

ISSUE NO:2



A Change in Status for Pluto !

Dr. Sharvari Nadkarni-Ghosh Scientist, IIT Kanpur

On October 25th, 2016 the space ship New Horizons sent back information about a special member of the solar system. Pluto. A massive ball of ice and rock is the ninth-largest and tenth-most-massive known object directly orbiting the Sun. And yet, it is not a planetsurprised ?

The International Astronomical Union in their 26th General Assembly in 2006 relooked at Pluto carefully! And declared that Pluto was no longer to be called a planet! It was to be given a new status... it was now a dwarf planet !

Why was this done to poor Pluto? Well, there is a good reason for it....

Pluto was discovered in 1930 by Clyde Tombaugh, seventy four years after the discovery of Neptune, and was initially classified as the ninth planet. It maintained this status until 1992, when astronomers found many other similar sized objects located beyond Neptune which were also orbiting the sun. This raised the question of whether Pluto could really be considered a planet. This debate continued until 2005, when a team of scientists based at the Palomar Observatory in California, found another object located beyond Pluto, but significantly more massive than Pluto. This object was called *Eris* and its discovery finally prompted the International Astronomical Union to give a precise definition of a planet. A planet is now defined as

(a) an object that orbits the Sun,

- (b) has enough mass to assume almost spherical shape (small bodies like comets and asteroids are not always spherical)
- (c) should have `cleared the neighbor hood' around its orbit i.e., there should not be too *many* similar or smaller sized objects around it (it can have a few isolated moons).

Under this definition, Pluto lost its status as a planet and instead got classified, along with Eris, as a dwarf planet. There are thus only eight objects in our solar system that satisfy the IAU definition of a planet, our Earth being the only habitable one. It turns out that there are many small objects, including Pluto clustered in a belt beyond Neptune, called the `*Kuiper belt*'. Eris lies beyond this belt in a region called the 'scattered disk'. Planet or not, Pluto, however, has an special identity. It has five known moons, named as Charon (the largest), Styx, Nix, Kerberos, and Hydra. There is an ongoing debate in IAU about whether Charon is a partner of Pluto, a binary. The IAU has not for-

malized a definition for binary dwarf planets.... So to date Charon is officially classified as a moon of Pluto. You never know when this status changes next!



Pluto imaged from the space craft New Horizons. (Wikipedia)



Good, Strong and Mighty Bugs in our bodies : The Microbiome

Dr.Uma Ladiwala

We each think of ourselves as one living human - "me". Would you be a more than a little surprised to learn that in your body live, not just a few thousand (1000), but trillions (1,000,000,000,000) of non-human bugs – the bacteria which can be seen only using a microscope? They are found in the intestine, on the skin, in the mouth, ears , lungs and other sites. All together they are referred to as the "micro-biome" of the body. They are of a few different types and different people have different combinations of these. When touching or kissing each other, these are passed on to the other person. Pets too have them. In fact they are all around us.



Image courtesy Royalty free stock images

Our common belief has been that all bacteria are bad; that they are "germs" that cause diseases and must be killed by antibiotics right away. It is fairly recently that scientists realized the important roles these good bacteria play and that getting rid of them is very dangerous and damaging to the health of the person. In fact, it turns out that these resident bacteria are the good guys who police the organs and protect them from the bad guys – the germs- that cause disease! Thus, they keep our immunity in good shape. Other extremely important functions they perform are to help with digestion of food and extraction of nutrients; they make vitamins, improve metabolism and lead to weight loss and even improve mood and functioning of the brain! No wonder they are known as the mighty microbiome! Disturbing or destroying them, however, by taking too many antibiotics very often can lead to gas problems, bad mood, allergies, asthma and tiredness and frequent infections. This is because antibiotics are like grenades that kill not only the bad bacteria that cause disease, but these good bacteria too.

How did these bacteria get there in the first place? At and after childbirth, they come from the placenta, from mother's milk and later from various foods as well as dirt around. So when babies put things into their mouth- it's not always a bad thing! What do the bacteria get in return for all this – food, of course! They are most happy with wholesome high-fibre plant-based foods such as asparagus, carrots, garlic, leeks, onions, radishes and tomatoes, and fermented foods like yoghurt, khimchi etc. You can now even get them in capsule form from a pharmacy – and these are known as pro-biotics (meaning " for living organisms"). They don't do well with processed foods rich in fats and food based on refined flours and sugars such as bread, cakes and pastries. So to keep the good bacteria mighty and yourself healthy you need to be careful and eat the right type of food. This will keep you healthy throughout your entire life.

Science in daily life

Autophagy: another reason to exercise regularly

Dr Bhavna Daswani

Faculty, Department of Life Sciences, Sophia college

We are all aware of the plethora of benefits that we may derive from regular exercise but if we get to know about autophagy we may actually feel like exercising still some more! So what is autophagy? The word 'auto' means self and the word 'phagy' means to eat. Oops...does this mean that we kind of eat ourselves? Not really!

