

**Tom Kirkwood**

**Reith Lectures 2001: The End of Age**

**Lecture 4: Making Choices**

The freedom to make - and continue making - choices is perhaps the greatest single index of well-being. Choice matters in ageing for two very powerful reasons. First, although many fruits of the scientific revolution lie in the future, scientific understanding of the ageing process tells us already that there is a great deal we can do now by making the right choices. Second, as we get older, choice often seems to be taken away. The infirmity of age undoubtedly sets barriers to certain kinds of choice, while financial hardship - an all-too-common companion of old age - sets others. But choice tends to be limited by age much more than is really necessary, either through negative expectations or just poor planning. The revolution in longevity puts choice high up the list of priorities.

It is because choice is so important that I chose to give today's lecture, on the subject 'Making choices', here at Berryhill retirement village, near Stoke-on-Trent. Berryhill takes for granted that members of its community have the right to choose. We all know what can happen in institutions where choice is suppressed for the sake of so-called efficiency. But if choice leads to health, and health leads to reduced dependency, then choice is more efficient, not less.

When scientists began to study the rhythms of the heart, they made a surprising discovery. The healthy heart has a chaotic rhythm - chaotic, that is, in the mathematical sense. Within certain limits, the heart's rhythm bounces all over the place, and it bounces back. The sick heart, on the other hand, settles to the same dogged pattern. It has lost the dynamic range of health.

Berryhill is not chaotic, but it certainly does a great deal to preserve the dynamic range of health.

In an earlier lecture I said that about a quarter of what determines the length of our lives is inherited through the genes. This means that three-quarters is determined not by our genes but by something else. This 'something else' includes the choices we make about how we treat our bodies through life. These choices can have big effects on how we will age.

If we look around the world, we find that even among the developed countries there are significant variations in life expectancy. Japan, for example, has the longest life spans. It also has exceptionally low levels of heart disease. In the United Kingdom or the USA, the death rate from heart disease among 65-74 year olds is about 600 deaths per 100,000 people each year. In Japan, the number is less than 100 - an astonishing six times lower. But if we look at Japanese people who have migrated to the United States, we find that Japanese Americans typically have the American rather than the Japanese patterns of disease and mortality. The switch occurs when they alter their choices and, for better or worse, adopt the American way of life.

To understand why lifestyle has such a great impact, we should recall that ageing is not some fixed process but comes about through the accumulation of subtle faults within the cells and organs of our bodies as we live our lives. For this reason, the ageing process is malleable. It can be altered by choices that affect either our exposure to damage or our ability to cope with it. Just as we can alter the life span of a car by how well, or badly, we drive and maintain it, we alter the ageing of our body by how well, or badly, we take care of it. We are not programmed to die, but to survive. There is much we can do to assist this programming as it strives to help us.

The obvious starting point is nutrition. The idea that we should eat healthily is hardly new. But what is new is that we now have an understanding of precisely why certain foods are beneficial for ageing, while others are not. We can translate traditional health education, founded as it was on good old common sense, into choices that are evidence-based.

The human body, unlike the car, does a great deal to maintain itself. Many of the materials that the body requires for its maintenance can be synthesised within our cells, but some must come from outside. Trace elements like zinc and selenium are required only in tiny quantities but they play essential roles in the chemistry of life. Our health suffers if they are absent. Vitamin C is something else we must get through our foods. Some species manufacture their own vitamin C but humans cannot. We get our vitamin C from fruits and vegetables. It is an important antioxidant. When a molecule of vitamin C meets a free radical, it becomes oxidised, thereby rendering the free radical harmless. The body can recycle the vitamin C so it can do this time and again, but it cannot make the vitamin C in the first place.

Growing awareness of the role played by vitamins and trace elements in health has led to a burgeoning market in nutritional supplements, many of which are sold on the basis of their alleged anti-ageing properties. You can emerge from a shop nowadays carrying a bag full of all kinds of pills and potions that, if the labels could be believed, would have you living as long as Methusaleh.

It is, in fact, extremely hard to confirm the efficacy of nutritional supplements. There is recent indication from studies in the US that the effects may even be negative.

Our best evidence that nutrition has important effects on ageing comes from epidemiological studies where the patterns of nutrition are studied in populations, and statistical associations with health and disease are detected. The long lives of the Japanese are attributed to their traditional diet, which is rich in fish, vegetables, and soya products, while being low in sugar and fats. The Mediterranean diet, also associated with longer life, is rich in vegetables, fish and olive oil. Wine, another standard ingredient of the Mediterranean diet, is happily also good for health - at least in moderation. The death rates from heart disease in Mediterranean countries are a good deal lower than those in northern Europe, even if they are not as spectacularly low as in Japan. Italy, for example, has a three-fold lower rate than the UK.

