



Department of
Biotechnology
Fergusson College
(Autonomous) Pune

BIO-GRAPHIA

CALLIGRAPHY OF THE MYSTICAL CORPUSCLES!!



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BIOTERRORISM!!!

Anthrax bioterrorism: an overview

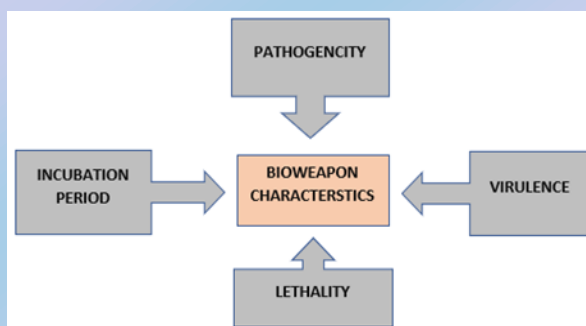
Microbes are the foot soldiers of the 21st century

- Jeremy Refkin (Quoted by Thatcher)

BIOTERRORISM:

As a frightening act by deliberating or dissemination of infectious agent such viruses, bacteria, toxin, insect or engineered product as result of biotechnology intentionally with various dispersed method exposing in environmental condition to cause disease to livestock, plants and animals by an extremist or terrorist. On a mass scale in order to devastate the population of an area. Origin of bioterrorism occurs by underlying drivers such as globalization & demographic growth. Biological Weapons are the one which is easily produce, cost effective, and less time consuming. The concept of employing disease as a weapon has existed for centuries because biological agents are easy to develop as weapons, their lethal intensity is higher than the chemical weapons, cost effective and are not easily detected unlike nuclear weapons. Bioterrorism aims to create casualties, terror, societal disruption, or economic loss, inspired by ideological, religious, or political beliefs. Bioterrorism can theoretically lead to elevated dismalness and mortality, because in a short timeframe, aerosolized natural operators or animal sickness can taint or kill multiple people. Indeed, even non-aerosolized attacks, such as the *Bacillus anthracis*.

CATEGORY A	CATEGORY B	CATEGORY C
HIGHLY MORTALITY DISSEMINATE EASILY; NEEDS SPECIAL ACTION. EXAMPLE <i>Bacillus anthracis</i>	MODERATELY EASY TO DISSEMINATE; MODERATE MORBIDITY EXAMPLE ALPHAVIRUSES	EASILY PRODUCED POTENTIAL FOR HIGH MORBIDITY & MORTALITY EXAMPLE NIPHA VIRUS



EPIDEMIC OF *B. anthracis*

BIOLOGY: *B. anthracis* is a Gram positive, rod-shaped, aerobic, facultative anaerobic, sporulating, capsulated bacterium. Though they are aerobic in nature, but still can survive in anaerobic conduction as they produce spores which are resistant

SPECIAL REWARD
Up to \$2.5 million

For information leading to the arrest and conviction of the individual(s) responsible for the mailing of letters containing anthrax to the New York Post, Tom Brokaw at NBC, Senator Tom Daschle and Senator Patrick Leahy:

The mailings took place in the Trenton, NJ, area on or about Sept. 18 and Oct. 9, 2001.
Anyone having information, please contact America's Most Wanted at 1-800-CRIME TV or www.amw.com.
All information will be held in strict confidence. Reward payment will be made in accordance with the conditions of Postal Service Reward Notice 296, dated February 2000.

to environmental condition, spores are resistant to high temperature, pressure, pH, chemicals, UV and deficiency of nutrients. Anthrax has been known since ancient times; however, it acquired attention as biological warfare disease after 2001 incidence in United States. *B. anthracis* is supposed to be the most potent BW agent because of its hardy spores, various modes of infection and high mortality rate.

AS A WEAPON- Anthrax spores are easily found in nature, can be produced in a lab, and can last for a long time in the environment. It said to be a good weapon because it can be released quietly. The microscopic spores could be put into powders, sprays, food and water. In 2001, powdered Anthrax spores were deliberately put into letters and mailed through the U.S postal system. Twenty two people including 12 mail handlers got. Anthrax and 5 of these 22 people died. Patient had a 'flu-like' illness associated with myalgias and malaise. Patients ultimately developed dyspnea, retrosternal chest pressure and respiratory failure requiring mechanical ventilation. The diagnosis of inhalational Anthrax is difficult during nonspecific prodromal illness.

