

The background of the slide is a vibrant, cartoonish illustration of a gut microbiome. It features a variety of colorful, anthropomorphic microorganisms. There are green, blue, yellow, and orange oval-shaped bacteria with large eyes and simple mouths. Some have long, thin flagella. There are also purple, pink, and blue more complex shapes, some resembling viruses or larger bacteria. The background is a light blue sky-like color with soft, pink and purple cloud-like shapes. A horizontal wooden-textured banner is placed across the middle of the image, containing the title text.

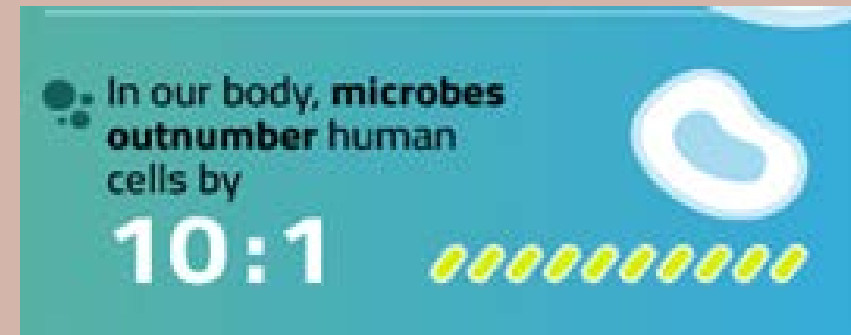
NUTRITION TO KEEP GUT MICROBIOME HEALTHY

Objectives

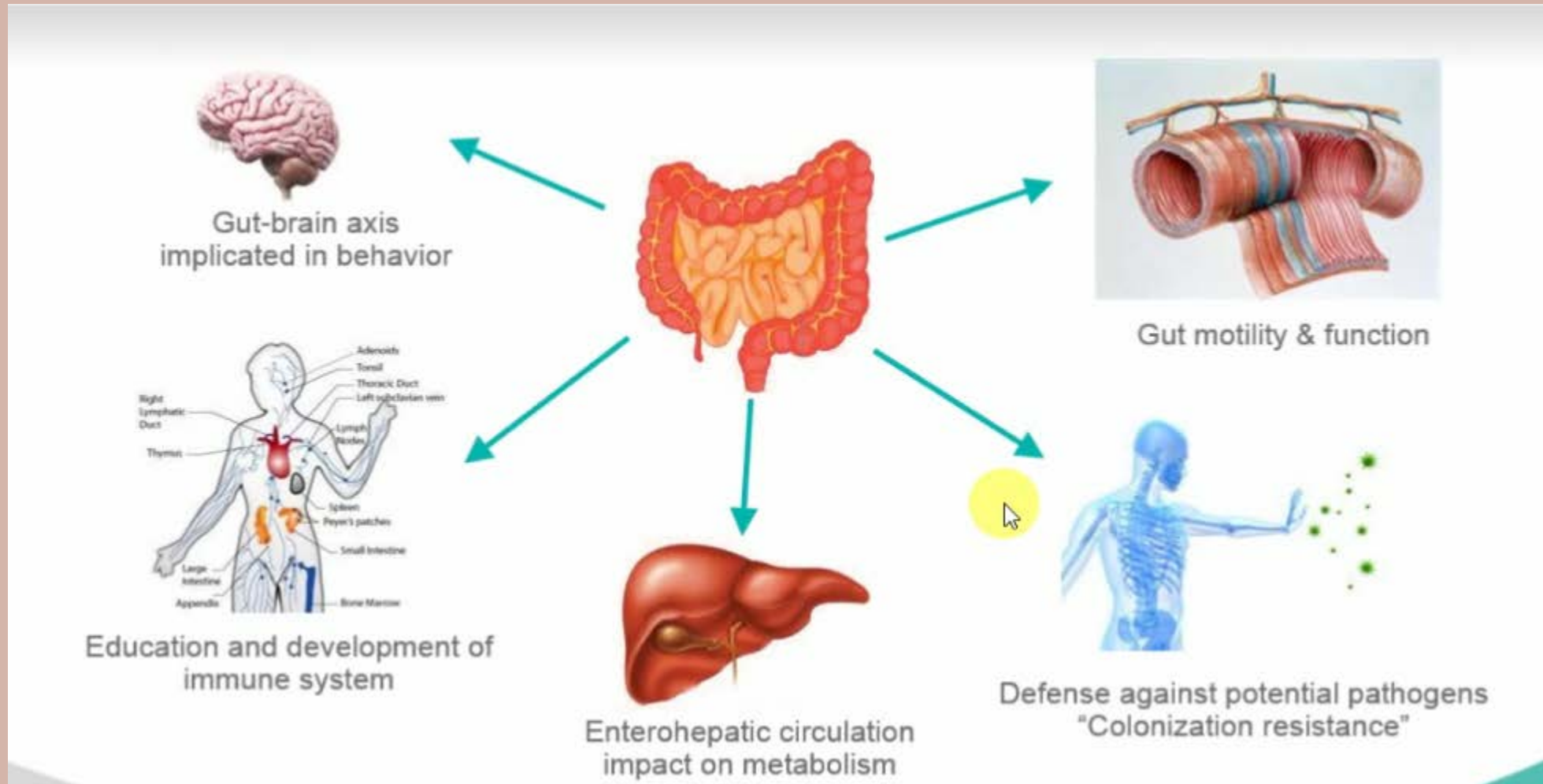
- ▶ Probiotics and Prebiotics
- ▶ Human milk oligosaccharides (HMO)
- ▶ Factors derailing HMO
- ▶ Symbiosis Vs Dysbiosis
- ▶ Researches focusing on effects of missing Gut microbiome



