GENOPHILIC

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Department of Biotechnology,
Fergusson College (Autonomous),
Pune.

Science and Nature: an amalgamation

Dr. Sonali Joshi
Head of the Department Biotechnology

Dr. Gayatri Gurjar
Editor-in-Chief

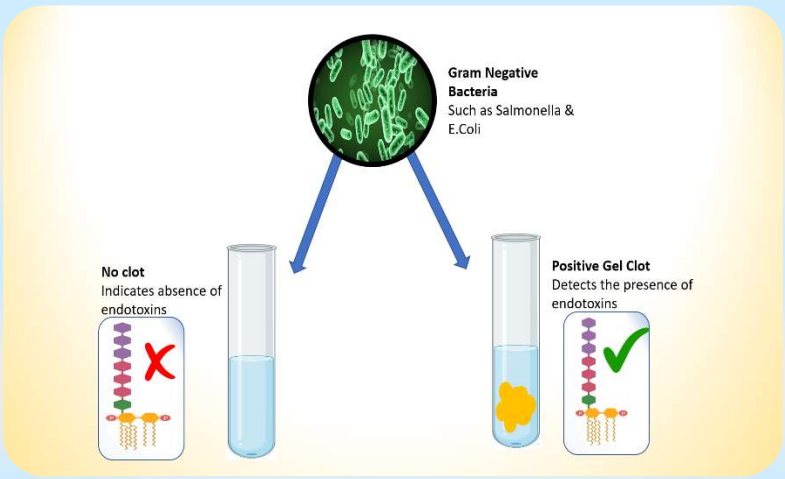
Liquid Gold

The 'liquid gold' that's actually blue in colour

Article and Illustration by
Isha Navare
F.Y.BSc.Biotechnology

Horseshoe crabs come with a string of interesting features. They have been around since the paleozoic era, survived major mass extinctions that wiped out even the mighty dinosaurs and their blood runs blue! This unique blue colour can be attributed to the presence of copper-based haemocyanin and it has completely revolutionised drug safety testing. A litre of it costs around $16000!. But the pretty blue colour is not what makes its blood so expensive.

The horseshoe crab blood is an excellent coagulant. Its innate immune system has an important compound called amoebocytes which assist in clotting of blood around an infection, be it viruses, bacteria or bacterial endotoxins. This translates to the infection site's isolation from its surroundings, thereby preventing its spread. Very simple yet
effective!



Vaccines, drugs, implants etc almost always have some contamination, especially endotoxins, which could prove lethal when given to patients. Horseshoe crab blood proved to be a boon as it led to the development of the Limulus Amoebocyte Lysate (LAL)test. LAL is an aqueous extract of amoebocytes. In an LAL test, LAL is added to the test material (drug, vaccine etc). Formation of a clot signifies the presence of endotoxin whereas absence of it indicates its safety level.

Save the blue

To ensure a continuous supply of this liquid, thousands of horseshoe crabs are collected. And contrary to what scientists say about the extracting process not hurting the animals, estimates suggest that 10-30% of these animals die after their blood has been extracted. This isn't just bad for the horseshoe crab themselves, but for an entire ecosystem as well because their eggs serve as food source to birds, reptiles, and fish. This certainly calls for lab-made artificial LAL tests as an alternative to save our blue-blooded friends from the threat of extinction.

"Science must be inspired by nature, not stolen from it"

The Bleeding Tooth Fungus

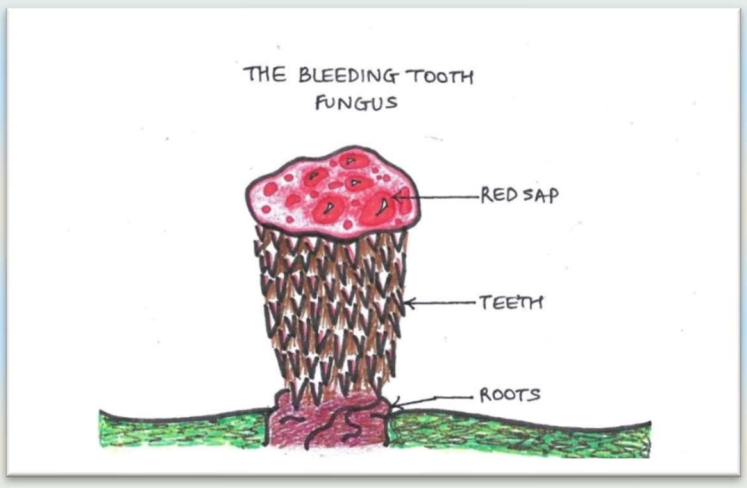
Discovering the horrors of the Bleeding Tooth Fungus

