ATAVISM

A STUDENT-RUN SYNAPSE NEWSLETTER

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ABOUT US

With an aim to nurture the skills of students, Department of Biotechnology & the Bioinformatics, JUIT, has created a platform called Synapse, for students to develop and exhibit their technical, outreach, arts and other skills. And the newsletter is a tiny idea of the members of Synapse Club. Atavism is a phenotypic trait that appears suddenly in an organism. Yes, it is that feature we have always had the genes for, but have never expressed. Have you heard of the dolphin with legs or the baby born with a tail? Because if you have, you know what we're talking about! Just like its name, this newsletter is a little something that we always had the genes for, but we never expressed. We agree that the newsletter isn't as weird as the chicken with teeth but it sure is something out of the blue to bring all of us together. We aim to make this newsletter the place you can go for the latest news in the biotechnology world, bizarre but true science headlines, and conversations that you should hear more of.

Gut Microbes: The Tiny Powerhouses Shaping Our Health!

The human gut is home to trillions of microorganisms, collectively known as the gut microbiome. These microbes, often overlooked, play a pivotal role in shaping our overall health, from digesting food and producing essential vitamins to regulating immune responses and even influencing our mood. The gut microbiome has emerged as a frontier in personalized medicine, offering potential breakthroughs in treatment strategies, including the use of probiotics, prebiotics, and even faecal microbiota transplants. Moreover, with growing evidence connecting gut health to mental well-being through the gut-brain axis, the microbiome is being explored as a key factor in managing conditions like depression and anxiety.Get ready to dive into the microscopic universe that holds the key to unlocking better health!

ARE YOU EVEN READING?

If you are, you're sure to have feedback for the team. Send it to 211909@juitsolan.in so that we can know. We would also love to feature your opinion on biology topics or your coverage of the latest research in the next issue. Your email could make our day!

References and Photo credits:

1. Images from https://images.app.goo.gl/9YpT79rNvq88HQUy8
2. Foster JA, Neufeld KA. Gut–brain axis: how the microbiome influences anxiety and depression. Trends in Neurosciences. 2013;36(5):305-312.

Microbiota-Gut-Brain Axis!!!

The gut-brain axis (GBA) represents a bidirectional communication network between the central nervous system and the gastrointestinal tract, with the gut microbiota playing a critical role in this interaction. This axis is now recognized as an important pathway that influences not just gut health but also mood, behaviour, and even cognitive functions. Mechanisms of Communication Several pathways mediate communication between the gut microbiota and the brain.

Role in Mental Health Research

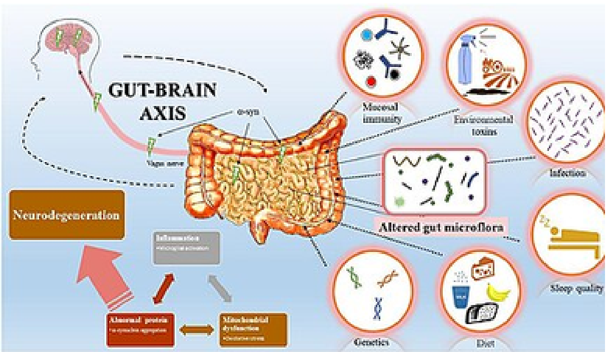
Dysbiosis may contribute to mental health disorders, including depression and anxiety. Studies have demonstrated that individuals with mental health disorders often have altered gut microbiota composition. Probiotic and prebiotic interventions have shown promise in improving mood and cognitive function by restoring healthy gut bacteria.

Mechanisms of Communication

- Neural Pathways: The vagus nerve, which connects the gut and brain, transmits signals from gut bacteria directly to the brain.
- Immune System: Gut bacteria regulate immune responses that can influence brain function.
- Microbial Metabolites: Bacterial metabolites like SCFAs and neurotransmitters (e.g., serotonin, dopamine) are produced in the gut and can influence mood and cognition.

Gut Microbiota and Stress Response

The gut microbiome is thought to play a significant role in regulating the body's stress response. Animal studies have shown that germ-free mice, which lack gut bacteria, exhibit exaggerated stress responses, while the introduction of certain bacterial species can normalize stress-related behaviour.

