

Can silicon support life?

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Life on earth, and all things 'organic', consist of compounds based on carbon. Carbon has this special place because of the way atoms combine and the way carbon is built. It turns out that silicon, an element the earth abounds in, has much the same structure. This leads to possibilities of a life form based on silicon, and the dangers of such creatures invading the earth!

Carbon and atomic structure

Atoms consist of a positive nucleus surrounded by electrons in 'shells'. A rule in forming the shells is that the outermost shell may have no more than 8 electrons. Thus, if there is a 9th electron, a new shell is formed with only 1 electron.

Further, atoms 'strive' to have 2 or 8 electrons in the outer shell. The ones that set out with this number are already 'there' and stay 'inert'. But others need to combine with other atoms, to 'exchange' or 'share', electrons and make up the duplet or octet. . Thus, hydrogen, which has only 1 electron, combines with another hydrogen, so that they feel they each have 2. Or, hydrogen combines with chlorine, which has 7 electrons, and 'lends' 1 electron to chlorine, thus ending up with 'none and eight'! Or sodium, with 1 electron in the outer shell, combines with chlorine for an 'eight and eight', and so on.

The case of carbon is peculiar, as it has 4 outer shell electrons. So, carbon can form different stable combinations, like with 4 hydrogen atoms, that 'share' one electron each, or with mixed atoms, like hydrogen, another carbon and then nitrogen or chlorine. Or with oxygen, 2 atoms of which share the electrons of one carbon atom, etc. This 'four-way' linking permits great variety in the combinations, including 'chains' and 'rings'!

The result is a whole range of 'organic' compounds, like plastics, petrochemicals, synthetics, and the very building blocks of life!

The silicon question

Silicon has much the same 'outer 4' structure, like carbon. Indeed, carbon and silicon are similar in many ways, like they both form polymers, which are molecules in long chains. Like carbon, silicon forms chains and rings, like polymeric silicones, used to waterproof cloth or lubricate metal parts. But the big question is whether more complex forms like enzymes and the great variety that is required to uniquely control biological processes are possible.

Silicon is out of beat

It turns out that silicon does not quite make the grade. The complex dance of life requires interlocking chains of reactions, which happen only within a narrow range of temperatures. Over the last century, delicate and 'life-like' structures have been created, but silicon analogs of many carbon compounds, in conditions that can support life, are clearly out of reach.

For instance, when silicon burns, it gives not carbon dioxide gas, but a solid, called silica, or sand! This itself rules out a handy means of waste disposal for silicon based life. It would be like having carbon-based life on a planet with temperatures of -80°C .