Some facts revised



Gut microbiome impacts whole body



Difference between Probiotics and Prebiotics

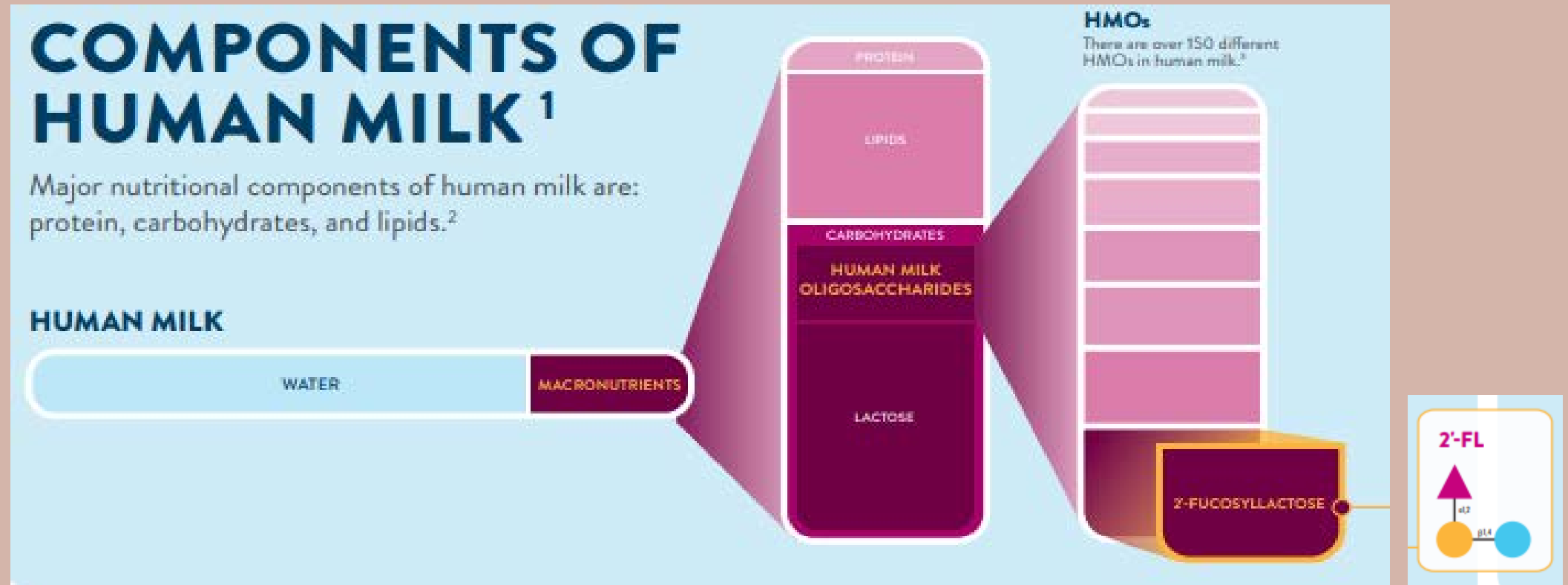
Probiotic : The term was defined by Parker (1974) as
“organisms and substances which contribute to intestinal microbial balance.”

Prebiotics

are nondigestible substances that feed the probiotics, helping them to thrive in the GI tract.

HUMAN MILK OLIGOSACCHARIDES

- A family of structurally diverse unconjugated glycans
- Recent studies show that HMO—a prebiotic found naturally in human milk—can serve as food for beneficial bacteria in the infant gut.



