Discovering science connections

**Biological and Physical Sciences + Planetary Science**

NASA’s Space Biology Program have been doing experiments to do with growing crops in microgravity and looking at the nutritional composition of those crops. They've been successful in growing edible lettuce and cabbage so far and are hoping for tomatoes to be added to the list soon. This is really great for space travel because launch mass can be reduced, longer duration missions can take place, as well as astronauts being able to enjoy some fresh food on the ISS (Massa, 2017). This brings into question, can the same be done on Mars?

The acceleration due to gravity is a value that varies on different planets due to their mass:

Earth ­­= 9.8m/s²

Mars = 3.7m/s²

ISS = 0.89m/s²

Plant growth is affected by tropisms – plant responses to stimuli from a particular direction. For example, gravitropism is a plant’s response that causes the roots to grow in the direction of gravity. These responses are important for the plant to develop properly and gain a sustainable nutritional composition (Takahashi, 2003). Therefore, the gravitational acceleration would affect the way a plant grows and in turn whether it’s usable as a crop. If crops can be grown in a microgravity environment such as the ISS, it’s likely that it will be possible to grow it in environments with levels of gravitational acceleration between 0.89m/s² and 9.8m/s²; such as Mars. This is one of many factors that would affect the habitability of Mars.

Another way gravity may affect plant growth is by changing the way capillary action (or flow) occurs. Plants on Earth exhibit capillary action which is the flow of water against gravity up the stem. This happens because water as a molecule is cohesive (attracted to other water molecules) and adhesive (attracted to the plant cell walls). This allows water to stick to the inside of the stem so that it doesn’t flow back down, as well as individual molecules dragging the molecule behind it up as it moves upwards. NASA’s Physical Science Program (Physcial Sciences Program, n.d.) has the capacity to research how capillary action occurs in space and therefore it’s function in plant growth in space.

A different factor that could affect plant growth is Martian soil composition, which has been found to be adequate for crop growth with the help of nitrate fertilisers (Osborn, 2020). This is because Martian soil has all the right nutrients needed for plant growth, the only issue is the levels of nutrients that may be in a particular plot of land.

These experiments from the biological and physical science division can help the planetary science division understand whether other planets in our solar system could be habitable, including the search for ‘ancient habitable environments’ on Mars.

**Heliophysics + Planetary Science**

Yet another factor that affects a planet’s habitability is the Sun. Solar wind can have an influence on the atmosphere and therefore how likely a planet is to be habitable. Therefore, NASA’s heliophysics division and the work they do to monitor the Sun’s activity can aid the planetary science division in assessing the habitability of planets in our solar system.

**Biological and Physical Sciences + Earth Science**

Global warming is a pressing issue that many aspects of science could aid in controlling. NASA’s Earth System Observatory in the Earth Science division aims to provide data on climate change and its effects such as natural hazards and changes in global food production (NASA Earth System Observatory, n.d.). In a more subtle way, NASA’s Combustion Science Program helps the fight against the enhanced greenhouse effect by studying combustion in microgravity. Combustion is the reaction between fuel and oxygen to produce carbon dioxide, water, and heat. Carbon dioxide is a greenhouse gas. Therefore, every combustion process such as cooking, driving a car, and burning fossil fuels releases greenhouse gases. NASA’s Combustion Science program studies the combustion process in detail in a microgravity environment as it eliminates effects gravity has on the combustion process (Gokoglu). By understanding combustion, NASA can help implement better/more efficient methods of using the combustion process in order to reduce the amount of greenhouse gases being released by human activities.

**What makes the perfect planet for life?**

Multiple of the NASA Science divisions appear to be leading us into this question. For example, the Earth Science division is monitoring the biggest reason why Earth is becoming increasingly imperfect: climate change. Will it get to the point where it severely affects Earth’s habitability, including threatening the end of the human race? The Planetary Science division aims to understand the overall habitability of our solar system, how it formed and how this may affect the creation and survival of life on other planets. The Astrophysics division goes beyond this and looks at the possibility of life beyond our solar system. Are we alone in the universe?

# References

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