Let's begin with understanding that a cell is the basic unit of life. Cells can either live alone such as bacteria or can live together with other cells like in higher animals such as humans (isn't it fascinating that we are made up of trillions of cells!). But how many of us really know how smart our cells are? Cells are actually very intelligent, they can respond to each other and also to the environment, they can divide as in multiply, some of them can differentiate meaning form from one type to another, some can even dedifferentiate and go back to its original form. Interestingly, cells are nice enough to even clean up their own mess! This is where the term 'autophagy' kicks in. Suppose we consider a cell to be a room, a highly cluttered and dirty room is analogous to a highly cluttered cell with lots of accumulated waste products. Hence, cells have a regular cleaning mechanism which is called 'autophagy' whereby cells remove unwanted material via the help of an 'autophagosome' or cellular dustbin. In fact, autophagy also helps in recycling cellular waste products when the supply of nutrients is limited (just like we recycle paper to conserve trees), which is why fasting is known to induce autophagy in our cells. So coming back to exercise, in the context of autophagy, several studies have shown that exercise also enhances autophagy in our cells which is basically ensuring that we efficiently clean our cellular clutter every day

In one such study, scientists performed a simple and elegant experiment wherein they compared active animals with lazy ones. Not so surprisingly, they found that the number of autophagosomes (or cellular dustbins) was much more in the laboratory mice that were made to exercise (by putting them onto a treadmill) compared to those laboratory mice that were made to laze around (by leaving them in a comfortable cage). This means that the active mice were even actively cleaning their cellular mess. So how did the scientists discover this? They used genetic engineering so that the proteins that make up the autophagosomes would fluoresce green; thus, the active mice exhibited more green fluorescence than the lazy ones. Another important aspect to consider is that autophagy took at least 30 minutes to begin increasing in the active mice. Also, the rate at which autophagy took place continued to increase till 80 minutes after which more exercise did not make any difference. Therefore, next time we want to justify our time allotted to sports, we might remember that by exercising a minimum of 30 minutes and maximum of 80 minutes we can help our cells to clean up their mess!

In verse

Earth

If you take a ship, beyond the visible sky Into the space, up really high My home will look like a Blue Green dot ! Blue of the oceans, Blue of the sea, Blue of the raindrop, wanting to be, Blue of the rivers, winding down Blue of the streams, with gurgling sound. That is the blue of the Blue Green dot! Green of the leaves, Green of the trees, Green of the grass, rising to the knees, Green of the jungle, stretching on the plains, Green of the meadows, blooming in the rains. That is the green of the Blue – Green Dot ! I care for green, I love the blue, For it is my only home, and yours too!

MSR

Stimulate your grey CHEM-GRID

							Dr.	Gall	Car	neiro
Е	Р	А	R	Т	Ι	С	L	E	Ι	В
Т	V	Ι	Ν	Е	G	А	R	L	S	А
А	E	Ν	Ι	Т	А	Т	E	U	Е	S
Т	В	D	Р	С	S	Ι	R	С	Ν	E
I	R	Ι	S	0	Т	0	Р	E	А	М
Ρ	Α	С	U	0	Н	Ν	С	L	К	I
I	S	А	А	Ρ	L	Е	Ν	0	L	L
С	S	Т	S	0	D	Ι	U	М	А	В
Е	Y	0	L	L	А	W	D	Т	Ι	U
R	Н	R	Μ	А	R	L	E	E	Т	S
Ρ	Р	Μ	В	R	0	Μ	Ι	N	Ε	R

The answers to the clues below may be found in any direction (including diagonally) in the grid above. An alphabet may be part of more than one answer. Strike out all the answers to the clues. You will be left with ten letters corresponding to the name of a famous scientist. See how fast you can identify the scientist. Have fun!

<u>Clues:</u>

- 1. A dilute solution of acetic acid
- 2. Solid formed when two solutions react
- 3. A proton acceptor
- 4. A minute portion of matter
- 5. A mixture of copper and zinc
- 6. A highly reactive metal with atomic number 11
- 7. To turn a solid straight into a gas
- 8. An alloy of iron resistant to rust
- 9. The liquid halogen
- 10. A unit ($1mg per dm^3$)

11. One of a set of atoms with same atomic number but different mass number.

12. Eight electron arrangement in the outer shell of a noble gas

13. Substance used to identify the end point of a titration

14. State of matter with no defined shape or volume

15. A rule to explain a set of observations

16. A bond where the bonding electrons are unequally distributed

17. Material defined by both shape and volume

- 18. A positively charged ion
- 19. Acyclic saturated hydrocarbons

20. A mixture of elements at least one of which is a metal

21. Solid non-metal with two major allotropes, white and red.

22. Element that is lustrous and a good conductor of heat and electricity.

23. Fourth quantum number of electrons in atoms 24. A group of atoms held together by chemical bonds

25. Number of protons in a hydrogen nucleus.

Long Long ago

No Limits to Research

Ms. Mona Seervai

Ex Principal, Bombay International School, Mumbai

Science is a search for answers to well-formulated questions through reproducible observations, controlled experiments and theory. There are some questions, which require unique solutions! Here is an account of how creativity crossed all barriers.

