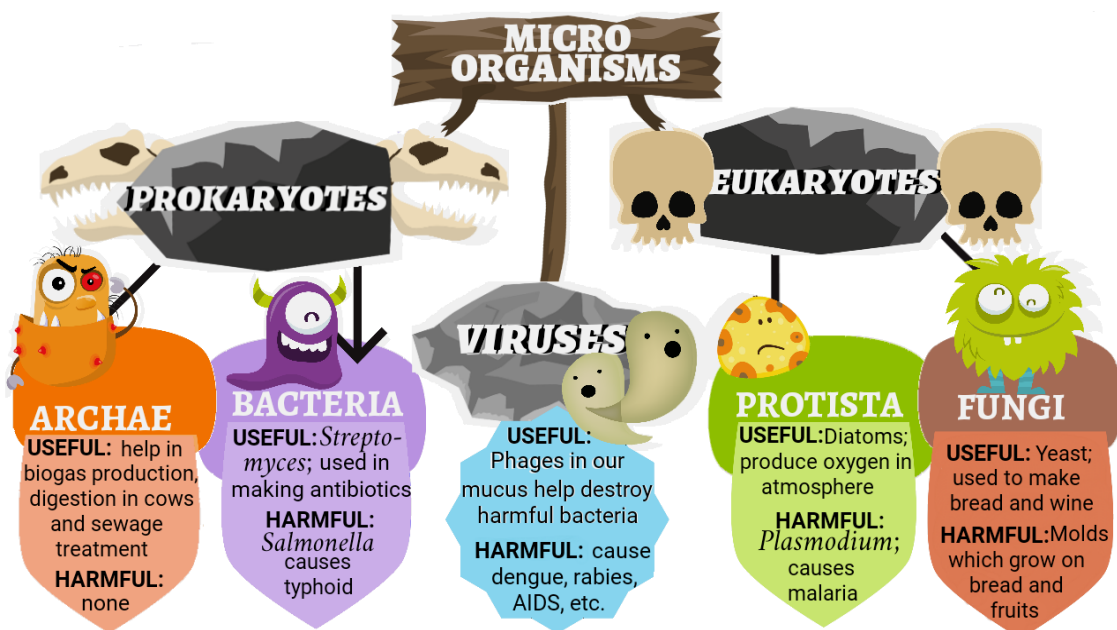


“Bacteria can be found virtually everywhere, from volcanic springs to arctic regions. Each square centimetre of your skin averages about 100,000 bacteria. If you get a handful of soil from your garden, you’ll be holding hundreds if not thousands of different kinds of microbes. In a single teaspoon of soil there will be 1 billion bacteria, 120,000 fungi & 25,000 algae!”



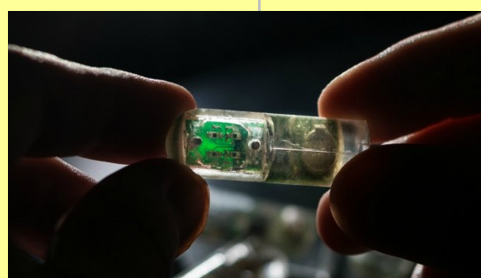
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BACTERIA + WI-FI = A PILL THAT TRACKS GUT HEALTH IN PIGS

Loads of vital health-related processes are happening in the dark chamber of secrets of our guts every minute. We don't yet have the superior technologies to see inside the gut and measure the chemicals present in there. So why not let the bacteria tell us what they see inside?

Bioengineers at MIT have invented a pill containing genetically engineered bacteria and electronics that can examine and wirelessly convey whether your guts are fine or not! Called IMBED (Ingestible-Micro-Bio-Electronic-Device) the 1.5-inch prototype pill contained genetically engineered *E.coli* which exhibited bioluminescence on



encountering the heme complex of blood. It was tested for detecting intestinal bleeding in pigs. Within an hour of the pills being inserted into the pigs' guts, the bacteria and electronics alerted the researchers to the bleeding in their guts and continued to transmit data for 2 hours.

And it is not just about intestinal bleeding. It is quite possible to evolve the bacteria to sense any biological marker. Such probiotic sensors could be engineered to be smaller, to examine internal processes for a long-term and to sense several molecular signals at the same time; in the future.

Each living creature must be looked at as a microcosm – a little universe, formed of a host of self-propagating organisms, inconceivably minute and as numerous as the stars in heaven.

