doubt about being able to cope, a perception that the resources available do not match the demands made. When it persists, stress can cause physical and psychological ill-health and adversely affect social functioning.' In the work environment, stress levels are linked to how much control one has over work demands. The less latitude that an individual has over decisions affecting workload, the higher the level of stress.

The lack of control over the pace and nature of work as a result of globalization is an important factor in growing rates of mental illness. The changes taking place are partly the result of economic restructuring as large companies move their operations to find cheaper workforces, 'downsize' or replace workers with technology, and enforce 'more flexible' terms of work to ensure global competitiveness. Agricultural workers may face greater insecurity of livelihood given declining terms of trade, more expensive seeds and other inputs, and domination of the sector by global companies. Even in countries such as China and Japan, where the 'iron rice bowl' was a traditional symbol of economic and social stability, there are now few 'jobs for life'. Thus, workers fortunate to have gainful employment must work harder than ever to maintain job security. With few exceptions, people in high-income countries are working longer hours, spurred by insecurities in the job market (Cooper 2001). The unemployed and underemployed face the mental stress of lack of work and possible impoverishment. As Brundtland (2001a) writes, 'people exposed to rapid change have to cope with insecurity and unpredictability. And, some of the consequences of change clearly are negative. This is especially the case if change is imposed on people who are powerless to influence how it affects them.'

The manifestations of work-related stress are increasing levels of sleep disturbance, gastric and duodenal ulcers, dyspepsia and irritable bowel syndrome. One of the biggest selling drugs in the world is Zantac®, a treatment for peptic ulcers. Work stress is also associated with cardiovascular risk factors such as hypertension and hypercholesterolaemia. When first diagnosed in the 1980s, it was argued that chronic fatigue syndrome (CFS) might be a result of 'burn out' or depression by high-flying workers. The high prevalence among young professional women, in particular, led to the condition being dubbed the 'yuppie flu'. While many health professionals now recognize it as a physical, rather than mental, illness, the cause remains unknown and effective treatment includes the use of anti-depressants and cognitive behavioural therapy (Reid et al. 2000).

Another manifestation of our heightened desire for speed and urgency in modern society is the rising incidence of 'road rage'. Road rage is defined as a driver reacting with anger at another driver, with the anger overtly expressed and communicated. Others use the term 'aggressive driving incidents' which are defined as events in which an angry or impatient driver tries to injure or kill another driver after a traffic dispute. As individuals seek to travel by car more frequently and, in many cases, more quickly, traffic congestion[4] or other obstructions cause heightened frustration. The US National Highway Traffic Safety Administration (NHTSA) estimates that 66 per cent of road traffic fatalities in the US (up to 1200 people) are caused by aggressive driving behaviours such as passing on the right (left hand drive), running red lights and tailgating. Such events have increased by 51 per cent since 1990, with 37 per cent of incidents involving firearms (Mizell 1996). Studies in the UK, Canada and Australia show similar trends (Joint 1995). As well as the environmental impact, it is believed that the spread of the automobile culture to other parts of the world is creating similar experiences.

A further example is the controversy over attention deficit hyperactivity disorder (ADHD). Variations in definition, benchmarks in diagnosis, and even nonrecognition of the condition in some countries make accurate global prevalence data impossible. Nonetheless, it is increasingly recognized that ADHD is a common but complex condition characterized by excessive inattentiveness, impulsiveness or hyperactivity that significantly interferes with everyday life. What is disputed is the cause of this condition and its appropriate treatment. Many medical professionals hold that it is a genetically inherited condition of brain dysfunction as shown in cerebral imaging studies. If accurately diagnosed, multidisciplinary management including treatment with drugs such as methylphenidate (Ritalin) is found to be highly effective. If untreated, the disorder may interfere with educational and social development, and predispose to psychiatric and other difficulties (Kewley 1998).

