Stargazey Pie!

A slice of Highlands astronomical life!

Tues 4th November 2014

HAS Meeting Notices November 2014

1. Current News and Dates for your Diary

- The HAS 20th Anniversary celebratory meal will be at Fairways on 22 November with Howie Firth as speaker.

- Our updated 2014/15 Programme of Events is available at reception; the details are also on the website at: www.spacegazer.com

- Evening sessions at the observatory are under way: Forthcoming sessions are:
  Friday 14th November – Public
  Saturday 15th November – Members
  Friday 21st November – Public

  Wrap up warm and always check the website (www.spacegazer..com) to check whether the session is running. Clear skies!

- **The next meeting is on 2nd December** - this talk, postponed from November, will be from by Professor James Dunlop, of the Royal Observatory, Edinburgh University, entitled "Early Galaxies".

- **January Outreach Day at the Eastgate Centre, Inverness** – advance notice that we will be holding our annual outreach day at the Eastgate Centre in January – date to be confirmed. This will be followed by viewing at the Observatory – we will need help with both – if you are able to volunteer for an hour or two please let a committee member know.

- **Suggestion Box** – at reception. Don't forget to let us know if you have any ideas you would like the committee to look at – this is your Society so please help the committee to provide what you are looking for or, of course, speak to a committee member.

- **Replacement of telescope mounts –** work is in progress to install the new mount for the LX200R telescope. Last weekend, Paul, Gerry, young James and Pauline removed the LX200R tube and placed it, carefully, in the observing station office. Unfortunately, more holes had to be drilled into the pier and tapped to allow the adaptor plate to be orientated south. Then the new EQ8 mount was fixed sucessfully to the adaptor plate. Testing of the mount is to take place before we demount the LX200R assembly.





- **Aurorae and Telephone alerts** – should you see an aurora, noctilucent clouds, or anything else of astronomical interest, please alert Paul (01667 456789) or Pauline (07751 112 586). It is never too late at night to let us know. PLEASE NOTE, the wording of the telephone alert is a little strange. If you receive a telephone call with a disembodied voice beginning, "This call will not cost you anything..." - please don't hang up, it is your aurora alert! Alerts can also be sent by text to your mobile – if you would prefer this option please check with Ronnie that we have you signed up for this.

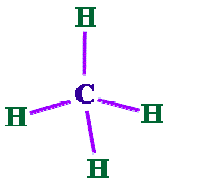
Main Event

Tonight we were very lucky that Paul Jenkins, one of our members and former Treasurer, was able to step into the shoes of Professor James Dunlop (who has had to postpone his talk until next month) and speak to us about Life in Space. Paul needs no introduction other than to say that as an engineer, he brings his engineer's eye for detail to his talks.

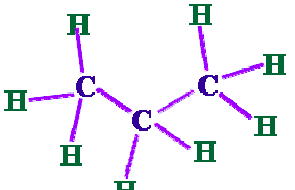
Paul began by clarifying what he means by life in space as we can think of it in a number of ways. One definition of life is: self-replicating molecules, although crystals replicate but are not alive. To be alive, an organisms needs to be able to grow, reproduce, digest excrete, move, respond to changes and maintain a constant internal state. However, even this list is not perfect; a fire meets some of these criteria, and a mule, which is most definitely alive, cannot reproduce. However, here in Earth's biosphere we consider life to comprise a carbon and water based, often complex, cellular form with genetic information that passes from generation to generation. Paul makes it clear that we need to be a little flexible in our definition of life.

When we come to space, Paul explained he meant the apparently empty and vacuum-filled space between the stars and planets but he also includes our Earth. We know life exists here but how did it get to our planet?

If we look at the chemistry of carbon, we can see it has six protons and six neutrons and, to balance the positive charge of the protons, there are six electrons, four of which are in the outer shell of the atom. Carbon atoms like to share their outer electrons and when side by side will form a covalent bond, which is very important in the chemistry of humans. The other outer electrons can combine with more carbon atoms, to form graphite and diamond. Or perhaps bond with hydrogen and make, for example, methane and propane, etc.

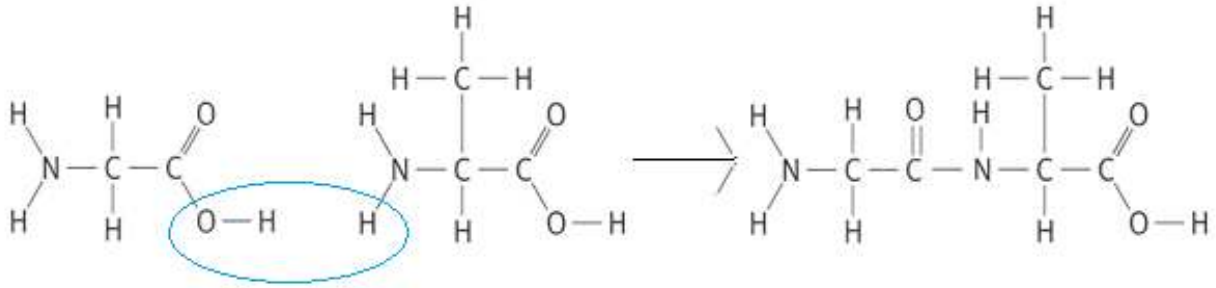


Methane



Propane

Oxygen and nitrogen can also combine with carbon and chaining atoms together is most important to life e.g. long chains of amino acids form proteins which are vital constituents of life.