Charles Darwin

PROBIOTICS + TRIPHALA = THE NEW ELIXIR OF LIFE!

You must have heard grannies preach- "We are what we eat". Well, microbiologists tweak this age old saying just a bit- "We are what our gut microbiome is." Probiotics significantly transform the structure and composition of the gut microbiome as well as change how our food gets metabolized.

The fruit fly, *Drosophila melanogaster* is an all-time favorite of researchers since this fabulous fly shares an amazing similarity (about 70%) with mammals in terms of their biochemical pathways. So in a way we are also mostly what the fruit fly is! (Except that we are not a fly, obviously!)



Scientists at the McGill University fed fruit flies with a combination of probiotics (*Lactobacillus* & *Bifidobacterium*) and a herbal supplement called Triphala. And viola! The flies lived up to 66 days old - 26 days more than the ones without the supplement. They also showed reduced traits of aging like rising insulin resistance, inflammation and oxidative stress.

The results hint that incorporating Triphala along with these probiotics in our diet will promote a long and healthy life and protect us against chronic diseases associated with aging.

NIPAH VIRUS CONTINUES TO KILL IN KERALA

Since May this year, the NiV or Nipah virus has kept health officials in India on their toes. To date, the current outbreak in Kerala's Kozhikode and Malappuram districts has cost over 17 lives. And the threats are not yet over.

The first outbreak was identified in 1999 in Malaysia and Singapore, which killed 100 people. Fruit bats are a reservoir of the virus; which spreads through infected bats, pigs, or other wild animals to human beings. The disease causes flu-like symptoms and lethal brain inflammation (encephalitis).

Reuters has reported that the Indian Government suspects Nipah virus infected the patients who consumed water from the wells colonized by bats infected with the deadly RNA virus. This emerging infectious disease (EID) has become a concern of global importance because there are presently no antiviral drugs or vaccines available to treat Nipah virus infection for either people or animals.

The infection is being controlled by proper infection containment procedures by the health officials in Kerala.

Microbes have been around longer than anything else on Earth – even dinosaurs!

The oldest known fossils, in fact, are cyanobacteria from Archaean rocks of Western Australia, dated 3.5 billion years old. This may be somewhat surprising, since the oldest rocks are only a little older: 3.8 billion years old!

What People Can Do to Prevent Infection

Wash hands after returning home



Cover mouths and nose while sneezing



Stay at home if sick



Keep homes and surroundings clean to prevent mosquito breeding



Vaccinate according to doctor recommendations



Do not panic when there is an outbreak



MUTANT ENZYME THAT BREAKS DOWN PLASTIC BOTTLES DISCOVERED ACCIDENTALLY!

Globally, around 1 million plastic products are being sold and used every minute. Only 14% of it is being recycled. If this continues, soon there'll be *plastic, plastic everywhere!*

Last year at a Japanese waste dump, scientists found a bacterium that had naturally evolved to enzymatically 'eat' plastic. Later, scientists at the University of Portsmouth, UK; tried to study how



The 'mutant' enzyme, called PETase by its

developers; doesn't take many days to start breaking down plastic – a process that takes centuries in the oceans! The researchers are working to speed it up even further to transform it into a viable large-scale process. They are also trying to exploit the ability of the enzyme to break down PET (the plastic polymer) into its simpler constituents in order to literally recycle the old plastic into new plastic with the same properties (kind of likereincarnating it!).



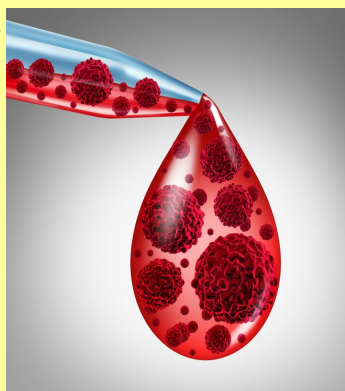
A study found that 30% of all people didn't wash their hands after using a public bathroom.

But 90% said they did. Just think what may be on their hands!

A BLOOD TEST THAT 'SEEKS' OUT EIGHT TYPES OF CANCERS

It has been observed that even very small tumors release some quantity of mutated DNA and abnormal proteins into the blood; even before symptoms are observed. Although DNA and proteins are also released from normal cells, the DNA and proteins from cancer cells are distinctive from those released by normal cells.

