Aging prevention

From Forty through seventy, the five major risk factors for heart disease are

- Family history,
- Smoking,
- High cholesterol,
- Diabetes,
- High blood pressure.

It is no small matter that the last three are related to diet and weight.

Once you see the pictures, you never forget. They elicit horror, pain and, yes, a gawking fascination.

An eight-year-old boy, bald and with withering limbs.

A nine-year-old girl stooped like a 99-year-old woman.

They are suffering from progeria -- premature aging-and usually meet their death by the time they reach their early teens.

Forget growing old gracefully. For centuries, graying adults have tried all kinds of things to live longer: prayers, yogurt, and mystical hot springs; even injections of goat-testicle extracts. Despite it all, the maximum human life span has not budged. At best, the statistics say, you can hope to reach about 120 years of age-and precious few actually do.

Working in the lab, biologists have already reared worms, fruit flies, mice and yeast that live twice as long as normal, thanks to mutations in a mere handful of genes.

Other researchers are peering into the increasing molecular disorder that characterizes aging in humans, from damaged DNA to misbehaving cells.

Physiologists are finding out why some people do get to celebrate their 100th birthdays. The oldest-known human, Jeanne Calment of France, recently died at 122, leaving researchers to marvel at the possibilities of long life. "Who is to say we could not go 10 or 20 years longer?" asks Caleb E. Finch, director of neurogerontology at the University of Southern California.

Jeanne Calment had the longest memory in human memory. As recently as 10 years ago, she recalled a trip she took to Paris where she saw an impressive new structure going up-the Eiffel Tower. Vincent van Gogh used to buy paint at her family's shop in Arles, and the artist made a bad impression on young Jeanne: he was ugly, bad-tempered and reeked of alcohol, she told reporters years later. At 85 she took up fencing and at 120 gave up smoking—"It was becoming a habit," she explained. She outlived all her descendants, including her grandson, a doctor, who died in 1963. Asked at 115 how she saw her future, she quipped, "Short, very short." But she was wrong: she lived seven more years, dying on August 4, 1997, at 122 years, five months and 14 days, the longest verifiable life span of any human being. She attributed her long life variously to olive oil, wine and a sense of humor. "I have only one wrinkle," she said, "and I'm sitting on it."

Most of us, of course, can never hope for longevity (or humor) to match Calment's—she is one in billions. But the number of centenarians is rising every year.

According to a July 1999 census report, there are about 72,000 people older than 100 in the U.S., a number expected to reach 834,000 within the next 50 years. Even more important, says Richard M. Suzman, associate director for behavioral and social research at the National Institute on Aging, the rate of disability in all populations, including the oldest old, has been dropping since 1982.

Demographers, geneticists and medical researchers hope that studying healthy people in their 80s, 90s, and 100s and beyond—the superstars of longevity will yield vital clues to how all of us can live longer, healthier lives.

Advice abounds about how to beat aging, by which we usually mean either living to the age of 150 or more or staying youthful while living out a life span closer to the biblical threescore and 10.

Some of the methods promoted over the years have sounded like sorcery: sleep with virgins, drink the blood of virile youth, and get injections of a concoction derived from the testes of dogs and guinea pigs. These techniques have done nothing more than line the pockets of the people hawking them.

You can drop cigarettes. Avoid alcohol. But there is one toxin you just cannot dodge -- oxygen. With every gulp of air, oxygen gives you life. Some of it, however, gets converted inside your cells into a radical molecule that can wreak havoc, degrading those same cells and others. A growing number of scientists say this damage is what causes aging. They also think they may one day be able to fend off oxygen's ill effects and help us live a lot longer.

