Health: Change the day you die

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You jog before breakfast and fit far more than five portions of fruit and vegetables into your daily diet. You wouldn't dream of smoking, and you never binge drink.

If that is you, chances are that you're not simply interested in feeling good today. You also want to prevent disease in later life and get the full value of your pension payments by living to a ripe old age. But are you certain that what you're doing will really help? Is there anything extra that could give you another couple of decades?

It's probably no coincidence that the science of longevity is becoming mainstream just as the baby- boomer generation hits pensionable age. With life span doubling in the last 100 years, and increasing by 12 months every three or four years, today's young pensioners have an unprecedented number of years ahead of them.

Yet, according to a recent editorial in the journal Nature, there is currently an explosion of excitement 'about the prospect of searching for, and finding, the causes of ageing, and maybe even the fountain of youth itself'. Part of this excitement is about recent findings on lifestyle choices. Avoiding stress and depression contributes to long life, as does driving a sports utility vehicle: your chance of surviving a serious accident rises tenfold if you're driving a big car, according to US statistics.

A healthy diet is a proven factor in longevity. Half of all premature deaths " and a third of cancers " are diet-related, according to the World Health Organisation. Around 150,000 premature deaths from heart attack, stroke and cancer could be avoided every year if more Brits ate the Mediterranean diet (based on fruit, vegetables, whole grains, beans, nuts and seeds), according to WHO estimates.

And it's not just what you eat, it's also how much. Experiments on mice have shown that halving food consumption slows down the ageing process. The California-based Calorie Restriction Society believes 'ageing is a horror that has got to stop now' " in the words of its spokesman Michael Rae, who is 6ft tall and weighs just over eight stone. Even if you don't sign up to starving yourself into extreme old age, there's 'substantial' evidence that obesity, which currently affects well over half of men and women in Britain, is a killer through its association with heart disease and diabetes.

Regular intensive exercise such as running extends life expectancy. Each hour of exercise lengthens life by roughly two hours, according to researchers who followed 17,000 Harvard graduates for 20 years. Less strenuous activities such as walking, golf, table tennis and mowing the lawn don't have such a marked effect. But keeping active is an acknowledged way of lengthening your life. Recent research conducted by the Department for Work and Pensions showed that working in older age promotes health and longevity.

The excitement referred to in Nature is about genetics. In June, Newcastle University opened its Centre for Integrative Systems, a collaboration between its biology and engineering faculties (partly funded by a pounds 6m grant from the Biotechnology and Biological Sciences Research Council and Engineering and Physical Sciences Research Council) as part of a programme designed to 'cure old age'. Maximum life span, according to the centre's leader, Professor Tom Kirkwood, who is director of the university's Institute for Ageing and Health: 'Is not clock-driven but malleable, through modifying exposure to environmental damage or enhancing the maintenance functions of repair genes.'

These 'repair' genes have already been largely identified and shown to work. A lucky earthworm has had its life span extended five

times by 'genetic intervention', and while there's no intention to try the same experiment with humans, Thomas von Zglinicki, Professor of Cellular Gerontology at Newcastle University, says: 'We are now beginning to talk about curing old age. It really does look as though there is no fixed, non-changeable upper limit to life span.'

The centre has already started recruiting 2,800 siblings from across Europe who have proved their longevity by passing their 90th birthdays. The group will be subject to a 'genome-wide search', with blood samples checked for every gene and combination of genes so far identified.

'The aim is to identify combinations of genes that contribute to longevity, and then see how this combination can be created either by nutrition or medication,' Professor von Zglinicki says. 'With a healthy life span, people should die of old age rather than disease, almost certainly extending their life span as a result.'

Next month, a multidisciplinary group of academics, led by engineers, will celebrate the recent breakthroughs in stem-cell research at the second annual conference of SENS (Strategies for Engineered Negligible Senescence). 'Replacing damaged organs to greatly extend the human life span by substituting young and healthy for old and failing is no longer science fiction. Laboratories around the world are making progress in building replacement lung, kidney, liver and heart tissue,' says Dr Leonid Gavrilov, a leading member of SENS and director of the Center of Aging at the University of Chicago.

Dr Gavrilov describes a 'eureka' moment while working as a geneticist in the former Soviet Union on 'an unpredictable, dilapidated mainframe computer'. Its complex behaviour was best understood, he suddenly realised, 'by resorting to such human concepts as character, personality and change of mood, and this observation led to the bizarre idea that living organisms, including humans, resemble partially damaged machines rather than new ones'.

Preventing damage, he says, is central to ageing science. 'One of the greatest interventions is ensuring an adequate supply of folic acid to expectant mothers, thereby preventing DNA damage " analogous, he says, 'to improving the manufacturing process of a computer chip'. Another milestone will be the elimination of chronic infections and inflammations that damage tissue and organs.

The Cambridge geneticist Dr Aubrey de Gray, another SENS member, believes that there's no reason why people shouldn't live to 500 and beyond. 'All the metabolic side-effects whose accumulation is eventually pathogenic are amenable to repair, just as with a vintage car,' he argues. 'It may be a lot of work to keep a car on the road past its 70th birthday, but if you're willing to put in that work indefinitely, you'll keep it going indefinitely.'

How long have you got?

The following quiz compiled by the nutrition expert Jack Challem (author of Feed Your Genes Right " Eat to Turn off Disease-causing Genes and Slow Down Aging, Wiley, 2005) is designed to show how many hereditary, dietary and lifestyle factors can work against you and the health of your genes. According to Challem: 'Every person inherits some type of genetic weakness, and acquires additional genetic damage each and every day of his or her life.'

YOUR RISK FACTORS

n I am more than 40 years old

n My father died of a heart attack before the age of 50

n My mother died of breast or cervical cancer before the age of 40

n Serious diseases such as arthritis, cancer, diabetes, heart disease or obesity run in my family

'Yes' answers point to a risk of disease related to either inherited or age-related genetic damage

YOUR CURRENT HEALTH STATUS

n I am overweight and so is at least one of my parents

n My energy levels are not as high as I would like

n I have been diagnosed with diabetes

n I have been diagnosed with cardiovascular disease or cancer

n I regularly take two or more different medications for diagnosed diseases

n The older I get, the more forgetful I seem to become

'Yes' answers indicate that your genetics, cell function and metabolism have been compromised, most likely because of dietary or lifestyle habits. The more 'Yes' answers, the more seriously your genes and health have already been compromised

YOUR STRESS LEVELS

n I am under a lot of stress at home, at work or while commuting

n I have a lot of resentment or anger about things that are not the way they should be in my life

n I have not been in a long-term relationship for several years, or am in a relationship that I do not find enjoyable or satisfying

n I tend to have a lot of 'down' days or feel depressed

'Yes' answers reflect a high level of stress, which can alter gene function in brain cells

YOUR DIETARY AND EXERCISE HABITS

n I usually skip breakfast or just have coffee and a doughnut

n I do not like eating vegetables and do not eat them regularly

n I make meals at home by heating processed food in the microwave and eat out in fast-food outlets

n I smoke cigarettes

n I drink spirits or beer every day

n I am too busy or tired to exercise regularly

'Yes' answers indicate that you are not providing a sound nutritional or lifestyle environment for your genes