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Today, we are going to design our own aliens!

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There are really 5 main things we have to focus on when it comes to life; air and atmosphere, light and radiation, temperature, water and gravity.

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Air and atmosphere concerns the gases that are in the atmosphere or the lack of an atmosphere to contain these gases. Like the Moon or Mars which have very little to no atmosphere whereas Jupiter's atmosphere is dense and mostly hydrogen and helium. Maybe even Io which is mostly sulphur dioxide which is toxic to humans.

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Even on our own planet we live side by side with plants that don't breathe the same way we do but rather the exact opposite, inhaling carbon dioxide and expelling oxygen. This symbiotic relationship might not only be on Earth! Along with this, there is even a small little creature at the bottom of the ocean known as the Loricifera that doesn't need oxygen to breathe as it is in parts of the ocean where very little oxygen is present, though scientists are doing more research on this and how it survives.

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Then we have to think about light and radiation. Radiation is a dangerous thing and without a thick enough atmosphere to shield us, we would be bombarded by radiation daily. Even with our atmosphere, we get sunburnt but on a planet like Mercury it would be even more dangerous because it is closer to the Sun and has pretty much no atmosphere!

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Light affects life in so many different ways. Say if our star, the Sun, was young and huge and blue. Our plants would have theoretically evolved to be redder to absorb more blue light to photosynthesise. Whereas on planets with very little sunlight like dwarf stars, the plants would be darker, almost black in colour to absorb more light. Animals who are nocturnal may evolve to have large eyes to absorb more light or possibly evolve to have no eyes and rely entirely on echolocation or even feeling the difference in water pressure like the Mexican tetra fish. They may have even evolved to have their own source of light like the anglerfish with its dorsal ray having what is essentially a lightbulb known as an esca attached to the end.

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Temperature is also a very concerning factor. Even on our own planet, the variations in temperature have drastically impacted the evolution of different species so on other planets this would be even more so with more extreme temperatures.

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For instance the polar bear and brown bear are distant relatives. The polar bear evolved from the brown bear to be white and blend in with its surroundings. The polar bear also has one of the richest diets in the animal kingdom and is the largest bear on Earth due to its need for the fat deposits to insulate it when it swims in the arctic waters. These are things to consider for alien worlds where the planet may be

freezing cold or boiling hot or both depending on when the Sun is in their sky. How would the alien adapt?

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And then, possibly most importantly for us is water. Earth is in this perfect zone known as the Habitable Zone around the Sun where liquid water is possible, Mars is also in this zone yet seems so completely different! It's obvious why we need water to grow and live but on other worlds, would another liquid do just as well? The main thing we look for on planets when it comes to potential life is liquid water, like the moon Europa in our own solar system. Europa is so far away from the Sun that this water is frozen, yet does that rule out life?

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Perhaps life could survive not only with liquid water but what about the liquid methane lakes of Titan, a moon of Saturn? Could that possibly sustain life too?

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And then there is, finally, gravity. Gravity is what keeps our atmosphere in place and its boundary is set about 100km above the surface of Earth, known as the Karman line. Gravity has a really large effect on us and the animals and plants of this world with even the slight variations in the gravity on Earth affecting evolution. So imagining worlds where they have twice the gravity of Earth would have a drastic effect on how your alien looks.

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For instance, on a low gravity world, trees would grow obscenely tall. This is even a problem with space missions as the lack of gravity affects people's bone mass. If you were born and raised on Mars you would be a lot taller than the average human but your bones would be weaker and your organs unaccustomed to our gravity if you came back.

Or if you lived in a high gravity place like Jupiter you would grow shorter and bulkier to withstand the crushing gravity. That is if you could find a place to stand without melting. Possibly the best bet would be to be able to fly.

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Now, here's an example of a martian which I will leave on screen for inspiration. As you can see it has evolved to live on Mars in very specific ways, like its thick shield to protect against cosmic radiation, its long eyelashes like a camel to protect its eyes during sandstorms, even a shield on its eyes to protect against UV radiation! It still has fins from when Mars had water, similar to how humans still have a tailbone but no tail! It also has suction cups for feet because of the low gravity and claws so it can burrow during sandstorms. These are all very specific features it has to survive on Mars, so how would an alien look on other worlds?

Possible questions to ask the class:

What do you think is the most important thing for life to survive?

Do you think there is extraterrestrial life out there?

Do you think the media portrays aliens in a realistic way? Is it good/bad?

Have you heard of the SETI Project?

More information on the SETI Project:

An institute of around 100 scientists who use telescopes to search for and understand life beyond Earth. SETI stands for Search for Extraterrestrial Intelligence and they are trying to detect evidence of technological civilizations that possibly exist elsewhere in the galaxy. Their main areas of interest and research are in astrobiology, radio astronomy and light astronomy and education and outreach to students with an interest in STEM and science research. The SETI team also use the I-LOFAR radio telescope in Birr, Co Offaly in their search.