

# Who wants to live forever?

Real anti-ageing therapies may soon become reality. But, as yet, no one has asked the general public what they think about life extension

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For millennia, human civilization has been fascinated with overcoming death. Immortality, eternal youth or at least the prospect of reaching biblical age have had a strong lure for religion, art and popular beliefs. Life after death, which is, in essence, eternal life, is the one central element of nearly all religions since Ancient Egypt. If we believe the Old Testament, some of the patriarchs lived for several hundreds of years. In the medieval ages, the fountain of youth was a popular myth, often illustrated in paintings, such as Lucas Cranach's *The Fountain of Youth* (Fig 1). And society today has not lost its fascination with immortality, as seen in Hollywood movies such as the *Highlander* films (1986–2000), *The 6th Day* (2000) or *Indiana Jones and the Last Crusade* (1989), and novels such as H. Rider Haggard's *She*. But for the first time, modern science may provide the knowledge and tools to interfere with the ageing processes and fulfil this age-old dream. This possibility has triggered an intense debate among scientists and ethicists about the potential of anti-ageing therapies and their ethical and social consequences. Given that anti-ageing therapies could dramatically change the social fabric of modern societies, it is quite astonishing that these debates have neglected the views of the larger public.

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The prospect of halting or at least slowing down the body's ageing processes is not so far-fetched. Several promising scientific developments may lead to interventions that could extend human life expectancy beyond the longest lifespan observed so far: 122 years, a record held by a French woman. Researchers are trying to use the enzyme telomerase to overcome the limit of somatic cell divisions to stop or slow cell senescence (Flanary, 2002; Hayflick, 2003). Others are searching for substances that mimic the effects of caloric restriction, which has been shown to extend the lifespan of mice by up to 30% (Ingram *et al*, 2004). The Human Genome Project has also provided new targets for pharmaceutical therapies that could slow ageing or prevent various age-related diseases (Guarente, 2003). On the basis of such developments, intervening in the biological process of ageing is now discussed in the scientific literature as a real future possibility (Aaron & Schwartz, 2004; de Grey *et al*, 2002a). As a result, scientists, ethicists and demographers have begun to consider the probable outcomes of life extension research. Some, such as the transhumanists, believe that humans may attain immortality in the near future and that this is a goal worth pursuing (Elliot, 2003). At the opposite end of the spectrum, critics of life extension research doubt that even small increases in the maximum human lifespan would be

possible (Olshansky & Carnes, 2001) and argue that we should focus our efforts on increasing average lifespan instead.

In the absence of scientific evidence and experience, researchers have used mathematical models based on demographic trends to argue both for and against a theoretical maximum lifespan for humans, but there is no consensus on these predictions (Aaron & Harris, 2004). Although some models suggest that humans may be able to extend their maximum lifespan beyond the current limit of about 120 years (Vaupel *et al*, 1998; Vaupel, 2003), others argue that it will be difficult to achieve any gains in life expectancy in a long-lived population because human biology eventually puts a limit on the body's ability to carry on (Carnes *et al*, 2003; Olshansky & Carnes, 2001). In addition, it is not clear how broader societal contexts, such as developments in medicine and public health, will contribute to life expectancy (Carey, 2003). In fact, some researchers have observed a trend towards increasing maximum lifespan among advanced societies (Oeppen & Vaupel, 2002). Medical advances during the past century and reduced childhood mortality, which takes away the pressure to produce progeny, are not only increasing the average but also pushing the maximum life expectancy, because our bodies adapt to this new environment by investing more resources into maintenance and longevity (Westendorp, 2004).

Citizens in the developed world can expect to live much longer than their ancestors a century ago, thanks to modern medicine, sanitation and improved food supplies. In Australia, for instance, life



**Fig 1** | Lucas Cranach d.f. “Der Jungbrunnen” (The Fountain of Youth) 1546, oil on canvas. Courtesy of Staatliche Museen zu Berlin—Preussischer Kulturbesitz, Gemäldegalerie. Photo by Jörg P. Anders.

expectancy at birth has increased from 57 at the beginning of the 1900s to 80 in 2000. The population of people older than 80 years is the fastest growing group in the developed world and the worldwide number of people older than 65 years is projected to increase from 249 million in 2000 to 690 million in 2030 (Nass & Thorner, 2004). This is a new challenge for society, and already has a massive impact on national healthcare systems, retirement schemes and the global labour market. Extending both the average and the maximum human lifespan even further will have immense social and political consequences. Modelling has become an important tool for predicting the demographic, social and medical consequences of various life extension scenarios, but no model has yet achieved any reliable forecasts. Whereas the examination of past trends is straightforward, there are ongoing arguments about whether information about past populations can be used to

forecast future scenarios, and differing interpretations of this data (Aaron & Schwartz, 2004; Carnes *et al*, 2003).