Others, however, question the medicalization of ADHD. In his book, *Ritalin Nation*, DeGrandpre (1999) questions why ADHD has become the most commonly diagnosed child psychiatric disorder in the US, with Ritalin prescribed in 90 per cent of the cases. Prior to the 1960s, hyperactivity was rarely treated as a medical problem. In 1961 the US Food and Drug Administration (FDA) approved Ritalin for use in children with behavioural problems. He writes that by 1975, 150,000 children were being prescribed drugs to reduce hyperactivity. This rose to about a million American children by the late 1980s, and two million by the late 1990s. It is now estimated that ADHD affects 7 per cent of US children between 6 and 11 years (CDC 2002). The US consumes 80–90 per cent of Ritalin in the world. DeGrandpre asks whether this increase in ADHD is a reaction to the faster pace of modern life and, in particular, overstimulation received by children. He and others (Armstrong 1995; Hallowell and Ratey 1995) cite the pressures of time and availability of constant, fast-paced stimuli in everyday life as contributing to the creation of 'restless minds and impulsive personalities'. He argues, 'the speedup of culture means we experience more stimulus events each day, but the nature of these events also has undergone a dramatic transformation' (DeGrandpre 1999:27). The result is children unable to focus attention on 'slow' activities such as schoolwork, instead craving constant stimulation through computer games, television and other intense experiences.

> Is attention deficit disorder (ADD or as it is now called, attention deficit hyperactivity disorder, or ADHD) really a newly discovered medical disease, or is it a culture-induced brain dysfunction that results from our growing addiction to speed? Might the craze over stimulants like cocaine, crack, methamphetamine, and ecstasy in the 1980s and 1990s have a deep cultural connection to our speeding-up society? And might the rush for speed also be connected with the rise of coffee/caffeine culture and the Ritalin solution? (DeGrandpre 1999:16)

While evidence of the above trends in mental health come largely from the US, where fast-paced lifestyles are most pronounced, the export of these lifestyles through processes of globalization raise the prospect of similar experiences in other countries and population groups, notably those most 'plugged into' the globalization lifestyle. Norman Sartorious, head of the European Association of Psychiatrists (as quoted in Holden 2000: 39), argues that depression is often thought of as a by-product of high-stress, urban and western lifestyles, but it is worsening in low-income countries. Greater economic insecurity, the physical effects of malnutrition and infections, war and social dislocation may all be contributing to a future epidemic of mental health. As Lewis Judd, former chief of the US National Institute of Mental Health (NIH) puts it, 'I see depression as the plague of the modern era' (as cited in Holden 2000: 40).

4.6 Designer genes: Evolution out of the window?

> *Sequencing the human genome is one of the transforming events in science – events that change our whole view of where we stand in the universe. Ever since Darwin we've been trying to understand the detail of how the world got to be the way it is, but it's only now that we are beginning to understand the history of life as it's written in our genes.*
>
> Sir Robert May, Chief Adviser to the UK Government (2000)

The evolutionary process, according to Darwinian theory, occurs at the speed at which ecological pressure is exerted, and an adaptive response through natural selection is elicited. Depending on the life cycle of the organism in question, evolution can occur in a few minutes (as with bacteria) or over hundreds of years (e.g. oak trees). Importantly, evolution occurs synchronically with other organisms and the natural environment. The process is a continuously dynamic yet gradual one of adaptation and response.

The advent of increasingly sophisticated methods of genetic modification, whereby genetic material (Box 4.1) is selected, removed or manipulated to strengthen or weaken particular characteristics of an organism, creates the capacity to alter the timescale of natural evolution. The manipulation of genetic material is, of course, far from new. Agricultural practices dating back 10,000 years or so sought to give Mother Nature a helping hand through selective breeding of plants and animals. Indeed, defenders of the current use of genetically modified organisms (GMOs) argue that the technology is simply an extension of such practices. However, it is important to distinguish among three methods of genetic modification: (a) crossbreeding of different individuals of the same species (undertaken for at least 10,000 years); (b) crossing sexually incompatible species of the same genus (since the 1970s); and (c) moving specific segments of genetic material between unrelated organisms (since the early 1980s). What is distinct today is the widespread use of the latter two methods, potentially resulting in more far reaching changes to the genetic makeup of plants and animals, and at an unprecedented rate of change. This has a range of implications for human health.

The question of timeframe is central to debates about GMOs. In nature, plants and animals battle it out for survival and dominance,

Box 4.1 What's in a gene?

The field of genetics is the study of heredity and variation in individuals and the means whereby characteristics are passed from parent to offspring. The founder of genetic research was Gregor Mendel, an Austrian monk, who studied the passing of genetic information between yellow and green garden peas during the early nineteenth century. The field developed rapidly from the early twentieth century into many subfields, such as population genetics and molecular genetics, and later becoming entangled in political ideology (eugenics).

