Biology and Society

Unit Six: Human Longevity

How long should we live?

Jeanne Louise Calment (1875-1997)

Jeanne Louise Calment was born in Arles, in the south of France on February 21, 1875. On Monday August 4, 1997: Jeanne Calment, the world's oldest person, died at age of 122. Her genes may have contributed to her longevity as her father lived to the age of 94 and her mother to the age of 86. Although, she long claimed an occasional glass of Port wine—along with a diet rich in olive oil—were the keys to her long life. Quote attributed to Jeanne Calment: "I took pleasure when I could. I acted clearly and morally and without regret. I'm very lucky."

Web Reference http://www.wowzone.com/calment.htm

The Top Record Holders

	Years / Days		Born	Died
1. Jeanne Calment	122	164	February 21,1875; August 4,1997	
2. Shigechiyo Izumi	120	237	June 29,1865; February 21,1986	
3. Sarah Knauss	119	97	September 24,1880; December 30,1999	
4. Marie Meilleur	117	230	August 29,1880; April 16,1998	
5. Estella Jones	117	229	November 10,1881; June 27,1999	
6. Tane Ikai	116	175	January 18,1879; July 12,1995	
7. Carrie C. White	116	88	November 18,1874; February 14,1991	
8. Janina Izykowska	116	+	February 27,1882 alive Feb 1998	

Web Reference

Other Records of Note

Marie-Louise Meilleur 117 years 230 days
born August 29,1880, died **April 16, 1998**

Ontario, Canada: Meilleur was born in Kamouraska on Aug. 29, 1880. After her first husband, Etienne Leclerc, died of pneumonia, Meilleur moved to Rapides des Joachims with her four young children to be closer to her sister. In Rapides des Joachims, Meilleur met and later married Hector Meilleur. They had six children together. In 1972, Marie-Louise moved to be with her daughter. At the age of 107, she moved to a nursing home.

At the time of her death, she had 75 grandchildren, 80 great grandchildren and 55 great-great-grandchildren.

She was described as a hard working woman who was strict.

Terms and Definitions to Know

Life Span—Individuals have a specified life span that is operationally defined by age at death.

Maximum Life Span—The documented longest-lived member of a species defines the maximum life span.

Life Expectancy—Life expectancy is the average age to which people are expected to live when they are born. For populations, demographers and actuaries calculate an average life expectancy based on the use of a life table. In heterogeneous populations, like humans, the maximum life-span is always greater than the life expectancy, by definition.