Much research is now being done to identify exactly how and why the nutritional choices we make have these long-term impacts on health and longevity. Ageing results from accumulation of damage. If we remove known sources of damage from our consumption we slow the damaging process. Smoking damages us. Toxins

damage us. Saturated fats damage us. Excess sugar damages us. We are beginning to discover much about the biochemistry of these different kinds of damage and how they play their part in age-related degeneration and disease.

On the other hand, if we consume foods that aid the fight against damage - antioxidant-rich fruits and vegetables and cholesterol-lowering fish and olive oils - we enhance our protection. By narrowing the gap between the rates of damage and repair we can expect to extend our span of healthy life.

Another important area of choice is exercise. Our organs were designed to be used and their evolution took place in conditions far removed from today's. It is very striking that the age-related increase in blood pressure, which is almost universal in developed countries, is not seen in people like the Masai of East Africa who maintain very high levels of physical activity throughout life. Sedentary life styles are unnatural and we adopt them at our peril.

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Not only is exercise good for heart and lung function, it is also essential for healthy bones. Our skeletons are not static but undergo continual remodelling by cells evolved for this purpose. Osteoclasts nibble away at the bone surface removing microscopic signs of wear and tear. Osteoblasts repair and fill the holes with new bone material. The thing that stimulates these cells to do their work is exercise, which might be as simple as going for a walk or climbing the stairs. It is very striking that the rate of hip fracture among older people has increased two-fold during the last fifty years. Changing patterns of exercise may be partly to blame.

We know that exercise is good in youth but we are less aware that it takes on a greater, rather than a lesser significance, as we grow old. A simple task, like rising from a chair, taxes our muscles to a much greater fraction of their residual capacity when we are old than when we are young. Like an athlete, an old person must regularly perform at the limit of his or her physical ability. So however old we are, we can benefit from training, even if we have to perform our exercises from a chair. Randomised controlled trials on the effectiveness of exercise have shown that for older people the increase in muscle strength can be the equivalent of taking the muscle back in time to an age that is 15 years younger.

In addition to its training effects, there is evidence that exercise can retard - or even reverse - some of the molecular deterioration that accumulates with age. Research in Newcastle, home of the Great North Run, has shown that veteran athletes have fewer mutations in the mitochondria - the cellular power units - of their muscles than non-athletes of similar ages.

A key feature of mitochondria is that these tiny organelles have their own small genomes and their own life cycle inside our cells. Long ago, mitochondria were free-living bacteria that found life more comfortable inside another cell and have earned their keep ever since by being useful converters of energy. Each cell contains hundreds or thousands of them and they are forever renewing themselves, even if the cell in which they live has ceased its division.

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Mixed in among the good mitochondria are mutants that have had their DNA damaged by free radicals. One of the hot research questions in the field of cellular ageing today - one on which my colleagues and I are hard at work - is why the bad mitochondria build up in aged cells like muscle and how this contributes to ageing vulnerability. The benefit of exercise may come about because driving our cells to their energetic limits forces a kind of natural selection among the mitochondria, which helps check the expansion in numbers of the bad ones.

Exercise for the brain is as important as exercise for the body. Memory loss due to age, in the absence of an underlying disease like Alzheimer's, is much exaggerated. We forget things at all ages, but we are strongly (and wrongly) conditioned to blame only our age if we forget when we are older. Personally I can recall having the equivalent of so-called 'senior moments' since the age of seven, when I sent out invitations to my birthday party but forgot to indicate who they came from.

We must acknowledge, however, that on the average certain aspects of cognitive performance do decline with age. I emphasise "on the average" not only because there are very old individuals whose cognition remains remarkably sharp, but also because regularly practised skills, like music, chess, bridge or crossword puzzles, tend to be unusually well-conserved. Regular mental exercise seems to preserve the patterns of neuronal interconnection that might otherwise atrophy from disuse.

As a gerontologist, I am often asked what I do myself to stave off the ravages of ageing. The answer is that I practice what I preach - at least most of the time. I eat a very varied diet, including a high proportion of non-meat meals. The important thing with healthy eating, as with dieting, is not to attempt the impossible. If you don't enjoy what you eat, it won't work, but experimentation can lead to new tastes being acquired. I used to dislike tofu, but I love it now. I am also passionate about porridge, but that is another story. I do not take nutritional supplements, preferring to get vitamins and trace elements the natural way through foods.