According to CDC (Centre for Disease Control and prevention) norms, *B.anthraxis* is placed in high priority category-A due to its ease of dissemination, high mortality rates, epidemic potential and special preparedness it requires. However, there are steps that can be implemented if an Anthrax emergency ever did happen. Even if casualties are limited, the impact of Bioterrorism can be very high. Thus, its measures aimed at enhancing public health, diagnostics, including microbial identification and typing, generic antimicrobial therapeutics, surveillance and therapeutics to overcome drug resistance, training and education will both enhance the ability of society to combat 'regular' infectious disease outbreaks and mitigate the effects of bioterrorist attacks.

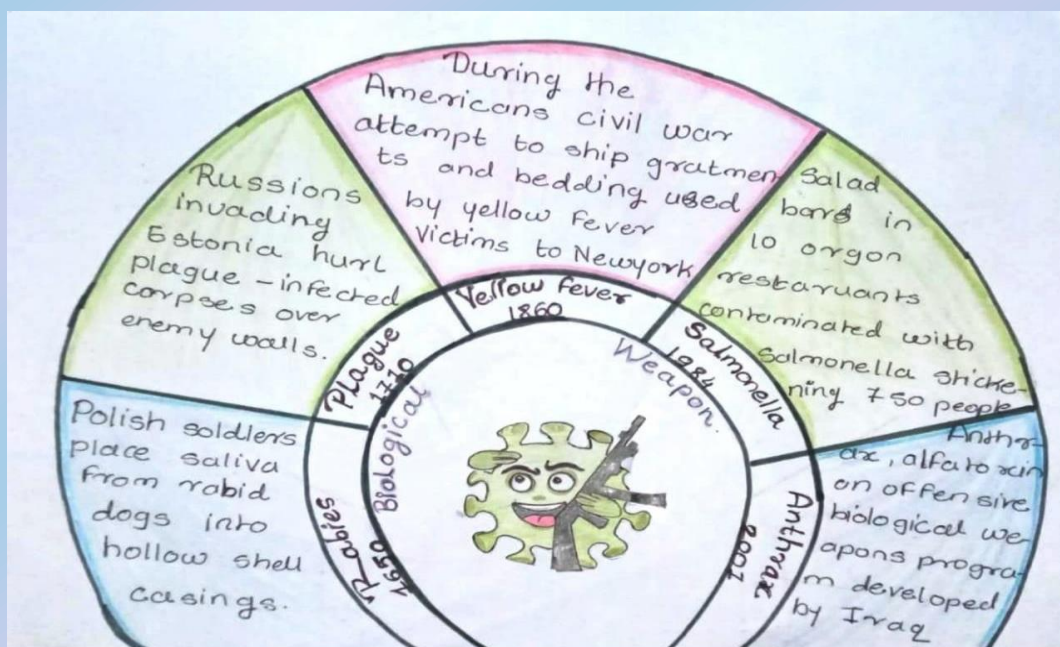


Anjali Ingale



Aditi Hazra

The timeline of bioterrorism!!!



Vrushali Arote

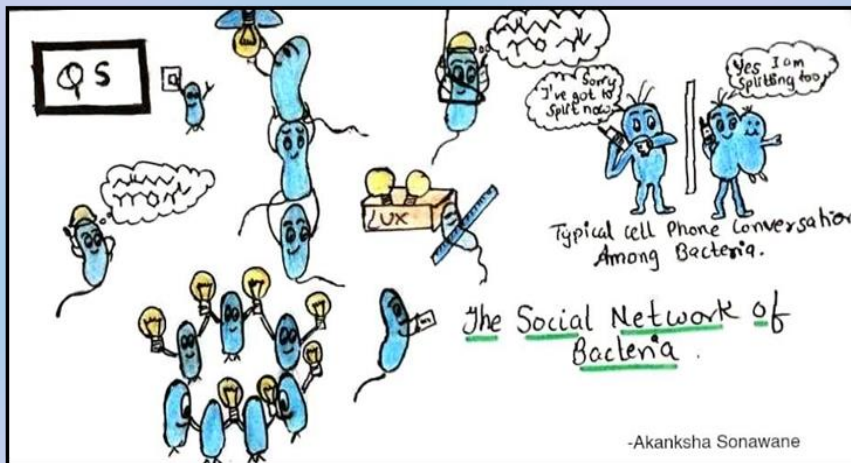


Vaishnavi Narwade

QUORUM SENSING (QS)

THAT'S HOW BACTERIA CONVERSE!!

