

THE GUT MICROBIOME

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& Dr Sheena Fraser



GENESIS

WHO ARE WE?

DR SIOBHAN & Dr SHEENA

NHS GPs

BSLM Diplomates

Lifestyle Medics

Gut Microbiome in Primary care

UK GMFH Expert Panel



MICROBIOME MEDICS

The Gut Microbiome for Clinicians

British Society of
lifestyle medicine



GUT MICROBIOME COURSE

On-line self-paced course

Modules covering all aspects of Microbiome Science

Suitable for all clinicians

All the tools & knowledge you need to take you help you
confidently navigate the new science of the Gut
Microbiome

Lifestyle Medicine perspectives



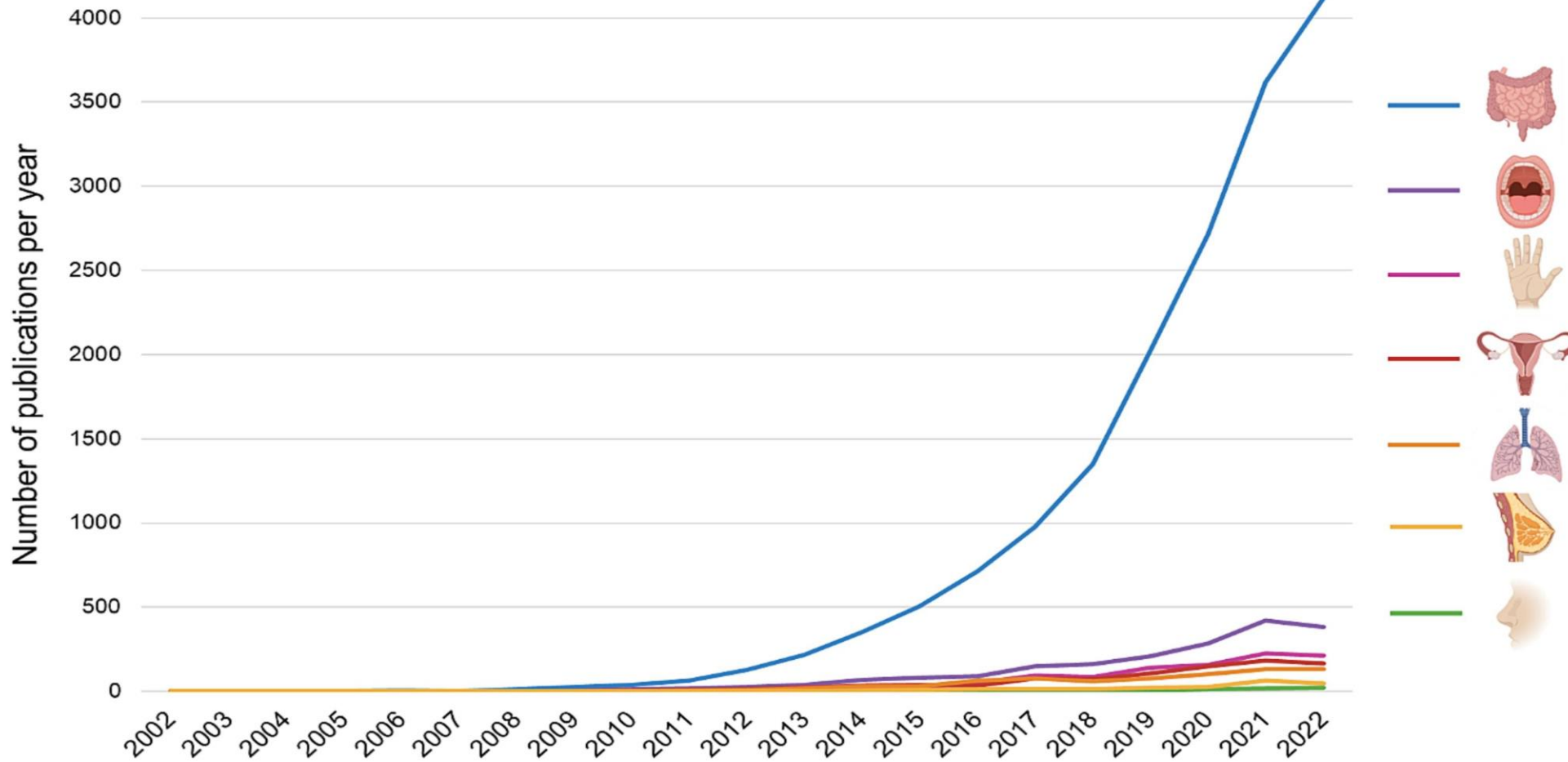
MICROBIOME MEDICS
PODCAST

OVERVIEW

- **What is the gut microbiome (GM)?**
- **What does it do?**
- **Where does your GM come from?**
- **Perinatal window of opportunity**
- **Lifestyle medicine & the GM**
- **Q&A**



