

Do Elephants Get Cancer?

Name _____

Because elephants are so large, they have many cells in their body dividing all the time to grow and maintain their body mass; one would expect just by chance alone they would have to get cancer.

Video: Go to Google.com and search ksl.com “Could Elephants’ ‘Superhero’ cancer gene protect humans too?”
<https://www.ksl.com/?nid=1012&sid=36864497>



What is the job the “guardian of genome”? _____

How many copies of the p53 gene do average humans, humans with Li Syndrome and elephants have? Fill in the table.

	Average Humans	Humans with Li Syndrome	Elephants
Copies of p53 genes			
Chances of developing cancer	25%	90%	< 5%
Apoptosis with stressors present	50%	10%	100%

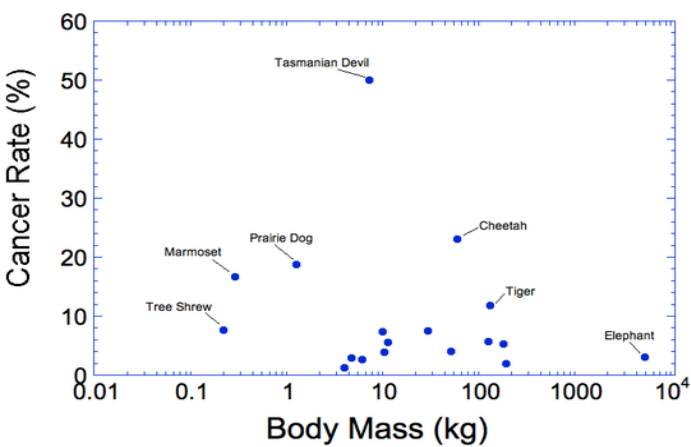
What types of stressors did scientists use on elephant blood as part of the study?

Using the table above, explain how having more p53 genes is advantageous in an elephant’s defense against cancer.

Describe the relationship between DNA, mutations, apoptosis and cancer. _____

Use the graph on the right to answer the following questions.

Describe the relationship between cancer rates and the body mass of the animal.



Using what you know from all the information above, how do you think human cancer patients could potentially benefit from the knowledge of the elephants p53 gene?

Do Naked Mole Rats (NMR) Get Cancer?

Name _____

While some of the mechanisms that underlie cancer resistance in small, long-lived mammals have been identified, the mechanisms by which large bodied animals evolved enhanced cancer resistance are unknown. Naked mole rats (NMR) (*Heterocephalus glaber*), for example, which have very long lifespans for a small-bodied organism evolved cells with extremely sensitive contact inhibition.



Video: Go to YouTube.com, and search “Why is the Naked Mole Rat so weird?”

<https://www.youtube.com/watch?v=QCWaYU7nnR0>

What happens to humans when oxygen drops from 20% to 5%? _____

What happens to NMR's when oxygen drops to 0%? _____

What special proteins do diving animals have to maintain oxygen levels when diving? _____

Video: Go to YouTube.com and search “The Inner Beauty of the Naked Mole Rat”

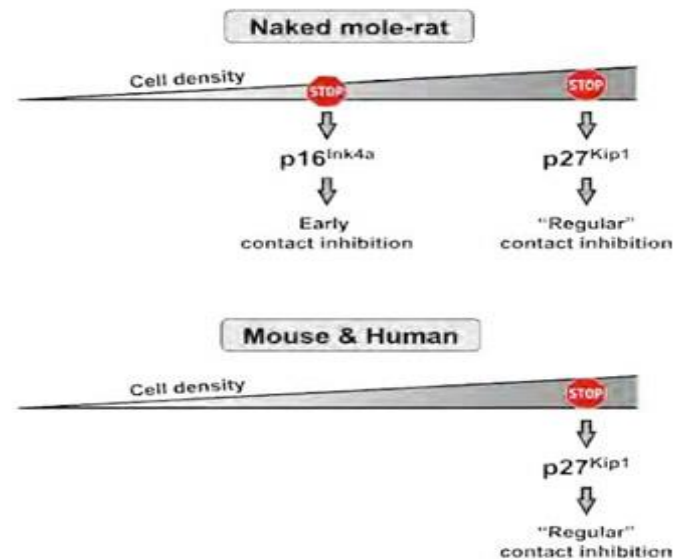
<https://www.youtube.com/watch?v=BQEna4Qovq4>

What is contact inhibition? _____

When NMR cells lose their claustrophobia, how does this affect their chances of developing a tumor? _____

The effect of p16 gene is so pronounced that when researchers purposely mutated the cells to induce a tumor, the cells' growth barely changed, whereas regular mouse cells became fully cancerous.

Using the figure, compare contact inhibition between naked mole rats and humans.



What benefit can stopping cell proliferation have on the ability of the animal to become cancerous?

Previous work has sought to kill the cancerous cells as soon as they begin to grow. This often involved toxins which are given to the patient to kill the cancer, but which have negative side-effects on healthy cells.

How can human cancer patients potentially benefit from knowledge of the naked mole rat p16 gene?

Do California Sea Lions Get Cancer?

Name _____

Science can benefit greatly from studying wild populations of animals. California Sea Lions (CSL) (*Zalophus californianus*) are large carnivorous mammals ranging along the west coast of North America from Baja California, Mexico in the south to British Columbia in the north. CSLs spend periods on land so they are more accessible as a study species than many other marine mammals. Approximately 1000 animals found dead along beaches each year and are examined and sampled at specialized wildlife rehabilitation facilities, offering an opportunity for studying.



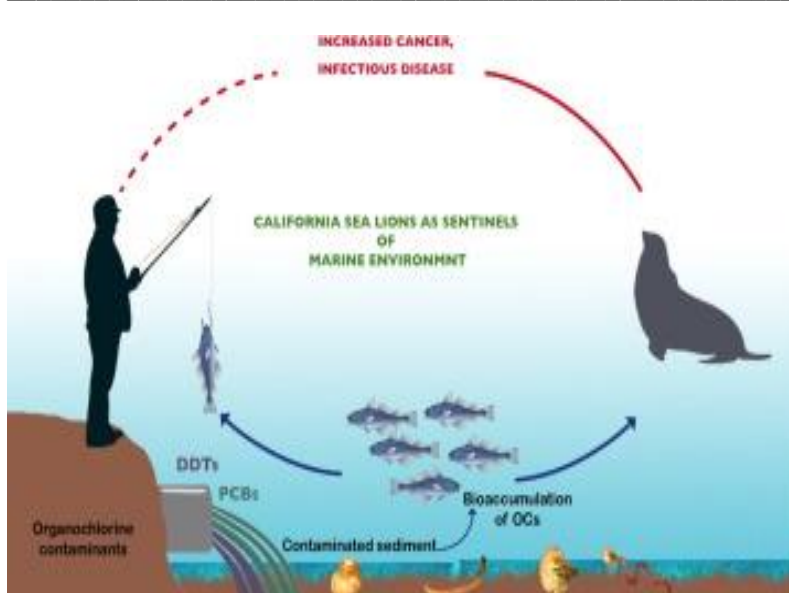
Video: Go to Google.com and search “Sea Lions and Cancer” <http://www.ktvu.com/news/173258555-video>

What sex of sea lions are developing the cancer and which part of their body is it most commonly affecting?

What factor do scientists believe is causing a higher rate of CSLs to develop cancer? _____

How are the deaths of the sea lions potentially beneficial to scientific studies of human cancer? _____

What are three potential contributing factors that may be leading to such high rates of cancer in this species?



Using the diagram, describe how pollutants in the water can have a similar impact on both sea lions and humans.

Studies on other aquatic species have linked tumors to contaminants in highly industrialized regions. Pollution off the Pacific coast may also be weakening the sea lions' immune systems. Some of the chemicals may be suppressing the animals' immune systems. *This suggests that a virus is not the cause of their cancers.*

In your own words, describe the relationship between pollutants, immune systems, viruses and cancer.

How can human cancer patients potentially benefit from the knowledge of what is causing cancer in sea lions?

Do Tasmanian Devils Get Cancer?

Name _____

Tasmanian devils are the largest carnivorous marsupial in the world. They have a stocky and muscular build, black fur, pungent odor, extremely loud and disturbing screech, keen sense of smell, and ferocity when feeding. The Tasmanian devil's large head and neck allow it to generate among the strongest bites per unit body mass of any extant mammal land predator, and it is both a hunter and a scavenger. Although it usually is solitary, it sometimes eats with other devils and defecates in a communal location.



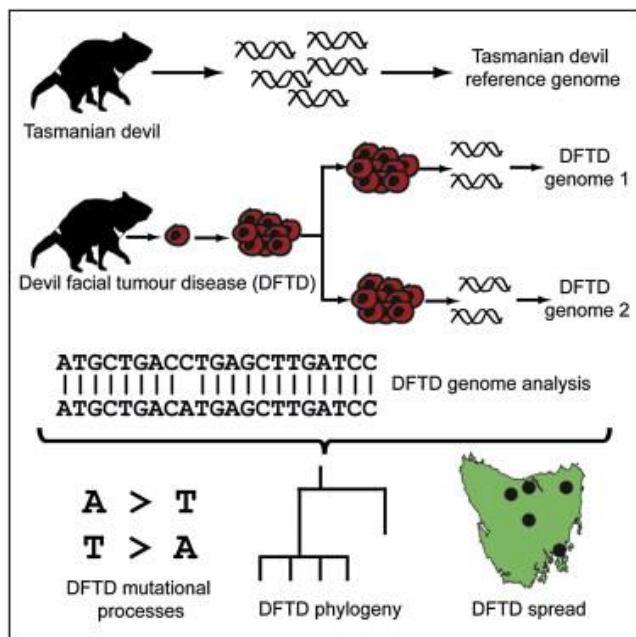
Video: Go to YouTube.com and search “Last of the Tasmanian devils? Infectious cancer to blame”

https://www.youtube.com/watch?v=g31Ky8_mqHk

How did the Tasmanian devil first develop the facial tumor disease? _____

Describe how the cancer is spread from one individual to another? _____

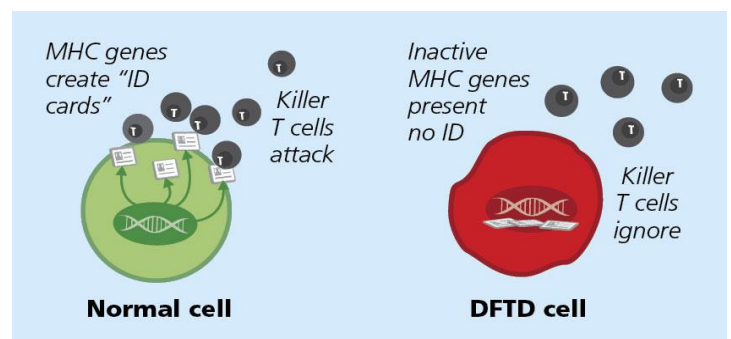
How can analyzing the genome of a healthy population help save this species from extinction? _____



In the diagram on the left, how does the Devil Facial Tumor Disease (DFTD) genome analysis differ from a typical genome?

This cancer is **not** transmitted by a virus but from the transfer of living cancer cells physically implanted into each animal (ex. biting another animal) evading the immune system.

If all of the tumors shared the same chromosomes, from where most likely did the original cancer stem? _____



What happens if Killer T cells (a type of white blood cell that kills viruses) can't detect a cancerous cell?

How could studying T cells help save the Tasmanian devil from extinction? _____

How can human cancer patients potentially benefit from the knowledge of how Tasmanian Devil Facial Tumor Disease is transmitted? _____

Describe 2 mechanisms that animals have evolved that enhance cancer resistance.

1. _____
2. _____

Describe 2 mechanisms in which animals have had an increased chance of developing cancer.

1. _____
2. _____

A lot of cancer research focuses on animals that are prone to cancer. But scientists also think it's possible to learn strategies for preventing tumors by studying animals that are cancer-proof.

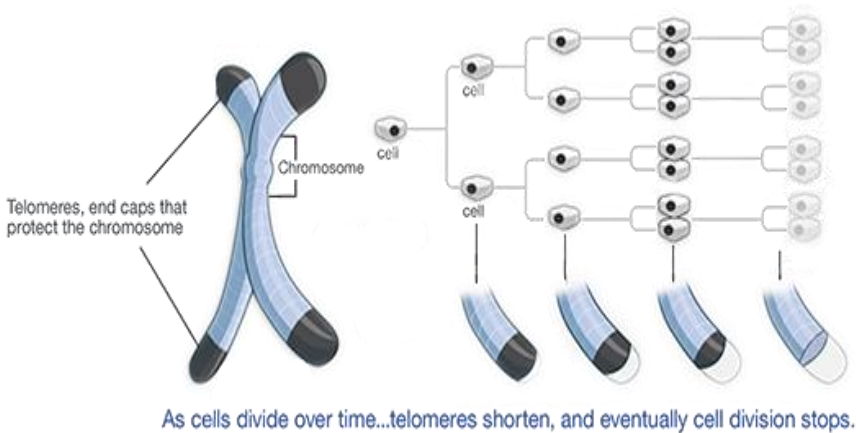
Driving Question: How can human cancer patients potentially benefit from the study of different cancer rates in other animals?