Quorum sensing (QS) - A glimpse into the chat room of bacteria!!!!

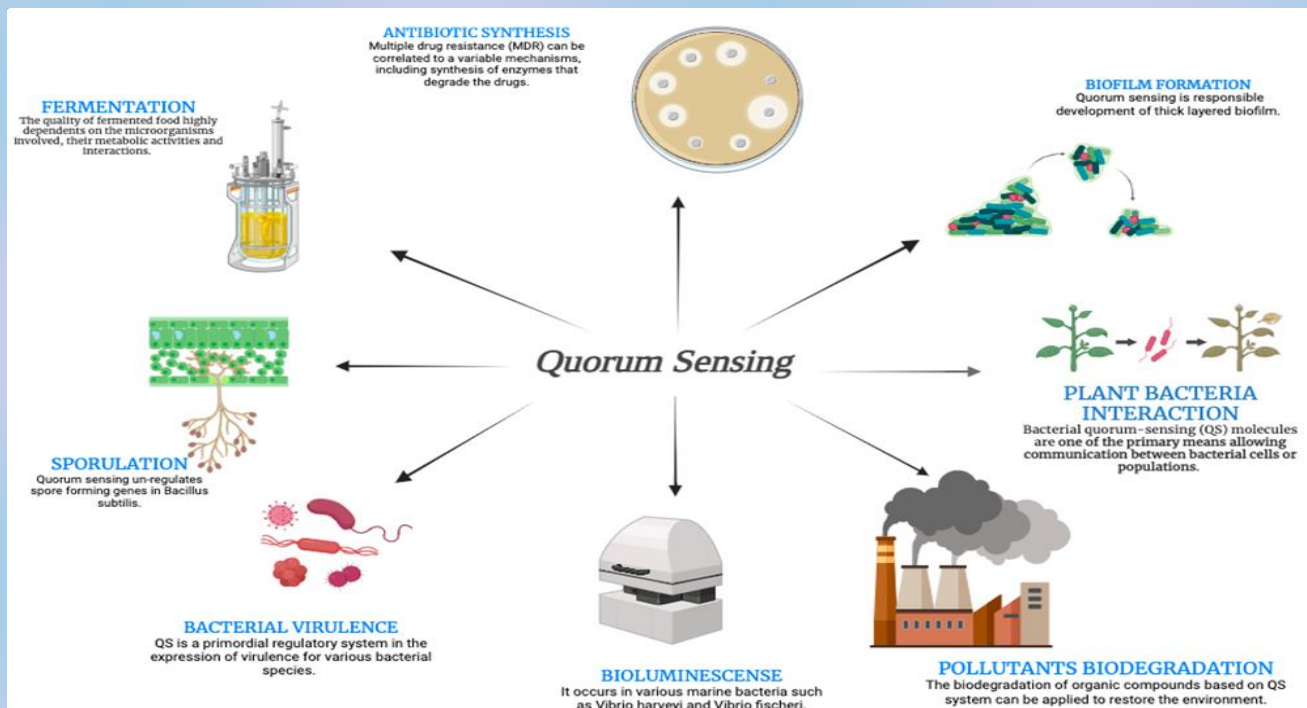


Quorum sensing (QS) is the communication mechanism between bacteria. A mechanism through which bacteria release a chemical signal (aka Autoinducer); spread these signals and as a resultant effect, bacteria function as a community to bring upon different bacterial beneficiary processes- virulence, competence, antibiotic production, motility, sporulation, biofilm formation, etc.