MICROBIOME RESEARCH EXPLOSION



McGuinness AJ, Stinson LF, Snelson M, et al. From hype to hope: Considerations in conducting robust microbiome science. *Brain Behav Immun.* 2024;115:120-130.



MICROBIOMES



Communities of microorganisms in a specific location

Bacteria

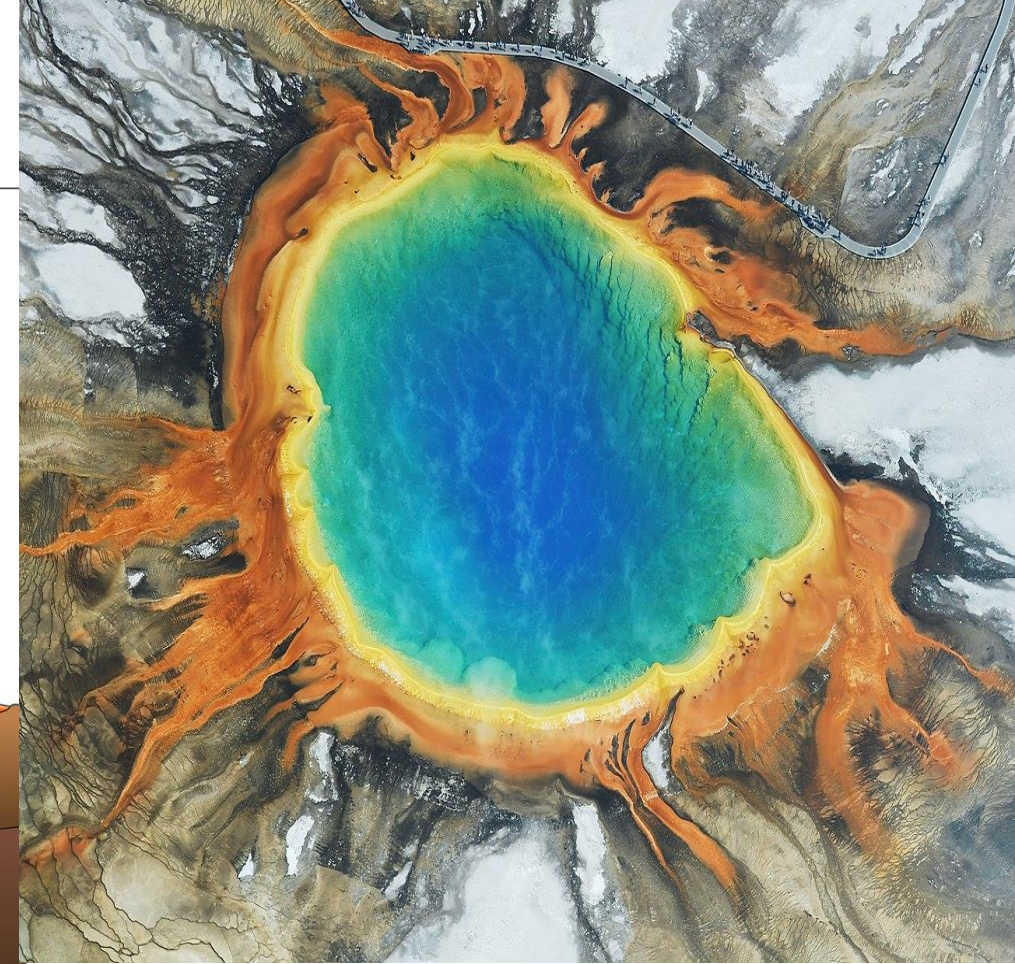
