Why Supercentenarians Hold the Key to Extended Life [1]

1 [2]

Supercentenarians are rare people who have reached the age of 110 and remain fit. Amazingly, many of them never get sick, despite having some bad health habits in some cases. Scientists say it all comes down to genetics — which could lead to a gene therapy that promotes longevity. Here's how super-c's will help us extend human life.

Centenarians are rare as it is, but supercentenarians are far rarer.

To qualify as a supercentenarian, a person has to reach the age of 110. But because so few men reach this advanced age, their cut off is typically taken to be 107. Some 85% of centenarians are women and 15% are men. Among supercentenarians, however, the female prevalence may be as high as 90%.

A Rare Breed

In the U.S. and other industrialized nations, centenarians occur at a rate of about one in every 6,000 people. Interestingly, this rate is increasing; as early as 1994 the prevalence rate was one per 10,000, so centenarians are one of the fast growing segments of the population. There are currently around 54,000 centenarians living in the United States.

But out of these, only about a dozen will make it to 110, or one in every 4,500 centenarians. Worldwide, there are only about 65 individuals over the age of 110.

The first valid cases of supercentenarians appeared in the 1960s and their numbers have steadily increased since the mid 1980s. And like centenarians, their numbers are also increasing. The current prevalence of known supercentenarians in low-mortality countries is about 10 times higher than it was in the 1970s.

2 [3]

Vibrant and Healthy

"Supercentenarians are truly special," says James Clement. "Only people who

have special, protective, genes are capable of living this long." Clement is the CEO of Androcyte [4], a company dedicated to the study of super-c's.

Until recently, the only studies on longevity involved incredibly short-lived organisms, like nematode worms [5] and mice [6]. Human studies, on the other hand, have largely been limited to cells grown in petri dishes. Looking to overcome this limitation, Clement and colleagues have launched the Supercentenarian Research Study [7], an Androcyte-funded initiative that's working to identify the genetic variations that protect supercentenarians from disease and allow them to live nearly perfectly healthy lives until just shortly before their deaths.

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Indeed, supercentenarians are wonderful and intriguing models of aging. For example, the annual probability of death between the age of 110 to 114 is a constant 50% — meaning that mortality doesn't follow a curve at these highest stages of extended life. There's clearly something going on at the biological level.

As gerontologists like to say, "The older you get, the healthier you've been [8]," meaning that longevity can be tied to one's health history. Of centenarians, 15% have no clinically demonstrable disease at age 100, and they're called "escapers." About 43% are "delayers", or centenarians who don't exhibit an age related disease until age 80 years or later. And 42% of them are so-called "survivors", or those with a clinically demonstrable disease prior to the age of 80 years.

Without a doubt, one of the most remarkable things about supercentenarians is that they're vibrant well into their second century, both mentally and physically; some of them have never even seen a doctor.

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Image: Courtesy Supercentenarian Research Study

A 2006 study of 32 supercentenarians age 110 to 119 [9] revealed that 41% required minimal assistance or were independent. Very few of them had a history of vascular-related diseases, including myocardial infarction (6%) and stroke (13%). Some 22% were taking meds for hypertension, 25% had a history of cancer (all cured!), diabetes (3%), and Parkinson's disease (3%). But osteoporosis (44%) and cataract history (88%) were common.

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Image: Courtesy Supercentenarian Research Study

Remarkably, many supercentenarians did virtually nothing special to prolong their lives.

"Lifestyle doesn't seem to be an important factor," Clement told io9. "Most

supercentenarians smoked and drank all of their lives, yet seemed to be unaffected by these apparently unhealthy practices. I've met a lot of men and women over the age of 107, and most of them have been astonishingly healthy all of their lives. Many of them live by themselves, and still care for themselves. Some, like the 111-year old Barbados man we met, have never been sick a day in their lives, and few of these people ever suffered with a disease."