Early immune development



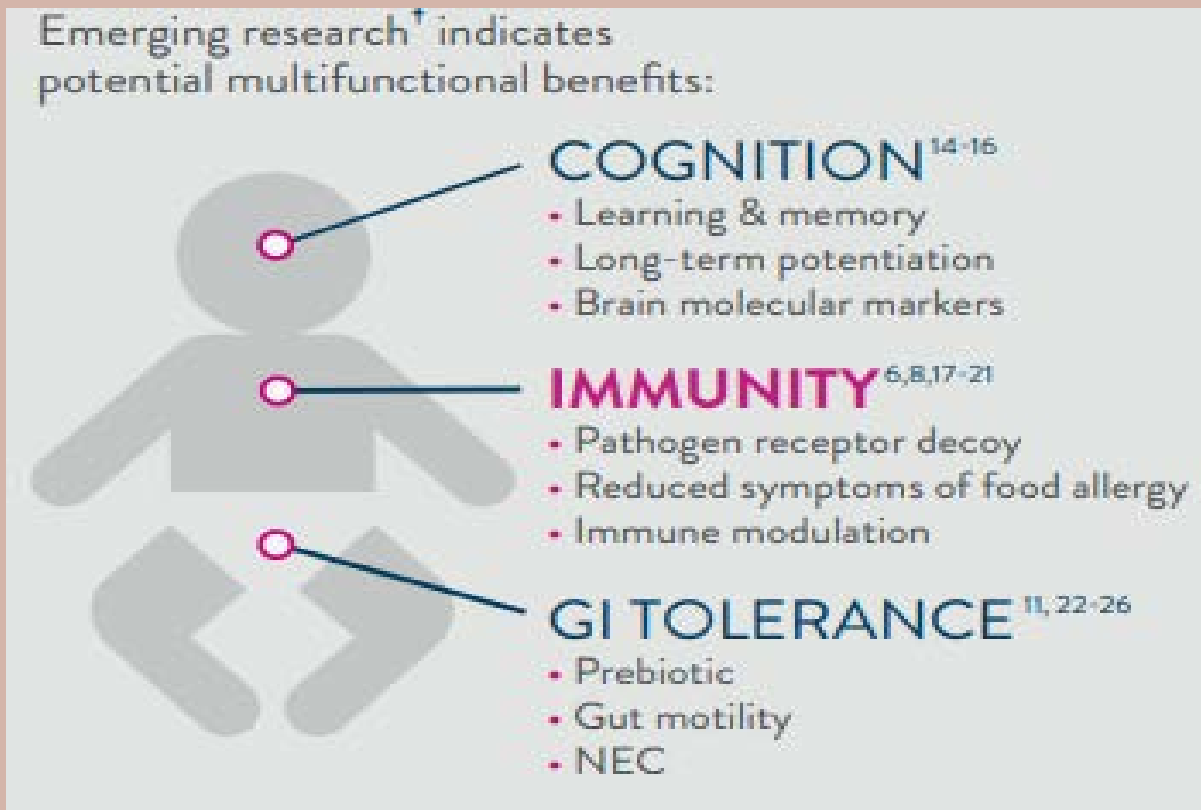
70%

Of immune system is in gut , prebiotics supports colonization of gut which helps in immune system development

Prentice A. Constituents of human milk. United Nations University website. [http:// archive.unu.edu/unupress/food/8FI74e/8FI74E04.htm](http://archive.unu.edu/unupress/food/8FI74e/8FI74E04.htm). Accessed February 26, 2016.

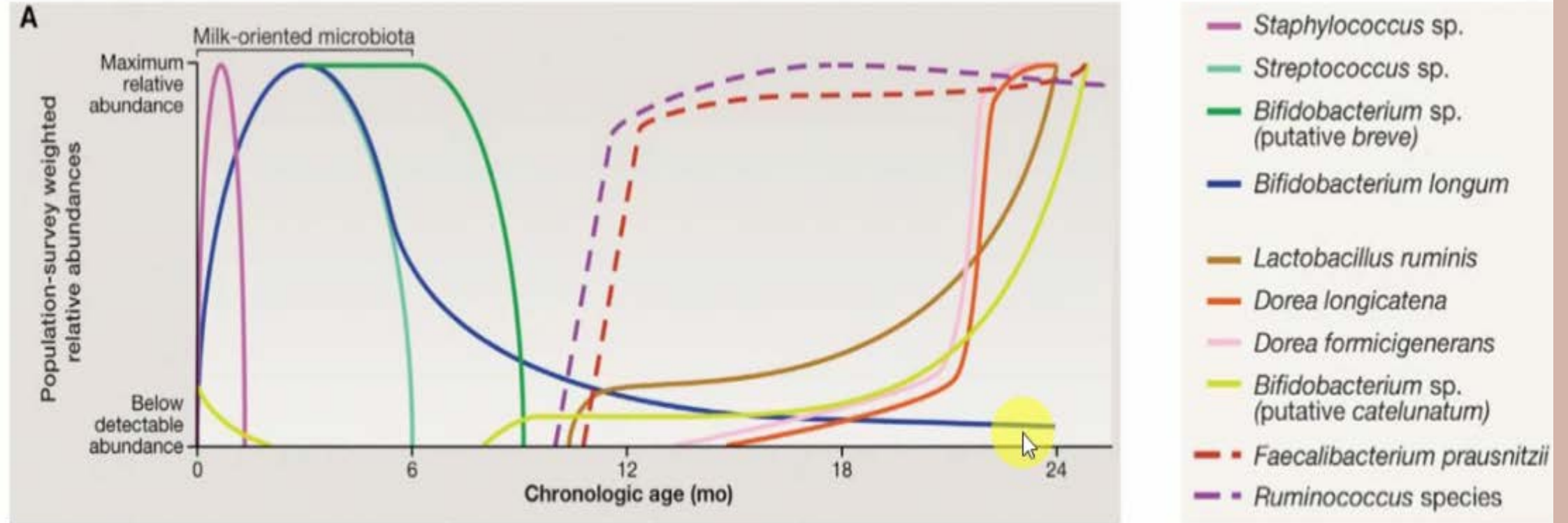


Prebiotics and more functions



Bienenstock J, Buck R, Linke H, Forsythe P, Stanisz AM, Kunze WA. Fucosylated but not sialylated milk oligosaccharides diminish colon motor contractions. PLoS One. 2013;8(10):e76236.

The Early Gut Microbiome



Cultivating Healthy Growth and Nutrition through the Gut Microbiota

Sathish Subramanian,^{1,2} Laura V. Blanton,^{1,2} Steven A. Frese,³ Mark Charbonneau,^{1,2} David A. Mills,³ and Jeffrey I. Gordon^{1,2,*}

But...humans have changed almost everything



Gut microbiome described 100 years ago

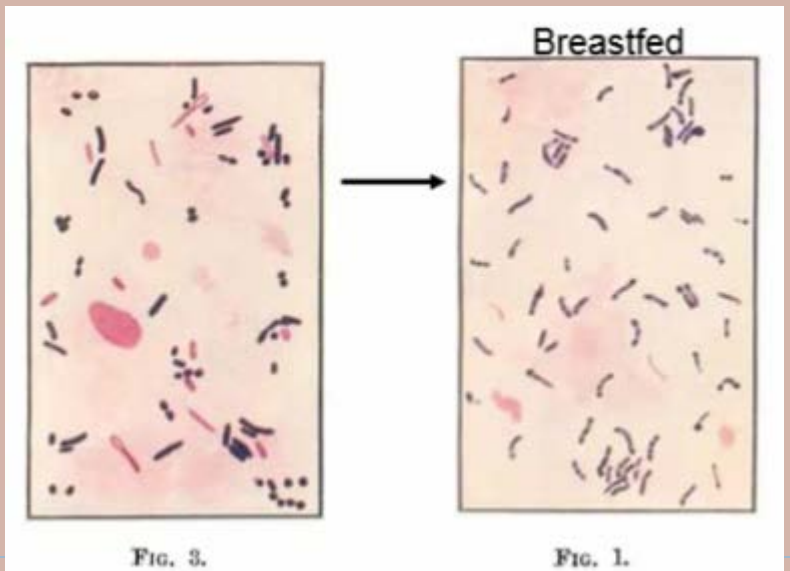
*“In four of the others, the results were nearly identical. The films showed the punctate form of *B. bifidus* in nearly pure culture...in the flora of breastfed infants (the ideal), the acid-tolerant group is immeasurably predominant and is of the strictly anaerobic type called *B. bifidus*.”*