The gene is the fundamental unit of genetic material found at a specific location on a chromosome. There are 24 chromosomes in the human body. A gene, of which there are around 30,000–40,000 in humans of varying size, is chemically complex. The genetic code refers to the specific information, carried by DNA (deoxyribonucleic acid) molecules, that control the particular amino acids and their positions in every protein, and thus all the proteins synthesized within a cell. The shape of a DNA molecule is the double helix. DNA information is coded into nucleotides (or bases) of four types: A, G, C and T for short. A change in the genetic code results in an amino acid being inserted incorrectly in a protein resulting in a mutation. Genetic engineering (recombinant DNA technology) is the artificial modification of an organisms's genetic make-up.

There are various types of genes depending on their function. Genes can be dominant, with the characteristic occurring whenever the gene is present, or recessive, with the characteristic occurring only when the gene is present in both members of the chromosome pair (homozygous). The total information stored in the chromosomes of an organism is known as its genome.

Sources: US Department of Energy (1992), *Primer on Molecular Genetics* (Washington DC: DOE Human Genome Program); and Jones S., *In the Blood: God, Genes and Destiny* (London: Flamingo, 1997).

with evolutionary competition taking place gradually and continually over generations. At this pace, other organisms adapt simultaneously so that the entirety of the natural world is in constant and interdependent flux. The use of modern methods of genetic modification introduces changes within a single generation, allowing certain genes to dominate according to selected criteria. The food industry, for example, uses these techniques to breed for characteristics that improve profitability such as disease and pest resistance, frost tolerance, herbicide tolerance and ripening delay (Beringer 1999). These characteristics may or may not be compatible with those that would develop with natural evolution.

In many cases, tampering with evolution can yield beneficial results. Genetic engineering can speed the effectiveness of a baculovirus, a type of virus that infects caterpillars of certain moths, so that it kills pests before they have time to strip a tree of its foliage (Bishop et al. 1988). Research is also under way to develop and spread a synthetic gene throughout populations of the mosquito species that are vectors for human forms of malaria. Malaria infects 500 million people and causes two million deaths each year. As Meek (2001: 3) describes,

> Until now, spreading genes throughout a species was something only evolution was capable of, over millions of years of natural selection … [This research aims] to transform the malaria-carrying mosquito into a subtly different species – still a bloodsucking nuisance, but no longer a killer – within two to 25 years of releasing the first GM insects.

Genetic research on plants also holds much promise. The development of faster growing crops, such as varieties of rice that mature 30–50 days earlier and have 50 per cent higher yields, will produce much-needed food for growing populations. Other 'first generation' products have specific agronomic traits, including herbicide tolerance and insect resistance, to improve productivity. A further area of development is plant-based vaccines and other medically-related compounds (Dunwell 1999).

Current evidence suggests that consuming GMOs does not pose a direct health risk. Indeed, so-called 'second generation' products of GM foods, expected to reach consumer markets by 2020, will seek to improve product quality or higher value traits including added vitamins and micronutrients, modified starch and oil content, reduced levels of allergens and toxins, and resistance to freezing. However, there is some evidence that disrupting the intricate dance of evolution could have unforeseen and potentially irreversible consequences. Foremost are the potential environmental impacts. There are concerns that GMOs have already been extensively introduced without sufficient understanding of the long-term consequences for native and natural species of plants and animals. Over one-half of the soybean crop in the US is GMOs (Beringer 1999). The total world acreage of herbicide-tolerant and insect-protected corn, soybeans and cotton grew from 4 million to 102 million acres between 1996 and 2000, with estimates of potential global growth of up to 875 million acres (Monsanto 2000a:7). GM crops were grown in thirteen countries by 2001 and tested in dozens of others (Vidal and Aglionby 2001). Food products (for example soft drinks, salads, breads) containing GMOs are widely sold, generally without being labelled as such.