Article and Illustration by:
Aarya Kuvalekar
F.Y.BSc.Biotechnology

Mother Nature and Science are like two best friends. Each is different in personality, but when they come together, they're always showing off their natural wonders and phenomena which never fail to amaze us. Talking about natural phenomena, ever heard a fungus could bleed? Well, there is a species that excretes red sap which can be mistaken as blood! This fungus is called the Bleeding Tooth Fungus.

Bleeding tooth fungus (scientific name: *Hydnellum peckii*) also commonly called devil's tooth, is seen to bleed which has hilariously spooked some passer-by. In reality, the red substance is not blood but a kind of sap that is occasionally excreted due to root pressure.

The fungus is found to maintain an ectomycorrhizal symbiotic relationship with tree roots (especially pine tree roots) in which the hyphae of the fungus form a protective sheath around the tree roots to exchange nutrients.



Mudra Deshpande
S.Y.BSc.Biotechnology
(Editor)

Shreyas Joshi
S.Y.BSc.Biotechnology
(Layout Designer)

Divya
S.Y.BSc.Biotechnology
(Editor)

As a result, whenever the exchange of water and nutrients takes place, the fungus has to deal with high root pressure. This causes the fungus to excrete red sap which is nothing but the water that has absorbed red pigments present inside the main body of the fungus.

The bleeding tooth fungus is a rare, oval-shaped, bumpy textured fungus that is mostly found in regions of North America's pacific northwest, Europe and Korea. Although this plant seems dangerous it's not at all poisonous. Interestingly, the red sap is said to contain a chemical called Atromentin that possesses anticoagulant and anti-bacterial properties which helps in dealing with blood clots present in the vessels.

The Merry Game-te Corner

Created by Divya Bhardwaj
S. Y. BSc. Biotechnology

Code Decode

Fill in the blanks and unjumble the highlighted letters to decode the word of this issue.

I. *Hydnellum peckii* also commonly called devil's = _ _ _ _ _

II. The horseshoe crab blood is an excellent = _ _ _ _ _ _ _

III. Jellyfish continue life in the free swimming form of = _ _ _ _ _ _

IV. The red sap is said to contain a chemical called = _ _ _ _ _ _ _ _ _ _

Word of the Issue

_ _ _ _ _ _

Heredity Hunt

Find the words listed in the word search below :

Let the Hunt Begin!

Find Us

GOLD RADIATION

BLOOD BACTERIA

CRAB PLANULA

KOREA COCCUS

POLYP REVERSE

K	**A**	**A**	**I**	**R**	**E**	**T**	**C**	**A**	**B**	**X**	**A**	**B**	**G**	**A**
D	S	L	P	Q	M	O	I	A	Z	C	E	N	V	P
S	L	I	D	E	C	A	P	D	C	I	R	X	H	I
N	F	O	G	C	D	S	L	R	O	L	T	V	D	J
E	T	U	G	T	B	F	A	A	C	D	U	A	F	R
O	U	D	R	Y	O	B	J	D	C	N	K	L	A	S
U	I	Z	Z	I	K	H	V	I	U	F	O	U	U	H
R	O	P	F	U	A	R	E	A	S	C	C	N	T	R
S	E	Y	K	E	S	U	T	T	U	D	O	A	S	N
T	C	L	R	W	K	K	U	I	Y	O	V	L	G	X
R	J	O	E	E	H	E	H	O	E	O	U	P	R	U
S	K	P	Q	Y	G	D	F	N	A	L	D	P	W	W
A	E	S	R	E	V	E	R	Y	U	B	A	S	Q	I