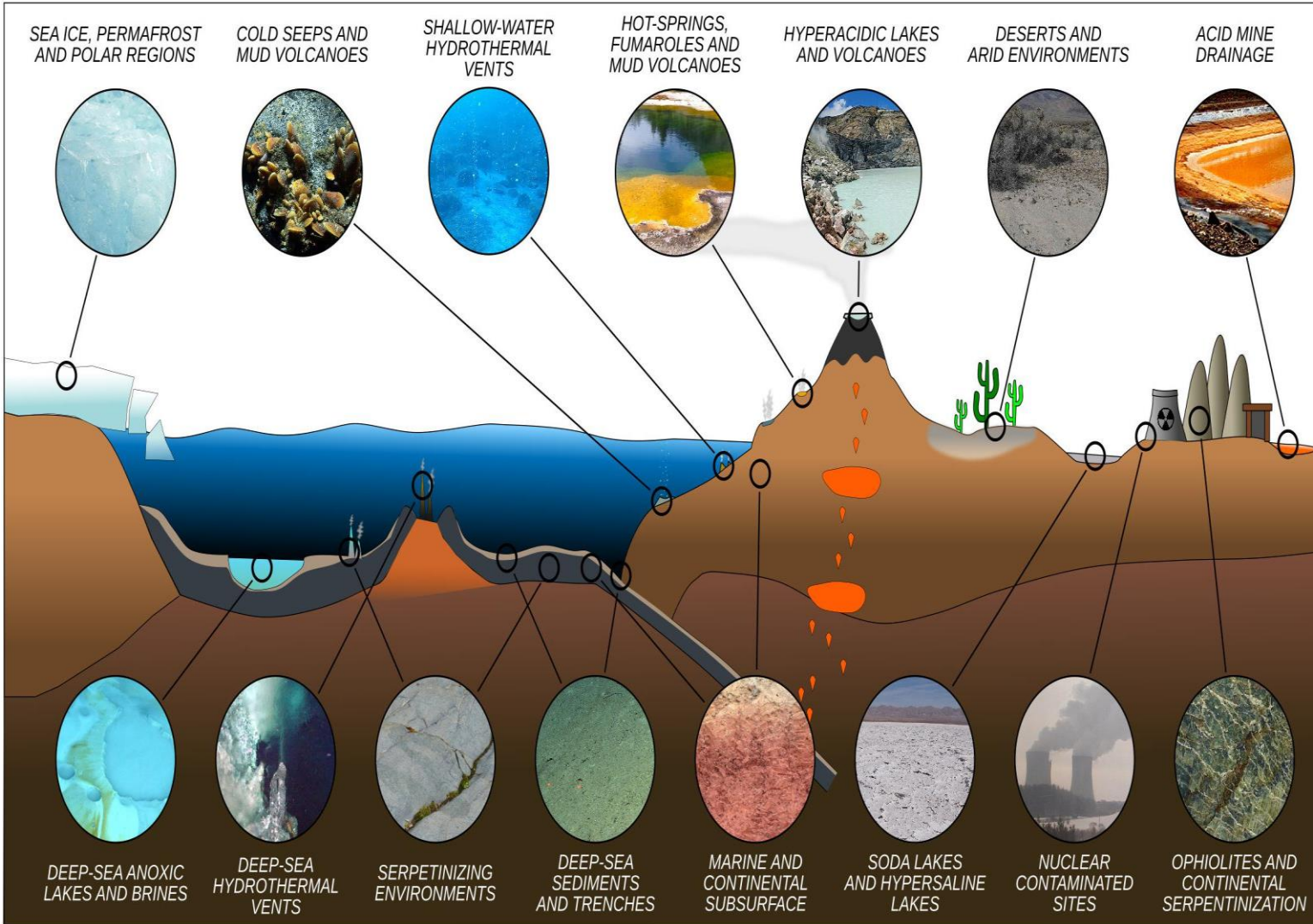
Fungi

Archaea

Protists



EXTREMOPHILES



Merino N, Aronson HS, Bojanova DP, et al. Living at the extremes: Extremophiles and the limits of life in a planetary context. *Front Microbiol.* 2019;10(MAR). doi:10.3389/fmicb.2019.00780

