Protecting against cancer: What can we learn from animals who live for centuries

We live in a promising age, when science has begun unraveling the double helix of DNA, and with secrets that could allow significant extension of the human lifespan, and arguably more importantly extension of the "healthspan" — the length of time that a human can be not just alive but also healthy and productive.

In the last 125 years, life expectancy for the average person in industrialized countries has risen from under 40 years to well into the 80s. The increase was rapid during the first half of the 20th century as researchers learned to be proactive against infectious disease with antibiotics and an increasing number of vaccines. Today, the usual causes of death are very different from what they were a century ago and life expectancy continues to increase slowly, because of incremental medical advances.

Alongside incremental advance, there also are an increasing number of clues from watching other animal species that possess higher longevity than humans, or a lack of cancer, or both, that we could use to boost lifespan and healthspan dramatically. Careful study of the molecular biology of such animals might lead to new therapies for cancer and aging and diseases with associated genetic links to aging like Alzheimer disease, macular degeneration, as well as progeria, a rare condition in which children age rapidly and die of many of the same conditions that kill people in old age.

On the other hand, the interest that most people have in staying young and healthy can make them vulnerable to marketers of extracts from high longevity animals, despite lack of a rational basis of how the product might produce the desired effect. Such marketers are the literal snake oil salesmen (and snake oil saleswomen) of modern times who may be pushing the longevity of animals as a solution too far.

Telomeres, clams, and tortoises

australia-zoo-harriet-the-aldabran-tortoise-brisbane
Harriet the tortoise

In 2006, a clam nicknamed Ming died at the age of 507 years. It belonged to the species *Arctica islandica* and was called Ming, because analysis of the shell showed it had come to life during the Ming dynasty. It died because it was pulled out of the water off the coast of Iceland and killed, otherwise it might still be alive today. Of course, a clam has no brain. It's just a bunch of cells sitting at the bottom of the ocean. So, while interesting, the longevity of such a creature may not strike us as something that could be applied to human beings.

But that same year, a tortoise named Harriet died at the age of 176 in an Australian zoo. She was a celebrity, particularly because she had been a pet of Charles Darwin. Some less famous tortoises have been recorded actually living *longer* than Harriet. In both tortoises and clams, accumulating evidence suggests that the longevity could be due to genetic up-regulation of telomerase, an enzyme that helps keep chromosomes from wearing out by keeping nucleotide sequences called telomeres long.

Before people start posting comments that the data are not so clear on the connection between telomere length and aging, the point is that we are delving into the molecular basis of aging for humans and other

animals, not to suggest that we understand enough yet to intervene with human lifespan today. When it comes to telomere length, things are very complicated and science does still have numerous questions, many more in fact than answers. For instance, there are inconsistencies between various methods for measuring telomere length in different body tissues, telomeres shorten at different rates in different cells and tissues, and we don't know in which chromosomes having longer telomeres is more important. Also, while emerging gene therapies may be able to lengthen telomeres by increasing telomerase activity, how this might relate to the interplay between aging and diseases like cancer is uncertain.

On one hand, there are studies showing correlations between long telomeres, longevity, and lack of cancers in certain shellfish. But on the other hand, many types of cancer are able to grow, while overpowering the body's immune system, because the cancer cells gain a kind of immortality by increasing lengths of their telomeres. If you have precancerous or cancerous cells in your body that normally may not develop into an actual malignancy, you certainly do not want to help them along with a gene therapy that could increase telomerase in all cells, because it is not precisely targeted. In fact, there are some effective anti-cancer drugs that work by inhibiting telomerase, thus causing telomeres to shorten quickly in the rapidly dividing cancer cells so that they die out. This is not to put a damper on the idea for telomerase-related anti-aging therapies that are being studies. Rather, the point is that it's a potentially powerhouse clinical approach that could be a double edged sword, so it requires a lot more study.

Similarly, there's an anti-oncogene called *P53*. Research on it was featured in a recent PBS story on the New Hour, because elephants have about 40 copies of the gene and hardly ever get cancer. It made a wonderful story, because scientists are doing research to see whether we might eventually use the elephant P53 gene to fight cancer in humans. While humans also have P53 and it's similar to elephant P53, the typical human has only two or three copies of the gene, while people and families having just one copy or lacking the gene all together have a high incidence of cancer. In addition to the genetics, it works particularly well on television, because everybody loves a story about that shows elephants. At the same time, it's also responsible reporting, because, while the genetics and human biology may turn out to be as complex as the telomere issue with many years of laboratory research needed before it produces anything clinical, the science is sound.

Beware of 'shark' oil salesmen

In contrast with the science stories, because people do have a fascination with our non-human counterparts, phenomena in certain species, such as longevity and lack of cancer, or even the ability to strike fast or outrun a car, also present opportunists in the unregulated supplement industry to make a quick buck. The practice goes back to the snake oil peddlers of the 19th century, but for years people have been able to purchase bottles of shark liver oil. That's sold because sharks don't get cancer and today you can even buy it for your dog. Since it's considered a supplement, not a pharmaceutical, you can't be sure of the concentration of shark liver oil in the product, but that really doesn't matter, since there's no more basis for thinking that products extracted from a cancer-less shark should be helpful in a human to prevent cancer. In addition to a two-century long life span, tortoises also don't get cancer, but that doesn't mean that you should start dining on tortoise soup.

Why do consumers fall for such schemes? Maybe, there's a lingering superstition in society, the same

superstition that made people in centuries passed think that drinking, or being transfused with, the blood from particular animals would give people characteristics of that animal. Maybe, it's predatory marketing, or maybe it's a combination of both. Whatever the reason, however, as scientists proceed through the hard, nitty gritty work of testing, repeating experiments, and verifying, gradually genetic based therapies will come into clinical practice and society will learn to tell the difference by observing the results.

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