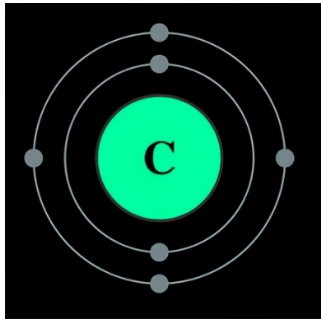


'Thank God for Carbon ~ in this life and the life to come'.



Introduction

Prepare for what I hope will be an exhilarating ride! In this article we will meander around the importance and uniqueness of carbon, look at some of the drawbacks and benefits of carbon dioxide, and consider the role of carbon in our present bodies.

It is good to be reminded of our geochemical origins, so we will visit the early chapters of Genesis, also looking at how we will 'return to dust' before taking on our New Bodies in the New Creation where carbon will again play a vital role. What will the New Creation and our New Bodies be like? Read on!

I hope the chemistry will not put you off but rather draw you into the wonder of how we are made and how God is involved in the science of our existence. Enjoy the ride!

Carbon – the Unique Element of Life

Because of its name 'carbon', from the Latin for 'coal', and because of carbon dioxide (CO₂), carbon itself (C) has got a bad press. However, it is one of the most remarkable elements in the periodic table and one which we can thank God for; without it we wouldn't exist!

Carbon's special properties come about because it is the smallest of all atoms which has 4 outermost electrons in its valence shell. This means that it can easily bond with other carbon atoms and form long straight chains, branched chains or cyclic chains. This ability is called 'catenation' and there is no other element that can touch carbon in its ability to do this.

As well as being able to form strong single, double or triple bonds with itself, it also likes to share its electrons with a number of other non-metals including nitrogen, oxygen, hydrogen, phosphorus and sulphur, forming what are called covalent bonds.

Compounds that contain carbon and hydrogen bonds are called 'organic compounds' and there are millions of them.

Another fascinating property of carbon is that it can exist as a number of what are called 'Allotropes'. An allotrope is a different physical form in which an element can exist. Two completely different allotropes of carbon are diamond and graphite.

Diamond is the hardest substance known, is colourless, and has no tendency to conduct electricity. Graphite, on the other hand, is one of the softest substances known, is black, and is a good conductor of electricity. Both are pure carbon, so how can they have such different properties?



The answer is that the strength of diamond is due to the spatial arrangement of each carbon atom bonding with 4 others at the corners of a tetrahedron. In graphite, each carbon atom is bound to 3 others, all in one plane or sheet. But the distance between each plane is relatively large and the bonds between each plane are weak and easy to deform. This allows one plane of atoms to move relative to other layers, so the graphite is soft enough to use in pencils and as a lubricant in motor oils.

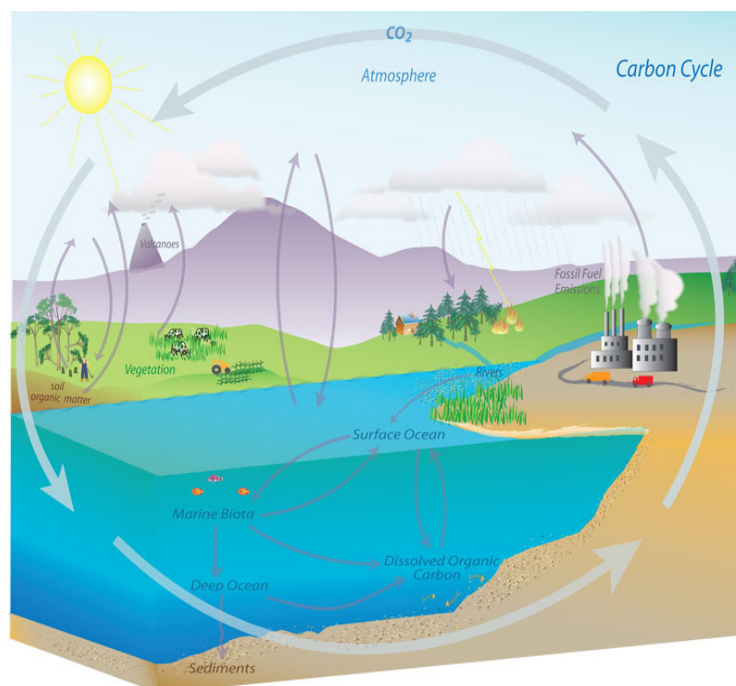
However, the oxides of carbon are problematical. Carbon monoxide (CO) is poisonous at relatively low concentrations in the air as it bonds preferentially with haemoglobin in our blood reducing the amount of oxygen it can carry. Hence the need for carbon monoxide detectors if we have gas-fired boilers, fires, ovens etc. in our homes. Carbon dioxide (CO₂) can suffocate us.

