Christmas 2014

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Is Rudolph's shiny nose a result of bioluminescence?

/ Edward Sallabank *- 12 W*

We all know the story. Santa's in trouble! He needs to deliver his presents, but he can't see through the snowstorm. Enter the hero Rudolph with his magical glowing nose to light the way and guide Santa around the world.

How could this be? A possibility is that Rudolph's nose is bioluminescent.

Bioluminescence is the biochemical emission of light by an organism. Organisms produce light for many reasons. For example, fireflies use flashes to communicate and attract mates, whereas the famous angler fish uses a hanging light to attract prey. Scientists believe mechanisms for bioluminescence have evolved numerous times and with different roots for different organisms. However, the procedure can be simplified into needing a luciferin (a light-emitting chemical) and a luciferase (an enzyme which catalyses the light-emitting reaction). Luciferase catalyses the oxidisation of the luciferin when light is needed. This puts the luciferin in an excited state. Upon returning to its ground state, energy is released in the form of photons.

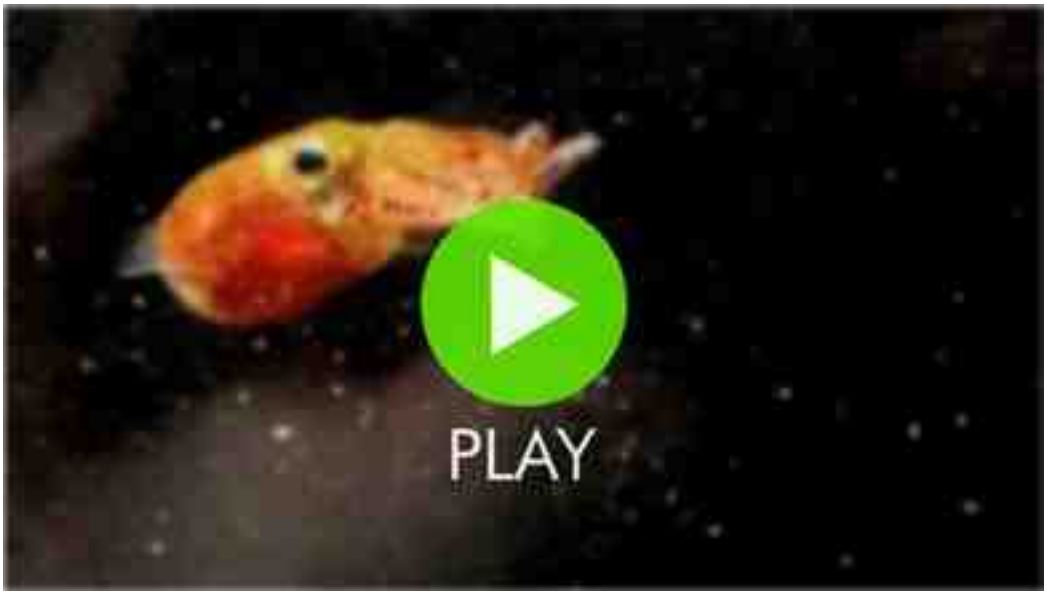
Light emission in nature is generated in an organ called a photophore, or by specialised cells called photocytes. Photocytes are typically found in epithelial (surface) tissue and this allows the light to be seen. If Rudolph's nose contained a layer of photocytes the light produced would not be as strong as it has been reported due to the limited number of photocytes possible in a few layers of cells. A second possibility is that the photocytes are not Rudolph's. Instead, there could be a symbiotic relationship between the reindeer and bioluminescent microorganisms. A real example of this relationship is between the Hawaiian Bobtail Squid and the bacteria Vibrio Fischeri, where the bacteria light up the underside of the squid, therefore, when looked at from below, the squid is hard to distinguish from moonlight on the water's surface. However, the same problems will remain whether the photocytes are Rudolph's or not.

Instead, we need to think bigger: the light would have to come from a photophore. Photophores contain photocytes, but also have structures which

act like lenses, magnifiers, reflectors and filters. These structures allow more efficient bioluminescence and brighter light. Perhaps Rudolph's nose doubles as a photophore. This would make sense as the nose is an ideal place for the organ given that it would be easy to get the oxygen required for the chemical reactions.