Claims that GMOs can be kept wholly separate from the natural environment are seen as foolhardy by some critics. There are numerous precedents of intentional and unintentional release or escape of plant and animal species into non-native environments, with direct consequences for indigenous species. At best, introduced species can become an interesting ecological anomaly, such as parakeets in the UK. In some cases, they can become unwanted pests that may cause damage to local habitats (e.g. rabbits and wild pigs in Australia). One-half of weed species in the US are nonindigenous plants (Pimentel 1986). In other cases, non-native species (e.g. ruddy duck and grey squirrel in the UK) can displace indigenous species and even cause them to become extinct. Furthermore, the global migration of plant diseases remains a serious concern. In May 2002, fears of a new disease called 'sudden oak death' caused by the fungus *Phytophthora ramorum* (the same family of fungus that caused the potato blight during the nineteenth century) led the UK government to ban plant imports under the Plant Health Act 1967 from parts of the US where the disease is rampant (Brown 2002b).

Despite industry reassurances, evidence of GMOs impacting on the natural environment has raised widespread concern. Tests on the toxicity of pollen[5] from GM maize for the monarch butterfly initially found the butterflies were harmed. However, the study fed the butterflies exclusively on food they would not normally eat, and with doses of pollen eight times the level likely to be found in the wild (Losey et al. 1999). Subsequent field research has found no significant differences between butterfly survival in areas planted with GM and conventional maize (Henderson 2000). GM maize has also been at the centre of findings by the Mexican government that, despite its own ban on GM maize, there are high levels (up to 95 per cent of samples) of contamination in areas that act as the gene bank for one of the world's staple crops. Mexico is home to hundreds of varieties of maize which are allowed to crossbreed in order to produce optimal crops for extreme conditions. It is suspected that corn imported from the US for food has been used by farmers as seed, unaware that it contains grain derived from GM crops. This conclusion is supported by the fact that the worst contamination was found near main roads where maize is sold to villagers. In remote areas, there was only 1–2 per cent contamination. It is unknown which variety of GM maize was responsible for the contamination because the three companies that produce the product, Monsanto, Syngenta and Aventis, use the same technology and refuse to disclose information on the protein used, on trade secrets grounds (Brown 2002).

A further health-related fear surrounding the widespread use of GMOs is the spread of genes from one microorganism to another by natural mechanisms, such as plasmids, raising the prospect that antibiotic resistance could be transferred to other species. Most GM products contain a gene for antibiotic resistance as a marker for scientists to spot which plants have taken on new genetic features. Research has found a wide range of genetic transfers between microorganisms living in various habitats including genes that confer antibiotic resistance. For example, resistance has been found to pass from *Enterobacteriaceae* living in the gut, to *Neisseria gonorrhoea*, the cause of venereal disease, and *Haemonphilus influenzae*, the cause of influenza, as a result of widespread use of antibiotics in modern medicine (Connor 1988).

The ultimate target of genetic modification, and perhaps the most controversial of all, is the human genome. When the Human Genome Project (HGP) completes its task (Box 4.2), namely mapping of the entire human genetic code, an entirely new world of R&D opens up. There is broad agreement that this information will yield positive benefits for human health. Medical applications are expected to revolutionize health care during the twenty-first century, enabling, for example, an improved ability to prevent or mitigate inherited disorders at an earlier stage. Other applications include the development of new drug therapies, treatments for addiction, and therapies for jet-lag and sleep disorders. At the same time, the 'genomic revolution' and the prospect of GM people raises a host of moral and ethical issues regarding the application of the technology. Early debate over ownership of the human genome has been resolved in favour of keeping it within the public domain, but not before a race by some biotechnology companies to obtain the code first in order to assert patent rights. There are also important issues concerning how knowledge about genetic makeup could be used, for example, in antenatal care, employment, immigration and the insurance industry.

Box 4.2 The Human Genome Project

The Human Genome Project is an international research programme initiated in 1986 involving scientists from 16 institutions in six countries (China, France, Germany, Japan, UK and US) to determine the DNA sequence of the entire human genetic code. The aim of the project is to determine the DNA sequence of the entire human genome which can then be used to identify an estimated, 30,000–40,000 genes, and to identify their positions on individual chromosomes. This entails a complete mapping of the genetic information contained in the chromosomes of the human species.

The project is funded by grants from government agencies and charitable trusts including a so-called 'peace dividend' from nuclear research by the US Department of Energy. The total cost of producing the complete sequence will be an estimated US$3 billion. In June 2000 the first working draft of the 'Book of Humankind' was completed and made publicly available. The final phase of the project, filling in gaps and increasing overall sequence accuracy, is due for completion in 2003.