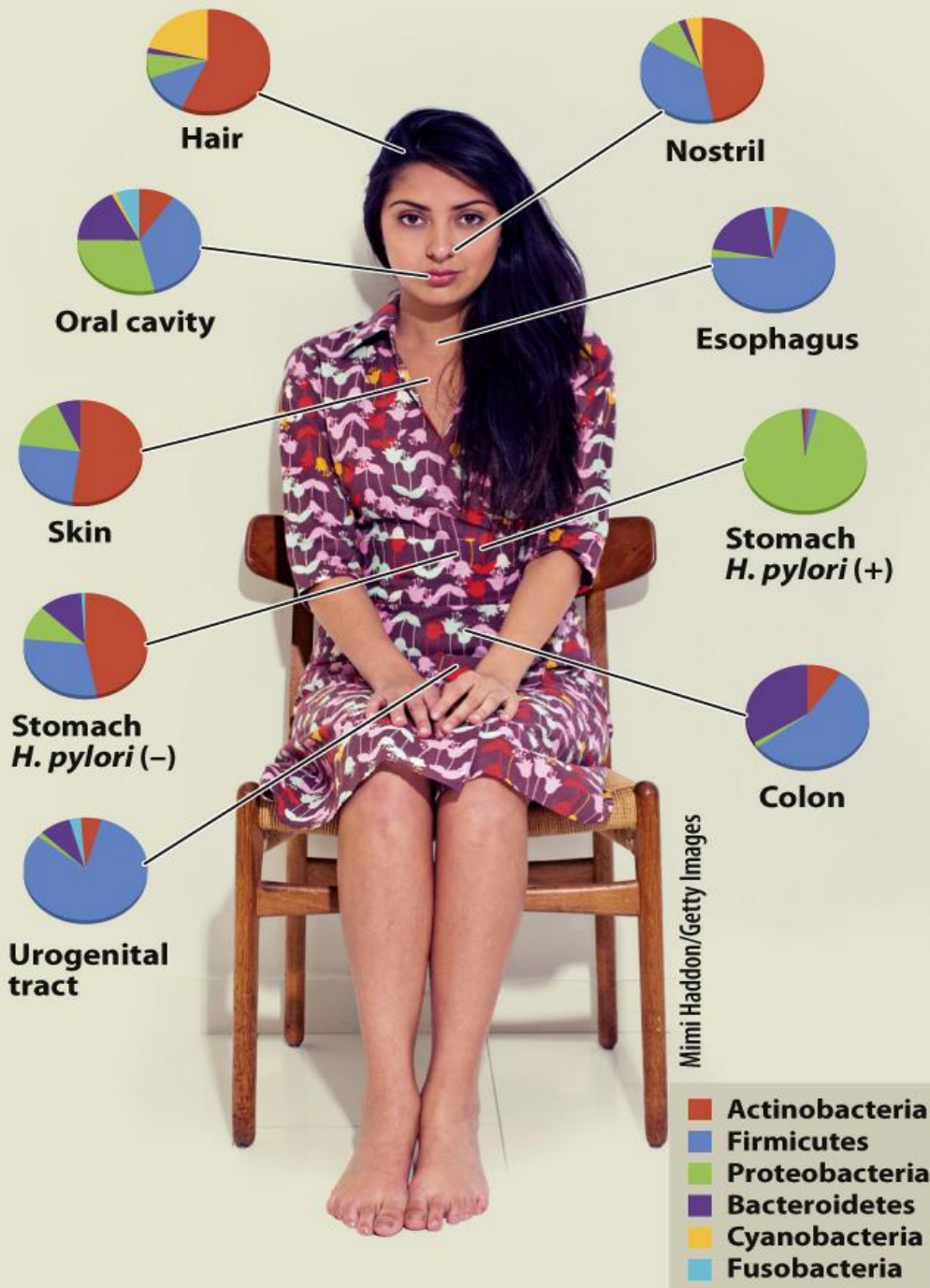


>50%
cell count

>99%
gene count

**YOU ARE A
WALKING MICROBIAL
ECOSYSTEM**





MICROBIOME =
MICROBIOTA (microbes)
 +
BIOME (habitat)

Includes everything- viruses, microbial genes , microbial metabolites, local cells & environmental conditions (pH, O2)

GUT MICROBIOME (GM)

Highest microbial density in colon & most researched

Mostly bacteria

>100 trillion microorganisms > 1000 different species

Unique 'fingerprint'