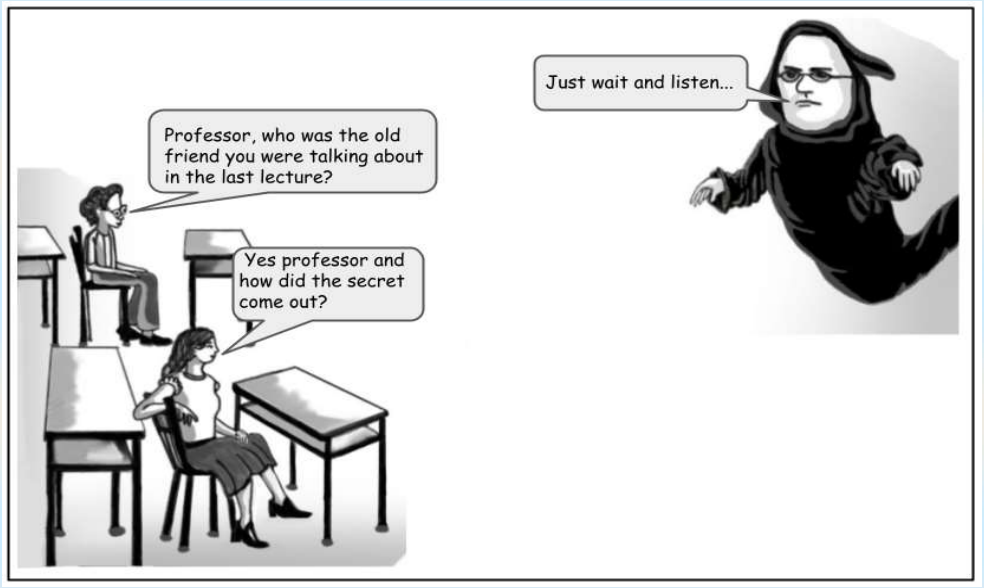
Gags by Gregor

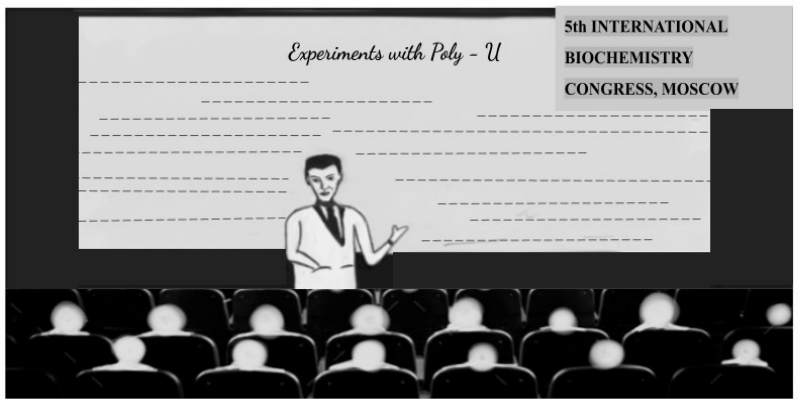
Q. What do you call a cab that provides drug therapy?
A. Chemotaxis.

Back to Basics with Friendly Grandpa Ghost Mendel!

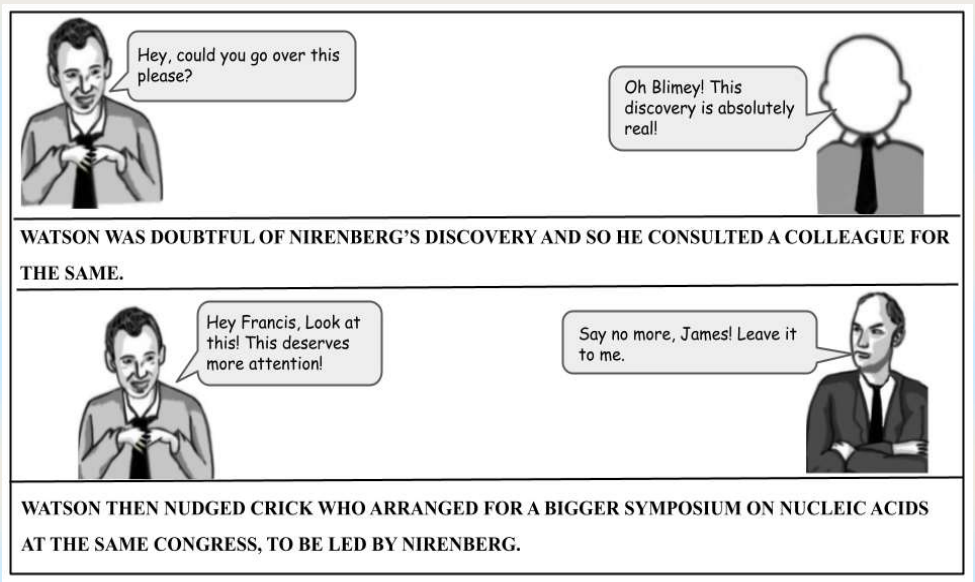
You know the legendary Gregor Mendel. You might not know the legends in the race to find messengers of life! Come, discover the story with Mendel himself, and see where the journey takes you!