Scientists have long known that oxygen is capricious. As molecules go, it gets around, reacting with all kinds of things. Mostly, that is good. Oxygen combines with fats and carbohydrates, in a part of cells known as the mitochondrion, to churn out the energy that gets you through the day. But the conversion is not perfect. A small amount of oxygen is regenerated in a nasty form called a free radical, or oxidant-the very thing that causes metal to rust. The oxidants careen about, binding to and disrupting the membranes, proteins, DNA and other cell structures that make your body work. Over time, this damage adds up, and the result just might be an older, frailer you.

Despite the national propensity for fad diets and miracle health cures, despite the ubiquitous talk of 'eating healthy'-- a concept so mercurial that every decade brings a new definition-- only a single dietary regime has ever been conclusively demonstrated to extend the life span and improve the health of laboratory animals, let alone humans.

It is known in the scientific lingo as 'caloric restriction' or 'calorie restriction' and less technically as "eating considerably less than you might normally prefer"--perhaps 30 to even 50 percent less. In other words, an average-size human on a calorie-restricted diet might consume 1,500 calories a day, compared with the 2,100 calories of the typical American. It is four or five small meals a day, predominantly vegetables and fruits. Calorie restriction, quite simply, is a draconian diet and a lifelong one at that. "It requires a psychological profile only one person in 1,000 has," says Richard Miller, associate director for research at the University of Michigan Geriatrics Center.

Nevertheless, the study of calorie-restricted diets has lately become a hot-ticket item among longevity and nutrition researchers, who have taken to extolling its virtues with remarkably unrestrained enthusiasm. Their reasons are clear-the list of the beneficial effects of calorie restriction in laboratory animals reads like the packaging on a miracle cure.

Calorie restriction will, for instance, increase both average and maximum life spans, and the fewer calories consumed, the greater the increase; it will reduce the occurrence of virtually all age-related diseases, including heart disease, diabetes and cancer. It will prevent kidney disease and cataracts as well as the development of Parkinson's and Alzheimer's diseases. It will lower blood cholesterol and forestall the age-related deterioration of the immune system. In mice, calorie restriction from an early age raises the maximum life span from 39 months to 56 months and at the same time preserves

what passes for intellectual function: a three-year-old calorie-restricted mouse, for example, can negotiate a maze with the quickness and ease of a normally fed mouse of six months, which is the mouse version of salad days.

Biologists have always warmed to the notion of a cellular alarm clock that would mark off the moments of a cell's life and ring when its time to die had arrived. The existence of such a molecular timepiece might suggest ways to slow the ticking or even rewind the clock and thus give people lengthened, healthier lives.

Would that biology were so manifestly simple. Mother Nature does not wear a Rolex, and scientists have yet to hear a ticking sound inside a cell's walls. The closest thing that anyone has found to a cellular clock resides at the tips of chromosomes in the nucleus of cells. Chromosome ends, stretches of DNA called telomeres, do not contain genes that program hereditary traits. But they do bear some resemblance to a kind of clock or a fuse that sets off a time bomb.

An explosion of work surrounding stem cells, which can differentiate into many other cell types, raises hope for medical repairs beyond our imagination-mending a damaged heart, fixing a failing liver, improving a forgetful brain and, most exciting, significantly extending life. Instead of using bionic parts, this technology could provide us with longer and healthier lives by enabling us to control our natural repair mechanisms.

This emerging field takes advantage of a cell that may emerge from the moment of conception. When a sperm cell works its way into an egg during fertilization, some scientists consider the result to be a stem cell. Other researchers consider stem cells to appear after several cell divisions that turn a fertilized egg into a hollow sphere of cells called a blastocyst. That sphere includes a region called the inner cell mass, consisting of a group of stem cells. Wherever stem cells

first arise, they can branch out in many directions. A stem cell holds all the information it needs to make bone, blood, brain-any part of a human body. It can also copy itself to maintain a stock of stem cells.

Atherosclerosis, diabetes, cirrhosis, hepatitis and other afflictions kill or disable millions of people every year by ravaging their organs over time. The elderly suffer the greatest toll. Bioartificial organs-a merger of mechanical parts with cells grown in laboratory cultures-could reduce premature death, improve quality of life and serve as vital bridges for seniors waiting for natural organ transplants.