—Logan, in 1913, echoing the findings of his contemporaries, Tissier and Moro

Journal of Pathology and Bacteriology, Vol. XVIII.
THE INTESTINAL FLORA OF INFANTS AND YOUNG CHILDREN.¹

By W. R. Logan, M. D.

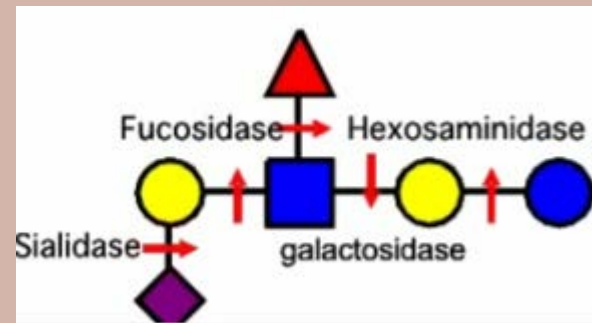
From the Research Laboratory of the Royal College of Physicians, Edinburgh.



Bifidobacterium longum infantis and HMO .

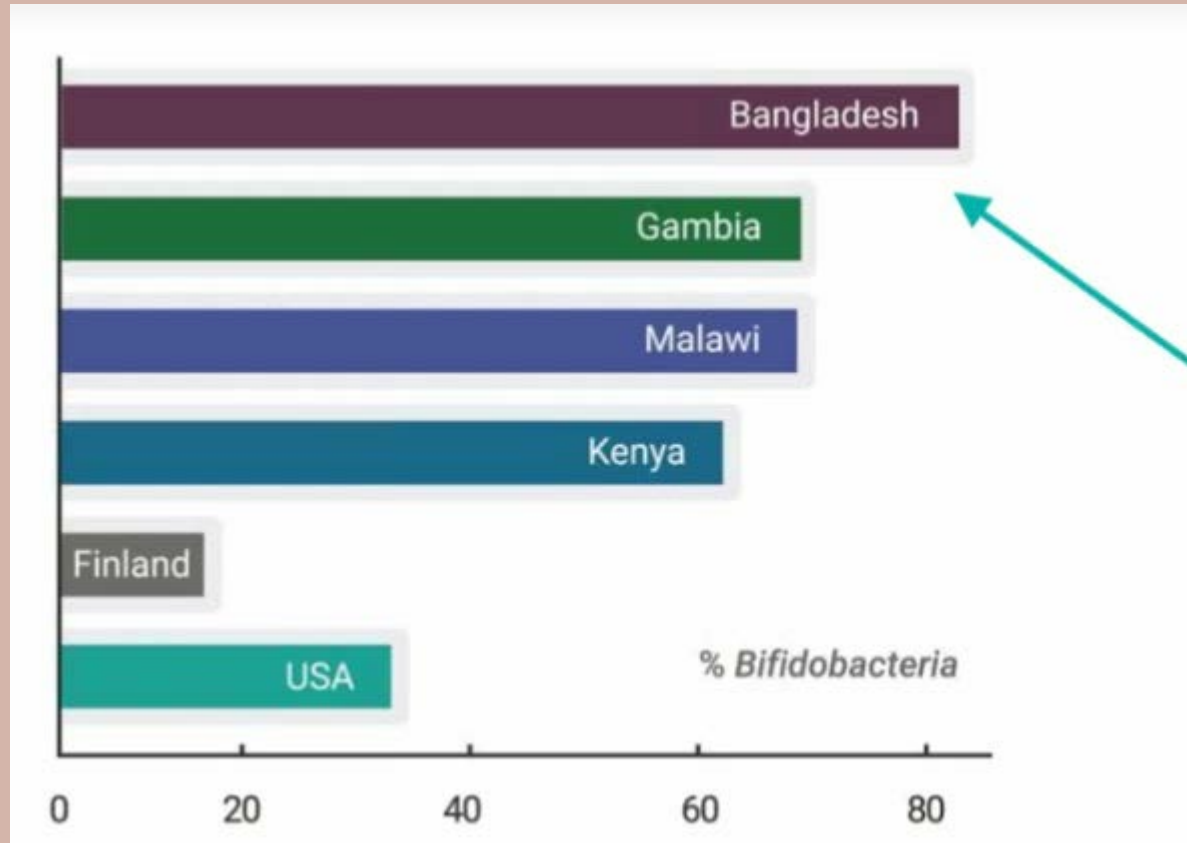


Dr. David Mills
*Professor in Food Science and Technology
and Endowed Chair in Dairy Food Science
at UC Davis*
UC DAVIS
FOODS FOR HEALTH INSTITUTE



← 4 enzymes needed to break HMO

Its still diverse for some parts of world



Some countries like Bangladesh still have high levels of bifido among breast feeding infants.