Akanksha Sonawane



Execution of QS in different aspects:

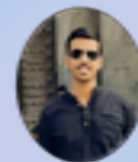


Dimple Saini

Paradigmatic quorum sensing circuit

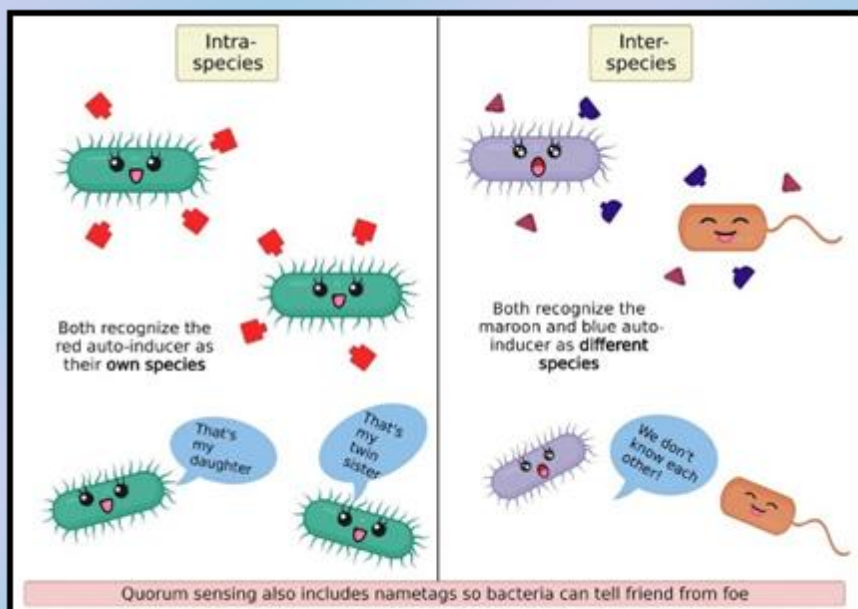
QS involves regulation of gene expression in response to fluctuations in bacterial cell populations and thus the entire bacterial population can respond in sync to external stimuli. The nature of chemical signals, the relay mechanisms and the target genes controlled by bacterial Quorum sensing systems differ in Gram negative bacteria and Gram positive bacteria...

	QS in Gram negative bacteria	QS in Gram positive bacteria
1) Autoinducer produced	Acylated homoserine lactone(AHL)	Oligopeptide
2) QS system utilized	Lux I - Lux R type system	Autoinducer peptide binding transcription based QS regulation.
3) Mechanism	The AI binds to the Lux R gene, it further binds to target genes, being able to control gene expression.	The Autoinducer peptide bound to the membrane undergo auto phosphorylation due to receptor kinase. This in turn activate required genes in QS regulation
4) Model organism	<i>Vibrio fischeri</i>	<i>Staphylococcus aureus</i>