Now that we've established that Rudolph must have a photophore, let's consider the colours. Folklore dictates that Rudolph's nose is red, which is a very rare colour for bioluminescence. Railroad worms and Stoplight Loosejaws (deep-ocean fish) are two of the very few red-emitting organisms. The mechanism for bioluminescence in Railroad worms is not fully understood, but the Stoplight Loosejaws employ a brown filter so only red light passes through their photophore. This filter, therefore, would be what Rudolph has.

In many ways, Rudolph's unique traits may represent a huge leap forward in reindeer evolution. Despite being ridiculed by his peers early in his life, his new position at the front of the sleigh has cemented his position as alpha male, thus increasing the chance of him passing on his genes.



Glowing Squid – Science Nation

Did you know?

1) APPENDIX TO LIFE

The appendix gets a bad press. It is usually treated as a body part that lost its function millions of years ago. All it seems to do is occasionally get infected and cause appendicitis. Yet recently it has been discovered that the appendix is very useful to the bacteria that help your digestive system function. They use it to get respite from the strain of the frenzied activity of the gut, somewhere to breed and help keep the gut's bacterial inhabitants topped up. So treat your appendix with respect.

2) SUPERSIZED MOLECULES

Practically everything we experience is made up of molecules. These vary in size from simple pairs of atoms, like an oxygen molecule, to complex organic structures. But the biggest molecule in nature resides in your body. It is chromosome 1. A normal human cell has 23 pairs of chromosomes in its nucleus, each a single, very long, molecule of DNA. Chromosome 1 is the biggest, containing around 10bn atoms, to pack in the amount of information that is encoded in the molecule.

3) GOOSEBUMP EVOLUTION

Goosepimples are a remnant of our evolutionary predecessors. They occur when tiny muscles around the base of each hair tense, pulling the hair more erect. With a decent covering of fur, this would fluff up the coat, getting more air into it, making it a better insulator. But with a human's thin body hair, it just makes our skin look strange.
Similarly we get the bristling feeling of our hair standing on end when we are scared or experience an emotive memory. Many mammals fluff up their fur when threatened, to look bigger and so more dangerous. Humans used to have a similar defensive fluffing up of their body hairs, but once again, the effect is now ruined. We still feel the sensation of hairs standing on end, but gain no visual bulk.

How plants prepare for the winter.

/ Musab Hasan *- 12 RI*

Plants have the extraordinary ability to adapt themselves in order to survive the harsh winters. The most obvious adaptation is in the form of their annual leaf drop; although, there are also many other changes that plants undertake to help them prepare for the winter climate. However, all the changes plants undergo in the winter are triggered by changes in the photoperiod of the shorter days in winter.

Unlike us, plants do not detect the autumn and winter period by the changes in temperature. Plants detect seasonal changes by the length of daylight, known as its photoperiod. The light sensitive chemicals in plants detect these changes. Each plant has a different photoperiod and it is this change in the photoperiod which triggers a plant to start to prepare for the winter where much lower levels of light will be available. However, recent evidence has shown that the length of an uninterrupted dark period is the more critical factor in determining the plants response. When the length of this period gets to a critical point, a short-day response is induced in the plant which causes it to start preparing for the winter.

By August most perennial plants have begun their preparations for their annual rest. Many plants set their flower buds at this time and as the days grow shorter and the availability of light becomes scarcer, many perennial plants' growth slows and eventually stops. This is called the plant's period of dormancy and reduces its metabolic processes to a minimum. The plant remains in this state until good growing conditions return in the spring. This dormancy reduces the amount of water and sugars the plants need in winter helping them to survive in conditions where access to these substances is not adequate for normal levels of growth.

Plants also undertake a process called cold hardening; the process in which plants store large amounts of carbohydrates in the summer months when they can photosynthesise is at their optimum

rate. The accumulation of these sugars changes the chemical composition of water cells. Sugars and certain proteins, when concentrated in cells, act like a type of anti-freeze within the plant and reduce its freezing point. This prevents the water in the plant freezing and water movement from coming to a stop. Roots and bulbs are the main storage areas for the carbohydrates produced by photosynthesis. The stems of many perennial plants contain large amounts of nutrients to help them survive the winter when photosynthesis is no longer an option to accumulate energy. Long-term storage underground in roots is also an option for plants as they are protected from both the extremes of the weather and the appetites of local wildlife. The toughness of winter kale, for instance, is derived from this sugary protection and it's only when frost has helped to break down the starch in the leaves, that this vegetable becomes palatable for humans. This process protects plants from damage as a result of freezing including membrane damage.