Dr. Barry Marshall is an Australian doctor. During his training he developed an interest in general medicine, and was more concerned about his patients and doing a proper diagnosis, rather than moving into specialist practice. At the time, he was not particularly interested in research, and it is said that he was an unlikely candidate for a Nobel Prize.





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Dr. Barry Marshall

The time was the early 1980's and Dr. Marshall was doing gastroenterology as one of his six-month training terms in Perth. There were many reported incidents of gastric problems. The common belief during these years was that stomach problems were directly linked to stress or unhygienic spicy food, alcohol or anti-inflammatory drugs. The causes were arbitrary, and Doctors believed that the environment in the stomach was acidic, and hence it would not be possible for a microorganism to survive.

At this time, Dr. Marshall's laboratory received a letter from Dr. Robin Warren saying, 'we have 20 patients with bacteria in their stomach, where you shouldn't have bacteria living because there's too much acid. Is there a doctor in gastroenterology who wants to work with me on this and find out what's wrong?'

Dr. Marshall became curious, especially since the bacteria Dr. Warren had seen looked like Campylobacters, which cause a common infection in chickens. Dr. Marshall's father worked in a chicken factory and this was familiar to him. He decided to collaborate

with Dr. Warren.

Within a week Dr. Warren taught Dr. Marshall about the stomach and the histology in gastritis. Together they learned about bacteria related to the gastrointestinal tract. In 1982, they started taking a culture from every patient, finally grew the bacteria in situ, and named it Helicobacter pylori. However there was no clear link between the bacteria and gastritis. They tested several patients who had symptoms of ulcers, and of 100 patients, only 13 had harboured the bacteria.

Now what?

Dr. Barry Marshall thought differently, and hypothesized that it could be bacteria. He was unable to conduct studies with lab mice (because the bacteria, *H. pylori* affects only primates) and he was prohibited from experimenting on people. Dr. Marshall grew desperate. Finally he ran an experiment on the only human patient he could ethically recruit: himself.

He first ran an endoscopy on himself, to ensure that he was not a carrier of the bacteria under investigation. He took some *H. pylori* from the gut of an ailing patient, stirred it into a broth, and drank it. As the days passed, he developed gastritis, the precursor to an ulcer: He started vomiting, his breath began to stink, and he felt sick and exhausted. Back in the lab, he biopsied his own gut, culturing *H. pylori* and proving unequivocally that bacteria were the underlying cause of ulcers.

His family had quite a reaction to this self-experimentation technique. He took a course of antibiotics on orders from his wife! He was cured, and no longterm damage done, but in this manner he was able to unequivocally establish a link between gastritis and the bacteria *H. Pylori*. Dr. Warren and Dr. Marshall published a paper anonymously, however it gradually became known that the male volunteer was none other than Barry Marshall.

In 2005 Dr. Marshell shared the Nobel Prize for Physiology and Medicine with Dr. Robin Warren for this discovery. It may not be wise to drink bacterial cultures in the hopes of discovering something new. However, in designing original research, it is essential to think differently in order to move ahead. Good science demands great research and taking risks, which go beyond one's self.

References:

http://www.biography.com/people/barry-j-marshall Canadian Journal of Gastroenterology, Vol 22, No. 11, November 2008 Australian Academy of Science, interviewed by Dr. Norman Swann in 2008

Students' Speak

Whatsapp message :

Hii, this is Gauri here....I read the newsletter. I understood it. I liked it but I liked the Alfred Nobel's article the most. Thank you Aunty.

Gauri Nandana R Nair, Class V, Delhi Public School, Nerul, Navi Mumbai.

Thank you very much. It was a pleasure reading it. I want to be a part of ISRO when I grow up. Aditya Singh, Class VIII, Worli Seaface M.C.G.M School.

The newsletter was very interesting. I got to learn and know a lot. The interesting part was the story of Alfred Nobel and the article on Science in daily life. Vijay Kahar, Class VIII, Worli Seaface M.C.G.M School.

Stimulate your grey, Issue 1 : Answers to crossword

Down : 1. Plasma; 3. B-Lymphocytes ; 6. Reticulocytes ; 8. Heamoglobin ; 9. Phagocytosis ; 10. CBC 11.Leukocytes ; 12 . Platelet ; 13. Connective; 14. Monocytes

Across: 1. Fibrin ;4. Barr body; 5. Hematocrit; 7. Stem Cells; 12. Plasma cells ;15 Erythrocytes

Through the lens, Issue 1 : The picture is that of a little egret, scientifically called *Egretta garzetta*.

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Dr. Gail Carneiro, Sophia College for Women, Mumbai

Dr. Uma Ladiwala, Formally in UM-DAE Centre for Excellence in Basic Sciences, Mumbai

Prof. Medha S. Rajadhyaksha, Sophia College for Women, Mumbai.

We look forward to your feedback and suggestions. Write to us at <u>spectrum.sciencehues@gmail.com</u>

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Dr. Radhika Tendulkar, St. Xavier's College Autonomous, Mumbai

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Layout and design by Ishaan Patil, SYBSc,St. Xavier's College Autonomous, Mumbai