While developed countries have much lower abundance

Huda et al 2014; Davis et al 2017; Vatanen et al 2016;

*Yatsunenکو et al 2012; Frese et al 2017;
Subramanian et al 2014; Lewis et al 2014*

Factors that derail the healthy Gut microbiome

- ▶ Formula feeding
- ▶ Mode of delivery
- ▶ Antibiotics
- ▶ In absence of Bifidobacterium
dysbiosis sets in



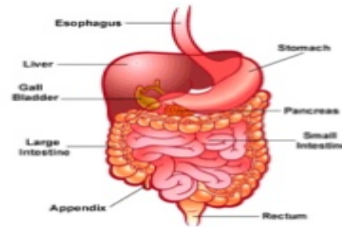
Dysbiosis is opposite of Symbiosis

- ▶ Symbiosis: to live together with our microbes in a relationship where we are useful to each other

What's the type of symbiosis?

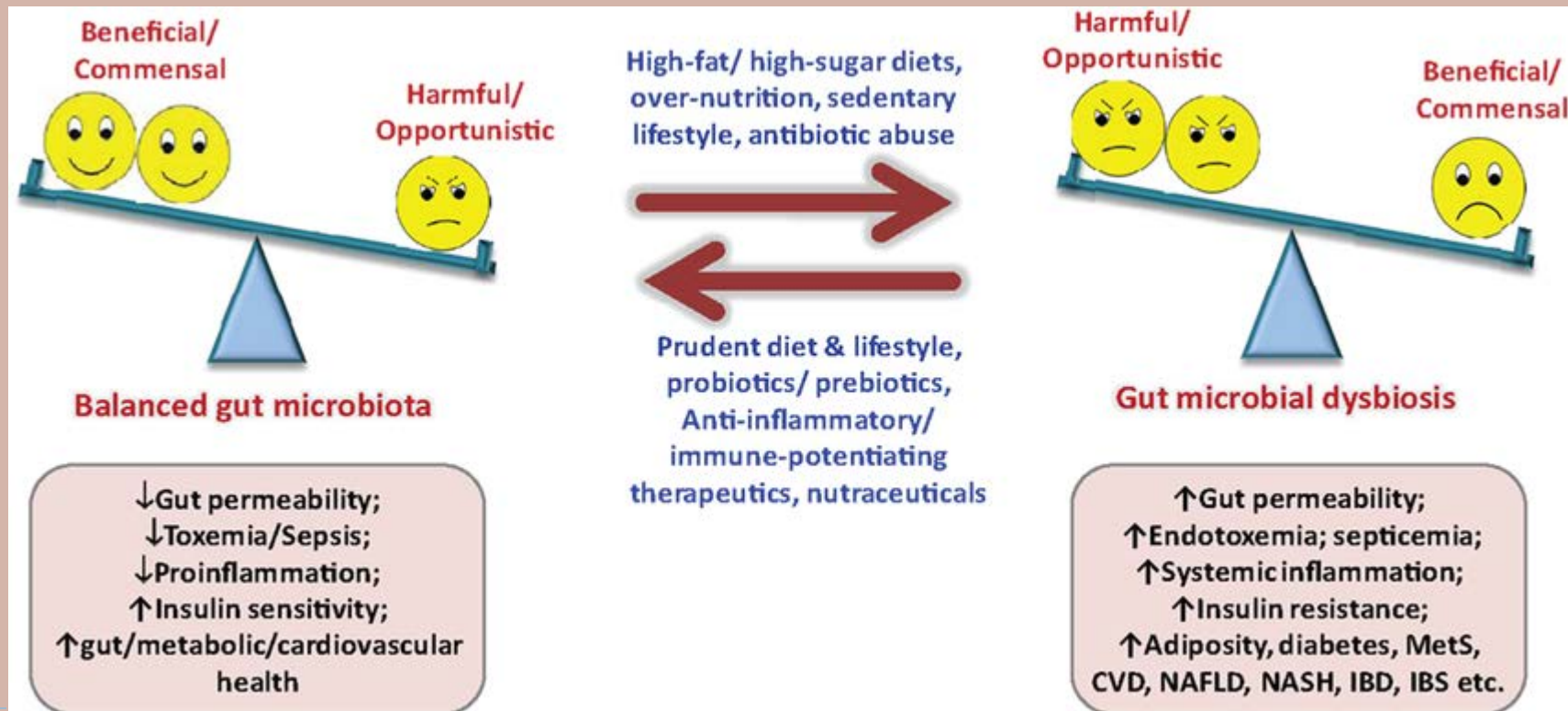
Human intestine provides food for bacteria that live inside digestive system

Beneficial bacterial live in the intestine of humans and help digest cellulose from plants which humans don't have the enzymes to break down.



Dysbiosis

- Is a term for a microbial imbalance or maladaptation inside the body, such as an impaired microbiota.



What happens in dysbiosis in infancy

- ▶ Colic
- ▶ Infections
- ▶ Constipation
- ▶ Excessive weight gain

Neonatal gut microbiota associates with childhood multisensitized atopy and T cell differentiation

Kei E Fujimura¹, Alexandra R Sitarik², Suzanne Havstad², Din L Lin¹, Sophia Levan¹, Douglas Fadroshe¹, Ariane R Panzer¹, Brandon LaMere¹, Elze Rackaityte¹, Nicholas W Lukacs³, Ganesa Wegienka², Homer A Boushey⁴, Dennis R Ownby⁵, Edward M Zoratti⁶, Albert M Levin², Christine C Johnson^{2,7} & Susan V Lynch^{1,7}

Gut bacteria dysbiosis and necrotising enterocolitis in very low birthweight infants: a prospective case-control study

Barbara H Warner, Elena Deych, Yanjiao Zhou, Carla Hall-Moore, George M Weinstock, Erica Sodergren, Nurmoammad Shaikh, Julie A Hoffmann, Laura A Linneman, Aaron Hammes, Geriika Khanna, Lucina C Rouggy-Nickless, I Malick Ndao, Bentley A Shands, Marilyn Escobedo, Janice E Sullivan, Paula G Radmacher, William D Shannon, Phillip I Tarr