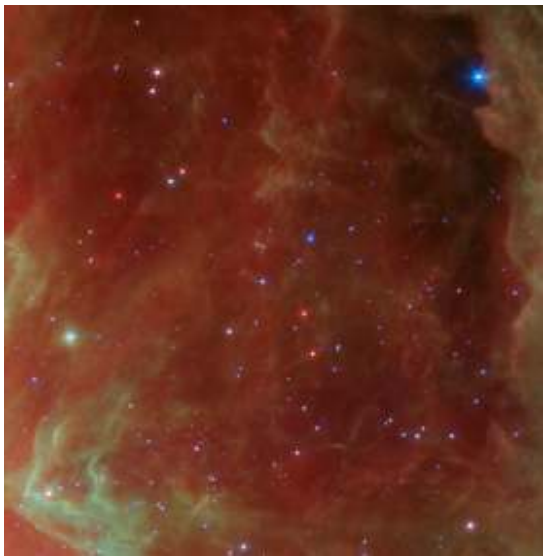
Glycine Alanine Start of a protein chain

The important point here is that complex molecules like proteins can be made from simple molecules such as amino acids. Therefore, simple combinations of common elements can quickly lead to complex life.

Paul discovered some surprising facts about the human body: we are made up of 37 trillion cells but we also carry 370 trillion bacteria within us.

For chemical reactions to occur a catalyst is needed and the whole system requires energy, which comes in the form of ultraviolet light from the stars.

There is a lot of dust in space made up of basic elements such as carbon, iron, etc. as well as water. The dust comes from supernova explosions: a large number of elements being created by the star as it goes through its life and also through the explosion itself. Reactions occur on the dust grains through adsorption (where atoms or molecules stick to the surface) and are catalysed, with energy supplied by starlight thus forming new compounds. This has been going on for billions of years.



We see dust in our own Galaxy as well as many others. The Great Orion Nebula is a well known example of a star forming region and in pictures taken with the Spitzer space telescope which uses infrared light it is possible to see proto-stars that are just forming – these are the red dots (left) and many will have infant solar systems forming from all that dust.

Using spectroscopy it is possible to find molecules that are precursors of life and amazingly these were being formed before the gas and dust clouds generate stars and planets. How do these precursor chemicals turn into living organisms? It can be speculated that they may well fall from space and on Earth they can do this either as dust drifting down to Earth, and It has been estimated 100 tonnes of dust reaches the surface every day, or as meteorites which may preserve these precursor chemicals within them.

We saw this meteorite in the Natural History Museum the day it arrived but it had started out as a piece of Mars. (Right).

As humans we can only survive in a fairly narrow set of conditions whereas some life, known as extremophiles, can tolerate environments such as high pressure (deep sea creatures around hydrothermal vents), dehydration, radiation and no oxygen (tiny creatures called Tardigrades), freezing conditions in Antarctica (microbes) and bacteria which can survive after being encased in amber for 40 million years or bacteria which can live deep underground. Therefore, surely it could be possible for life to be transferred between planets? Paul tells us that his talk tonight is a taster of a talk we are hoping to have from Professor N.C. Wickramasinghe of Cardiff University about transpermia.

In our solar system, Mars is being explored by rovers looking for places where life could be viable. Then there are the outer moons, some of which like Europa, Enceladus and Callisto have water oceans beneath their surfaces.

Ours is one of many solar systems; the number of confirmed extrasolar planets is now 1,832 and some of these planets may well be in the Goldilocks (habitable) zone around a Sun-like star. Perhaps some of these planets have life on them. Brian Cox believes we may be the top product of natural selection in the whole universe. Paul disagrees. He has shown how precursor chemicals are being created in space, how these chemicals can fall to the surface and survive and grow if conditions are right. In our Galaxy there are up to 11 billion potentially habitable Earth-sized planets orbiting Sun-like stars and another 29 billion orbiting red dwarf stars – surely there must be life elsewhere. However, Paul does admit that technologically developed life might be a little less common.

A fundamental belief amongst astrophysicists is that physics is consistent throughout the universe. If that is true then precursor chemicals have been, and are still being, produced which must have combined and generated life somewhere.

Paul finishes by telling us we are not alone...

Thank you Paul, for a thought provoking talk about life in space, about how it could get started more easily than we realised and may therefore be present out there somewhere in our Galaxy and beyond.

Next time we have Dr Professor James Dunlop speaking on ‘Early Galaxies’ the talk postponed from October. Not postponed is our usual tea and biscuits prepared for us by Marian. Clear skies.

Pauline Macrae