

How to Live to 100

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Humans have searched for the keys to long, healthy life for millennia. Snake oils have come and gone, old wives' tales are handed down and people at least since ancient Greece have sought water from a magical 'Fountain of Youth.'

For a long time, people were happy just to make it into middle age. Much is made of avoiding diabetes, high blood pressure and vascular disease, but fighting off infection is just as important to long life. The most important interventions that have improved longevity worldwide are the provision of clean water and safe sewage disposal. These two public health measures, by reducing infectious disease, drastically cut the infant mortality rate and enabled life into middle age. Since 2000, expanded access to antibiotics and HIV treatment is responsible for boosting life expectancy in many third world countries. Infection prevention and treatment are just as important to reaching a *very* old age, when one needs clean air and water and a healthy immune system to fight off rather than succumb to infections.

Since most Western societies have achieved reasonable sanitation, attention has turned to defining factors that enable a healthful, very-old age. Some studies look at population pockets with extreme longevity, while others compare very old people to those who die young in more standard populations.

In the 1970's, Alexander Leaf searched worldwide for healthy old people. He observed that abundant daily physical activity, living in the mountains and eating a low saturated-fat diet were common in purported centenarians around the world.

The Valley of Longevity in Vilcabamba, Ecuador became notorious for its long-lived residents, who

claimed to live as long as 135 years. Strict analysis of birth records has refuted claims of extreme longevity, but the Valley's residents do remain healthy and vigorous into old age. Their water, fruit, and herbs, given credit for longevity, have been used in fountain-of-youth products, but there is no proof that these, rather than genetics or other lifestyle factors, are responsible.

In Sardinia, Italy extreme old age is relatively common. Their centenarians believe it's because they eat healthfully (lots of vegetables, cheese and olive oil and little meat) and don't stop working. Others believe it's the air, or at least the pleasant weather which keeps people in a good mood. Until recently most transportation was "human-powered," so they got plenty of exercise. There must also be a genetic component because there are as many male centenarians as female, whereas the usual ratio is 4 females for every male. There is little intermarriage with those outside the island, so whatever longevity gene keeps these men alive is not diluted out in the gene pool.

The Okinawa and New England Centenarian studies are ongoing efforts to identify determinants of long life. I find it interesting that, at least as first devised, the studies differed significantly with respect to the type of data collected. The Okinawa Centenarian study has studied the longest-lived people in the world since 1975. Overall, Japanese life expectancy is the highest in the world, but the proportion of centenarians in Okinawa is double that of the general Japanese population. The investigators did physical examinations and lab tests, but focused heavily on activities of daily living, lifestyle habits and spiritual, psychological and social factors. Over time they increased emphasis on numerical data, genetics and diet.

Okinawan centenarians rarely have serious infections, diabetes or vascular disease (heart attack, stroke, high blood pressure) until very late in life.

They eat traditional agrarian diets and practice a cultural habit known as *hara hachi bu*, which is eating only until they are 80% full. Though they eat fewer calories than do other Japanese, they are short and the exceptionally old are not necessarily very thin. Compared to the rest of Japan, Okinawans eat many more legumes and sweet potatoes and less of other foods, but have better than average vitamin and potassium levels. They live physically active lives, avoid tobacco and drink little alcohol. Their lack of education and money doesn't keep them from living long happy lives.

Okinawan centenarians have very low levels of cholesterol, oxidized lipids, and homocysteine, normal antibody levels and very clean arteries into old age. These characteristics clearly contribute to freedom from disease, but it's debatable if they result entirely from diet and lifestyle. Perhaps their genetic make-up protects them from whatever lousy lifestyle they might choose.

In medicine, every disease is subject to the nature (genetic make-up) vs. nurture (environment and lifestyle) debate. All centenarian populations demonstrate a significant genetic effect. World-wide, having relatives who have lived very long lives gives anyone a much better, though not guaranteed, chance of doing so also. It's easy to suppose that there is something special about the environment or lifestyle of Sardinia, Okinawa and Vilcabamba that enables long life. A more likely rationale is that they are geographically isolated and their inhabitants rarely married people from outside their gene pool. A few people with good longevity genes might beget many ancestors who stay put, concentrating that gene pool in one location. However, these population pockets also follow similar lifestyle and dietary habits, so we don't know how much of their longevity is determined by their genes and how much lifestyle and their environment plays a role.

The New England Centenarian Study studies a more diverse gene pool. It began in 1995 by studying the super-elderly in eight towns in the Boston area before expanding to all of North America. They initially focused on diet and numerical measures, like weight, blood pressure and cholesterol, but

have added new emphasis on factors related to environment and psychological health.

Preliminary findings from the New England study have led to a Life Expectancy Calculator (<https://www.livingto100.com/calculator>). They've added extensive questions about life stress, sleep, relationships, work and environment to the original dietary and numerical questions (blood pressure, cholesterol, weight, dietary portions) asked 15 years ago.

These are some characteristics that have emerged from the New England study as predictors of long, healthy life: Most centenarian women and nearly all of the men are lean; a significant smoking history is rare; they experience less stress as a result of life's adversities and have fewer stressors; bodily functions, such as memory and the ability to procreate, remain healthy longer; longevity runs in families; their offspring score low in neuroticism and high in extraversion; and the longer you live, the longer you may live, assuming you are not hit by a truck.

Eighty-five percent of centenarians are women. Though many more women live 100 years, the males who make it to that age tend to have less disability. Perhaps women survive age-related disease better, living into very old age with some degree of disability. If men with illness are more likely to die from it, living to 100 would require freedom from disease and disability.

Living longer than 90 years is not related to societal advantages, such as education or socioeconomic status. While those things influence survival to, and past, age 65, their impact diminishes or disappears completely in the very old. Similarly, religion, ethnicity and patterns of diet, including vegetarianism, might get you past the U.S. average life expectancy of 78, but don't guarantee making it to 100. Even Seventh Day Adventists, whose strict adherents live 7-10 years longer than the average American, don't necessarily live to 100. And their lifestyle involves more than just a vegetarian diet: Their religion asks them to make other healthy lifestyle choices of abstinence from smoking,

regular exercise and devoting time to family and church.

We see what we look for and so far, we see that coming from long-lived genetic stock, getting plenty of exercise and sleep, consuming a diet that emphasizes plant foods and avoiding stress, pollution, tobacco, trauma and infection will help you to have a long, healthy life.