Researchers from Johns Hopkins University, USA, have developed a blood test that can detect 8 common cancers (viz. the liver, stomach, pancreatic, oesophageal, bowel, breast, ovarian and lung cancers);



even in their early stages. Aptly named CancerSEEK, the blood test really 'seeks' out tiny amounts of abnormal DNA and proteins released into the bloodstream from cancer cells and indicates the presence of cancer.

Moreover, since different cancers have their own unique blueprint of mutations and distorted proteins; CancerSEEK can not only discover that there is cancer somewhere in the body but can also point out its location for us!

THE HIV VACCINE : NOT A DREAM ANYMORE!

NIH scientists have found an unusual site of vulnerability on the HIV virus' surface proteins and have designed a novel and potentially powerful vaccine.

The experimental vaccine treatment elicited antibodies (in mice, guinea pigs and monkeys) that neutralized dozens of HIV strains from

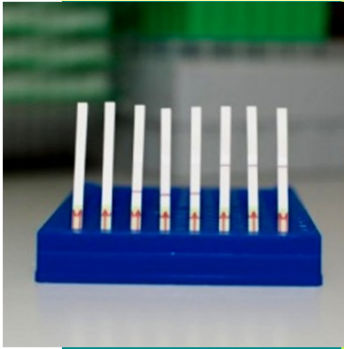
around the world. This study is a breakthrough in the ongoing quest to develop a safe and effective HIV vaccine.

The NIAID scientists will use these findings to further optimize the vaccine and then manufacture a version of it suitable for safety testing in human volunteers in a carefully designed

and monitored clinical trial anticipated to begin in 2019.



The paper-strip
SHERLOCK assay



The yeast used by brewers produce fruity esters that can add delicious aromas to your beer. But it's not you the yeast are trying to impress. Rather, they're trying to attract fruit flies and catch a ride. This trick may have evolved to allow the yeast to jump to another place when a colony starts to outgrow its current home.

‘SHERLOCK’ TO THE RESCUE!

The dengue infections sky-rocketed last year in India with 11,832 more cases of dengue compared to 2016. Moreover, the Zika virus has also arrived and begun its attacking spree.

SHERLOCK has come to the rescue (as always, but it is not our dear Holmes this time!). Developed by the researchers at the Broad Institute, USA; SHERLOCK (Specific High Sensitivity Enzymatic Reporter unLOCKing) is a virus detection kit that detects both

the dengue and Zika viruses within less than 2 hours, which would previously take days.

Not only this, our new SHERLOCK has a high sensitivity of 1 virus per microlitre and the ability to distinguish between the dengue and Zika viruses and even among different strains of the dengue virus itself! The researchers have developed a new process called **HUDSON** (Heating Unextracted Diagnostic

Samples to Obliterate Nucleases) that pairs with SHERLOCK for viral detection directly from body fluids (blood or saliva), enabling instrument-free virus detection directly from patient samples.

The icing on the cake is that SHERLOCK is very cheap since it employs a paper-strip assay without any elaborate instrumentation and hence can be used even by the lay public. We're proud of you, SHERLOCK!

GROWING BROCCOLI IN THE MICROGRAVITY OF SPACE

As astronauts at the International Space Station continue to spend more time away from Earth on each coming exploration, it is crucial to provide for their nutritional and dietary needs.

A group of students at Valley Christian High School, California are working on whether microbes can help broccoli grow better in space. Their initial ground experiments were successful, as the broccoli grew faster and notably larger than the control study. Mentored by scientists at the NASA Ames Space Research Centre, they then 'sent' their experiment for 'space-testing'!

The Orbital ATK Cygnus spacecraft, that launched on May 21 from Virginia, carried supply cargo for the International Space Station along with 6 broccoli seeds out of which 3 were coated with two different species of bacteria. These "beneficial" bacterial endophytes can live inside crops and not only improve their growth but also help the plants grow better in extreme low gravity and nutrient and/or water deficient environments.

This experiment is a step forward towards growing vegetables in the challenging, microgravity environment of the space station and on the moon and Mars in the long run; as humans continue to explore space.