Health Expectancy—the average age up to which an individual can expect to have vigorous heath. Vigorous health can be defined as being able to move about normally and having clear mental faculties.
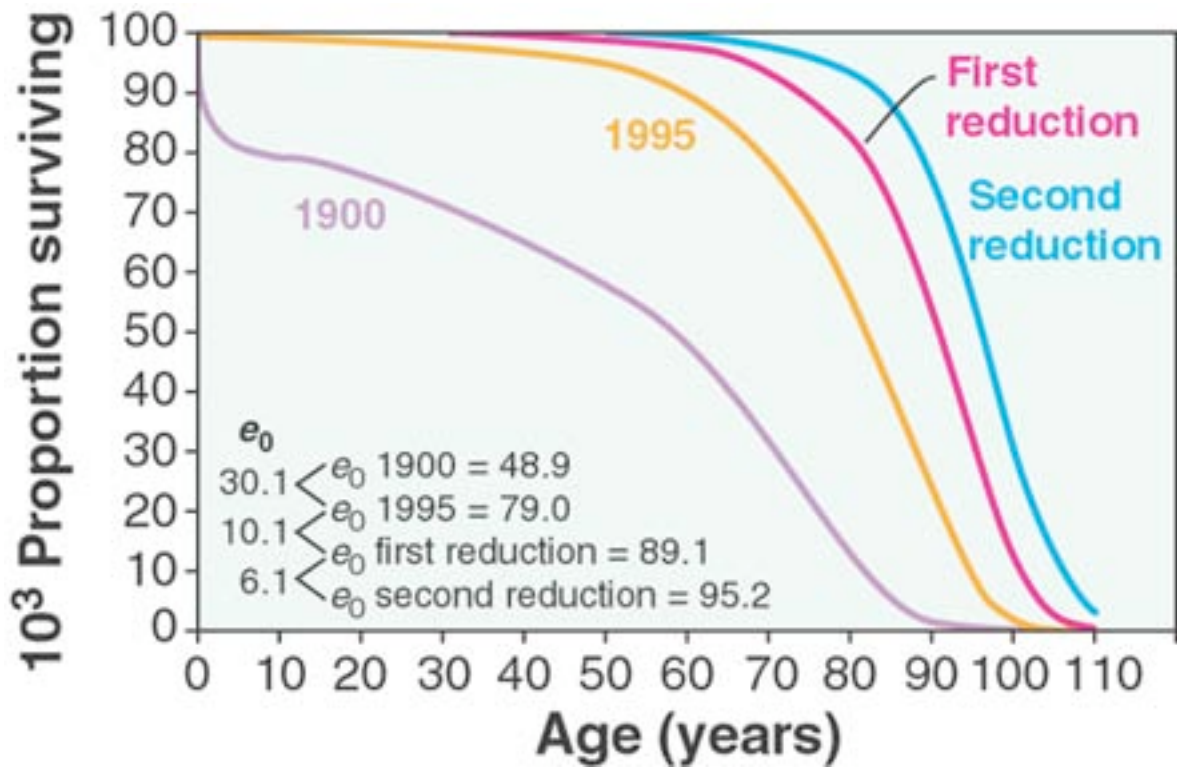
Survival curves and life expectancy at birth for females in the United States (1900, 1995, and projected).

U.S. Life Expectancy Reaches New High

by Maggie Fox, Reuters News Service, Oct 10, 2001

Heart disease and cancer are still the biggest killers, but Americans are surviving longer and more are dying of diseases associated with old age, a government report issued on Wednesday showed. Life expectancy for Americans has reached a new high of 76.9 years, compared with 76.7 years in 1999, mostly because fewer people are dying early from heart disease and cancer, the national Centers for Disease Control and Prevention reported. Death rates from murder, suicide, accidents, stroke, diabetes, chronic lower respiratory diseases, chronic liver disease and AIDS were also down in 2000, the report said. More and more Americans are lucky enough to die of old age, said Ari Minino, a demographer at the CDC's National Center for Health Statistics, who helped write the report.

"What we are seeing is an emergence and increase in illnesses that affect mostly the older population," Minino said in a telephone interview. "It's just because the population in the United States is getting older."

The report, based on medical files of most of the reported deaths in the United States, finds increases in deaths from Alzheimer's disease, influenza and pneumonia, kidney disease, high blood pressure, and septicemia or blood infection. "These are age-related diseases," Minino said. "There has been an increase in a condition that debuted into our 15 leading causes of death list. It is called pneumonitis," he added. "It afflicts mostly the elderly. It is an injury to the lungs caused sometimes by vomit and sometimes by particles of food or liquid that are aspirated into the lungs."

The report finds that 2,404,598 people died in the United States in 2000, 13,199 more than the year before. But because there were more Americans living overall, the death rate fell. Out of every 100,000 Americans living in 2000, 873 died, down from 877 per 100,000 in 1999.

Another piece of good news in the report—fewer babies died. "The preliminary infant mortality rate in the U.S. fell to its lowest level ever in 2000—6.9 infant deaths per 1,000 live births, down from a rate of 7.1 in 1999," the CDC said in a statement.

"A healthy pregnancy is a major factor in reducing the risk of infant death," CDC director Dr. Jeffrey Koplan said in the statement. "Timely prenatal care and avoiding harmful behavior like smoking are two examples of how pregnant mothers can protect the health of their infants."

Men are still more likely to die before women, with the life expectancy for a male born in 2000 now being 74.1 and for a female 79.5 years.