It is believed that this information will transform health care in the twenty-first century by improving diagnosis and treatment of many inherited disorders such as cystic fibrosis and sickle cell anaemia, as well as other human illnesses such as cardiovascular disease, cancer and asthma. Genetic tests may eventually allow detection of predisposition to certain conditions, in turn, opening new avenues for preventive medicine. The development of more effective treatments may also be possible including the replacement of faulty genes with a correctly functioning one (gene therapy).

As well as the HGP, around twenty non-human organisms have been sequenced by scientists around the world. This research can provide clues to the functioning of human genes, and provide inexpensive models for studying different aspects of human genes such as cell division and growth of specialized tissue. The completed genomes so far include a number of disease-causing organisms of global significance including *Plasmodium falciparum* (malaria), *Mycobacterium tuberculosis* and methicillin-resistant *Staphylococcus aureus* (MRSA).

Source: International Human Genome Sequencing Consortium (2001), 'Initial sequencing and analysis of the human genome', *Nature*, 409, 13 February: 860–921; and US Department of Energy (1997), *Human Genome Program Report* (Washington DC: Office of Biological and Environmental Research).

Less deliberate than GM, yet far reaching, is the way in which intensifying population mobility is contributing to changes in the genetic makeup of human societies. In a world where people have become increasingly mobile, and one in a hundred people live in a country not of their birth, an unprecedented mingling of genetic pools is occurring known as genetic admixture. The greatest degree of genetic admixture can be found in countries with the highest rates of immigration such as the US, Canada and Australia.

The health consequences are mixed. On the positive side, greater genetic admixture can reduce the risk of inherited genetic disorders where both partners need to carry the relevant recessive gene. For instance, the high incidence of Tay-Sachs disease, a disorder of the central nervous system, among Ashkenazi Jews is due to the high proportion (one in eighteen) of carriers of the gene within the community compared to the US population as a whole (one in three hundred). Importantly, the strong cultural preference for marrying within the community has contributed to the higher incidence of the disease. By encouraging a greater mixing of genetic pools, genetic admixture reduces the statistical probability of such diseases being passed on to future generations.

On the more negative side, there is evidence that greater mobility of human genes can increase the risk of certain conditions. The presence of the sickle cell gene among Africans and their diaspora has been an evolutionary response to protect against malaria. Genetic admixture reduces this genetic resistance. It is also believed that one of the risk factors in pre-eclampsia, a potentially fatal condition in pregnancy, is the degree of genetic difference between the partners. The condition is caused by the rejection of the father's genetic material in the foetus by the mother's body, and interracial couples are thought to have an increased risk of this occurring (Ward and Lindheimer 1999). Beyond genetic admixture, the settlement of people of particular genetic makeup in a new social and natural environment may contribute to an increase in certain conditions. For example, South Asians settled around the world have higher rates of coronary heart disease (CHD), prevalence of non-insulin dependent diabetes (five times higher than Europeans), and hypertension than populations who have remained in the region. These patterns are not explainable by smoking prevalence or dietary features (for example percentage of energy from fat, ratio of polyunsaturates to saturates). Rather, these may all be manifestations of a single underlying syndrome, namely a result of past genetic adaptations to conditions of unreliable food supply and physically demanding work. As food supply becomes plentiful, and lifestyles change, South Asians may be more genetically prone to develop these conditions (McKeigue and Sevak 1994).

In summary, globalization is accelerating the movement of many kinds of genetic material around the world. As genomic research progresses, the desire to manipulate the links between genes and human welfare will increase. Human intervention in genetics, however, means enabling certain genes – some that may not otherwise do so – to dominate, and others not to. GM, for example, breaks down normal gene barriers through the insertion of genetic material from one species to another, and at a rate faster than nature would allow. The implications for the natural environment and human societies, and the complex ethical issues raised, are only beginning to be understood.