Antibiotic Exposure in Infancy and Risk of Being Overweight in the First 24 Months of Life

Arto Sarti, MD^a, Laura J Vinta MD, PhD^a, Ulla Sankilampi MD, PhD^a, Leo Dunkel MD, PhD^a, Harri Savolainen MD, PhD^a

Stool Microbiota and Vaccine Responses of Infants

AUTHORS: M. Nazmul Huda, MS,^{a,b} Zachery Lewis, BS,^c Karen M. Kalanetra, PhD,^c Mamunur Rashid, MS,^b Shaikh M. Ahmad, PhD,^b Rubhana Raqib, PhD,^b Firdausi Qadri,

What happens in dysbiosis in adulthood

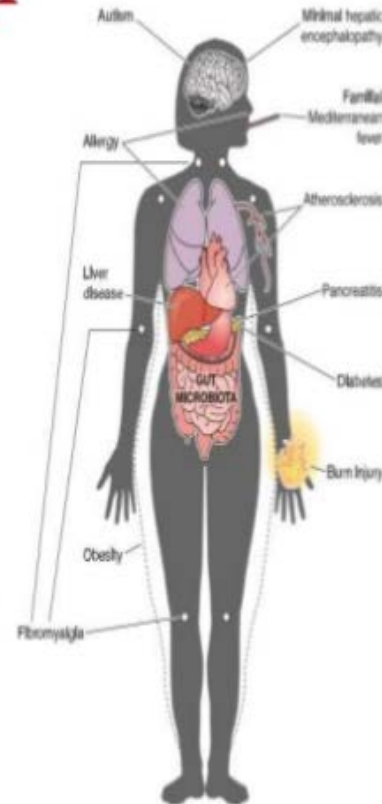
Dysbiosis and disease

• Diseases of the GUT

- Malabsorption syndrome
- Malignancies: Colorectal cancer
- Inflammatory Bowel disease (IBD)
- Irritable Bowel syndrome
- Diarrheal diseases
- Clostridium Difficile Infection (CDI)

• Non-mucosal diseases

- Obesity and metabolic syndrome
- Malignancies: liver cancer, breast cancer
- Complications of liver cirrhosis
- Allergic conditions
- Autoimmune disorders (T1DM, arthritis etc)
- Abnormalities of the gut-brain axis- Autism and other neurological disorders
- Obesity and other metabolic disorders
- Chronic fatigue syndrome
- Periodontal diseases



Some microorganisms go missing resulting in chaos in gut , leading to diseases

Gut microbiome in hospitalized infants

- 12 subspecies found in rooms and infants
- Most common were *Klebsiella pneumoniae*, *Escherichia coli*, *Pseudomonas aeruginosa*
- Authors concluded that room habitats contained bacterial groups that often colonize infants housed in the NICU

ARTICLE

DOI: 10.1093/aem/afz015-00018

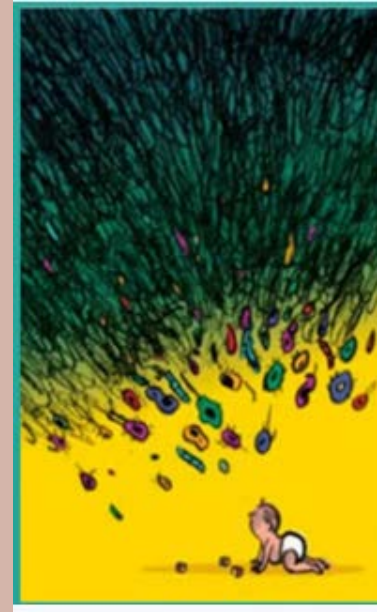
OPEN

Strain-resolved analysis of hospital rooms and infants reveals overlap between the human and room microbiome

Brandon Brooks¹, Matthew R. Olm¹, Brian A. Firek², Robyn Baker³, Brian C. Thomas⁴, Michael J. Morowitz², Jillian F. Banfield⁴

Discussion

Newborn preterm infants are commonly colonized by nosocomial antibiotic-resistant pathogens, and are at increased risk for serious infection and death^{1,2}. The detailed genomic evidence presented here demonstrates that rooms can be reservoirs for early-stage colonizers of the microbiome of hospitalized premature infants. This finding provides a mechanism to explain how infants in the same NICU could be colonized by the same strains, despite hospitalization periods separated by years. We conclude that the room environment should be regarded along with diet, mode of delivery, and antibiotics as a determinant of the early gut microbiome.



Reintroduction of a symbiont

Symbiont :an organism living in symbiosis with another.



Dr. Jennifer
Smilowitz



Dr. Mark
Underwood



RESEARCH ARTICLE Open Access

Safety and tolerability of *Bifidobacterium longum* subspecies *infantis* EVC001 supplementation in healthy term breastfed infants: a phase I clinical trial