Rohan Sharma

Recent developments and future perspectives of quorum sensing



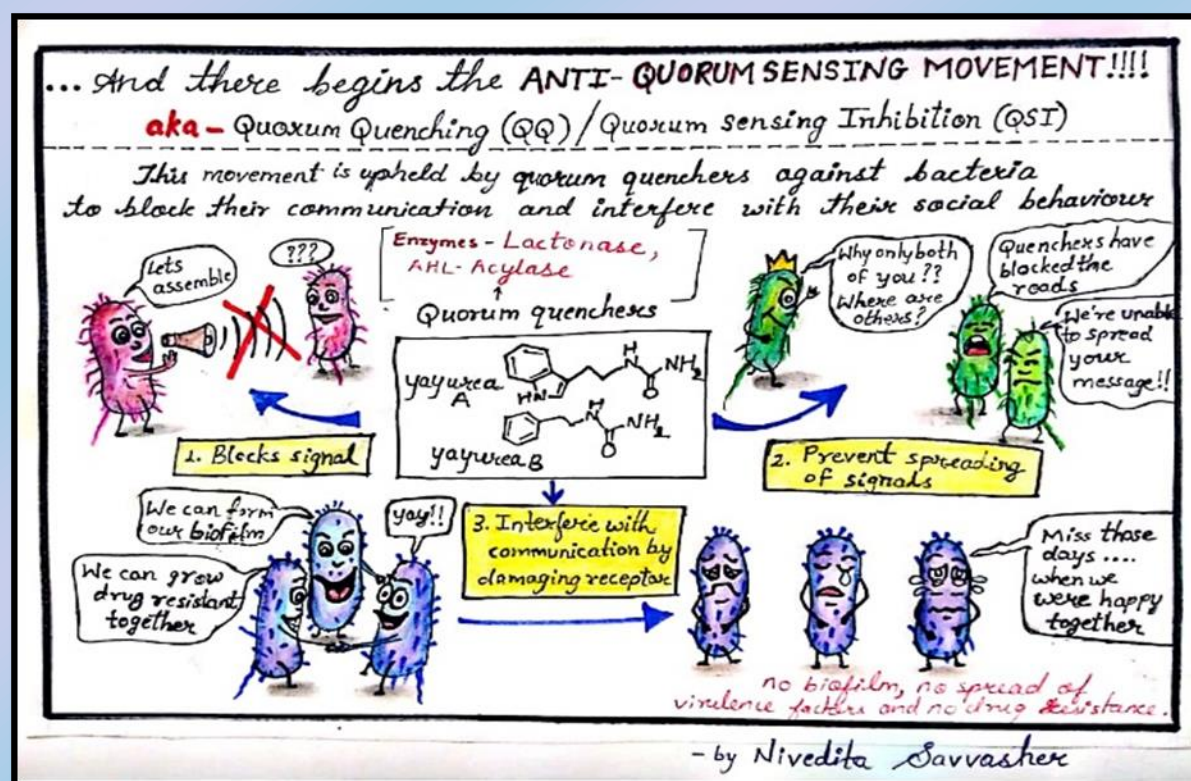
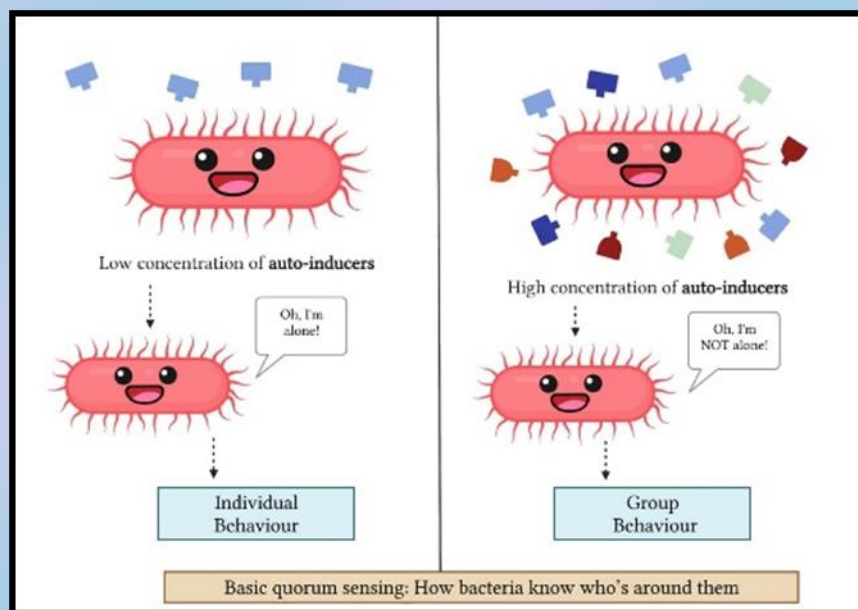
The story of bacteria “talking” to each other probably started long before it was discovered 25 years ago by Dr. Steven Winans in *Vibrio fischeri* and *V. harveyi*. Just like it is hard to observe single stars producing light in the night sky until the entirety of it is covered with bright shiny objects, light emission in these two marine bacteria was determined to occur only at high cell-population density in response to the accumulation of secreted autoinducer signaling molecules. These are encoded by the luciferase structural operon luxCDABE. Another example of Quorum sensing has been observed recently in antibiotic production by *Streptomyces* spp., conjugation in *Enterococcus faecalis*, and

fruiting body development in *Myxococcus xanthus* were also recognized to be controlled by intercellular signaling. Interesting right? This anomalous behaviour in bacteria is quite similar to chemical signalling in eukaryotes. Why should our microscopic friends remain behind? They too coordinate group behaviour by secreting chemicals and forming complex hierarchical regulatory circuits in an intra and inter-species dependent manner. This is critical for bacterial survival and interaction in natural habitats. One such example of inter-species communication is seen in enteric bacteria via the LuxR-I quorum-sensing system, the LuxS/AI-2 system, and the AI-3/epinephrine/norepinephrine system. This helps enteric bacteria in host recognition and assessment of their environment. Defense against chronic infections causing, biofilm-forming Gram-negative bacteria has been taken to a level beyond inhibiting their growth due to the expository advancement in our understanding of quorum sensing in biofilm formation. Compounds that not only specifically attenuate the production of virulence factors by bacteria but also affect biofilm formation in a manner that is unlikely to pose a selective pressure for the development of resistant mutants are now under research and development.