Many plants also develop physical layers to protect themselves from problems like water loss and other issues relating to the cold winter climate. Evergreen trees and shrubs form a layer of wax around themselves specifically to prevent water loss. Many pine trees also have these protective layers which serve multiple purposes including pollution protection and withstanding Ultraviolet Radiation.

Plants such as conifers alternate their growth and branching patterns for the winter. Conifers have a main stem as opposed to many stems in hardwoods. The subsequent cone shape sheds snow more effectively. The conifer branches grow at more obtuse angles to the main stem. This allows branches to reach snow shedding angles with less bending. Longer wood fibres also offer more flexibility generally meaning that there is less weight on the branches and snow falls off easily.

These are only a few of the many clever adaptations which many species of plants have for coping with the lack of light and water in the winter. With research into plant Eco-physiology going on around the world, we can hope to find out more about how organisms like plants have developed adaptations to cope with the winter climate whilst we continue to rely on technology for our survival.

– Pine cones on Evergreens

– Winter kale

How does marine life survive in winter?

/ Akhilesh Sivaraman *- 12 W*

Come the season of frost, when temperatures are sub zero, bodies of water – lakes and ponds – freeze over. This could be a huge problem in marine ecosystems. However, water has a few interesting properties which prevent the death of marine organisms.

Water as a liquid is denser than ice. This is because, in its liquid form, H_2O molecules are closer together while as a solid the water molecules are regularly arranged in a crystal lattice so that there is an even space between each molecule. More importantly, this space is larger than the distance between H_2O molecules in liquid water. Only the top layer of water freezes because the layer of water under the ice sheet is cooled to 4°C, the temperature at which water is its most dense, the layer falls and displaces water below it. The new layer of water at the top is colder than but less dense as it becomes frozen. Interestingly, the colder water rises to the top while the warmer water falls to the bottom of a body of water. The opposite happens in the summer.

What if the science was different? If ice were denser than liquid water, marine life would likely find surviving in winter extremely difficult because large chunks of ice would form then sink. This process would repeat so that all of the liquid eventually becomes ice in a body of water, which would mean that marine life is unable to live!

Water, in all its forms, is transparent, therefore, marine plants are able to photosynthesise. As we know from biology lessons, photosynthesis is a hugely important reaction that is crucial to normal growth, not only for the plant itself but for the whole ecosystem; it provides plants with glucose, for respiration, and oxygen is released, which is needed by other organisms to respire. The release of oxygen from photosynthesis becomes more important in a marine ecosystem when there is a sheet of ice above the organisms preventing oxygen outside the ecosystem from dissolving in the water.

Marine organisms are also well adapted to icy waters. A great example of adaptation by fish in some polar regions is the ability to produce a glycoprotein that acts like antifreeze. This stops liquid in their bodies from freezing. Moreover, many fish will slow down their metabolic rate by moving less and finding the warmest possible pockets of water they can find to spend the winter months in.

So, this Christmas, when you're sitting in the warm habitat of your own known as your "house", consider the fact that you shouldn't really be concerned for marine life out there in the cold. They're adapted to survive the extreme conditions which you or I wouldn't dream of spending a night in.

Could Jurassic Park happen?

/ Samuel Moore *- 8 GR*

Have you seen the film Jurassic Park? It stars dinosaurs made from preserved blood encapsulated in amber. In this article, I will try to answer two questions: could it ever happen, and would it be ethical?

It is every biologist's dream to rebirth the dodo, the mammoth and other extinct animals. Recently, DNA (Deoxyribonucleic Acid) was found to have a half life of around 521 years, suggesting that mammoths, dinosaurs and other prehistoric animals cannot be re-birthed. Naturally, it's very unfortunate that we cannot relive the sci-fi epic and Hollywood blockbuster that we love more so than we fear. However, this still makes it within our reach to rebirth certain animals, such as dodos and gastric brooding frogs. The process is not too new - in fact it is almost identical to cloning.

First, you need the DNA of the animal you are trying to rebirth. This could sourced be from almost anything - it could be from blood samples or a preserved part of the animal. The DNA is useless on its own - you need something to put the DNA into. This is an ovum (egg) of another animal similar to the animal you are trying to clone. In order to use this egg, you first have to destroy the native nucleus of the egg, using either a precision tool or exposing the egg to UV rays, and then you must insert the new DNA.