Many thousands of people worldwide die annually waiting for a transplant, and many thousands more never even make it onto a waiting list.

Three-year-old Sam likes to feel starfish in his hands, and you can just forget about changing the subject when he is discussing planets. But Sam is not quite your average toddler. He is almost bald, his seven teeth do not align properly, and he is smaller than his peers. So far these are the only clues that he has Hutchinson-Gilford syndrome, a rare genetic disorder that mimics some aspects of aging.

No one can predict what course Sam's disease will take, but children with Hutchinson-Gilford syndrome typically develop arthritis and grow slowly. Their skin becomes thin, and age spots and prominent veins emerge. Most acquire severe atherosclerosis that can thwart blood flow to the brain and other organs. About 50 percent of afflicted children die of heart disease or stroke by their early teens.

It is hard to believe now, but 30 years ago the average layman and the average doctor thought that 'senility' was the result of either normal aging or hardening of the arteries. "What do you expect from an old person?" people would say. Mercifully, science has enlightened this rather Dickensian view. Today we may be close to understanding

what causes the major neurological diseases of old age, which ravage mental and physical function-the very stuff of life-and in their extreme form can kill.

But that does not mean we have found cures for the millions suffering from Alzheimer's disease and the millions with Parkinson's. The numbers could swell fourfold by 2040 as baby boomers reach old age. Legions of us worship at the temples of Physical Fitness and Cooking Light, in an attempt to ensure strong bodies at retirement. But what can we do when it is our brains that betray us?

To a degree, we are all ticking time bombs. As we eat, sleep, think and work, our cells divide again and again. Randomly over time, occasional bad copies are created. Meanwhile external insults such as tobacco smoke trigger other mutations. Most of the sinister cells are too crippled to survive, but some do. And sometimes they undergo further aberrations. When enough mutations have occurred, the result can be cancer. "We are all walking around with millions of premalignant cells," explains Robert A. Weinberg, professor of biology at the Massachusetts Institute of Technology's Whitehead Institute. "If we live long enough, we will all come down with one form of cancer or another."

Blood vessels are built to last. Up to about 100 years, some experts say, under normal wear and tear. For that to happen, you not only have to abide by a heart-healthy lifestyle-low-fat diet, weight in check, exercise, stress management, blood pressure control, good cholesterol numbers, moderate alcohol use, no smoking-but you also should be a woman, have the right genes and age slowly.

Cut to reality: we are not perfect. Our blood vessels endure various assaults because of factors only some of which we can control. We get heart disease-some millions have it, and a million or more die from heart attacks annually. The older we get, the more likely it is we

will end up with it. The proof is in the numbers: heart disease affects an estimated 15 percent of adults in their late 30s to early 40s, about 50 percent of 55-to 64-year-olds, and 65 percent of those in the next decade.

Is it not great that we are all going to live to 100? Sure... if we can stay healthy that long. Will greater longevity mean 30 years of quality old age or a 30-year purgatory of pain, disability and isolation?

Most of the scientific work on aging concerns the physical body-genes, cells, organs, and plaques in the arteries and brain. As our bodies last longer, however, we face an increasingly daunting challenge to psychological well-being. Even if we live through bone loss, hearing decline, arthritis, heart trouble, cancer and a weakened immune system, the daily battles threaten to wear down our spirit.

Indeed, with a growing arsenal of countermeasures to the physical ailments of aging, quality old age will depend more and more on good mental health.

That is a tough nut to crack, because age weakens our minds as much as our bodies, severely challenging our ability to remain mentally acute and emotionally positive. There is hope, though: science is beginning to provide clues about how to overcome the major mental challenges of old age.

Not everyone is so sanguine about getting older. Some of us fight it tooth and nail, both of which looked whiter and shinier years ago.