A Look Into Different Possible Lifeforms Other Than Carbon, Its Alternatives

Kashyap Vyas

The human body is without a doubt, a wonder. It is a machine that acts based on the commands that we give, and it can also act on its own. The human body has also sparked many questions to which we still don't know the answers. And even today, we are learning new things about ourselves.

The magnificence of its creation leaves us thinking where it all began? To answer this question, we need to look into ourselves and the organic life around us.

RELATED: SCIENTISTS DISCOVER LIVING CELLS HAVE FORMED CARBON-SILICON BONDS

The first realization that we had about our origins was when scientists went about testing a multitude of life forms on Earth and found that every living thing has one common element in it – carbon.

When we study life, we notice that the ability of each carbon atom to sustain a network of four covalent bonds at the same time.

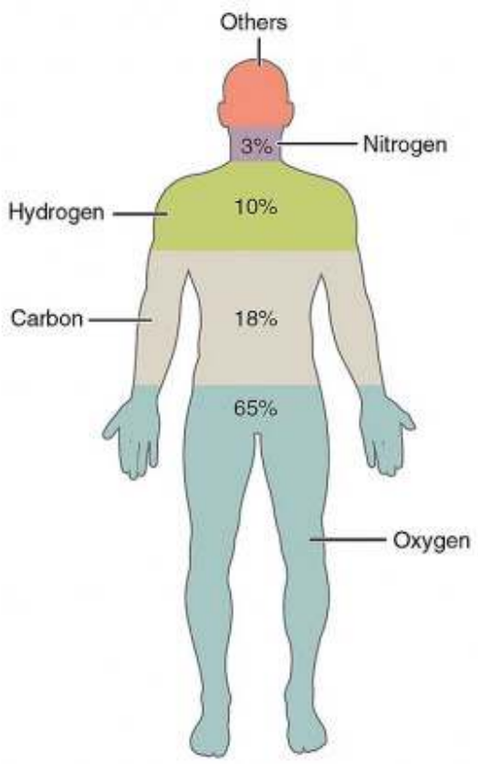
The Earth is filled with carbon-based lifeforms. The unique bonding ability of carbon enables it to form many different forms, such as charcoal, graphene, and diamond.

In bonding with other elements, carbon can create a diverse category of organic compounds.

Most life forms do not use all the elements in the periodic table. In fact, an organism may incorporate just a handful of elements in large quantities. In nature, the predominant chemical elements are known as CHNOPS, or Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulphur. These are the most common elements found in all organic molecules on Earth. They are often referred to as the ingredients of life, as their presence is found from the largest mammals to the smallest paramecium.

So, why are these elements so prominent where others are not? Scientists believe it is because of their abundance and their bond-creating abilities.

In many organic life forms, Sulphur has been replaced with Calcium as one of the most numerous elements. It is calculated that 99% of the human body is comprised of these six elements. Among them, oxygen, carbon, and hydrogen are most numerous.



Element	Symbol	Percentage in Body
Oxygen	O	65.0
Carbon	C	18.5
Hydrogen	H	9.5
Nitrogen	N	3.2
Calcium	Ca	1.5
Phosphorus	P	1.0
Potassium	K	0.4
Sulfur	S	0.3
Sodium	Na	0.2
Chlorine	Cl	0.2
Magnesium	Mg	0.1
Trace elements include boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).		less than 1.0

Source: OpenStax College/Wikimedia Commons

Oxygen makes up around **65%** of the total mass of a human. The second most common elements are carbon and hydrogen, making up around **18%** and **10%** of the human body by mass respectively.

Since our bodies are **60% water**, it is easy to see why oxygen and hydrogen are in abundance. Carbon is found in organic compounds in the body such as fats, carbohydrates, proteins, and nucleic acids.

Hydrogen is found in water and in many organic compounds. Similarly, nitrogen is found in nucleic acids and proteins.

In human DNA, nitrogen forms a key component of the genetic code. Phosphorus is found in the molecule ATP, which is the primary energy carrier of the body. It is also found in the human bones.

Calcium makes up around **1.5%** of the human body by mass and is abundant in human bones, proteins, and muscles.

We have discussed a lot about carbon and how its presence in organic compounds led to the term “carbon-based life.”

Carbon is regarded as the building block of life, but this notion leads to something referred to as Carbon Chauvinism.

This is a belief that carbon-based life applies to the whole universe. In other words, if aliens exist, they would also be based on carbon.

However, there is an element other than carbon that can sustain similar types of bonds. It is situated right below carbon in the periodic table – silicon.

Silicon is also capable of forming four covalent bonds, just like carbon, and this element has been used as a building block of extra-terrestrial life in many science fiction creations.

Similar to carbon and oxygen, silicon is abundant on Earth. Most of us have interacted with the oxidized form of silicon, called silica, at some point in our lives in the form of sand.

When carbon oxidizes, it turns into carbon dioxide gas. Our body oxidizes carbon to produce energy, giving off carbon dioxide as a waste product. However, when silica is oxidized, it turns into a solid - sand. Silicon bonds are also more unstable than carbon bonds. Another reason why there are no silicon-based organisms is that silicon cannot use water as a solvent in the same way that carbon can. It would require a completely different solvent, such as methane, which is not stable in normal conditions.

Life on Earth is capable of chemically manipulating silicon. For example, microscopic particles of silicon dioxide called phytoliths are found in some plants, and a type of photosynthetic algae called diatoms incorporates silicon dioxide in their skeletons. However, there are no known natural instances of life on Earth combining silicon and carbon together into molecules.

Researchers have succeeded in creating synthesized molecules made up of both silicon and carbon. These compounds are used in products such as pharmaceuticals, adhesives, paints, and fungicides. Scientists have also recently found a way to use microbes to chemically bond carbon and silicon together.

A paper published in Science by Frances Arnold and her team gives us insight into these findings.

Even though silicon-based life on Earth is not probable, we cannot rule out the fact that it might not be the case on other planets, where the atmospheric conditions are much different than that of earth.

Final words

With our limited information about the far reaches of space, it would be too naive to say that other lifeforms must necessarily be formed out of carbon. As researches have shown, life can make use of other elements to develop.