Is it ethical?

This process can cause many arguments to arise regarding ethics. There are all the same controversies of regular cloning - many people, including myself, believe that we should not 'play God' as we would if we were to clone these animals.

In addition, there is always the chance that the animal would be very confused. A wooly mammoth or a dinosaur might find its new habitat very strange. The "reinstated" life might also pose a danger to humans, especially large animals like mammoths or dinosaurs, or microorganisms like viruses and bacteria.

Finally, perhaps there was a reason it became extinct - perhaps it was not well adapted for the environment in which it was originally born. By rebirthing it, we could condemn it to the same, natural fate again. On the other hand, many people say it is our duty to bring animals that we made extinct back into existence, such as dodos. The topic is one of great debate - one which I do not have time to explore to it's true depth.

So it might take a while for the technology to develop, but who knows? Maybe we will see Christmas dodos on the table in the near future!

A Christmas discovery inside the Chernobyl Reactor.

/ Dario Kan *- 9 BL*

It was Christmas day in 2013, and whilst you were enjoying your turkey and pudding, the Chernobyl scientists were out making a biological discovery inside the infamous nuclear reactor - the very same that was responsible for the 1986 disaster.

The scientists had found a black slime covering the walls of the reactor, which was completely unexpected considering the fact that the area was extremely radioactive. Therefore, being the curious creatures they are, they sent in a robot to retrieve some samples of the slime. It was more than they could have ever hoped for.

It turned out that the slime was a collection of fungi. The special thing about these fungi was that they did not just survive in a radioactive environment; they actually used gamma radiation as an energy source! When samples were exposed to gamma radiation at 500 times the normal amount, the fungi grew at a significantly faster rate.

The way that they survived is explained by the use of the chemical melanin; something found in human skin as well, in the same way that plants use chlorophyll. The fact that they can survive because of melanin has completely opened up a new area of research. It is the question that 'if humans also have melanin in their body, does that mean that they are getting a fraction of their energy from radiation as well?' There is also the question whether there are other living things in regions where there is plenty of radiation?

With those questions in mind I finish my article. Just remember, all of this was discovered on Christmas day.

The future of life on Earth.

/ Madhav Deval *- 8 BR*

Imagine what would happen if humanity either went extinct or lost interest in their home planet after colonizing many more. All of those great man made wonders of the world would fall into decline and disappear. In a mere million years, the pyramids and all glass objects will have vanished.

The question now arises how does evolution fill the spaces left by this once dominant species and a number of hypotheses have been put forward. **After Man: A Zoology of the Future (1981)** is a book written by Dougal Dixon, who presents his views on what life on earth will be like in 50 million years. He gives a world largely dominated by descendants of rats, *"The raw materials for this reparation are the kinds of animals that do well despite, or because of, man's presence and which will outlive him - those that man regards as pests and vermin"*. He says that rabbits will have evolved to fill the role of today's grazers and that rats have taken the place of almost all true carnivores but for those in South America (which is an island once more) Antelopes meanwhile have spread from coniferous forests of Europe (as the Horn-Heads) to the Himalayas (as the Gigantelope).

After the whales and Dolphins went extinct, a new evolutionary niche was open to penguins and it was one they soon colonized. An alternative view was presented in the Future is Wild (2002) a thirteen part documentary that takes viewers through life first after 5 million, then 100 million and finally 200 million years after man leaves the planet in a range of habitats. Our descendants would then send probes back to Earth to observe how life has changed. Many other animals and plants also disappear, especially well-known mammals, such as cats, dogs, whales, elephants, rhinos, dolphins, bears, seals, hippos and apes. This documentary was based on research and interviews with dozens of scientists, though some conclusions these scientists made are controversial, with other scientists criticizing many conclusions made in the series. In 2007 an animated series was made and appeared on Discovery Kids. In addition to this three titles have been published in twenty languages.

5 million years after man is still the age of Mammals. Much of the world is covered by ice caps and the Mediterranean is now a giant salt flat. The early episodes describe a world after an ice age, when giant sea-birds roam the beaches and carnivorous bats rule the skies. Ice sheets extend as far south as Paris in the northern hemisphere and as far north as Buenos Aires in the southern hemisphere. The Amazon rainforest has dried up and become grassland. The North American plains have become cold desert, and Africa has collided with Europe, enclosing the Mediterranean Sea. The part of Africa east of the African Rift Valley has broken away from the rest of the continent. Asia has dried up and is now mountainous. The once warm, tropical area of Central America has been transformed into a dry area.