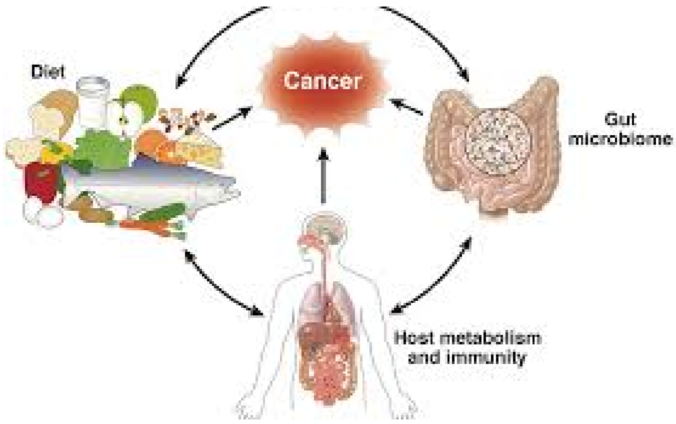


The gut-brain axis opens exciting possibilities for novel therapeutic approaches to mental health disorders, including the use of psych biotics—probiotics designed to influence mental health. Future research into the microbiota-gut-brain connection holds the potential for breakthroughs in treating conditions such as depression, anxiety, and even neurodegenerative diseases as the gut-brain axis (GBA) is a complex, bidirectional communication network between the gastrointestinal tract and the central nervous system (CNS). This interaction is mediated through neural, hormonal, and immune pathways, with the gut microbiota playing a key role. the gut-brain axis is a dynamic system that links gut health with brain function, and its study is opening new doors for treatments of mental health and neurological conditions.

References &Photo credits:

1. Photos credits: https://images.app.goo.gl/SD65EGjzfg6QF6MF9
2. Cryan JF, Dinan TG. Mind-altering microorganisms: the impact of the gut microbiota on brain and behavior. Nature Reviews Neuroscience. 2012;13(10):701-712.
3. Foster JA, Neufeld KA. Gut–brain axis: how the microbiome influences anxiety and depression. Trends in Neurosciences. 2013;36(5):305-312.

Gut Microbiome in Cancer Therapy: Expanding Insights



The relationship between the gut microbiome and cancer therapy, particularly immunotherapy, is an emerging field of immense interest. As our understanding of the human microbiome expands, so does the evidence linking gut bacteria to the efficacy and outcomes of cancer treatments. The gut microbiome's influence on cancer therapy opens a new frontier in personalized medicine, especially in how patients respond to immunotherapies like checkpoint inhibitors.

Checkpoint Inhibitors and Gut Microbiota

Checkpoint inhibitors, such as anti-PD-1, anti-PD-L1, and anti-CTLA-4, have revolutionized cancer treatment by unlocking the immune system's ability to recognize and destroy cancer cells. These therapies work by blocking immune checkpoints—proteins that act as brakes on immune responses—thereby allowing T cells to attack tumors. Despite their promise, the clinical efficacy of checkpoint inhibitors varies significantly across patients. The gut microbiome has been identified as a crucial factor influencing this variability.

Fecal Microbiota Transplant (FMT) in Cancer Therapy

Fecal microbiota transplant (FMT) is a procedure where fecal matter from a healthy donor is transplanted into the gut of a recipient to restore microbial balance. Initially developed as a treatment for recurrent Clostridium difficile infections, FMT has recently gained attention for its potential in cancer therapy.

Early studies in mice and humans have demonstrated that FMT can improve the response to checkpoint inhibitors in cancer patients. For instance, transferring the microbiome of a cancer patient who responded well to immunotherapy to a non-responder led to a significant improvement in the latter's response. This suggests that the gut microbiome plays a direct role in modulating the immune system's ability to recognize and destroy tumors.

Microbiome-Based Therapies: Probiotics, Prebiotics, and Synbiotics

Given the gut microbiome's impact on cancer therapy, there is growing interest in microbiome-based therapies to optimize treatment outcomes. These therapies include:

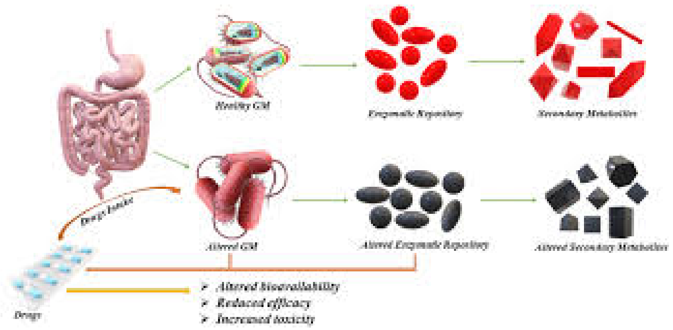
Probiotics: Live microorganisms that confer health benefits when consumed. Certain probiotic strains, such as Lactobacillus and Bifidobacterium, have shown promise in enhancing immune responses during cancer treatment.