ALTERED BODY ODOR INDICATIVE OF MALARIA, CLAIMS STUDY



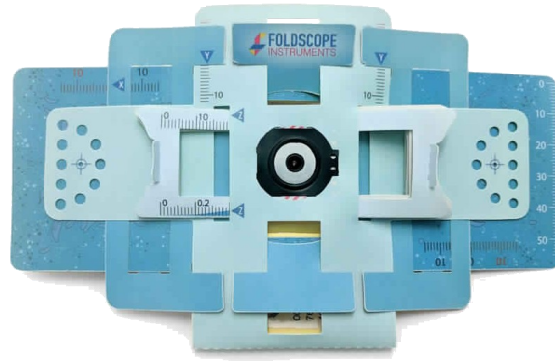
The female *Anopheles* infects thousands every year with her food habits but asymptomatic carriers of malaria are reasonably far more dangerous. The experimental work on mice showed that malaria causes variation in body odor of the infected person in ways that 'attract' mosquitoes especially at the stage wherein the infectious phase of the malaria protozoan is in higher amounts. The change in body odor is brought about by altering amounts - up or down; of the different volatile compounds already present in the body.

Researchers, who studied these changes in body odor amongst certain malaria patients, further want to use it as a diagnostic tool particularly for the identification of those who carry the infection but show no symptoms of the illness.

FOLDSCOPE : THE ULTRA-AFFORDABLE PAPER MICROSCOPE!

Foldscope is the ultra-affordable, paper microscope that you can assemble yourself. Designed to be extremely portable, durable, and to give optical quality similar to conventional research microscopes (magnification of 140X and 2-micron resolution), Foldscope brings hands-on microscopy to new places.

Foldscope was invented by Manu Prakash and Jim Cybulski; while Jim was a Ph.D. student in Manu's laboratory at Stanford University. Their inspiration for the Foldscope came from field visits around the world where they continually encountered bulky, broken



microscopes, or a lack of microscopes entirely.

The Foldscope Kits are now available in USA, Canada, Europe, Australia, New Zealand

and India. Foldscope's mission is to bring affordable scientific tools to everyone (not just communities who have the resources - but everyone). They believe that every child in the world should be able to carry a microscope in his or her pocket.

To make this possible and sustainable, they offer two different types of kits: the Deluxe Individual Kit, and the Classroom Kit.

The proceeds of Deluxe Individual Kits are used to bring down the costs of the Classroom Kits to \$1.75 per Foldscope.

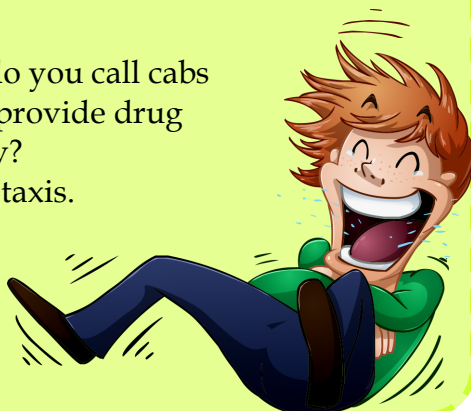
IT'S A 'PUN'TASTIC MICROBIAL WORLD !

What's a pirate's favorite amino acid?
Arrrrrrr-ginine.