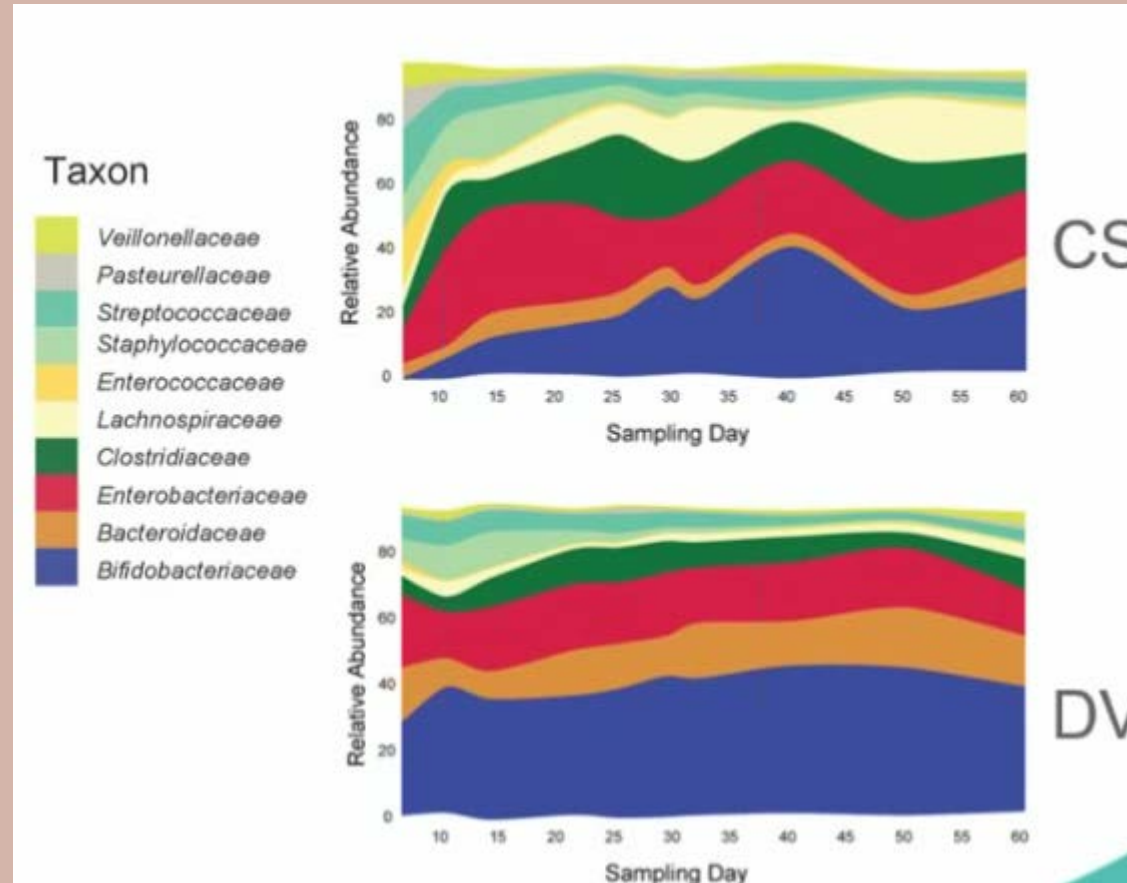
Jennifer T. Smilowitz^{1,2*}, Jackelyn Moya¹, Melissa A. Breck¹, Chelsea Cook¹, Annette Fireberg¹, Kathleen Angkutsiri¹ and Mark A. Underwood¹

- 66 mothers were recruited ,all were term infants exclusively breast fed , born vaginally or C- section

- One group received B infantis 18 billion CFU/day for 21 days , starting 7 days after birth

- Both group received lactation support for first 60 days .Fecal samples were collected throughout 60 days .

Key finding of the research



Blue area shows the bifidobacteria

The supplementation increased the bifido population and sustained over time

40%

Higher bifido bacteria in vaginal delivered infants

25%

Lesser bifido in C- section delivery



**Antibiotics reduces
good bacteria**





**Breast feeding had a significant impact on
microbiome**

Probiotics for infants and children

- ▶ Probiotics are promoted for
- ▶ Diarrhea.
- ▶ Infant colic
- ▶ Allergy
- ▶ Eczema symptoms

However, the evidence is mixed on whether probiotics are actually effective for a range of infant conditions.



Safety of Probiotics

- ▶ Safe and well tolerated in normal, healthy infants and children.
- ▶ Good tolerance has also been observed in premature infants.
- ▶ Very low birth weight babies
- ▶ HIV-infected children and adults.
- ▶ Late pregnancy.
- ▶ Some cases of probiotic septicaemia in immunocompromised adults and children,



Probiotics with antibiotics

Probiotics must be prescribed with start of antibiotics and continue for at least one week after the end of the course.

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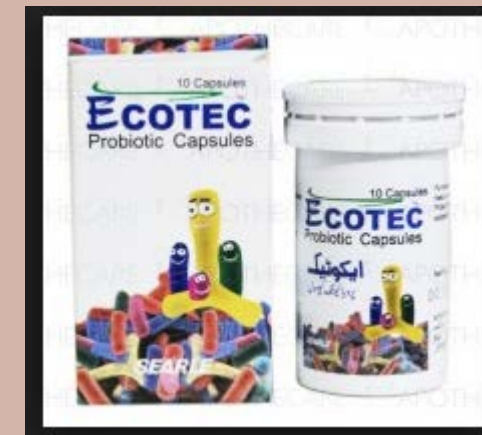
Commercially available probiotics in Pakistan