In terms of exercise, I enjoy running but do so irregularly. However, I walk our dog each morning before breakfast. I keep a bicycle at work to get to meetings in other parts of the university, and I nearly always choose stairs rather than lifts. I am a great believer in the importance of maintaining a positive attitude to life. One is never too old to take up a new challenge or acquire a new skill. My own latest challenge has been to start learning to play the piano, something that brings me enormous pleasure. And I have a long list of plans for the future.

I have dealt so far with what we might call the 'easy' choices. I don't want to imply that holding to a healthy diet, sticking with an exercise plan, and maintaining a positive attitude through thick and thin is simple. But the choices are, in principle, straightforward.

I want now to turn to the harder choices - the choices that our society has to confront as it wakes up to the reality of the longevity revolution.

An important question is the priority we place on ensuring that older people are not denied the freedoms of choice that younger people take for granted.

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Inevitably, ageing involves loss. But prejudice and lack of appropriate provision frequently force a premature closing down of options, sometimes through neglect, sometimes through benign but misguided over-protection.

Over-protection can create or reinforce anxiety and self-doubt. If we treat old people as weak-spirited because they are frail, we do them serious injustice. The better alternative is to provide encouragement and support, which boosts confidence and self-reliance, contributing directly to a greater sense of well-being in spite of the infirmities of age.

Not everyone, of course, wants to live in a retirement village and we need a spectrum of choices that reflects the variety of personal preference, which increases rather than decreases with age. We must therefore take a radical look at how society can accommodate its growing numbers of older people while preserving the freedom of choice. New sheltered housing is commonly tucked away on the margins of the society, but older people whose mobility is often impaired need to be able to get out and about and engage with the rest of us. Access to amenities like shops, cinemas, parks, banks, museums, and even places of work is important. Public transport needs to be reliable and secure.

Immediately, the alarm bells start ringing. How much will it cost? Can we afford it? What about other priorities, like schools? When we talk about hard choices, nearly always we mean that something else will have to be sacrificed to pay for it. Perhaps this is so, and we need very carefully to consider how we balance our priorities.

But the trouble with our present mechanisms is that we marginalize older people and demean their sense of self-worth, so these discussions hardly begin on a level playing field. We also tend to lose sight of the fact that nearly all of us today can expect to grow old. Thus, in adjusting society today to make better provision for today's older generations - the vanguard of the longevity revolution - let us not lose sight of the fact that we are shaping the society in which the current schoolchildren and working generations will themselves grow old.

If we decide to invest in creating a better society for older people now, we are not stealing money from the young but investing it for their future as well. Our current short-term fiscal obsessions, coupled with hopelessly prejudiced and outmoded attitudes to ageing, are preventing us from seeing the wood for the trees.

Even from a purely fiscal point of view, it may be a smart move to invest in better infrastructure for older people if we want to prevent the much-vaunted 'burden' of care from overwhelming us. Properly accounted, the costs of reorganising our society to meet the needs of older people need not be a negative entry on the balance sheet. Interventions like pacemakers for people with neurocardiovascular instability, a

significant cause of falls in old age, have been shown to pay for themselves many times over, when they reduce demand on National Health Service facilities and postpone the age at which the high costs of dependency are incurred. And this is to say nothing of the gain in quality of life.

It is all too easy to see how imperfections in our present society lead to dependency. For a variety of reasons, many older people lose the habit of going out. Physical inactivity causes faster wasting of muscle and bone, which leads to increased risk of falls and fractures. Less social interaction means less mental stimulus, leading to a turning-in on oneself and greater vulnerability to depression.

A stark manifestation of the 'hard choice' mentality is the age-related rationing of medical care. Clearly there is an extremely difficult choice that must be made if there is one kidney available for transplant and ten recipients. But few choices are really as tricky as this and we are on thin ice, unsupported by our scientific understanding of the ageing process, if we make general assumptions about health and future life expectancy based solely on age.

Age is a statistic that is held to be of paramount importance in a patient's medical notes. But should it be? Why do we need to record a patient's age? Why not get rid of age from the medical record altogether and let the patient's biological state speak for itself? That way doctors decide how to treat you because of what's wrong with you, not because of how old you are.

The revolution in longevity has come so fast that we are still largely stuck in mind-sets of the past. The key ingredient distinguishing ageing from other social divisions is that it affects us all. We need to recognise therefore that when we make choices - sometimes hard financial choices - about initiatives to meet the challenge of an older population, it is not 'them and us' we are dealing with but 'us and us'. Let's be more robust in confronting the reality of our longer lives. We are making choices for ourselves.