In terms of climate change, CO₂ absorbs lower energy, longer wavelength infra-red radiation from the sun that would otherwise be reflected back from the surface of the earth. Thus CO₂ traps heat.

The Carbon Cycle

But just like forests, oceans act as a carbon sink, absorbing CO₂ through organisms that use it for photosynthesis and a certain amount of CO₂ will dissolve in the water and produce a weak acid (carbonic). Oceans hold about 50 times more carbon than the atmosphere, but they have always both absorbed and emitted CO₂ depending on conditions. This is called the carbon cycle, which is defined as, 'the physical cycle of carbon through the earth's biosphere, geosphere, hydrosphere and atmosphere e.g. through photosynthesis, decomposition, respiration and carbonification'.

(See the National Oceanic & Atmospheric Administration website).



Eggshells and Coral Reefs

When you have your lightly boiled egg for breakfast, the eggshell, which is almost pure calcium carbonate (CaCO_3), doesn't dissolve in the water. But if the water was saturated with CO₂, the resulting carbonated water, now containing carbonic acid (H_2CO_3), would, over time, react with the calcium carbonate to form calcium bicarbonate ($\text{Ca}(\text{HCO}_3)_2$) which **is** soluble in water. Your eggshell would dissolve.

This is what is happening with some of our coral reefs. The exoskeletons of the marine animals making up the coral are calcium carbonate, and, with the increased acidity of some of our oceans, the exoskeletons are dissolving and the corals are dying.

CO₂ and the Food and Drinks Industry

CO₂ however, also has some positive qualities. It is used a lot in the food and drinks industry e.g. to remove caffeine from coffee beans, to keep food cool, to extend shelf-life, and to prevent the growth of bacteria etc.

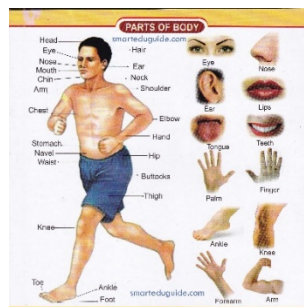
Many people prefer their drinks to be 'fizzy' rather than 'still', hence a 1 litre bottle of soft drink could contain as much as 3.5 litres of gaseous CO₂. This gives the drink 'sparkle' and imparts a biting soda taste in the mouth as well as having a preservative effect.

Another positive use of CO₂ is that when baking soda is mixed with a weak acid, say tartaric, and sold as baking powder, on mixing with water it produces CO₂ which causes the dough or batter to rise. Bakers rely on CO₂!

Carbon and the Human Body

But it is when we come to consider the human body that we realise how dependent we are on carbon. Psalm 139:13-16 tells us, in non-chemical terms, that God 'knit us together in our mother's wombs', and 'when I was woven together in the depths of the earth, your eyes saw my unformed body'.

It is no surprise to learn that carbon is the main component of proteins, fats, sugars (e.g. glucose – C₆H₁₂O₆), DNA, muscle tissue, nucleic acids, carbohydrates etc., so let's hear it for carbon and praise God for it! Without it and its amazing properties, we simply wouldn't exist!



Oxygen (mainly as water) is the major constituent of the human body (65% by mass), followed by carbon (18%), hydrogen (9.5%), nitrogen (3.2%), and phosphorous (1.2%). If you are an adult weighing 70 kilogrammes, 13 kilogrammes of you exists as carbon (by mass) ~ this represents 18% of you or 9000 pencils worth!

'I praise you because I am fearfully and wonderfully made; your works are wonderful; I know that full well'. (Ps. 139:14)

We have just been celebrating Jesus' incarnation so it is worth remembering that Jesus' body was composed of the same chemicals as our own. As Charles Wesley reminds us in one of his hymns, '[Jesus] laid his glory by, [God] wrapped him in our clay'. Wonderful!