(Note: Read Left to Right)





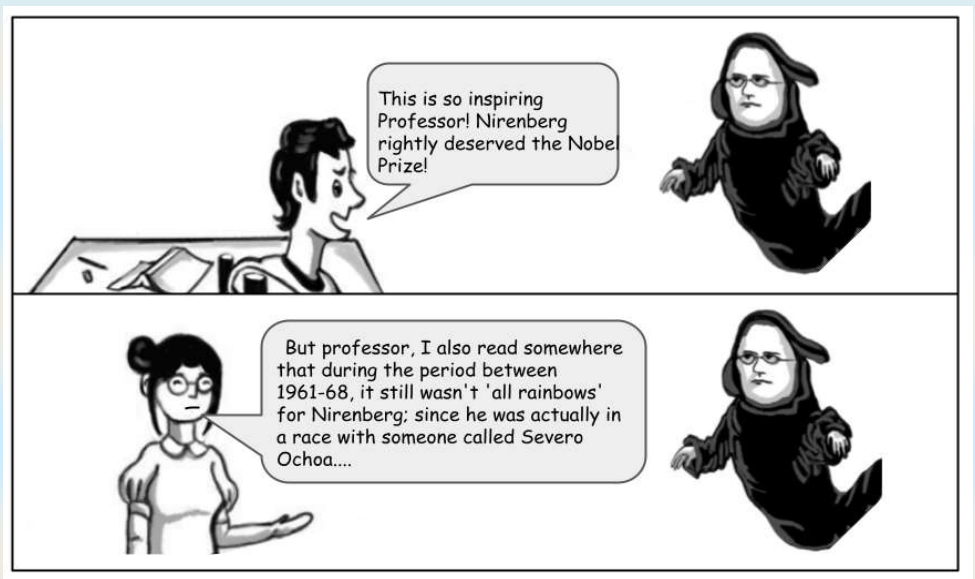
IN AUGUST, 1961, NIRENBERG PRESENTED HIS FINDINGS TO A SMALL, DULL AUDIENCE OF 35 AT THE INTERNATIONAL BIOCHEMISTRY CONGRESS, MOSCOW. DO NOT WORRY THOUGH! AS IF MAGICALLY, NIRENBERG MET WATSON A DAY BEFORE AND DISCUSSED HIS PAPER WITH HIM.

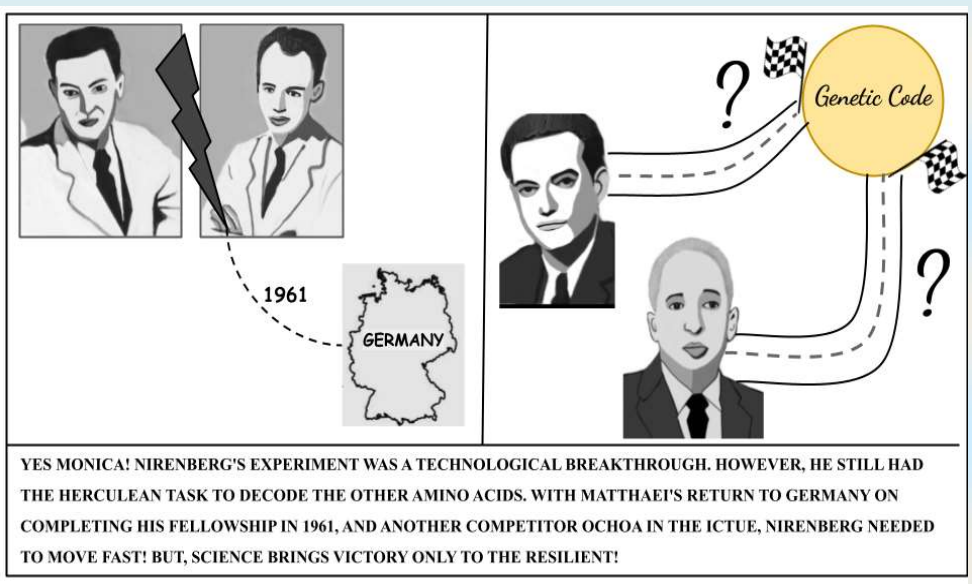


WATSON WAS DOUBTFUL OF NIRENBERG'S DISCOVERY AND SO HE CONSULTED A COLLEAGUE FOR THE SAME.