In the scenario for 100 million years in the future (the Age of Diversity), the world is much hotter than at present. Octopuses and enormous tortoises

have come on to the land, much of which is flooded by shallow seas surrounded by brackish swamps. Antarctica has drifted towards the tropics and is covered with dense rainforests, as it was 300 million years before, in the Carboniferous period. Australia has collided with North America and Asia, forcing up an enormous, 12-kilometre-high mountain plateau much taller than the modern Himalayas. In this Great Plateau the last mammal species (a rodent called the poggle) is being farmed for food and hormones by spiders.

The hypothetical world of 200 million (the Age of Invertebrates) years from now is recovering from a mass extinction , wiping out 99% of the species on the planet. Fish have taken to the skies, squid to the forests, and the world's largest-ever desert is filled with strange worms and insects. All the continents have collided with one another and fused into a single supercontinent, a New Pangaea. Deadly hurricanes called hypercanes batter the coastlines of the continent all year long. The north-western side of Pangaea Ultima, soaked with an endless supply of rain, has become a temperate forest. Mountains resting at the end of the coast prevent most of the rain's moisture from reaching a long line of scrubby rain shadow deserts. The very center of the continent receives no rain at all and has become a barren, plant less desert. At this point primitive intelligence seems to have arrived again in the form of the Squibbon, an arboreal squid who's lack of bones and big brain allow for incredible flexibility in the trees.

So we can see a lot of the things that some people think could happen. But will it? Is it possible? Well, we know that due to continental drift, The Americas and Australia will eventually crash into Asia, and yes in time, the world's continents will merge together and create this Novopangaea, or at least they probably will. As well as this, an Ice age is predicted from the next thousand to fifty thousand years and the sequence of glacial and then interglacial (what we are in now) is expected to continue for quite some time.

But this article is about life, not the continents and this poses a complex question with an infinite amount of variables. One thing that we must assume is that eventually, Humans will stop harming the planet and leave it, otherwise the population will be too big to sustain, all animals will have been hunted and eaten, and eventually the chemicals will radically change the colour of even the skies and seas.
Another thing that we have to assume in order to at

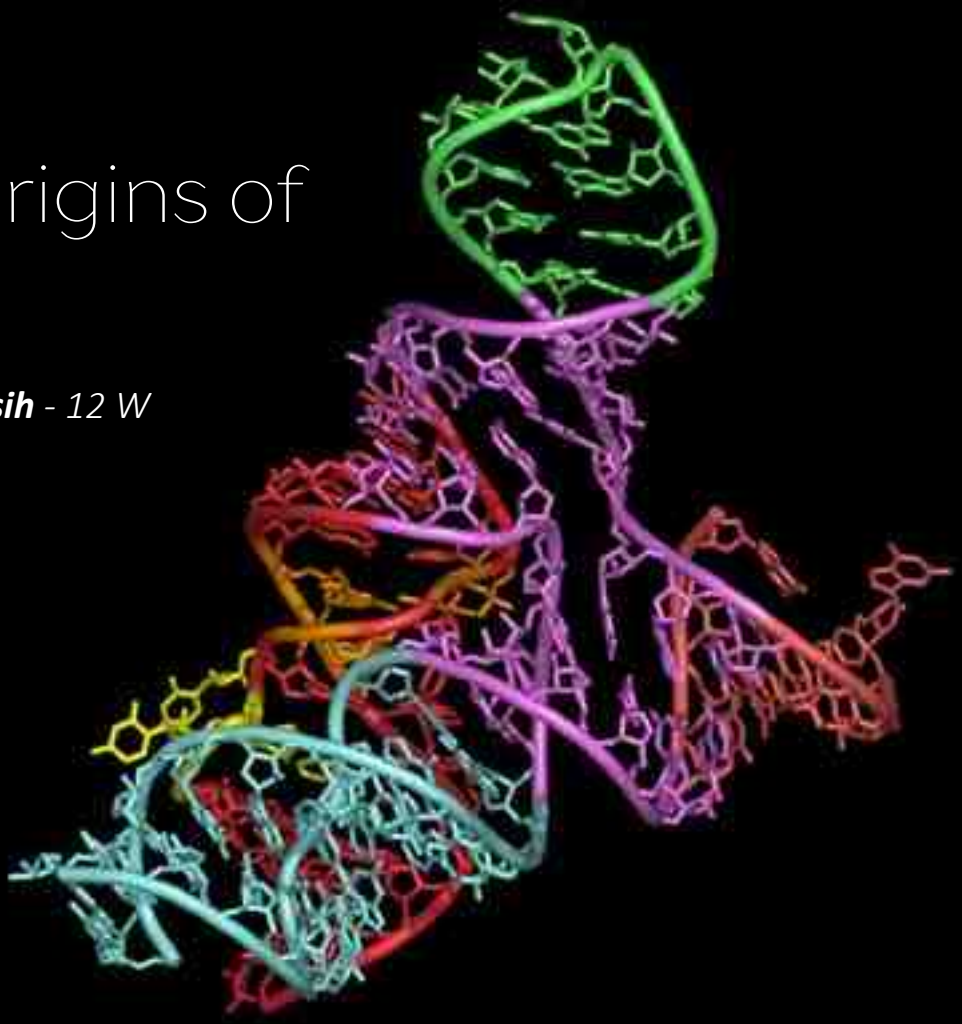
least allow some of the above to happen, is that no asteroid or volcano will kill off most life on earth, in which case we will have to rely on either the most primitive life or the most isolated (Hydrothermal vents as habitats perhaps) to re populate the earth.
If these criteria are met, there are many animals that could evolve to take advantage of whatever situation they might find themselves in. These animals are ones that thrive in almost any situation and so the most obvious candidate is the brown rat, though after consideration, most relatively small omnivores are not highly specialised and therefore could survive and become the ancestor of all mammal life on earth.
Of the birds, it would be the herbivores, omnivores and insectivores that thrive and the carnivores that being highly specialised probably would not survive. In fact this can be applied to most chordates. A prime example of this is the order Carnivora. Unfortunately, members of the order Carnivora have fairly short species lives; the average genus only lives for around six million years.