ACTIVE PARTICIPANTS NOT PASSIVE PASSENGERS

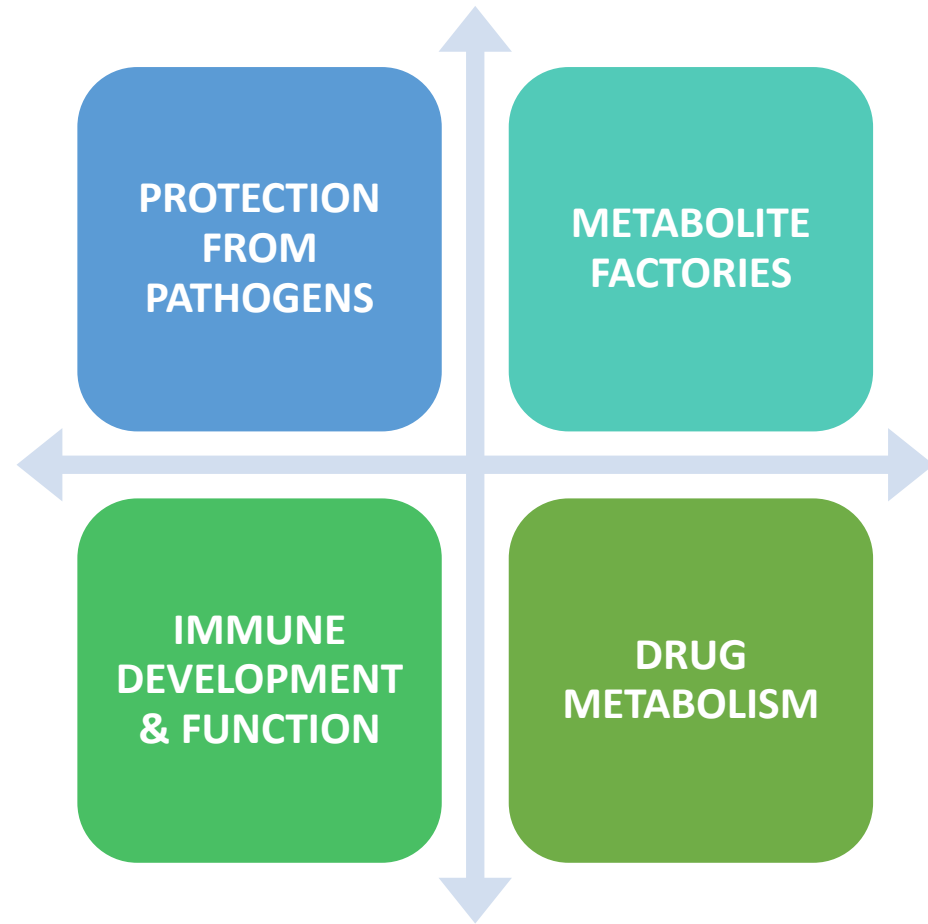
GM as 'organ'



WHAT DOES THE GUT MICROBIOME DO?