- ▶ Biflor-(*saccharomyces boulardii*)
- ▶ Enflor



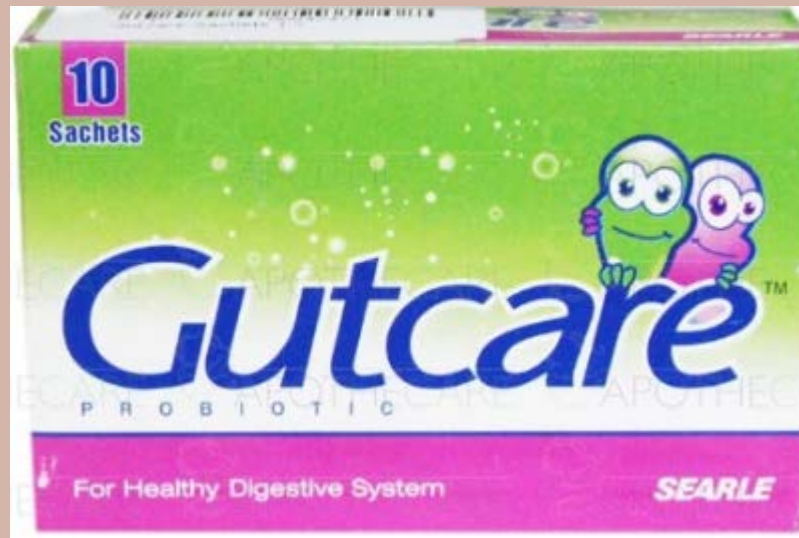
Ecotec

- ▶ Lactobacillus acidophilus LA-5,
- ▶ Bifidobacterium BB-12,
- ▶ Lactobacillus delbrueckii ssp.bulgaricus LBY-27,
- ▶ Streptococcus thermophilus STY-31.



Gutcare

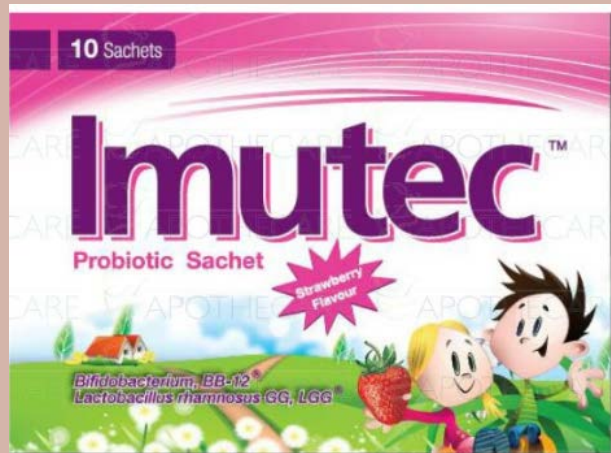
- ▶ Ingredients :Bifidobacterium 420mg, Clostridium Butyricum 500mg



Ezegut and Imutec



Drops for infants **Ingredients: Lactobacillus**



Ingredients: Bifidobacterium

Foods containing natural probiotics

- ▶ Yogurt
- ▶ Cottage cheese
- ▶ Buttermilk
- ▶ Kefir
- ▶ Soy sauce
- ▶ Miso (fermented soyabean)
- ▶ Tempeh (fermented soyabean)
- ▶ Fresh sauerkraut



Prebiotics

Foods containing Prebiotics

- ▶ Wheat
- ▶ Barley
- ▶ Rye
- ▶ Flax
- ▶ Oatmeal
- ▶ Onion
- ▶ Garlic
- ▶ Leeks
- ▶ Legumes
- ▶ Asparagus
- ▶ Leafy greens
- ▶ Berries
- ▶ Bananas
- ▶ Honey





Researches on effects of missing Gut Microbiome

Gut Microbiome -May Hold Key to Immunotherapy Outcomes

- ▶ The microbial environment in the intestines, not only may affect an individual's risk of developing and surviving colorectal cancer but may also have a dramatic impact on the efficacy of anticancer immunotherapies



Significance of Gut Bacteria in Multiple Sclerosis

People with multiple sclerosis (MS) show differences in gut bacteria composition compared with those without the disease.

Researchers evaluated 42 stool samples from patients who had relapsing-remitting MS or secondary progressive MS with relapses and compared them with samples from 28 healthy donors.

Gut Microbiome can control Anti tumor immune function in Liver

Scientists found that if mice were treated with antibiotics certain bacteria in gut were depleted which resulted in change in composition of immune cells , leading to tumor growth in liver .

National Cancer Institute , USA recently published a paper on may 24th , 2018



Probiotics effective in prevention of C- diff

What is Clostridium Difficile infection

is a bacterium that can cause symptoms ranging from diarrhea to life-threatening inflammation of the colon.

Organism can spread from contaminated objects & surfaces especially in hospitals.

Mild infection can lead to diarrhea while severe one can lead to sepsis.

evidence suggests that probiotic prophylaxis is a useful and safe Clostridium difficile infection prevention strategy.

Infect Control Hosp Epidemiol :2018.



'Too Clean' Could Be a Trigger for Childhood Acute Leukemia

Institute of Cancer Research (ICR) in London, United Kingdom, presents strong evidence that the disease is caused through a "two-step process" of genetic mutation and exposure to infection.

Acute leukemia is the most common childhood cancer in developed countries and accounts for about one third of all pediatric malignancies.

a lack of microbial exposure in early life could increase the risk of developing leukemia.

The paper was published on May 21 , 2018 in *Nature Reviews Cancer*.



FDA issues final rule on safety and effectiveness of antibacterial soaps and sanitizers

September 2, 2016

The U.S. Food and Drug Administration issued a final rule establishing that over-the-counter (OTC) consumer antiseptic wash products containing certain active ingredients can no longer be marketed.

Companies will no longer be able to market antibacterial washes with these ingredients because manufacturers did not demonstrate that the ingredients are both safe for long-term daily use and more effective than plain soap and water in preventing illness and the spread of certain infections.



<https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm517478.htm>



A photograph of a road with a yellow banner across it. The banner has the text 'TAKE HOME MESSAGES' in black capital letters. The road is paved and has a white line down the center. There are some white posts on the sides of the road.

TAKE HOME MESSAGES

Promote breast feeding

Make sure to avoid unnecessary antibiotics

Probiotics must be taken as soon as you start the antibiotics and continue for at least one week after the end of the course.

Normal soaps are good enough to clean

Promote weaning with natural foods