Top Ten Causes of Death in the U.S. in the year 2000

Heart disease killed more than 700,000

Cancers killed more than 550,000

Stroke, which killed 166,000

Chronic lower respiratory diseases, which killed 123,000

Accidents, which killed nearly 94,000

Diabetes, which killed nearly 69,000

Influenza and pneumonia, which killed 67,000

Alzheimer's, which killed more than 49,000

Nephritis and other kidney conditions killed 37,000

Septicemia (bacterial infection) killed more than 31,000

Web Reference
http://www.cdc.gov/nchs/deaths.htm

What is the future maximum human life span?

Four Opinions

One

March 9, 1999—At a recent meeting in Los Angeles, a small group of eminent academic scientists agreed that science might be on the brink of being able to stretch the human life span, perhaps significantly. Future generations, they said, may be able to avail themselves of scientifically established techniques to stretch the human life span like a piece of taffy until it reaches **150, even 200 years**.

> "It is going to be very hard for us to deal with. The idea of expanding the human life span to 150, 200 or more years puts a distance between ourselves and all of our history. And it puts humans in uncharted waters. All of human wisdom on how to live a life, no longer would apply." said Dr. Gregory Stock, the conference organizer.

Even as the scientists spoke of what might lie ahead, some drew back, nervous about public reactions and stung by their experiences when they voiced their opinions. Dr. Campisi of Berkeley said she recently gave a public lecture on aging on her campus. Afterward, she said,

> "a number of people came up to me and said, 'How dare you do this research? The earth is already being raped by too many people, there is so much garbage, so much pollution.'" "I was really quite taken aback," Dr. Campisi said. "It was a small group but they just about nailed me to the wall."

And yet, most of the scientists at the meeting said, the question is no longer will it happen but rather when? (Kolata, 1999)

Two

 "Unless the aging process itself can be brought under control, the mortality trends observed from 1985 to 1995 remain consistent with the expectation that **future gains in life expectancy will be measured in days or months rather than years**. In an environment of optimism about modern medicine and human longevity, it is sobering to realize that life expectancy (at birth or at older ages) could actually decline for some populations because of the re-emergence of infectious diseases, social and political unrest, or natural disasters."(Olshansky, et al. 2001)

Three

 "The goal of research on the phenomenon of cellular senescence is not unlike the goal of all research on the biology of aging. It is not to make us all immortal; that is not only impossible but also undesirable. Nor is it to stop or slow down the processes of aging, because those processes are inevitable. And because the determinants of our longevity are driven indirectly by most, if not all, of our genes, it is also very unlikely that tampering with that process is either probable or even desirable.

 Instead, our goal in this research and other research in the field of aging should first be to understand why old cells are more vulnerable to disease than are young cells. Once accomplished, those differences, if exploitable, could result in a **maximum 15-year increase in human life expectation**. Then the underlying inexorable processes of aging will be revealed as the cause of death. Unfortunately, those processes, absent the replacement of all vital organs—including the improbable replacement of the brain--will almost certainly be inescapable."

From the American Federation for Aging Research (AFAR)

Four

      "It is unlikely that we can stop the progression to increased life-spans and even "immortality," and it is doubtful that we can produce coherent ethical objections. **We should start thinking now about how we can live decently and creatively with the prospect of such lives.**" (Harris, 2000)

What is the forecast for the population over age 60?

"At the global level the proportion above age 60 is likely to increase from its current level of 10% to around 22% in 2050. This is higher than it is in western Europe today. By the end of the century it will increase to around 34%, and extensive population aging will occur in all world regions. The most extreme levels will be reached in Japan, where half of the population is likely to be age 60 and above by the end of the century." For North America the proportion above age 60 in 1995 was 16.4%. It is projected to be 30% by the year 2050. (Lutz, et al. 2001)

**What are the ethical issues raised by the prospect
of increasing human life expectancy?**

• The economics of aging populations

• Over-population

• Reproduction

• Competition between generations for jobs and resources

• Equality of health care

A Summary of Human Reproduction and Longevity

• What type of research is being done on human reproduction?

• What are the motives of those doing this research?

• What is the relationship between science and medicine?