THE GM ACTIVELY PARTICIPATES IN MOST ASPECTS OF PHYSIOLOGY & HEALTH



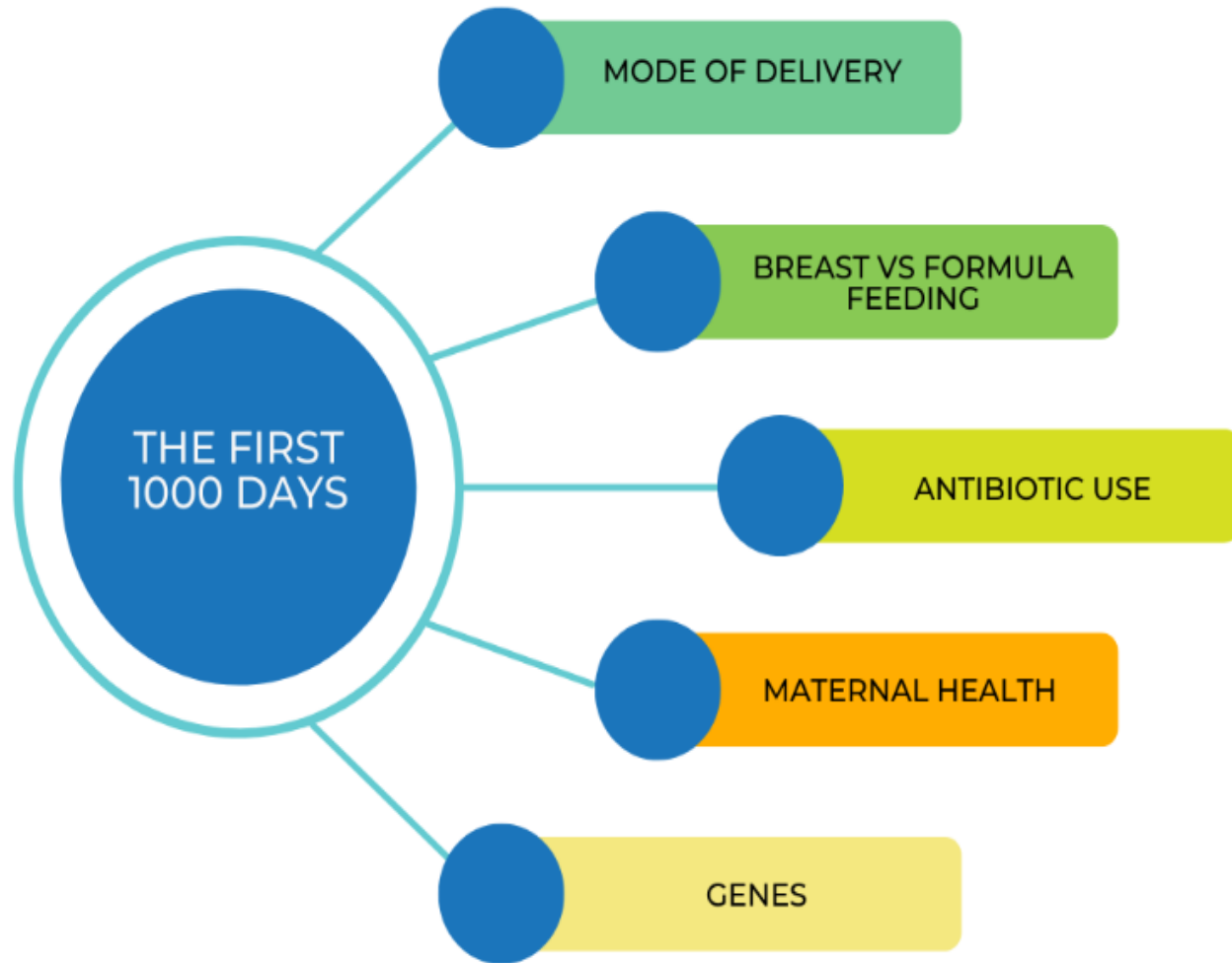
Valdes AM, Walter J, Segal E, Spector TD. Role of the gut microbiota in nutrition and health. *BMJ*. 2018 Jun;361:k2179.



HOW DID THE MICROBES GET THERE?



GM GENESIS



VAGINAL DELIVERY (VD)