The ultimate answer is that we don't know. An infinite range of things could happen, ranging from bacteria having to repopulate the earth since human's radiation killed off all complex life forms to humans bringing back extinct animals (it is theoretically possible).

I suppose we'll just have to wait and see, but first, without any further ado, we need to start helping the planet to recover from our crippling effects on thousands of ecosystems so that it can begin to provide new situations for new species to take advantage of.

The Origins of Life.

/ Shayan Fassih *- 12 W*



Christmas is traditionally a time for us to appreciate Christ's death to relieve us of our sins. So to appreciate the life the Lord allows us to have, allow us to reflect upon the theories behind the creation of life itself . There are multiple theories as to how life on planet Earth began. The most prevalent and probable being 'Panspermia', 'RNA World' and 'The Spark of Life'.

Panspermia

The idea was first documented by Anaxagoras- a Greek philosopher. He thought that life was not initially created on Earth. It specifies that a separate body from outer space (such as an asteroid) collided with the Earth and brought microorganisms with it. This is the main ideology; however, some variations of this hypothesis are also present. For example, the 'Directed Panspermia' theory states that original cells came from a separate, extraterrestrial colony intentionally sending 'seeds of life' to our planet.

There is arguably some evidence for this theory. A meteor named Allan Hills 84001, which came from Mars approximately 15 million years ago, may have remains of nano-bacteria on it. Amino acids and hydrocarbons were also found on the meteor. The Indian Space Research Organisation also claims that they found living cells in the stratosphere; however, NASA argued that it would be impossible to find cells at such high altitudes. In conclusion, there is no solid evidence for this theory but it is still plausible.

However, even if this theory is proven correct, it does not answer where life originated from. It explains how life got to Earth and therefore, the question 'where did life come from?' would still remain because it must have originated elsewhere in the universe.

RNA World

The origins of this theory are unclear. It has been in the works of Francis Crick, Leslie Orgel, Carle Woese and more scientists; however, the term 'RNA World' was first used by, Nobel Laureate, Walter Gilbert. This theory argues that the very first molecule which created living cells was RNA. The main reasoning being that two of the main components of a cell are DNA and proteins (e.g. enzymes). DNA needs proteins and proteins need DNA; however, RNA has the ability to catalyze chemical reactions like an enzyme and store genetic material like DNA. The theory states that the RNA would have evolved to

become what we now know as DNA. It is supported by the fact that RNA has the ability to self-replicate. RNA is not as stable as DNA and would therefore not be suitable for the modern cell. There is a high risk of mutation in RNA. On the other hand, it is arguably plausible for primitive life. It could also fit in with the Panspermia theory as the body from outer space may have contained RNA, which led to the development of the first living cells.