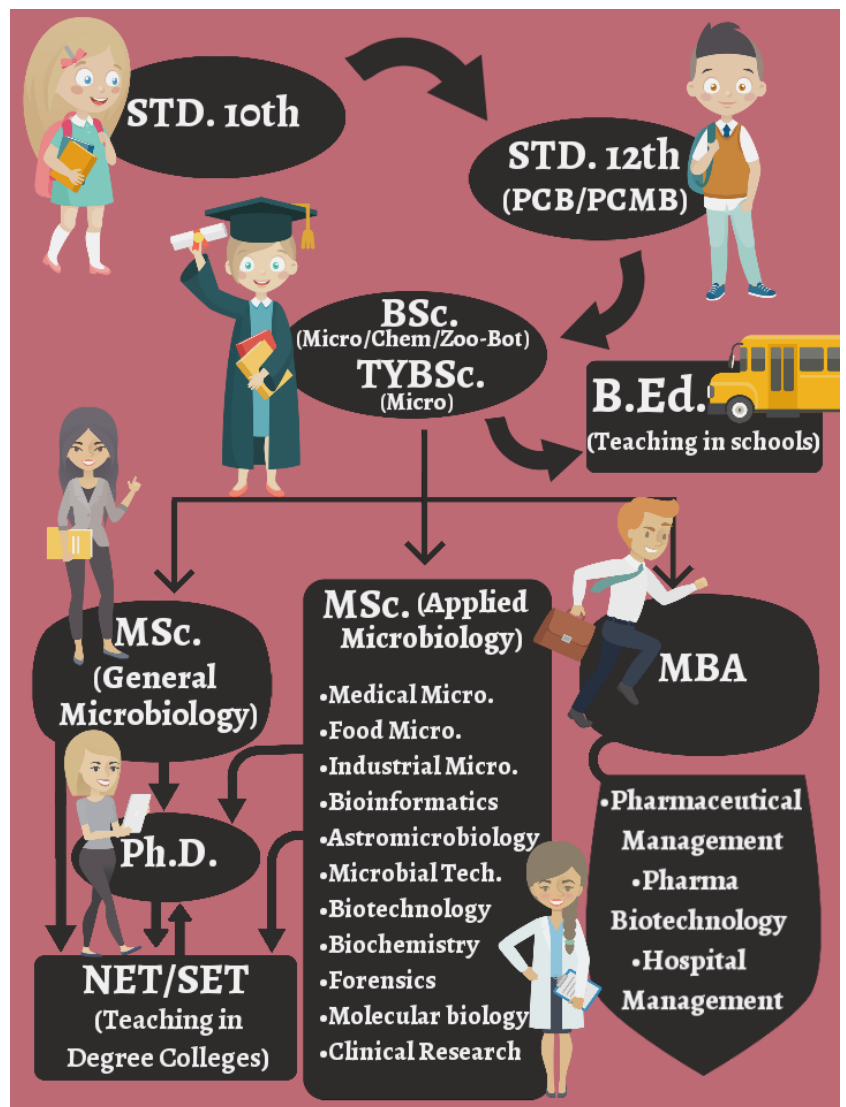
What did one cell say to his sister cell when she stepped on his toe?
Mitosis. (My-toe-sis!)

Why did the bacteria fail the math test?
He thought multiplication was the same as division.

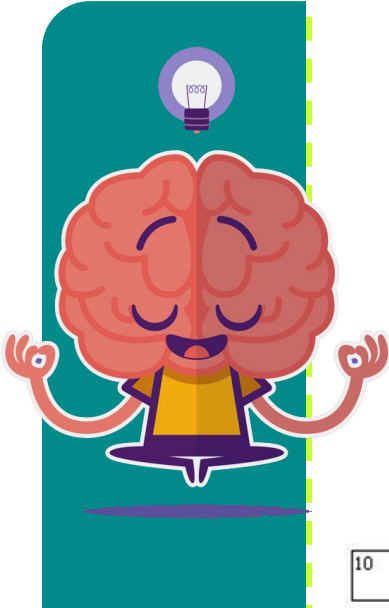
What do you call cabs which provide drug therapy?
Chemotaxis.