Scientists and demographers now predict various scenarios for the future of human ageing based on the ability of biomedical science to improve the body's capacity to maintain and repair itself. The most pessimistic scenario foresees prolonged senescence as an unintended consequence of our efforts to extend lifespan. There would be no increase in maximum life expectancy or quality of life; we would simply age over a longer time than we do now, as modern medicine is increasingly able to keep our bodies alive for longer. Compressed morbidity is another conservative scenario. By delaying the onset of chronic diseases that are associated with old age, this would increase average but not maximum lifespan. People would live longer and healthier lives within the existing maximum lifespan (Fries, 2003) and

the result would be a society with more elderly people who are healthy and active up to the time of their death.

Decelerated ageing is a far more ambitious goal. It targets the fundamental processes of ageing to increase both average and maximum lifespan. Under this scenario, people would continue to age, but the process would occur over a longer period and they would have more active years before any decline became evident. Some proponents suggest that a mean life expectancy of around 112 years could be reached and that 90-year olds could be as healthy and active as are today's 50-year olds (Miller, 2002). The most radical scenario is arrested ageing—if we were able to reverse our bodies' ageing processes. Continuous repair of damage caused by basic metabolic processes and environmental factors would result in an indefinite maintenance of function and postponement of ageing, thus allowing people to grow several thousand years old (Post, 2004; de Grey *et al*, 2002a).

Pessimists doubt that research will ever be able to help us achieve any significant gains in maximum lifespan (Coles, 2004). Those who are more optimistic refrain from making predictions about life expectancy, but they embrace the potential for interventions in the ageing process to reduce the burden of age-related diseases and disorders (Olshansky & Carnes, 2001). More adventurous researchers believe that biomedical research will increasingly provide the tools to control the ageing process with the most optimistic ones suggesting the potential for 'negative senescence' or immortality (Elliot, 2003; Hall, 2003; Vaupel *et al*, 2004). However, most scientists and ethicists do not regard the possibility of immortality as a realistic outcome of current ageing research (Hall, 2003).

Strangely enough, what have not been heard in these debates are the voices of ordinary people and their attitudes towards life extension research—there are, so far, only assumptions that are not even based on sociological studies. Equally, the scientific community has not made any serious efforts to reach out to the general public. Some scientists have communicated their views on life extension research to a broader audience—various popular books describe the science and implications of life extension (Bova, 1998; Hall, 2003; Guarente, 2003; Olshansky & Carnes, 2001)—but these may not be enough to start a debate. Aubrey de Grey, a biogerontologist at the University of Cambridge, UK, has called for an open debate between scientists and the public to overcome public misperceptions about anti-ageing research and its social implications (de Grey *et al*, 2002b; de Grey, 2004; Juengst *et al*, 2003b).

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This may indeed be necessary—some commentators fear that, as with any other new technology, the public could be misled to become gullible victims of unscrupulous 'life extension' entrepreneurs (Vincent, 2003). Others, however, have dismissed the call for an open debate

because it would give charlatans an opportunity to promote their useless anti-ageing products (Le Bourg, 2002), which seemingly ignores the fact that there is already a thriving 'life extension industry' (de Grey, 2002). A third group of commentators suggests that people will not be interested in living forever, but will experience the 'wisdom of repugnance' (Turner, 2004b), although this is not supported by any evidence. de Grey also pointed to an apparent paradox: there is huge public interest in and willingness to pay for cosmetic and other interventions that delay at least the appearance of ageing; however, many bioethicists assume that the public will be reluctant to pursue life extension (de Grey, 2004). Again, there are no data on why or how many people hold such paradoxical views. Nevertheless, it is fair to assume that people will take a great interest in biomedical life extension technologies for several reasons, such as fear of death, fear of age-related disabilities and the dying process, and the pursuit of health in old age (Turner, 2004c). The prevalence of these beliefs has not been explored empirically. This neglect of the public's attitudes is astonishing, given that public interest can have far more influence on the direction and application of biomedical research than can scientific evidence (Walker, 2002). As Hall points out, although the initial public reaction to any new, ethically sensitive area of biomedicine is often revulsion or at least unease, public discussion often helps people to become more informed and comfortable with the new technology (Hall, 2003).

Similarly, the large amount of literature on the concept of 'quality of life' for people with disabilities (Schalock, 2004) and older people (Bowling *et al*, 2003; Kahana *et al*, 2002) is not reflected in the debate about life extension, which has resulted in unfounded arguments. Harris (2004), for example, suggests that people would be willing to exchange quality of life for longevity, whereas Gregory Stock claims that most people would prefer both a healthier and longer life (Stock, 2004). There is no empirical data to support either claim, but a recent study suggests that interest in prolonging life may depend on a person's health status. Using prospect theory, Winter and colleagues (2003) found that frail participants expressed a desire to prolong life under more debilitating conditions than did healthy people.