4.7 Environmental sustainability and global health

> *The accumulation of evidence has us extremely worried … We have to get serious about global change. It is not only going to be a warmer world, it is going to be a sicker world.*
>
> Andrew Dobson, Princeton University as quoted in Radford (2002)

> *… there can be no trade and no economic development on a dead planet.*
>
> Edward Goldsmith, 'Global Trade and the Environment' (1996)

As described in Chapter 3, the long-term viability of the earth's biosystems can be seen as the ultimate determinant of human health in terms of sustaining life on the planet. A core concept in thinking about human-induced impacts on the natural environment has become sustainability. The term 'sustainable development' was coined in 1987 by the World Commission on the Environment and Development (Brundtland Commission) which concluded that economic development without attention to environmental constraints will, in the long term, threaten population health. Sustainability is premised on the principle that the rate of consumption of natural resources should be balanced with the rate that the earth is able to regenerate them (McMichael 2001). Time is a key factor in this equation. Communities that are sustainable are those living within their environmental means.[6] Those that do not are consuming resources at a pace that depletes the earth's capacity to sustain life. There are clear inequities, with high-income countries consuming a disproportionate share of the world's natural resources and contributing more than their fair share of pollution. The Netherlands, US, Japan and Israel are among the worst offenders as measured by the size of their ecological deficits (Wackernagel and Callejas 1995). The average American produces six tons of carbon dioxide, a Chinese person 0.7 tons and an Indian person 0.25 tons per year (Brown 2002c).

There is increasing evidence that current forms of globalization are accelerating the rate of environmental change. Since the Industrial Revolution, human activity has added 170 billion tons of carbon to the atmosphere, with a 2 per cent annual growth in emissions. Current concentrations of CO_2 are higher than at any time in the past 150,000 years (Flavin 1996). Meanwhile deforestation has continued apace, driven by the global trade in forest products rising from US$29 billion in 1961 to US$139 billion in 1998 (French 2000: 20). Similar pressures are being placed on the world's mineral, water and land resources. According to the Living Planet Index (LPI), natural wealth of the planet has declined 33 per cent between 1970 and 1999. This rate of decline, about 1 per cent annually, is unprecedented in human history. At the same time the ecological footprint, a measure of the changing human pressures on the natural environment over time, has increased by 50 per cent from 1970 to 1997, a rise of 1.5 per cent per year. This level already exceeds the biosphere's regeneration rate (WWF 2000). Similarly, according to surveys by the World Conservation Union (IUCN), an estimated one-quarter of the world's mammal species and 13 per cent of plant species are threatened with extinction (as cited in French 2000: 9).

Perhaps the best documented evidence comes from global climate change. Research has so far focused on gradual changes such as the natural waxing and waning of ice ages over millions of years or, more worryingly, human-induced warming of air and water temperatures over hundreds of years from the increased emission of greenhouse gases. However, there is emerging evidence that gradual changes have been punctuated by episodes of abrupt change including temperature changes of about 10° C (18° F) within a mere decade in some places. Severe droughts or floods have marked such abrupt changes, as well as accompanying impacts on human civilizations. For example, some glaciers in Alaska are now melting at an 'exceptionally high rate', with at least 8 per cent of the sea level rise in the past decade due to the thinning of their mass by several hundred feet. Climate warming is believed to be one of a number of factors controlling glacier mass balance, including local climate and glacier geometry (Arendt et al. 2002). Importantly, abrupt changes have been especially common when the climate system is 'forced to change most rapidly'. Hence, 'greenhouse warming and other human alterations of the earth system may increase the possibility of large, abrupt, and unwelcome regional or global climatic events' (US National Academy of Sciences 2001: 1). Current evidence suggests we may be in the midst of such a change, with six of the ten warmest years recorded occurring in the last ten years, the other four occurring in the 1980s.

As well as contributing to such alterations, globalization is expected to spread the resultant effects more widely:

> With growing globalization, adverse impacts – although likely to vary from region to region because exposure and sensitivity will vary – are likely to spill across national boundaries, through human and biotic migration, economic shocks, and political aftershocks ... the issues are global ... (US National Academy of Sciences 2001: 7).

This is evident in the increasing number of people affected by 'natural disasters' over the past three decades. According to the ICRCRCS report (2002), the number of disasters rose from 1110 to 2742 between the 1970s and 1990s. The number of people injured or made homeless by disasters rose from 740 million in the 1970s to more than two billion in the 1990s (including double counting of those repeatedly affected). The estimated economic losses (at current values) have grown from US$131 billion to US$629 billion during the same period. An estimated 25 million people are displaced by environmental causes, more than double the 12 million political refugees. It is anticipated that a sea level rise of 0.5 to one metre would similarly affect millions in low-income countries such as Bangladesh, Nigeria, Egypt and Guyana, and make uninhabitable at least five island nations including the Maldives, the Marshall Islands and Tuvalu.