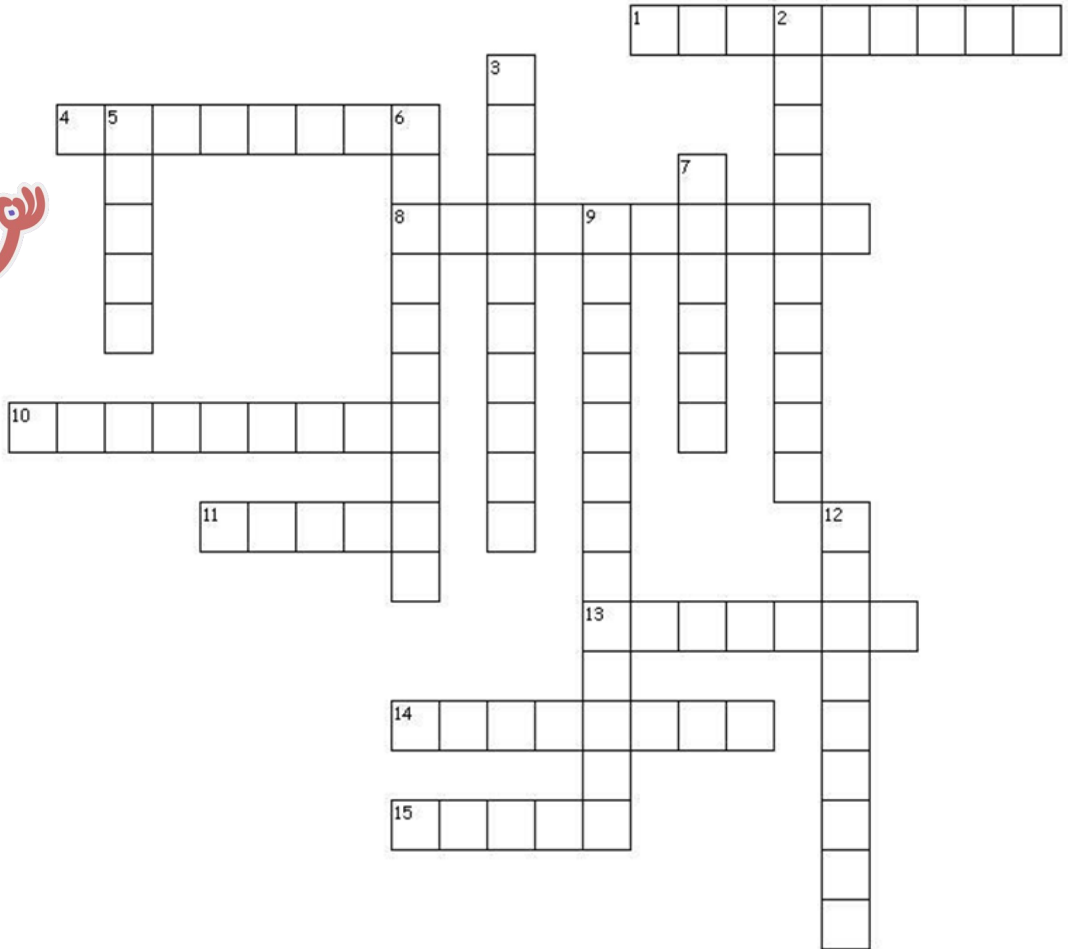
MICROBIOLOGY CAREER PROSPECTS



MICROBE WARS - Let The Enzymes Awaken!



It is usually not recognized that for every injurious or parasitic microbe there are dozens of beneficial ones. Without the latter, there would be no bread to eat or wine to drink, no fertile soils and no potable waters, no clothing and no sanitation. One can visualize no form of higher life without the existence of the microbes. They are the universal scavengers. They keep in constant circulation the chemical elements which are so essential to the continuation of plant and animal life.



Across

- 1. Mosquito that spreads malaria
- 4. Molecules responsible for earthy scent during rains
- 8. The first antibiotic discovered by Alexander Fleming
- 10. Organism that uses light as their energy source
- 11. A baker's best friend
- 13. Water borne disease caused by *Salmonella typhi*
- 14. A type of fungus that can be eaten
- 15. Primary test to diagnose AIDS

Down

- 2. Yoghurt is an excellent source of
- 3. Organism that cause common cold
- 5. Bacterium called as the laboratory pet
- 6. Organism that decomposes dead matter in soil
- 7. Disease spread by rats
- 9. A class of bacteria called blue green algae
- 12. A farmer's best friend that grows on legumes

Answers can be found on the last page :)

Millions of people don't actually need to use deodorant (especially East Asians) because they have a gene (ABCC11) that stops them from producing sweat that attracts body odor-causing bacteria. People with "dry earwax" have this particular gene.



'AAO CHALKE TUMHEIN' - A MICROBIOLOGY REWRITE



Aao chalke tumhein,
Hum leke chalein,
Ek aise 'incubator' ke taley;
Jaha '*E.coli*' bhi ho,
'*S.aureus*' bhi ho -
Aur '*Pseudomonas*' paley...
Ek aise 'incubator' ke taley...

'Host cell' mein palii,
Usey 'lyse' kari,
Aage 'phage' karti chaley;
Jaha 'sigma' bhi ho,
'Lambda phage' bhi ho -
Aur 'genomes' alter karein...
Ek aise 'incubator' ke taley...

Kahin 'Penicillin' na ho,
Koi 'Streptomycin' na ho,
'Cell wall' banatey chalein;
Jaha 'positive' bhi ho,
'Negative' bhi ho -
Aur 'mycoplasma' paley...
Ek aise 'microflora' ke taley...

Jaha door nazar daudayein,
'Colonized agar' lehraye;
Jaha 'odd' aur 'even phages',
'Plaque assay' banatey jaayein...

'Interaction' ke aise jahaan mein,
Jaha bukhaar ka level chada ho;
'WBCs' waha lad jayein,
Magar 'resistance' waha bada ho...