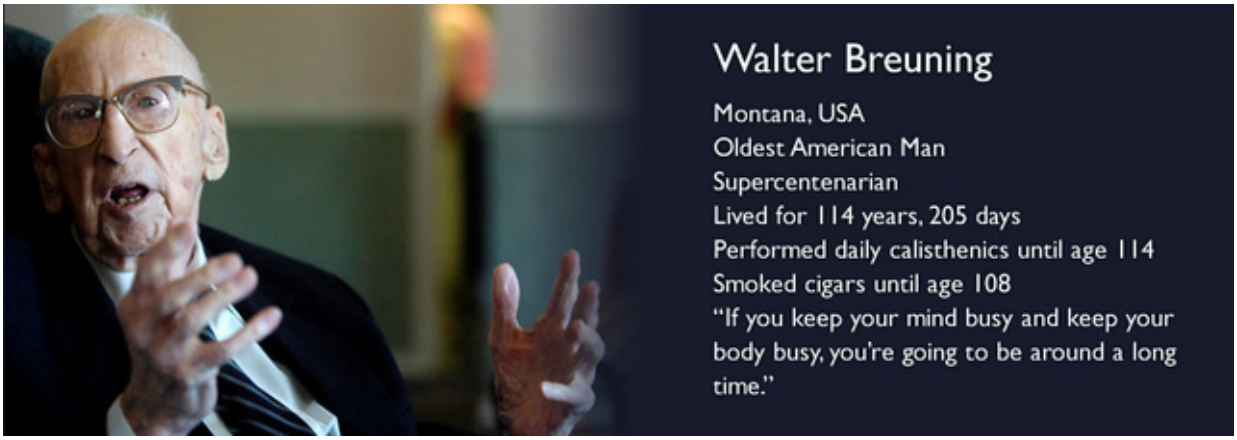

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Image: Courtesy Supercentenarian Research Study

Gerontologists know that siblings and children of both centenarians and supercentenarians have a much greater chance to be healthier and live to become a centenarian themselves than the rest of us. Research has found that the siblings of centenarians have about a 3.5 times greater chance of reaching 100 years than siblings of non-centenarians, and that siblings of male supercentenarians have a 17 times greater chance of living to 100 than that of the general population.

The Genes in Question

Longevity certainly appears to be heritable [10]. Alongside Androcyte's science advisor, George Church of Harvard Medical School, Clement's team is studying the DNA of these individuals in hopes of finding crucial genomic patterns.

Specifically, the study is looking into the ingrained protective mechanisms that stave off age-related conditions like cancer, cardiovascular disease, diabetes, Alzheimer's disease, Parkinson's disease, organ failure, immune system failure,

and neurodegeneration — as well as illnesses and injury caused by bone and muscle deterioration, dementia, loss of mobility, and cognitive decline. The point of the study is to compare genomic and molecular data from supercentenarians with those of "normal" individuals.

Various researchers — like Tom Perls, Nir Barzilai, and others — have identified certain genes that are common to a statistically significant number of supers/centenarians, but no one has, as yet, identified one or more genes that a majority of extremely long-lived individuals (107 and over) have in common.

"To appreciate why it's so extremely rare to live to 107 and beyond you need to think about it this way," explained Clement, "it may take several genes to help protect a person from various forms of cancer. You can have all of those genes, but still die early of cardiovascular disease. If you have genes that protect you from the many forms of CVD, you may nevertheless still die early from cancer, neurodegenerative diseases, diabetes, and so on. So a person likely needs numerous protective genes in every major category of disease risk, in order to sidestep these typical longevity landmines."

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In other words, super-c's are extreme mutants [11].

I asked Clement what he's ultimately hoping to achieve.

"Once we identify the protective genes, we can focus on numerous ways to upregulate those genes — including diet, environmental/lifestyle changes, and drugs — or change the bad alleles (substitution of a particular nucleotide for another) by gene therapy. Performing gene therapy using our adviser, George Church's CRISPR technology on autologous stem cells, seems like a good solution."

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But before we get to a gene therapy [12] that can make us all super-c's, we need to map the territory.

Although the Supercentenarian Research Study has blood samples from nearly a hundred individuals, it has the funds to sequence only a few of them.

Thankfully, DNA sequencing prices have dropped from $20,000 per person when they started in 2010 to about $2,000 now. For less than a quarter million dollars, the company could sequence all of them.

Doesn't seem like much in the large scheme of things.

[Other sources: Boston University School of Medicine: New England Centenarian Study [13] | Current validated living supercentenarians [14] | The Older Population Census Data 2010 [15]]

Top Image: From the documentary, How to Live Forever [16].

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