These findings seem to indicate that the choices people make about life extension may change over time as their health status deteriorates.

The media are equally important players in shaping public opinion about these issues. Hall (2003) noted that under the guise of 'balance', media outlets often simply report the most extreme and competing views under a sensational headline rather than critically assessing competing arguments and discussing realistic possibilities. This type of media coverage may have important adverse effects on public policy when politicians respond to the furore raised by unbalanced reporting of extreme views. It arguably occurred, for example, in the stem-cell debate with the disproportionate media coverage given to a few maverick scientists and religious adherents who proposed cloning a human being. The media have already started to focus their attention on life extension research. Newspaper coverage in the UK of the publication of the first draft of the human genome focused on the prospects of longevity (Smart, 2003), with some journalists suggesting that advances in molecular bioscience would allow us to live forever. Others painted a less favourable picture of interminable old age; few gave serious consideration to the social, psychological and economic costs of increasing trends towards longer lives. This media ambivalence may mirror public opinion but again there is no empirical data to determine whether this is the case.

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One of the few examples of research on public attitudes towards life extension suggests that it makes a lot of sense to survey the public. The International Longevity Center (New York, NY, USA) conducted a telephone survey of US adults that examined attitudes towards anti-ageing products (Harris Interactive Inc., 2003). It found that most people believe mistakenly that the US government regulates

vitamins, minerals and food supplements because they assume that these products were approved by a government agency, such as the Food and Drug Administration, in much the same way as pharmaceuticals. Although more than half of the respondents said they had seen, heard or read something about anti-ageing medicine, the majority did not believe that taking vitamins or other supplements could prevent or halt the ageing process. Only 2% had had any personal experience with anti-ageing medicines or knew someone who had and most believed them to be beneficial. Although there is research on public beliefs about complementary and alternative therapies (Brownie & Myers, 2003; Willison & Andrews, 2004), there is, as yet, no coherent picture of public beliefs and attitudes towards real life extension strategies.

At the same time, there is a rapidly increasing demand for products that claim to delay ageing, now that the post-World-War II baby-boomer generation nears retirement age. The demand for anti-ageing products may indicate an obsession with living longer, but it may also be a fascination with appearing youthful or with health and fitness that is driving consumer interest. Until empirical evidence about these issues is available, it is hard to draw meaningful conclusions about public opinion. What is clear, however, is that this interest among a largely affluent generation of people has created a huge market for products, services and interventions that all claim to overcome the effects of ageing and even prolong life. Post (2004) estimated that by 2003 around 2,500 physicians in the USA had established practices that specialized in longevity medicine to cater for the elderly.

The Internet has further enhanced the ability of companies to meet this demand with a wide range of products and services (Turner, 2004a). Many companies and organizations now promote a vast array of anti-ageing products, but there is no scientific evidence that any of these interventions actually delay or reverse ageing. Most of these products target only the effects of the ageing process, rather than ageing itself, but consumers are not always aware of the difference. Given the increasing demand for anti-ageing therapies and products, there is a huge potential for

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consumer fraud and exploitation by companies that promote their anti-ageing products using unscientific and unsubstantiated claims (Dangour *et al*, 2004; Perls, 2004). Some have therefore argued that scientists have a responsibility to inform the public and present 'the real story' about anti-ageing interventions (Juengst *et al*, 2003a). But the question remains as to how effective such public education campaigns will be if the temptation for many journalists to sensationalize minor scientific discoveries seems irresistible (Turner, 2004a).

Growing old is not made easier by hucksters and charlatans who sell all kinds of products that claim to alleviate the ageing process or extend life expectancy. Conversely, biomedical research will probably provide new therapies and drugs that could ease the burden of growing old and enable longer lives, if the optimists have it right. Furthermore, the populations of developing countries already enjoy much longer average and maximum lifespans, which puts their social security systems under increasing pressure. These trends support calls for an open debate among scientists, politicians and the general public. However, the absence of empirical research on the community's acceptance of, and broader attitudes towards, different types of life extension technology is a crucial gap in this policy debate, and there is a pressing need for interdisciplinary research to examine public assumptions (Barzilai *et al*, 2004; Inui, 2003; Turner, 2004c; Wick, 2004). In the absence of better knowledge, critics and supporters just assume that the general populace will enthusiastically embrace or reject life extension technology—whatever suits their arguments best. There is insufficient evidence to support either claim. It is time that social scientists begin to collect some.

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