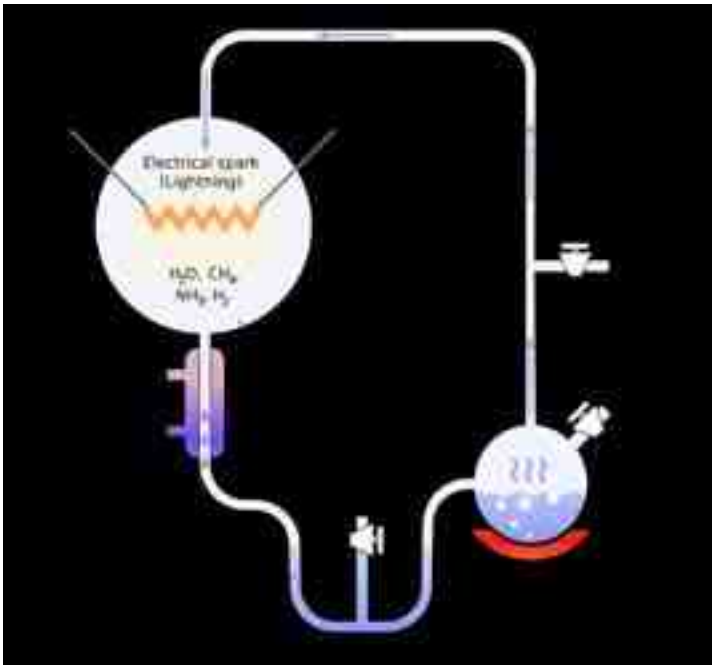
There are a few flaws with this theory. Firstly, it is not clear whether RNA was the first molecule. There may be an even earlier derivative. Furthermore, it leaves the question 'where did the RNA come from?' unanswered.

Electric Spark/ The Spark of Life

This idea states that lightning may have given rise to the first living cells. Collisions may have led to atoms becoming chemically bonded in molecules. These simple molecules may have collided and produced more complex molecules which the energy provided by and electric shock. Lightning has the ability to make amino acids and sugars out of water, methane, hydrogen and ammonia.

The Miller Urey experiment of 1953-54 supports this theory. Stanley Miller put simple molecules into a closed flask and created an electric spark in the reaction vessel. He analysed the water and found that it contained traces of amino acids- a complex molecule. This experiment increased the probability of the theory being correct.

Research has provided the information that the early atmosphere was actually poor in hydrogen which is an arguable flaw of this theory; however,



this is combated by the idea that volcanic clouds and eruptions may have led to an increase in these more simple molecules in our atmosphere.

Conclusion

It is almost impossible to determine which theory is correct. As with most aspects of science, we cannot ever be sure as to what the 'absolute truth' is, especially in this field, where there is minimal evidence and, of course, nobody is able to visually observe the creation of life. I personally believe that the most likely explanation for the origins of life on Earth is the third: 'The Spark of Life'. This is due to the fact that it has very few flaws and these flaws have acceptable counters. It is also one hundred percent possible as proven in Miller's famous experiment which is demonstrated in the diagram above

Year 10 Biology STEM Project

/ Gabriel Tweedale *- 10 BR*
& ***Kowshijan Vasanthan*** *- 10 BL*

Every Monday, students are selected to take part in a Biology STEM (Science, Technology, Engineering and Maths) project to carry out various experiments. Once a fortnight, students volunteer, taking time out of their lessons to engage in activities which enhance their understanding of all things biological.

The STEM Programme is an extra-curricular activity that the school offers to the pupils in Upper School. During the first half-term, the Year 10 students have been researching different aspects of a cress plant. Some students experimented the effect of light on the cress plants, while others investigated how the number of seeds affects the plants' growth. As part of the investigation, we write out a prediction and a method, followed by the results write up in the subsequent week.

After the half-term break, we began working on culturing bacteria. In this section, we are currently looking at how different conditions affect bacterial growth, and the effect of antibiotics on bacteria. Of course, there is a limit to what type of bacteria you can culture because of the dangerous associated

Above are photos of the petri dishes, containing various cultures of bacteria, which were used in the investigation.