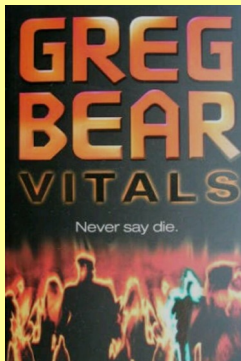
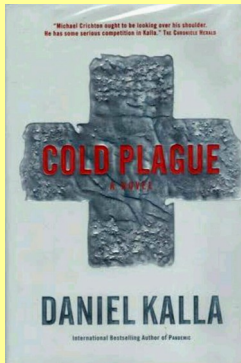
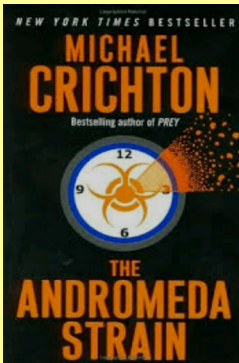
*Modified from the original classic -
Aa Chalke Tujhe Main Leke Chalun;
by Uzma, Gaurav and Vaidehi.*

In 1918 more people died from the influenza virus (approx. 30 million) than those who died in the First World War (10 million).

The role of the infinitely small in nature is infinitely great. - Louis Pasteur

MICROBIOLOGY IN THE MEDIA:

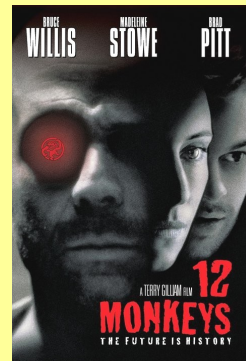
books



GAMES



movies



When cows fart and burp, they produce about 20% of the methane gas on the Earth!



A group of scientists transcribed the song "It's a Small World After All" into the DNA of a bacterium that is resistant to radioactivity, so that in the event of a nuclear catastrophe, we could pass a message on to future intelligent life!



THE MICROBIAL TIMES CONTESTS



DESIGN-A-MICROBE

A challenge for the artsy 8th grader, participants need to imagine and draw a cartoon microorganism and email the photo of their original work along with their name, class and school's name to —

themicrobaltimes2018@gmail.com

ONCE-UPON-A-MICROBE

Attention all creative story-tellers! If you are a 9th or 10th grader who loves writing stories, this is your chance to construct a dreamy fairytale of archae-c knights and fungi fairies! All participants should email their original stories; not exceeding 5000 words & in a PDF or MS Word format; along with their name, class and school's name to —

themicrobaltimes2018@gmail.com

Some Civil War soldiers had wounds that glowed in the dark because of bioluminescent bacteria that were puked up by nematodes. These bacteria actually killed off other pathogens and made the survival rate of those soldiers higher!

PRIZES TO BE WON!

The Top 5 Magically Microbial entries of each contest will receive their own 3D Paper Virus Build-It Kit from us for free; with the exception of the winner of Once-Upon-A-Microbe contest, who'll win a 32 page MICROBES comic designed by The Arizona Science Centre & Ask A Biologist. The winners and first runner-ups would get an e-certificate additionally.

(The 3D Paper Virus Build-It Kit can be ordered by teachers of respective schools for their class. We'll charge only for the printing costs. Queries regarding the same can be mailed at the above email id.)

Science is an attempt, largely successful, to understand the world, to get a grip on things, to get hold of ourselves, to steer a safe course. Microbiology and meteorology now explain what only a few centuries ago was considered sufficient cause to burn women to death.

- Carl Sagan



WE WOULD LOVE TO HEAR FROM YOU!

Send in your comments and suggestions at

themicrobaltimes2018@gmail.com

The Team!

Uzma Shaikh

Anagha Nair

Radhika Devkate

Vaidehi Shrestha

Aesha Agrawal

Gaurav Sriram

Pratiksha Chavan

Purva Chonkar

Siddhi Jain



- Answers to the crossword:
1. ANOPHELES
 2. PROBIOTICS
 3. RHINOVIRUS
 4. GEOSMINS
 5. ECOLI (*E.coli*)
 6. SAPROPHYTE
 7. PLAGUE
 8. PENICILLIN
 9. CYANOBACTERIA
 10. AUTOTROPH
 11. YEAST
 12. RHIZOBIUM
 13. TYPHOID
 14. MUSHROOM
 15. ELISA

Answers to the crossword: