Weekly Read Week 3A: this is the first part of an article from online magazine 'Wired'. Elon Musk is a South African billionaire who want to create a city on Mars.

https://www.wired.co.uk/article/elon-musk-mars-colony-spacex-radiation-genetically-modified-humans

If Elon Musk is to colonise Mars, he'll need to recruit a crew of genetically-modified humans

People who live on Mars may need to be genetically altered to be resistant to radiation. And while it might seem a long way off, research is already underway to work out how this can be done

By **ABIGAIL BEALL**

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Elon Musk dreams of creating a million-person city on Mars. But first, the SpaceX and Tesla founder is going to need a small group of people with an unusual genetic trait in common; resistance to radiation.

Radiation resistance in humans and animals is something we know little about, although we know it exists. At the moment, resistance tests are used to try and predict how much radiation cancer patients can survive, but one day this could be an important decider of who gets to venture into space.

Our Earth is protected from the harmful radiation from the Sun by our magnetic field, but astronauts that leave the planet will be bombarded with the dangerous particles.

Norman Kleiman, from Columbia University's Mailman School of Public Health, has spent his career using eyes as a way to study the effects of exposure to radiation. We know more about individuals, human or animals, that have genetic defects in certain genes or groups of genes and therefore exhibit radiosensitivity, than those who are more resistant to the effects of radiation, he explains.

However, it's not impossible that in the future, humans could be gene-edited to better withstand the harshness of space; not limited to the radiation. There are many other new factors people will have to cope with when venturing to space, and we might be able to achieve those using gene editing.

"Gene editing can build a new type of innate, biological defence for astronauts on long-duration missions, along with physical, electrical, and pharmacological methods for protecting them," says professor Christopher Mason, from Weill Cornell Medicine.

"Gene editing done in organisms like plants and bacteria so that they better survive non-native environments would certainly help space-faring humans by constructing familiar habitats and providing sustainable sources of food and medicine," says Lisa Nip, from the Massachusetts Institute of Technology. Its a promising field of research, but a breakthrough remains a long way off.

“Gene editing in living humans, on the other hand, is still in its infancy,” says Nip. “There hasn't been much in the way of human trials to demonstrate that gene editing is indisputably effective or safe, not to mention the ethical questions that come into play once human gene editing is scientifically validated in human trials.”

There are a number of ways researchers are looking into protecting humans from the effects of radiation.

“Melanin in humans helps to dampen the effect of UV radiation from the Sun, but some of the radiation in space can't really be tackled simply by amplifying melanin production in the skin,” Nip explains. “Cosmic rays are higher in energy than UV, so such melanin-producing genes may help a little, but not by much, especially if the exposure is constant like it is in space.”

This could be one of the routes we go down to prepare humans for long-term space exploration. “Such research could, in theory, help make humans more radiation-resistant, but it will be a long way off from making humans radiation-proof,” Nip adds.

- Label the following statements true or false:

-Elon Musk founded the company SpaceX
-We know a lot about radiation resistance in humans and animals
-Lisa Nip is a professor from Columbia University
-We are a long way off from making humans radiation-proof

- What is the main problem preventing Elon Musk’s dream of creating a million-person city on Mars?
- Find a **modal verb** in the sub-headline that suggests it is possible that people will one day be able to live on Mars.
- Find a sentence or phrase that the **writer, Abigail Beall**, uses in her article to present the idea that humans could survive on Mars.
- Give an example of one **fact** and one **opinion** that Abigail Beall uses in her article.
- Look up definitions for the following words:
  pharmacological/indisputably/validated