Sound of Science
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Newsletter of

Science Society

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Is it possible to live on other planets?

Can we create a second Earth? It is a current scientific challenge. First, we need to know the surviving criteria on that planet?

1. Shelter: A basic structure could be made out of Martian regolith, which can be used to create bricks. However, we would need to **add protection against harmful space radiation** on another planet. On Earth, our **magnetic field** does the job of deflecting cosmic rays, but on places like Mars, this is not the case. A paper published earlier this year in Advances in Space Research showed that clay from **carbonaceous asteroids** could act as a more effective shield from radiation than aluminum.

2. Water: Another vital resource. "Water is abundant in space," says Dr Philip Metzger, from the University of Central Florida. "It exists as ice in the Moon's dark polar craters, it is **stored in the clay minerals** in many asteroids, and it is found in a variety of forms on Mars." On Mars there are many candidates from which water could be extracted, including the **regolith (soil)**, **hydrated minerals**, and **old glaciers** buried under the surface.

3. Oxygen: In order to breathe, oxygen is quite crucial. Oxygen can also be combined with water to create useful things like methane, from

which rocket fuel can be created. If water is abundant, oxygen can be produced through **electrolysis**, using a **current** to separate the **positively charged hydrogen ions** from the **negatively charged oxygen**.

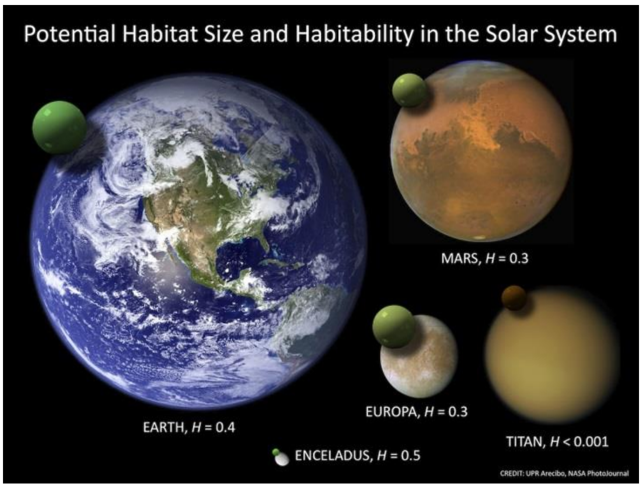
4. Food & Energy: For food, off-world farming techniques are tricky, but not impossible. Experiments on Earth using simulated Martian soil, like Food for Mars and Moon, based in the Netherlands, have managed to grow tomatoes. It is thought the Martian equator would be **warm enough for inflatable greenhouses to grow plants**, but these would also need a **power source**. And power might be a bit trickier, says Paul van Susante, senior lecturer in engineering at Michigan Tech University. "I am not sure what power sources we could scale up easily on Mars without bringing **nuclear power** from Earth," he says. "Small scale power is one thing, but on a larger scale local power generation may be needed in the form of solar farms."

Many astrobiologists believe that in order for life to arise and survive, it must be found on a planet or moon within the **habitable zone of a star**.

The habitable zone refers to the region around the star in which liquid water can form and remain liquid. The size of the star is important as well. **Stars that are much larger than the Sun have such short lifetimes**, that it is unlikely that there would be enough time for any kind of life, particularly complex life, to develop. Planets in the habitable zone of small stars may **still not be habitable** because these planets are so close to their star, they are tidally locked. This means that the **gravitational attraction** that keeps them in orbit around the star has caused the planet to always have one face of the planet facing towards stars and the other facing away. This would most likely cause the side facing the star to be **too hot** for liquid water to exist, and the other side would be **too cold**.

Our Sun seems to be just the right size to allow life to develop. It is small enough to have a long lifetime, but large enough that a planet can exist in the habitable zone and maintain **rapid rotation** as it orbits. Recent discoveries about some of Jupiter's moons have caused some scientists to consider expanding the definition of the habitable zone. The strong gravitational pull caused by large planets and **tidal interactions between orbiting moons** may produce enough energy to heat the cores of these moons. Under certain circumstances, this energy might be enough to keep at least parts of a moon warm enough to support liquid water, even if the moon was too far away from the star to be in the habitable zone created by the star.

The Milky Way also has its **own habitable zone**. The **center** of the Milky Way is much **denser with stars** than the outer regions. Nearby **supernova explosions** are much more **frequent**, and the radiation would sterilize any planets with life in that region. Stars very close to center of the galaxy would **receive intense x-ray radiation** from the supermassive black hole at the center of the galaxy, and life would be very unlikely to be able to develop in such an environment. Stars further towards the edge of the Milky Way galaxy tend to be Population II stars. These very old stars have **very few heavy elements**, and so these stars would be less likely to have planets, and less likely to have the complex chemistry required for life. In addition, we are fortunate that our star continues to remain in the habitable zone as it has done for billions of year. Many stars in the galaxy orbit with **more eccentric orbits**, so although they may cross the habitable zone from time to time, they probably do not remain long enough for life to arise and survive long term.



COMIC CORNER

RELAXING TIME

		5	4		1	3		
3				5				6
		7				2		
2	8	6				5	1	3
7	1	3				8	9	4
		8				4		
6				1				5
		2	7		6	1		

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9	6	5	4	2	1	3	7	8
3	2	1	8	5	7	9	4	6
8	4	7	6	3	9	2	5	1
2	8	6	9	7	4	5	1	3
4	5	9	1	8	3	6	2	7
7	1	3	5	6	2	8	9	4
1	7	8	3	9	5	4	6	2
6	9	4	2	1	8	7	3	5
5	3	2	7	4	6	1	8	9

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