But one more thing from Psalm 139. The psalmist goes on to say, 'How precious to me are your thoughts, O God! How vast is the sum of them! If I were to count them, they would outnumber the *grains of sand*' (verses 17 & 18).

From a chemical perspective, sand is silicon dioxide (SiO₂) and is called silica. In the periodic table, silicon is in the same group 14 of elements as carbon and also has 4 electrons in its outer shell. But it can't do what carbon can do. Because the silicon atoms are big, they tend to repel rather than attract each other and so cannot bond easily together in the way that carbon atoms can bond with other carbon atoms.

Silicon tends to form large matrix molecules of which sand is an example. Silicon, as Silica (SiO₂), is useful for making concrete, bricks, and is one of the main elements in the earth's crust, but it is not much use in building bodies!

Having said this, the average human body does contain about 7 grammes of silicon; most of it in hair, our finger and toenails, and in our bones.

In order to get silicon and carbon to make friends, you would have to heat them to about 2,500 deg. centigrade and they would form silicon carbide (SiC - carborundum), an abrasive. Silicon is also an important semiconductor in electronics and will form a chain with oxygen and methyl groups to form silicone polymers used as sealants.

But back to our bodies!

What I've written so far reminds us of our geochemical origin and takes us back to the early chapters of Genesis.

'The Lord God formed the man from the dust/clay/earth/mud (a'par) of the ground' (ha'adamah) (Gen. 2:7). We might even say we are made from humus ~ the words 'humus' and 'human' are related!

Like Abraham, we do well to remember this: 'I am nothing but dust and ashes.' (Gen. 18:27) As human beings, we are constructed from basic, common elements, as are all the members of the animal kingdom. 'The Lord God had formed out of the ground all the beasts of the field and all the birds of the air'. (Gen. 2:19)

Genesis 3:19 also reveals another truth, that we will die physically i.e. our bodies 'will return to the ground (ha' adamah) since from it you were taken; for dust (a'par) you are and to dust (a'par) you will return'.

If you have ever buried someone's ashes in the ground after their cremation, you will know what a powerful verse this is.



The death and decay of the human body is essentially the division of the body's compound substances into their constituent parts.

An important service we observe in the church I attend, is the 'Imposition of Ashes' held once a year on Ash Wednesday. Ashes, made from burnt palm crosses (mainly carbon), are used to form a cross on our foreheads and the following words are said: -

"Receive these ashes as a sign of the spirit of penitence with which we shall keep this season of Lent. God our Father, you create us from the dust of the earth: grant that these ashes may be for us a sign of our penitence and a symbol of our mortality; for it is by your grace alone that we receive eternal life in Jesus Christ our Saviour."



Of course, as Christians, we have many other amazing truths to hold on to (the Service of Imposition of Ashes is combined with the Service of Holy Communion); the Bible doesn't end with Genesis chapter 3 even though the book of Genesis itself does conclude with these sad, solemn, and salutary words, 'So Joseph died at the age of a hundred and ten. And after they embalmed him, he was placed in a coffin in Egypt'. (Gen. 50:26). A tragic end to a book that began so wonderfully.

So what are the other truths that God wants us to know about this important, though often neglected, subject?

Firstly, we are not just bodies but also living souls. Body + Breath = Living Soul/Being. 'And the Lord God formed man from the dust of the earth and breathed into his nostrils the breath of life, and man became a living being' (Gen. 2:7). Theologically, physical death is the separation of body from soul or body from spirit/wind/breath.

Secondly, our present bodies are perishable and weak, they 'embarrass us for they become sick and die'. (1 Cor. 15:43 – Living Bible)

Thirdly, Jesus has come to rescue us from the power of death. (Heb. 2:14&15) Death is seen as an enemy in the Bible, but through Christ's incarnation, death, resurrection, ascension and glorification, death has lost its sting and has been swallowed up in victory. (1 Cor. 15:54-57)

Fourthly, our present flesh and blood cannot inherit the kingdom of God, so a new kind of body (immortal and imperishable) is required. (1 Cor. 15:50)

Fifthly, Jesus has that new kind of body. His resurrection body is the first-fruit (singular in the Greek), the prototype. (1 Cor. 15:20)

Sixthly, God has put illustrations of death and resurrection all around us:

'When you put a seed/bulb into the ground, it doesn't grow into a plant unless it 'dies' first. And when the green shoot comes up out of the seed, it is very different from what you planted'. (1 Cor. 15:36 & 37 – Living Bible)

Seventhly, as we now share the characteristics of the first Adam, who was from the 'dust of the earth', so, through obedient and enduring faith in Christ, we will one day share his likeness as the 'man from heaven': - 'The first man [Adam] was of the dust of the earth, the second man [Christ] from heaven. As was the earthly man, so are those who are of the earth; and as is the man from heaven, so also are those who are of heaven. And just as we have borne the likeness of the earthly man so shall we bear the likeness of the man from heaven' (1Cor.15:47-49 - NIV)

And so it is that 'we eagerly await a Saviour from heaven, the Lord Jesus Christ, who by the power that enables him to bring everything under his control, will transform our lowly bodies so that they will be like his glorious body'. (Phil. 3:20&21)

The New Heaven, the New Earth and the New Jerusalem ~ What do we know?

We know that in the New Creation there will be no sun, no sea, no sex, no steaks, no Satan, no sadness, no sleeping, no suffering and no unredeemed sinners. There will be no keys, no NHS, no Police force, no clocks or watches and no death.

So who and what will be there? God himself will be with us on the New Earth; Jesus will be there; the Holy Spirit will be there; the redeemed people of God will be there; angels will be there; animals will be there (Is. 65:25); and there will be lots of worship and work for us to do!

There will also be lots of the familiar elements we have on this present earth e.g. pearl, calcium carbonate (CaCO₃); sapphire, aluminium oxide (Al₂O₃); jacinth, zirconium silicate (ZrSiO₄); jasper, silicon dioxide (SiO₂), and other gemstones that contain beryllium, fluorine, magnesium etc. There will also be pure (white) gold, like transparent glass. (Check all this out in Rev. 21:18-21)

There will also be water (H₂O), trees, leaves and fruit, so yes, that amazing element carbon will be there. (Rev. 22:1&2)

And what, more specifically, will our New Bodies be like?

Our new bodies will be like Jesus' resurrection body i.e. a physical, material body, with head, mouth, hands, arms, legs, feet etc. A body which can be seen, touched, heard and is able to eat food. Jesus was keen to reassure his disciples that he was not a 'spirit' or 'ghost'. 'See my hands and my feet, that I am myself', Jesus said (Lk. 24:39).

It is important to recognise that Jesus was resurrected as Jesus – we are not talking about re-incarnation, where the spirit is said to be clothed with a completely different body and personality. Jesus was very careful to point out to his disciples that he was back as himself, not as someone else.

I also believe that Carbon, Oxygen, Hydrogen and Nitrogen will again have a starring role to play in our new bodies.

Paul also differentiates between the 'earthly', 'natural', bodies we have had on this earth, and the 'spiritual', 'heavenly' bodies we shall have in the New Heaven and New Earth. This does not mean that our new resurrection bodies will be 'non-material', only that our new material bodies will be fully animated by the Spirit of God.

Being fully animated by the Spirit, we will never again feel tired, never again will we need to sleep. God neither slumbers nor sleeps and once we are like him, neither will we!

Our bodies will also be powerful and will not be subject to gravity (think of Jesus ascending to heaven). Never again will we need the transient thrills of Alton Towers!

They will also be personal; each of our bodies will retain our essential individuality. I will be resurrected as me, and you will be resurrected as you. For the first time you will be fully you, without any imperfections. We will also take on all the qualities and character of Christ; for the first time we will be fully like him, and fully ourselves.

One final thought. Knowing all of the above, the apostle Paul **wanted** to die, which he described as being 'with Christ' and 'better by far', but he was **willing** to stay in his body on this earth for the benefit of others.

However, most of us, if we are honest, are the other way round! We are **willing** to die but we **want** to remain in this body on this earth! (See Phil. 1:21-24)

Whether like Paul or not, we all as Christians no doubt reflect from time to time on the reality of death and eternity. I hope the journey through this article has helped you in your perspectives as we have considered the wonderful unity of the physical and the spiritual and some of the scientific facts which help us now to have faith for our material and glorious future.

"No eye has seen, no ear has heard, no mind has conceived what God has prepared for those who love him - but God has revealed it to us by his Spirit."

(1 Cor. 2:9&10)