State your claim: _____

Cite the evidence (from the four descriptions above) that supports your claim: _____

Explain your reasoning as to how your evidence supports your claim: _____

A "telomere" is a substance has no apparent reason for existing except to provide a kind of "blank leader" that protects the vital DNA code each time it makes a copy of itself. The amount of times the DNA in a normal cell can reproduce before this vital telomere is worn away is called the Hayflick limit.



Using the diagram on the left, what happens to the telomeres every time the cell divides?

What happens to the cell if there are no more telomeres? _____

Comparing the diagram above for a normal cell to what you know about the rate of growth in cancer cells, how do you think telomeres in cancer cells differ from normal cells? _____

What would any potential advantages and/or disadvantages be if scientists could alter the amount of telomeres we contained on our chromosomes?

Do Axolotls get Cancer?

Name _____

The **axolotl** is sometimes known as a Mexican salamander (*Ambystoma mexicanum*) or a Mexican walking fish even though it is not a fish. It is an amphibian. Some amphibians possess some capacity for regeneration, but the axolotl is one-of-a-kind. It can regenerate multiple structures like limbs, jaws, tail, spinal cord, skin and more *without* evidence of scarring throughout their lives. Axolotls can even receive transplanted organs from other individuals and accept them without rejection.



Video: Go to YouTube.com and search “Axolotls are Masters of Regeneration” <https://www.youtube.com/watch?v=Eo50ctoOTWs>

What is the main factor that is driving axolotl populations to decrease? _____

What is unique about the physical growth and the environment of the axolotl compared to other salamanders?

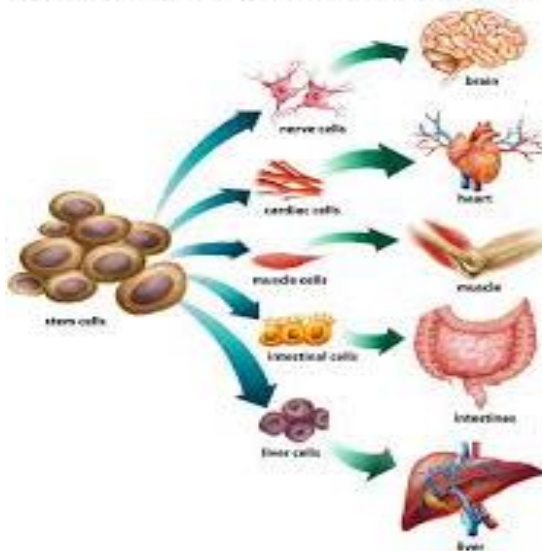
Describe how the regenerative properties of the axolotl “blow the competition out of the water”? _____

When the cells at an amputation site function more like stem cells, what advantage does this have for the regrowth process? _____

Describe what “plug and play body parts” means? _____

How do scientists use glowing proteins and albino axolotls to study cancer? _____

Potential Application of Human Stem Cells



Use the diagram on the left to describe the function of human stem cells? _____

How do human stem cells compare to the axolotl cells responsible for regeneration? _____

The capacity of human regeneration as we know it now, is limited. In both humans and axolotls, TGF- β 1 is involved in cell differentiation and proliferation, while p53 is infamous as being mutated in over 50 percent of all human cancers. Experiments with p53 and TGF- β 1 in axolotls showed that *both* TGF- β 1 and p53 appear to be essential for limb regeneration. Researchers working on limb regeneration hope the mechanism for regeneration from the axolotl can eventually be transferred into another species, as the axolotl is over 1,000 times more resistant to cancer than mammals.

How can human cancer patients potentially benefit from the knowledge of studying regenerative properties in Axolotls?