Health Care Costs

by Rodger Doyle, *Scientific American* April 1999

Rising medical costs are a worldwide problem, but nowhere are they higher than in the U.S. Although Americans with good health insurance coverage may get the best medical treatment in the world, the health of the average American, as measured by life expectancy and infant mortality, is below the average of other major industrial countries. Inefficiency, fraud and the expense of malpractice suits are often blamed for high U.S. costs, but the major reason is over investment in technology and personnel. America leads the world in expensive diagnostic and therapeutic procedures, such as organ transplants, coronary artery bypass surgery and magnetic resonance imaging. Orange County, California, for example, has more MRI machines than all of Canada.

Federal policy since World War II has emphasized medical technology and the widespread building of hospitals, even in rural areas. Other industrial countries, in contrast, followed the more cost-effective alternative of building up regional centers. The U.S. has long over-invested in the training of specialists at the expense of primary physicians, leading to a large surplus of specialists. Because specialists have economic incentives to perform unnecessary procedures, they may contribute to cost inflation.

Other industrial countries have managed to slow the growth in costs while achieving near-universal coverage. These include Britain, France and Italy, which have heavily centralized systems; Canada and Germany, which have decentralized systems but whose provinces play a key administrative role; and Japan, which combines strong national policy making with health care administration left largely in private hands. In each instance, central governments imposed strict fiscal controls even though they resulted in long waiting times for elective treatment and considerable delays in seeing specialists.

According to political scientist Lawrence R. Jacobs of the University of Minnesota, universal access is a key to the success of other countries in imposing fiscal controls because it helps to lessen friction between groups. The American system encourages discord, for example, between health care insurers and high-risk people whom they exclude from coverage. Americans who receive adequate care through employers have little economic interest in seeing coverage extended to the more than 43 million Americans now uninsured.

HEALTH CARE EXPENDITURE
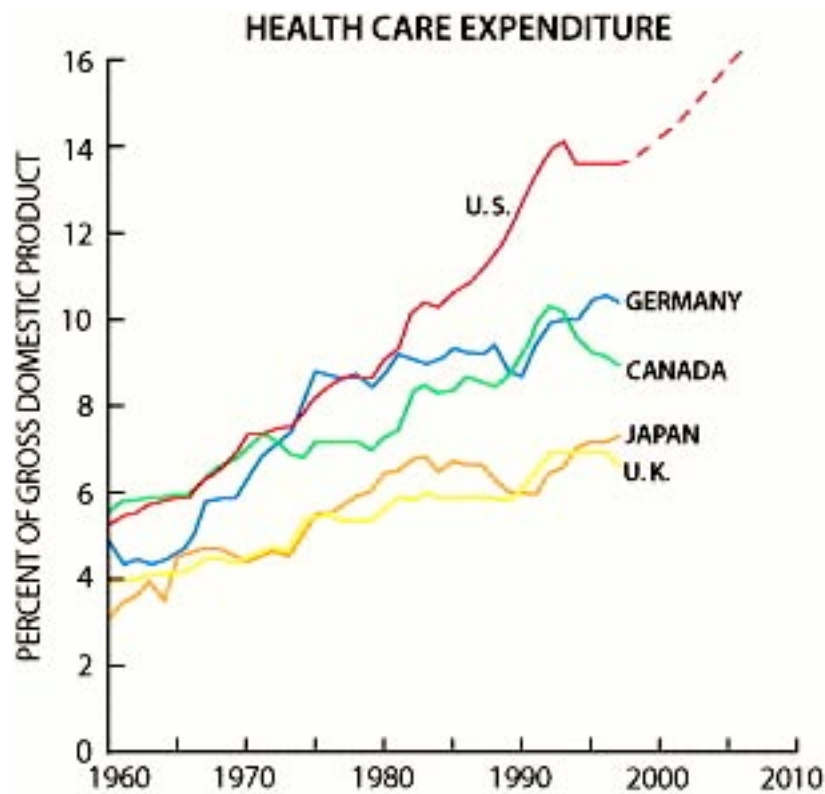
SOURCE: Organization for Economic Cooperation and Development, Health Data 1997. Dashed line shows projections for U.S. made by Sheila Smith, Mark Freeland, Stephen Heffler et al., "The Next Ten Years of Health Spending," in Health Affairs, Vol. 17, No. 5, pages 128–140; September –October 1998.