Prebiotics: Non-digestible fibers that promote the growth of beneficial gut bacteria. Prebiotics can be used to selectively enrich bacterial species that support immune function and improve cancer therapy outcomes.

Synbiotics: A combination of probiotics and prebiotics that work synergistically to modulate the gut microbiome and improve patient health.

References:
1 https://images.app.goo.gl/yWSZFxVYWgzd7eT1A
2 https://images.app.goo.gl/gEWbfz8Ft68QJS6z5
3 Gopalakrishnan V, et al. The influence of the gut microbiome on cancer, immunity, and cancer immunotherapy. Cancer Cell. 2018;33(4):570-580.

Microbial Influence on Drug Metabolism: A New Frontier in Personalized Medicine

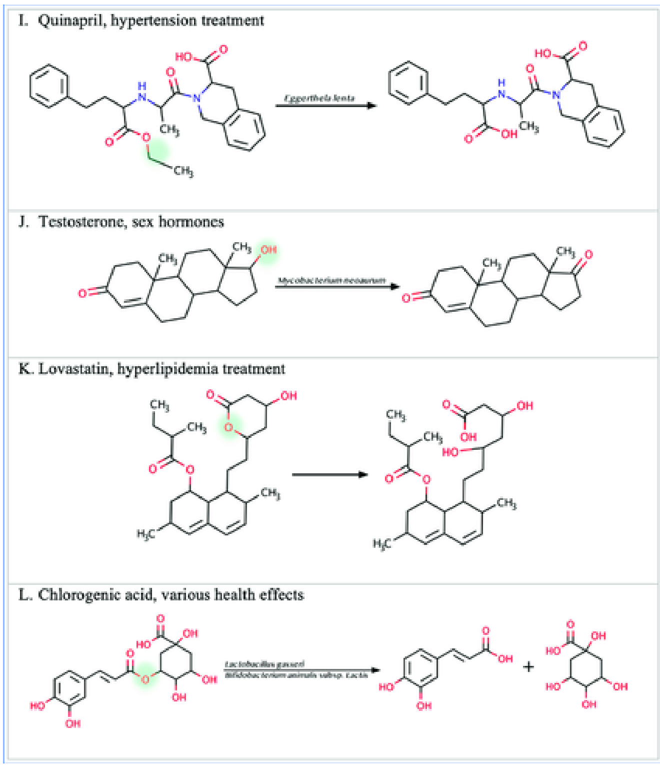


The human gut microbiome is a diverse community of microorganisms that not only aids in digestion and nutrient absorption but also plays a pivotal role in drug metabolism. As research delves deeper into this complex ecosystem, it is becoming clear that gut microbes can significantly influence the pharmacokinetics (how drugs are absorbed, distributed, metabolized, and excreted) and efficacy of various medications. This interaction opens the door to a more personalized approach to medicine, where microbiome composition could be used to tailor treatments for optimal outcomes.

How Gut Microbes Affect Drug Metabolism

Gut microbes can alter drug metabolism through two main mechanisms:

1. Direct Metabolism of Drugs: Certain gut bacteria possess enzymes that can directly modify drugs, sometimes converting them into active or inactive forms. This microbial biotransformation can either enhance or reduce a drug's therapeutic effect.
2. Modulation of Host Enzymes: Gut microbes can also influence the activity of the host's liver enzymes, particularly the cytochrome P450 family, which is responsible for metabolizing many drugs. By modulating the expression and function of these enzymes, gut bacteria indirectly affect how quickly or slowly drugs are metabolized.



One of the most well-studied examples of gut microbial involvement in drug metabolism is with digoxin, a heart medication used to treat atrial fibrillation and heart failure. Certain strains of Eggerthella lenta, a gut bacterium, can inactivate digoxin by reducing it to an inactive form, which may render the drug less effective in patients with a higher abundance of this bacteria. Understanding the composition of a patient's gut microbiome could help predict their response to digoxin and adjust dosages accordingly.

As research continues to uncover the intricate relationship between the microbiome and drug metabolism, the integration of microbiome data into clinical practice may become a cornerstone of future medical treatment, ushering in a new era of personalized healthcare.

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References & Photo credits:

1. https://images.app.goo.gl/CSW7ozikLm2pRcKd9
2. Haiser HJ, et al. Predicting and manipulating cardiac drug inactivation by the human gut bacterium Eggerthella lenta. Science. 2013;341(6143):295-298.