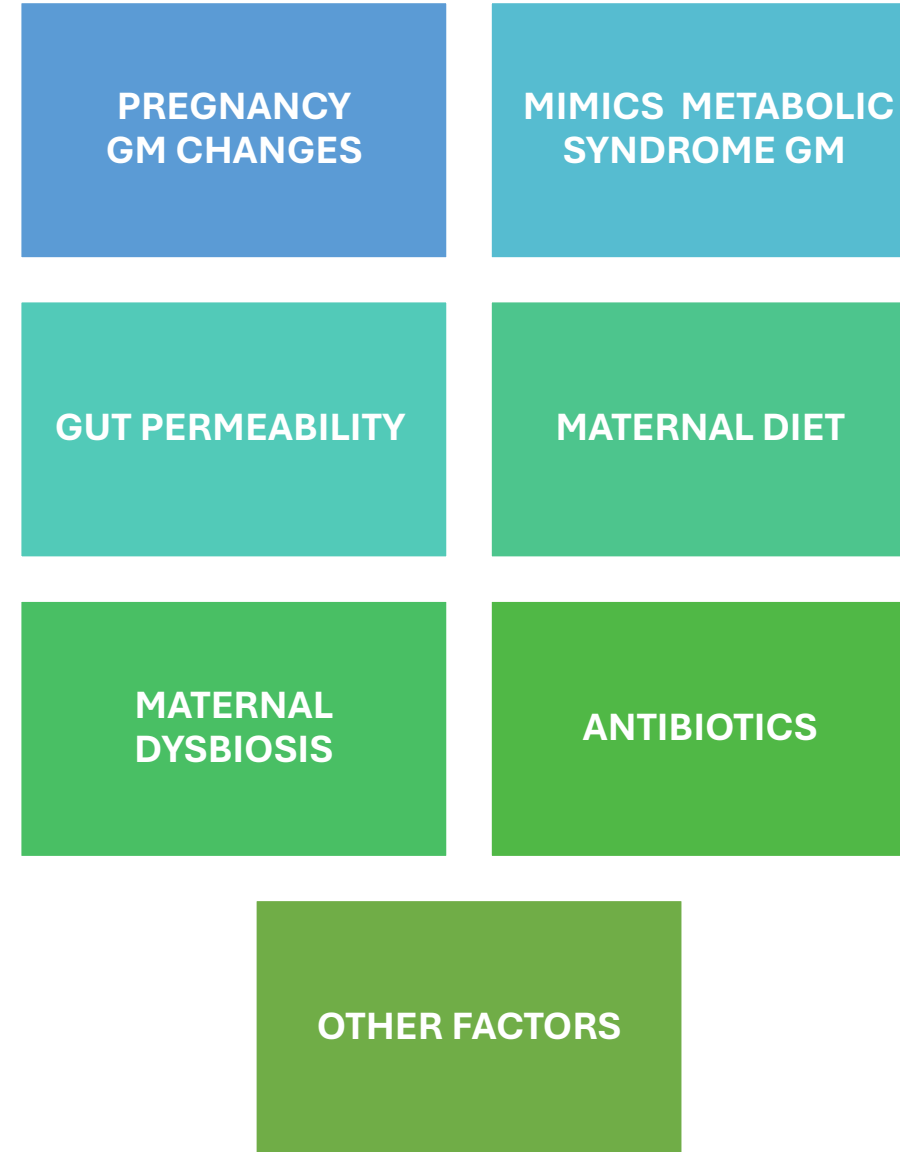
- Neonate coated in maternal vaginal & gut microorganisms
- Maternal GM species dominate infant GM 'pioneers'
- Neonatal gut is high in *Lactobacilli*, *Clostridium* & *Bifidobacterium* .
- VD infant reduced risk asthma, obesity, NCD & infections

Korpela K. Impact of Delivery Mode on Infant Gut Microbiota. Ann Nutr Metab. 2021 Aug;1-9.

Image : Tom Adriaenssen - <https://www.flickr.com/photos/inferis/110652572/> Wiki



Shaping the maternal gut microbiome



CAESAEREAN SECTION (CS)

Optimal CS rates to improve mortality = **15%** (WHO)

CS RATES (2020) **UK= 31%** (Brazil=54%)

CS INTERRUPTS GM GENESIS

- No exposure to maternal vaginal or GM
- GM neonate -skin of mother, attendants ,hospital environment
- Reduced species diversity
- Increased risk (NCD, Asthma & Atopy, Obesity, Coeliac Disease)



Djatkika C, Lusher J, Meyrick J, Byron-Daniel J. British Journal Of Midwifery - Caesarean section as an informed choice in the UK: a systematic review [Internet]. [cited 2024 May 29].

Betrán AP, Ye J, Moller A-B, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean rates: global, regional and national estimates: 1990–2014. PLoS One. 2016; 11:(2)1-12 Image: Fadhley , Salim (2014) Wiiki



ANTIBIOTICS

CS & PREM higher use

Prophylaxis Group B strep

Broad spectrum Abx - 10% neonates

Reduces species diversity & affects GM composition >1yr

Reduces *Bifidobacterium*

Associated Coeliac, Atopy & Allergies, GI disorders, Obesity & reduced immune development/function

Theodosiou AA, Jones CE, Read RC, Bogaert D. Microbiotoxicity: antibiotic usage and its unintended harm to the microbiome. *Curr Opin Infect Dis.* 2023;36(5):371–8.