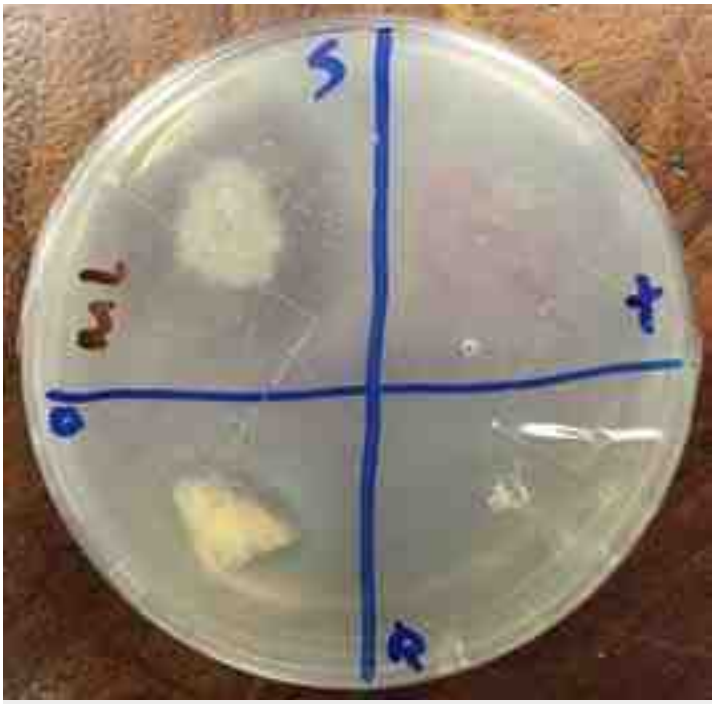
Interview with Sam – Cress plant exp.

with some species of bacteria. Personally, I (Gabriel Tweedale) focused my project on the effects various common substances had on agar plates over a period of time. Particularly, in my project I experimented with: S – soap, T – hand tissues, K – dust from a computer keyboard, and O – sample of Onion. These sample were removed using a sterile cotton bud and placed on both non-bacteria agar and agar with the bacteria micrococcus luteus. I returned to my experiment a week later and compared my results. This is what I found:

Soap: unsurprisingly the soap created a large area of inhibition. Source A shows where the sterile soap has fought off the spread of the bacteria in the agar, while in source B the soap has proven to grow a culture of its own

Tissue: proving that these tissues are successfully sterile, I had no visable results.
Keyboard sample: this sample had no antibacterial properties, as seen in Source A, although some yellow spots of bacteria can be seen growing in Source B.

Onion: as seen in Source A, the onion, unexpectedly, does have some antibacterial propperties, though due to the various bacteria inside it, it did grow a large amount of bacteria as seen in Source B.



Source A – Micrococcus Luteus agar

Source B – Non-bacterial agar

Despite the fact that this experiment hasn't caused a scientific breakthrough, it has been beneficial for me as it is good practice for designing and performing my own experiment in the future.

Overall, Biology STEM is an amazing programme that allows pupils to investigate almost anything and is a great way widen your scientific knowledge. All pupils will be aiming for a Silver Crest Award in Year 10 - a well recognised and commendable scientific achievement.

Interview – Density of cress plants

Interview – Density of cress plants

Editorial

Life magazine, as you may have noticed, has acquired a whole new look. The new team (SGS Leavers 2016) has been working hard to produce an ***interactive*** version of the latest Christmas 2014 issue, filled with video content that provides an insight into not only Biology as a *field*, but also as a *subject* that is *actively explored* throughout the school.

This issue, especially, contains interviews with Year 10 Biology STEM students, displaying their hard work in exploring bacteria in numerous ways.

At the moment, writers of the magazine range from Lower School to Lower Sixth Formers, and this time they've gone for a Christmas-themed approach to Biology. The publication is essentially student-run with Mr Davis supervising along the process.

Visit **www.sgsbiology.co.uk** to view past issues.

We hope you enjoy reading the new issue of ***Life!***

*If you are interested an article for the next edition of **Life** magazine, please email Mr Davis (Head of Biology) at **pdavis@suttonlea.org.***
The next issue will have the theme of "Shape and colour" and how they are important aspects of Biology.