WATSON THEN NUDGED CRICK WHO ARRANGED FOR A BIGGER SYMPOSIUM ON NUCLEIC ACIDS AT THE SAME CONGRESS, TO BE LED BY NIRENBERG.

THIS TIME NIRENBERG RECEIVED MASSIVE APPLAUSE FROM ALL OVER THE WORLD, OVER THE COURSE OF THE NEXT FEW YEARS. IN ONE IF HIS INTERVIEWS HE MENTIONED, "IT WAS A STANDING OVATION...I DIDN'T KNOW IT THEN, BUT FOR THE NEXT FEW YEARS, I BECAME A SCIENTIFIC ROCK STAR."





YES MONICA! NIRENBERG'S EXPERIMENT WAS A TECHNOLOGICAL BREAKTHROUGH. HOWEVER, HE STILL HAD THE HERCULEAN TASK TO DECODE THE OTHER AMINO ACIDS. WITH MATTHAEI'S RETURN TO GERMANY ON COMPLETING HIS FELLOWSHIP IN 1961, AND ANOTHER COMPETITOR OCHOA IN THE ICTUE, NIRENBERG NEEDED TO MOVE FAST! BUT, SCIENCE BRINGS VICTORY ONLY TO THE RESILIENT!

Author : Aarjvi Jain
S. Y. BSc. Biotechnology

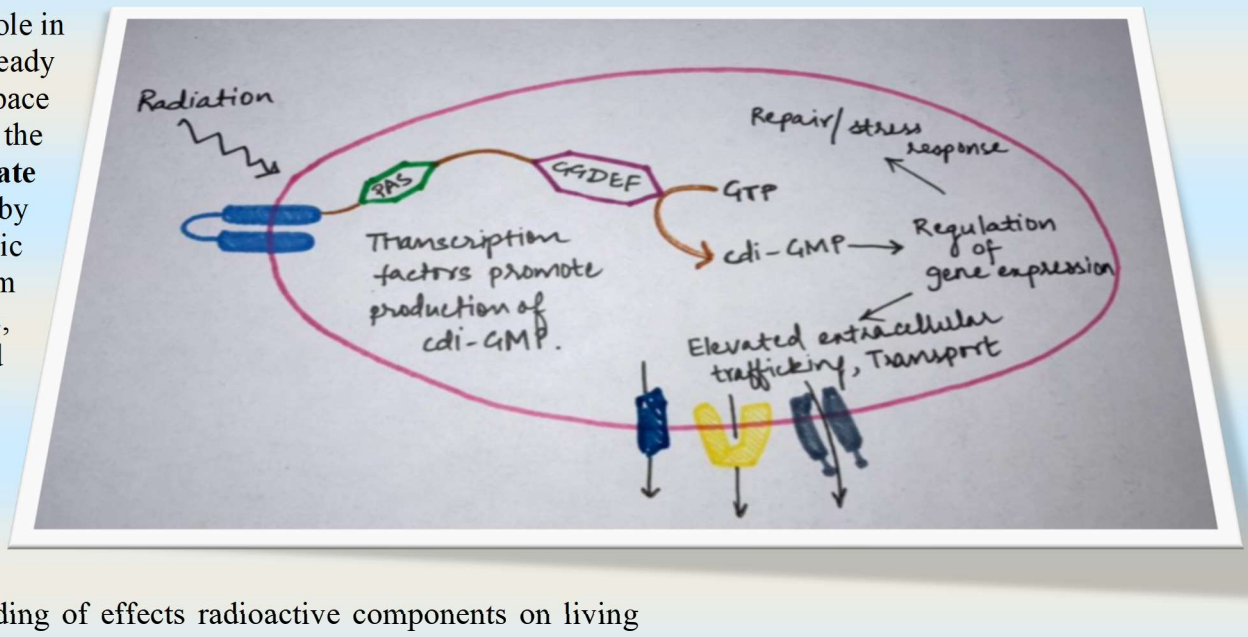
Co-author : Shravani More
F. Y. BSc. Biotechnology