Thus, developments in our understanding of the molecular and biochemical mechanisms involved in quorum sensing as well as the chemical signal-physiological response system will improve medicine by identification of bacterial pathogenesis and microbial flora-host interactions. This enormously increases the playfield of practical applications. To conclude, we can say that bacteria need quorum sensing to function like a multi-cellular unit that can work like a community.



Pragyananda Choudhary
& Dimple Saini



Nivedita Savvasher

CURRENT TRENDS IN BACTERIOLOGY

MICROBES AND CANCER: FRIENDS OR FOES.....?

“Hallmarks of cancer: new dimensions” has a new emerging hallmark -polymorphic microbes!

The symbiotic association of microbiome with human body has an impact on cancer pathogenesis. Polymorphic microbes within gut play a role in tumorigenesis, cancer differentiation and malignant progression. They positively and negatively interact with other hallmarks like tumor inflammation, avoiding immune destruction, genome instability and resistance to anticancer therapies.

11 microbial species on Earth are identified as direct human carcinogens (Oncomicrobes). Examples include some strains of *E. coli* that have pathogenicity islands that

Encodes a set of enzymes which synthesize Colibactin - a DNA alkylator that brings double strand break in nucleic acid. *Bacteroides fragilis* produces toxins which binds to surface of colonic epithelial cells stimulating proliferation signaling which further leads to colon cancer. As there's inclusion of microbes in cancer the gut microbiome can be modulated as a cancer treatment. There are studies going on tissue specific microbes to study their contribution in cancer.

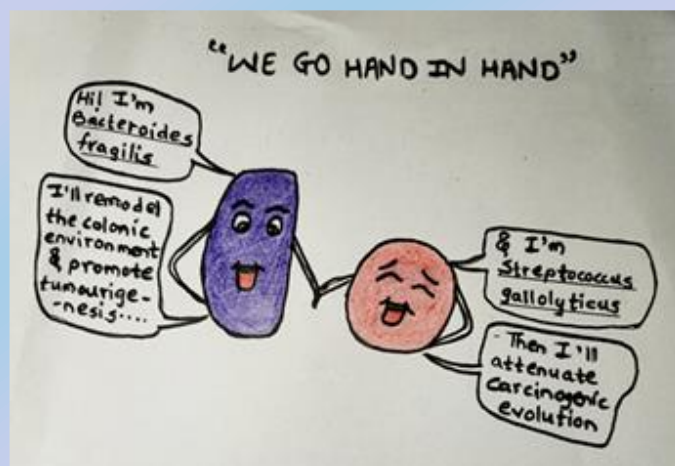


Fig: a bacterial driver-passenger relationship

Nishigandha Yadav



Interesting facts

1. Polymorphic microbes within the gut play an important role in pathogenesis of cancer. Microbes have both tumor-promoting and cancer-protective qualities.
2. Scientist demonstrated that gut microbiota can regulate cholesterol metabolism and can reduce cholesterol levels.
3. Signals in the micro biome data can be used to forecast future ecosystem process.
4. Diffusible signal factor (DSF) family represents an intriguing type of quorum sensing signal with multiple rates found in diverse gram negative bacteria.
5. Integrons are bacterial genetic element notorious for their role in spreading antibiotic resistance in clinical setting, they must be considered a threatening pool of resistance determinants.
6. *Chlamydia trachomatis* causes and a causative agent of blinding trachoma. It increases the risk of developing chronic sequelae, which will impact on girls from age 15 to 24.



Akshita Singh

Gut microbiota and cardiovascular diseases

Cardiovascular disease (CVD) is a health problem worldwide, and elevated cholesterol levels are a key risk factor for the disease. Imbalance gut microbiota has been shown to be associated with CVD development.