This 'new paradigm of an abruptly changing climatic system' highlights the need for a greater sense of urgency to achieve more sustainable forms of globalization. The impacts on human health, and indeed the survival of the human species, will not necessarily be gradual or reversible. Current forms of globalization are worsening this impact by encouraging the spread of unsustainable practices to other parts of the world. While contributions to this alarming situation vary by individual and country, the rate at which we are collectively impacting on the natural environment merits more timely action.

4.8 Conclusions

When scientists began to decode the human genome in 1995 they estimated it would take about ten years to complete. The publication of the final version in 2003, two years ahead of schedule, is not the result of progress in biology but advances in computer technology. The 3.12 billion 'letters' of the human genetic code were mapped by hundreds of computers at sixteen centres around the world. The exponential growth of computing power has been a major boon for medical research because it enables the automation of mundane and time-consuming tasks (e.g. data crunching). This has led to a new branch of science, bioinformatics that applies computer-assisted analysis to biological systems (Harvey 2000a).

These rapid advances by the Human Genome Project illustrate the opportunities to health from technologies that enable more rapid capacity to store, manipulate and reassemble large amounts of information. Health is one of the most information-intensive sectors, and can thus benefit dramatically from these advances. For example, accurate and comprehensive record-keeping is central to health care. Patient records need to be updated regularly with information from various practitioners, cross-referenced for potential contraindication, and comparable to allow analyses of trends in population health. In some countries, there is a shift towards the 'paperless practice' but in most, patient records are manually maintained (Harvey 2000b). Information technologies can speed this process and allow fuller information to be stored and manipulated about individuals and population groups.

Information technologies also have an important role in medical research. Computers are used increasingly to simulate human organs, such as the heart, to speed the testing of new drugs; 'the machine can accelerate trials enormously, both by 'fast-forwarding' the simulation of the drug's effects and by eliminating some of the need for human guinea-pigs' (Harvey 2000b:20). Drugs testing can be speeded by the internet which allows data to be collected more quickly from a wide range of sites on patient responses to treatments, and more frequently using automatic monitors (Harvey 2000b:20). Literature searches can be conducted far quicker through electronic databases such as Medline and Popline. Many hours and days spent locating journal articles on site in a medical library can now be done by logging on and doing database searches in minutes. In the UK, OMNI (Organizing Medical Networked Information) is an initiative to provide a gateway to 'evaluated, quality Internet resources in health and medicine, aimed at students, researchers, academics and practitioners in the health and medical sciences'. The dissemination of health research has been quickened by faster processing of manuscripts by publishers using new information technologies to communicate with authors and publish materials electronically.

Hence, along with the spectre that certain health problems, such as infectious disease, can manifest and spread more quickly, globalization may bring the tools necessary to respond to them in a more timely manner. Influenza is a perfect example of the age-old race against time between humans and viruses. The history of influenza, perhaps dating as far back as Hippocrates, tells us that it has long been a pandemic disease, able to spread across the world within a matter of days. It is known as the fastest changing virus. In most years, influenza remains a relatively mild illness caused by a minor change in the virus (antigenic drift). However, there is the periodic prospect of a major change (antigenic shift) in the virus that produces a far more virulent strain to which people have no immunity. This occurred with devastating effect in the so-called 'Spanish flu' pandemic in 1918–19 when an estimated 20–40 million people died (see Box 2.3).

The actual rate of spread of infection is affected by a number of factors, notably the virulence of the virus, and the balance between immune and susceptible populations. The 1977–78 influenza epidemic in the US, for example, spread at about one-tenth of the rate of the 1918–19 variant in spite of vast differences in modes of transport and hence human mobility (Pyle 1986: 2). Since 1947, continuous monitoring of the virus for antigenic shifts has been undertaken by a worldwide network of institutions coordinated by WHO. According to WHO's Global Management and Control of an Influenza Pandemic (WHO 1998a), an improved international response has focused on enhanced human and veterinary surveillance, improved, low-cost, laboratory surveillance techniques, increased laboratory safety capabilities, enhanced electronic communications about influenza, enhanced vaccine production capabilities and access to antiviral agents.