In recent years U.S. health care expenditures as a percent of gross domestic product have leveled off, probably as a result of the expansion of managed care. The projected increase to 16.6 percent of GDP in 2007 shown on the chart assumes that managed care will grow more slowly, that increasing consumer income will boost the demand for medical services and that medical cost inflation will accelerate. But the period of greatest stress will come after 2010, when baby boomers begin to retire. Not only will federal budgets be strained, but also employers, already paying far more in medical costs than foreign competitors, will be put at a further disadvantage in world trade.

How can the federal government ever assert fiscal control over medical costs? Victor R. Fuchs of Stanford University, a longtime observer of the medical economy, believes that comprehensive reform of the U.S. medical system will come only after a major political crisis as might accompany war, depression or widespread civil unrest. Such a crisis might arise as medical costs reach ever higher and threaten Social Security, Medicare and other popular programs; there could be political upheaval of such magnitude that medical reform will seem to be the easy solution.

National Institutes of Health
Press Briefing, FY 2001 President's Budget

The National Institutes of Health (NIH) serves the American public through the support and conduct of medical research. We have reached the end of a century in which the average life expectancy in the United States has increased by nearly 30 years–an accomplishment realized, in part, by research-based improvements in health. Continued improvements in the practice of medicine and health are possible, if we are prepared to take advantage of the achievements in fundamental science and informatics, including advanced computing and imaging.

In FY 1999 and FY 2000, Congress provided dramatic increases in the NIH budget, boosting our power to transform laboratory and clinical research into effective treatments and new approaches to the prevention of our most deadly diseases. As a result of these generous increases in our budget, the Institutes and Centers (ICs) at the NIH have many new initiatives underway, all of which will be continued in FY 2001 and beyond. This ramped-up investment in medical research will pay real dividends in the years to come–dividends in the form of new scientific knowledge, new treatments, new diagnostic tools, new cures, and new ways to prevent disease before it strikes.

Budget for fiscal year	1999	2000	2001
	actual	14% increase	5.6% increase
NIH Total	$15,633,189,000	17,849,235,000	18,849,235,000
National Institute on Aging	599,720,000	687,861,000	725,949,000

Update: The health institutes, a collection of 27 scientific institutes and centers on a college like campus in Bethesda, Md., has undergone a huge expansion in recent years, with its budget doubling to a proposed $27 billion for 2003 from $13.6 billion in 1998. (NYT, 3/7/02)

Aging is a Major Focus for Research Funds

"In the year 1999, the budget for the National Institutes of Health was ~15 billion dollars. The research and development budgets of the major pharmaceutical companies were in excess of $20 billion. At the current time the majority of those funds is focused on the major killers: heart disease, cancer, diabetes, asthma, etc. Most of these diseases have strong genetic components. It will be possible, circa 2005, to use gene-chips to scan people for the genetic mutations that lead to these diseases. Armed with that information we will be able to intervene with drugs or gene therapies that correct these diseases before they cause significant damage. Once these diseases are fully understood and therapies are in the pipelines, major funding will move to the only remaining "disease"—aging. So we can look forward to billions of dollars in research dollars going into understanding and developing interventions for aging processes."

"These facts and projections point toward a rapid understanding of the aging process and an application of technologies to significantly extend life-span. These technologies will be developed and applied faster than we age. The net result will be an unlimited maximum life-span. Will people live forever? Not as biological machines. The maximum average life-span will be determined by the rate of accidents which result in damage to the brain which is unrepairable. Depending on the accident rates for fires, earthquakes, floods, severe car/train/plane crashes, etc. the average life-span will be more than 100 years."

Robert Bradbury, Founder and President of Aeiveos Corporation, Seattle, WA.

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