A study of hypercholesterolemic (high blood cholesterol levels) mice showed that intestinal microbiota depletion by antibiotics resulted in elevated cholesterol uptake and synthesis in hepatic cells. The same study also showed that intestinal microbiota transplantation to mice from humans with elevated plasma cholesterol levels induced increased cholesterol levels. This suggests that the gut microbiota could regulate cholesterol metabolism and that it is feasible to reduce cholesterol levels by interventions involving the gut microbiota, such as fecal microbiota transplantation, antibiotics, probiotics, and prebiotics.

The gut microbiota and its metabolites can be beneficial in terms of decreasing the CVD risk using cholesterol-lowering effects; the metabolites are mainly short-chain fatty acids (SCFAs) and secondary bile acids (BAs).

There are five main pathways by which SCFAs can decrease cholesterol levels in the host.

1. Firstly, SCFAs can inhibit cholesterol synthesis by downregulating genes encoding enzymes involved in the synthesis of cholesterol from acetyl coenzyme A.
2. SCFAs can enhance the conversion of cholesterol to BAs, thereby reducing the cholesterol levels.
3. SCFAs can inhibit intestinal cholesterol assimilation by regulating cholesterol transporter expression.
4. SCFAs have also been proposed to affect cholesterol levels through signaling pathways mediated by G protein-coupled receptors 41 and 43 (GPR41/43).
5. SCFAs can influence cholesterol levels in macrophages by accelerating cholesterol export via the regulation of ATP-binding cassette transporter A1 (ABCA1), which transports cholesterol out of peripheral macrophages and the liver.

Newly Discovered functions of GUT MICROBIOME

Enhances Intestinal Barrier Integrity

Regulation of Neuro-inflammation

Modulation of circulating blood Metabolites

Regulate host metabolism and energy homeostasis

Maintaining Immune Homeostasis

Regulation of Feeding Behaviour



Rohith Ragesh

Rutuja Deshmukh



A Lip tint that's waterproof and..... ANTIMICROBIAL?!?!?

Now researchers have come full circle, looking again toward natural ingredients. Recent studies have reported that lipstick formulas incorporating natural colorants, such as red dragon fruit, can result in products with both vibrant colors and antimicrobial activity. And previously, cranberry extract has been shown to inactivate viruses, bacteria and fungi. So, Ángel Serrano-Aroca and colleagues wanted to use cranberry extract to create a deep red lip tint with antimicrobial properties.

First of all, why not just create a lipstick that's infused with antibiotics? Well, for one thing, the more often antibiotics are used, the greater the resistance bacteria will develop to them. Antibiotics also don't work on viruses, plus they may cause unwanted side effects when ingested.

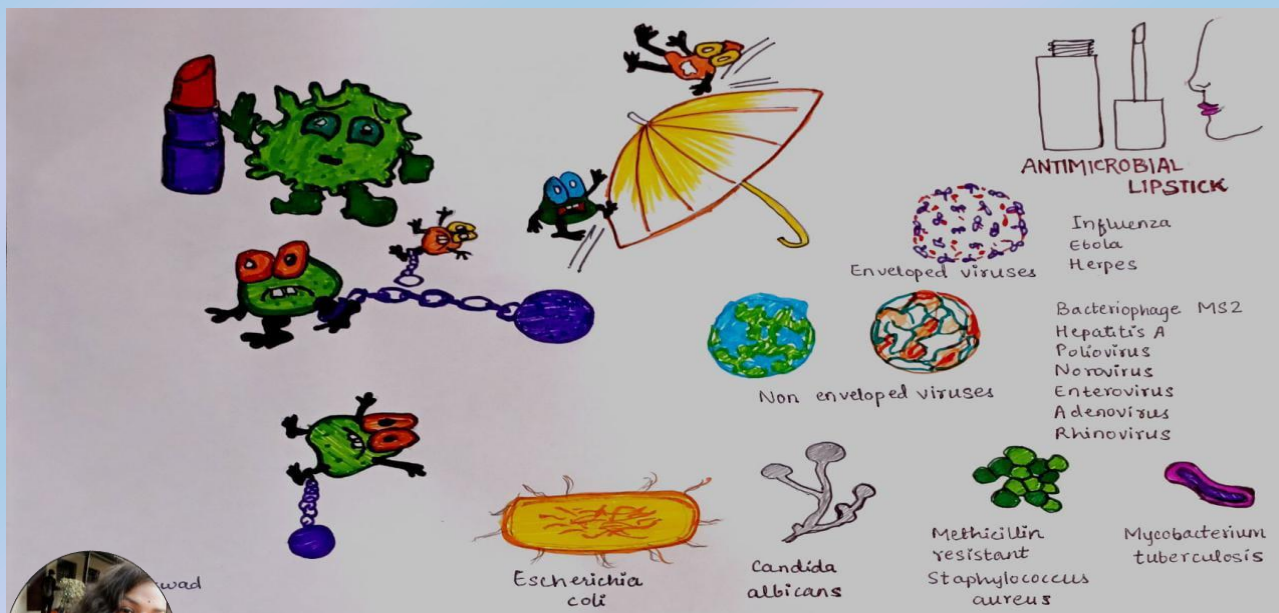
That's where cranberries come in. ...