The rapid isolation and characterization of influenza strains, in particular, is necessary for the development and distribution of effective vaccines. Each year WHO distributes newly detected strains to vaccine manufacturers. Using standard methods of vaccine production (growth of the virus in fertilized chicken eggs), the pharmaceutical industry orders millions of fertilized eggs up to a year in advance to ensure sufficient supplies, and can produce and distribute a vaccine in about six months. When an especially virulent strain emerges unexpectedly, however, with the capacity to pose a serious risk to a wider age group (up to 50 per cent of the world's population), it can take many weeks to build up enough stocks of eggs to start producing a vaccine (Firn 2001). Hence, there is concern that public health authorities would not be able to obtain sufficient vaccine stocks in time, and there would likely be a worldwide shortage when the next serious pandemic occurs.

> [I]t may well be, as it was in 1918, that a new pandemic will start in the United States. Moreover, even if the disease first appears in other parts of the globe, there may not be sufficient time to prepare enough of the immunizing agent to protect a sufficiently large segment of the population.
>
> (Weinstein 1976:1060)

Most recently, this occurred during the Beijing 'Asian A' influenza outbreak of 1993 when vaccine supplies ran short. The development of a new method of producing influenza vaccine by the Belgian company Solvay, using dog kidney cells, could if approved by regulators enable manufacturers to start producing virus (used to make vaccines) as soon as they are isolated by scientists (Firn 2001).

According to historical data, an antigenic shift is overdue. This heightened sense of concern lay behind the swift handling of two separate outbreaks of avian influenza in Hong Kong in 1997 and 2001 that resulted in the slaughter of 1.4 million and 1.2 million birds respectively as a precautionary measure. It has long been believed that the main source of major mutations in the influenza virus is the domestic duck of southern China, which is a natural carrier of avian flu viruses. From birds, the virus is believed to be transmitted to domesticated pigs and then humans. The habitation at close quarters of bird, pig and human populations in the region facilitates this process. What remains unclear is how globalization may be changing the likelihood of a virulent strain of influenza emerging, and how quickly it might spread worldwide. A far greater understanding is needed of the potential links between the intensification of food production methods, increased trade in food products, and shifting demographic patterns in the region and beyond, and patterns of antigenic drift and shift in the influenza virus. Otherwise, as Leahy (2001) reports, 'whenever Hong Kong's chickens sneeze, the rest of the world will be at risk of catching the flu.'

Similar types of internet-based networks have been set up, or are supported, for a range of surveillance, monitoring and reporting applications. In 1994–5 the value of the Salm-Net surveillance system and its links outside of Europe was demonstrated when the rapid exchange of information enabled the identification of the source of a major outbreak of *Salmonella agona* in Israel and associated cases in North America (Killalea et al. 1996). An EU-funded evaluation of the arrangements for managing epidemiological emergencies involving more than one EU member state concluded that existing networks to detect international disease outbreaks are essential and need further expanding (Brand et al. 2000). The process of revising the International Health Regulations by WHO, whose importance was illustrated by the SARS (Sudden Acute Respiratory Syndrome) outbreak in 2003, also relies on such networks of government and nongovernmental organizations to provide timely and accurate information about outbreaks, information that has not always been available in the past.

In short, the temporal challenges posed to health by globalization push us to harness the very technologies driving change to respond to them. This is already happening most notably in the area of infectious disease control. Other applications – remote sensing of global environmental change, drugs testing, clinical reviews, telemedicine – are far ranging and rapidly developing. Given the scope of this book, these cannot be covered here. Nonetheless, the key element of time is clear in all of them. The importance of ensuring that there is a shared capacity to use these technologies is also clear. Effective responses to many global health issues, by definition, require all population groups to contribute to their resolution. A global network for infectious disease, for example, is weakened overall by an inability of poor countries to participate. It is this shared interest in strengthening health systems worldwide that is perhaps the most pressing challenge ahead.

Key Readings

Anderson R. and R. May (1991), *Infectious Diseases of Humans, Dynamics and Control* (Oxford: Oxford University Press).

Gleick J. (1999), *Faster, the Acceleration of Just About Everything* (New York: Little, Brown).

Levine R. (1997), *A Geography of Time* (New York: HarperCollins).

Schlosser E. (2002), *Fast Food Nation* (Harmondsworth: Penguin).