Ilustrator:
Samidha Dabrase
F. Y. BSc. Biotechnology

The Supernatural Bacteria

Article and Illustration by
Anushka Thatte
F.Y. BSc. Biotechnology

The supernatural bacteria "*Deinococcus radiodurans*" holding the title of being the toughest bacteria ever known to mankind, was first discovered by Arthur W.Anderson in the year 1956. The bacteria is said to be the most radiation resistant organism within documentation and can survive in almost every type of environment. This makes one wonder as to "What gave this bacteria such extremophilic nature?". The answer as usual lies in the basis of all life, its genome. The bacterial genome has the code for three proteins which are homologous to plant desiccation and radiation resistance proteins. This extremophile is gifted with an extraordinary DNA repair mechanism which plays a irreplaceable role in resistance against damaging radiation.



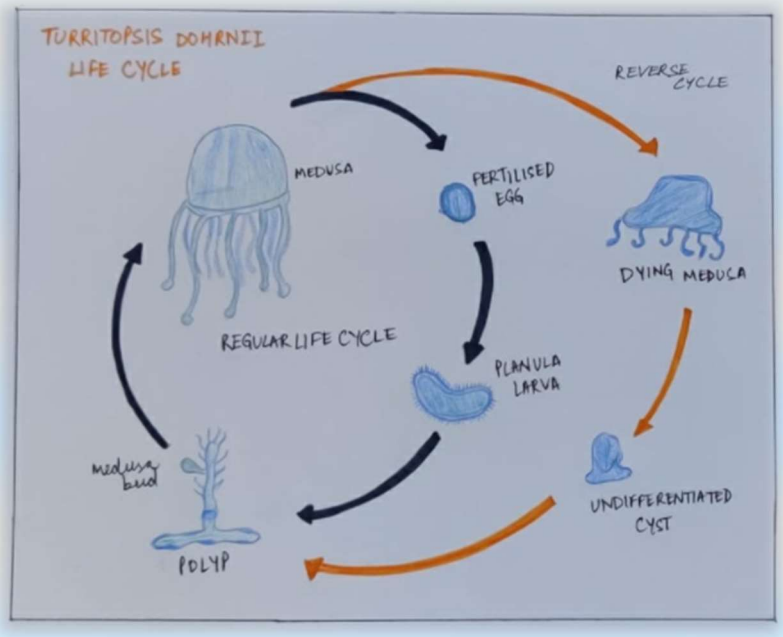
Deinococcus radiodurans can play an important role in future of space exploration mission. It has already been recruited as a member of international space station in Tanpopo orbital mission. At times the bacteria have also been called a **Consummate Survivor**. The bacteria's resistance is controlled by highly efficient active and passive enzymatic mechanisms. On one hand, the passive mechanism involves the presence of multiple genome copies, highly condensed nucleoid organization and accumulation of Mn(II) which prevents the formation of ROS. On the other hand, several pathways such as the DNA repair mechanism, including both Rec-A dependent or independent play a major role in its survival in high level radiation. Overall we can say that gram positive bacteria can play a major role in our understanding of effects radioactive components on living organisms and mechanisms that play a role in them. This in turn might help us find a way to survive in harsher environmental conditions.

The Immortal Jellyfish

Can death be escaped!?

Article by:
Surabhi Verma
F. Y. BSc. Biotechnology

Found worldwide in temperate to tropic waters, *Turritopsis dohrnii*, otherwise known as the 'Immortal Jellyfish' is the only organism currently known and documented, that is capable of reverting to a younger version of itself. The life of a jellyfish begins as a fertilized egg which becomes a larva, known as a planula. After a quick swim, this planula latches onto a surface which could be anything ranging from the ocean floor to a boat's hull, where it develops into a colony of sedentary polyps. Over time, medusae which we recognize as jellyfish and are therefore the motile form of the polyp bud off and continue their life in a free-swimming form.
It is fascinating to know that these medusea are genetically identical to the polyp from which they bud off and are characterised as the adult stage with 80-90 tentacles and is capable of reproducing sexually.
These tiny, transparent creatures that are smaller than our pinky fingernail, possess a remarkable survival skill. Whenever they are faced with some environmental stress like starvation, injury, sudden temperature, or salinity change, they hit the reset button. They take a leap back in their development process and the bell, termed mesoglea, and tentacles of the jellyfish eventually deteriorate into a cyst. This cyst has the ability to reactivate genetic instructions from earlier in its life-cycle and actually starts to create polyp cells. Thus, a polyp colony is born again which buds and releases medusae that are genetically identical to the injured adult.
The cellular mechanism behind this unique property of immortality is a rare process known as transdifferentiation. Transdifferentiation allows mature cells which have specialized to undertake specific functions to convert into an entirely different type of specialized cell. This provides an systematic way to recycle cells and is thus an important area of study in tissue regeneration and stem cell research aimed at achieving the repair or replacement of damaged cells.



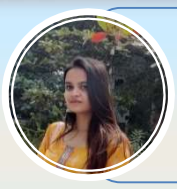


Illustration by:
Roshni Rout
S. Y. BSc. Biotechnology

Though this process can go on indefinitely, rendering *Turritopsis dohrnii* biologically immortal (as the organisms remain genetically identical), in reality, individuals can still die by succumbing to predation or disease. Thus, they are not truly immortal in that sense, however, their ability to switch back and forth between life stages in response to harsh conditions allows the species to bypass death and become potentially immortal.

How did you find it? Any feedback? Suggestions?

We would love to know what you thought of this issue of Genophilic, any suggestions are most welcome.

We will be taking a very short break and will resume with yet some new and interesting articles.

As we have expanded our horizons, our next issue will be on the topic "Genetics related organizations - their roles and achievements ".

We would appreciate your contributions on said topic.

Contact us on: editor.genophilic@gmail.com

References for Articles:

Liquid Gold

- https://www.youtube.com/watch?v=oXVnuG3zO_0&ab_channel=RealScience
- https://www.genengnews.com/magazine/326/horseshoe-crabs-are-at-risk-so-endotoxin-tests-are-too/
- https://www.pbs.org/wnet/nature/crash-a-tale-of-two-species-the-benefits-of-blue-blood/595/#:~:text=The%20 simplicity%20of%20its%20 immune,useful%20to%20our%20biomedical%20industry.&text=To%20fight%20 off%20infection%2C%20the,%2C%20 viruses%2C%20and%20bacterial%20endotoxins.
- https://www.intechopen.com/books/growing-and-handling-of-bacterial-cultures/what-is-limulus-amebocyte-lysate-lal-and-its-applicability-in-endotoxin-quantification-of-pharma-pro
- https://www.google.com/url?sa=i&url=https%3A%2F%2Fkepleybiosystems.com%2Fhsc%2F&psig=AOvVaw2-xzTRQBxT2ZVnYoNvY1mr&ust=1621669712410000&source=images&cd=vfe&ved=0CA0QjhxqFwoTCMC71syk2vACFQAAAAAdAAAAABAJ

The Bleeding Tooth Fungus

- Bleeding Tooth Fungus - What You Need To Know About Hydnellum Peckii (diys.com)
- Bleeding Tooth Fungus - A Natural Wonder - www.thegypsythread.org
- All About The Mysterious And Creepy 'Bleeding Tooth' Fungus – Mystical Raven

The Supernatural Bacteria

- www.ncbi.nlm.nih.gov
- www.ESRF.fr
- www.nature.com
- www.web.mst.edu

The Immortal Jellyfish

- https://www.science.org.au/curious/earth-environment/animals-can-live forever#:~:text=To%20date%2C%20there's%20only%20one,stage%20of%20their%20life%20 cycle.
- https://www.amnh.org/explore/news-blogs/on-exhibit-posts/the-immortal-jellyfish

References for Illustrations:

Liquid Gold
https://kepleybiosystems.com/hsc/

The Bleeding Tooth Fungus
SmallMushroom.jpg (191×269) (uwlax.edu)

The Supernatural Bacteria
www.nature.com

The Immortal Jellyfish
https://marinemadness.blog/2019/01/03/the-immortal-jellyfish/

Back to Basics with Friendly Grandpa Ghost Mendel!

References-

1) https://www.nobelprize.org/prizes/medicine/1962/crick/lecture/
2) https://history.nih.gov/display/history/Nirenberg+History+Poly-U
3) https://profiles.nlm.nih.gov/spotlight/jj/feature/syntheticrna)
4)https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/geneticcode.html