They contain micronutrients known as polyphenols, which inhibit the activity of viruses, bacteria and fungi. As a result, the microbes are unable to communicate with one another for reproductive purposes, so their populations simply die out instead of increasing. And because polyphenols don't outright kill the microbes, bacteria are unlikely to become resistant to them.

The experiment that led to the revelation-

For the experimental antimicrobial lipstick, Prof. Ángel Serrano-Aroca and colleagues at Spain's Valencia Catholic University Saint Vincent Martyr added cranberry extract to an existing lipstick cream base. That base contained a number of skin-health-boosting ingredients, such as shea butter, vitamin E, provitamin B5, babassu oil and avocado oil. The resulting lipstick was then added to cultures in which viruses, bacteria and *Candida albicans* fungus were growing. Among the viruses was a surrogate of COVID-19-causing SARS-CoV-2, while the bacteria included harmful drug-resistant varieties such as *Staphylococcus aureus* and *Escherichia coli*. It was found that just one minute after contact, all of the viruses were completely inactivated. The bacteria and fungus were likewise substantially inactivated after five hours of contact.

Rutuja Bhujbal



Shruti Gaikwad

POEM OF GOLEM!!!
TRENDS SAME AS FRIENDS....

Ohh trends, the current trends
We should also follow come on my friends...
From the microscopic world to the visions of right,
We'll find ourselves on the path so bright....

The cosmic dance of ours to maintain the balance,
With the secret story so far to be heard in the silence....
The story of ours, ohh so same as yours!!!
Floating underneath your eyes....
Yes, right there where the current trends lye...

We could also fly and wander so high....
Think of it... no no, its not a lie!!!
We are the Bacteria,
Ofcourse the future kings of your area....

Play with us, with your motivation electrified,
But, make sure that its not a tie....



Samruddhi Mandakmale

FUZZLE OF PUZZLE

Here's some fill in the blanks to give a nudge to your retention power-

1. This was the oldest bioweapon to be recorded in history of mankind _____
2. _____ enzyme imparts the ability of Bioluminescence to various microorganisms.
3. Micro nutrients present in cranberries that inhibit the growth of bacteria and viruses are termed as _____.
4. Auto inducers are _____ produced and released by quorum sensing bacteria that increases concentration as a function of cell density.
5. _____ is the oldest life form on Earth and has existed for _____.
6. A gram positive, rod shaped, sporulating, capsule forming bacteria that wrecked havoc during the WW II _____.
7. Polymorphic microbes within the gut play an important role in _____.

Word Search

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B D R K V F Y L E P R O S Y N
B T V M L B I O W E A P O N S
X I B U I Z M V O F F O H S W
C R O V L U C I F E R A S E D
R P N T D V A S A R D N M I R
I P O N E J I A F A B T I V A
S L R L K R N L N B E H C D S
P A H E Y E R M H I C R R S M
R G P L B P B O L E O A O S A
C U S I I C H N R S L X B Q L
J E U D O O A E T I I D I U L
Y D W D F E G L N F S R A O P
Y N I C I O V L G O I M L R O
M F D G L W U A W W L F Z U X
E A P I M B A J W D P S X M N
  
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Bioterrorism	Polyphenols	Bioweapons
Luciferase	Microbial	Salmonella
Biofilm	Leprosy	CRISPR
Plague	Anthrax	Small pox
Quorum	Rabies	E coli



Shambhavi Chaturvedi



Nishant Pandey

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QUORUM SENSING

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