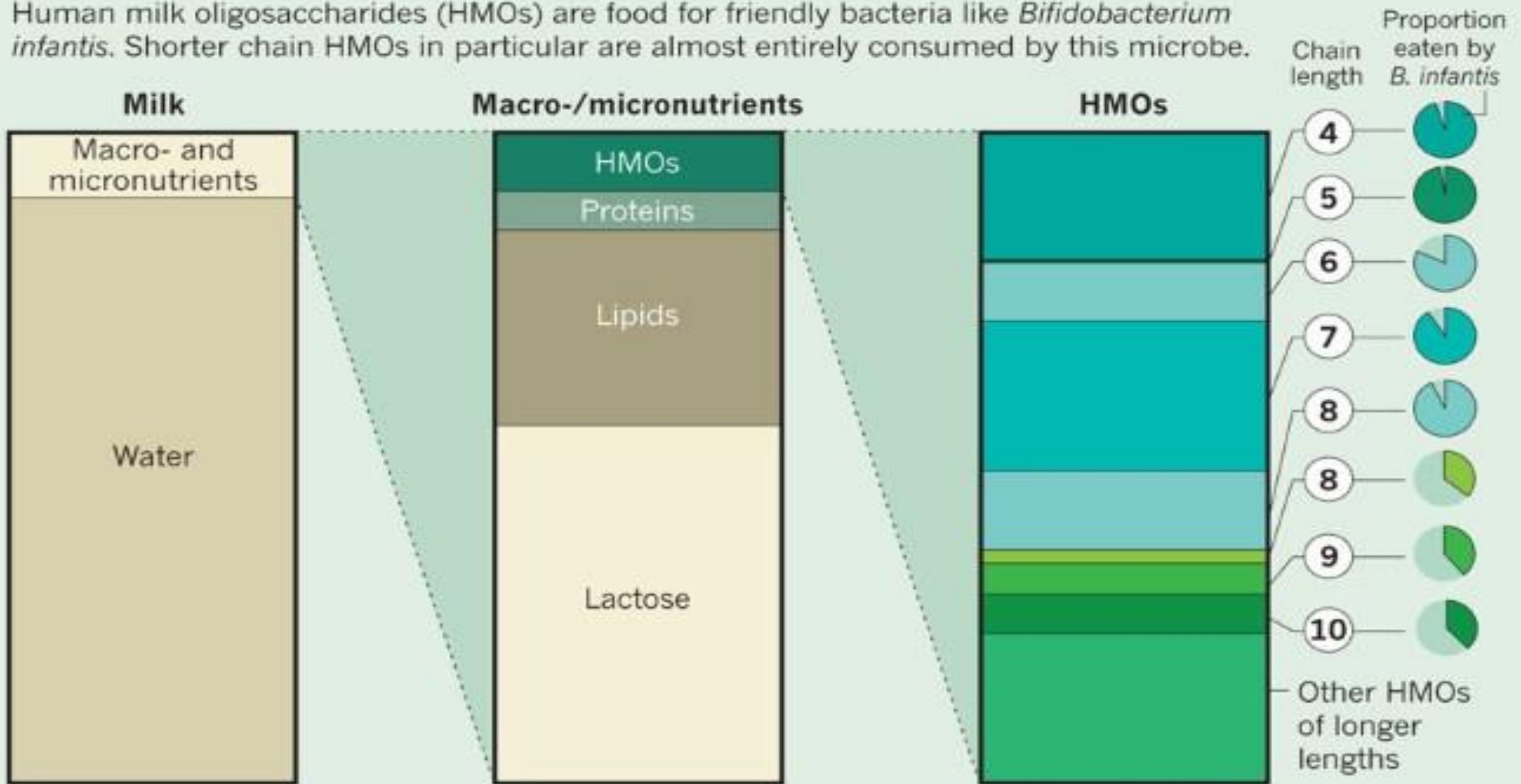
BREAST MILK & THE GUT MICROBIOME

BREAST MILK IS PACKED WITH FOOD FOR MICROBES



WHAT'S IN HUMAN MILK

Human milk oligosaccharides (HMOs) are food for friendly bacteria like *Bifidobacterium infantis*. Shorter chain HMOs in particular are almost entirely consumed by this microbe.



HUMAN MILK OLIGOSACCHARIDES (HMOs)

200

- **HMOs= carbs just for the microbes**
- **3rd most abundant BM component**
- **Prebiotic (food) for *Bifidobacterium infantis***
- **Immune protection – gut infections**



**BREAST MILK
IS
TEEMING WITH
LIVE BACTERIA**



BREAST MILK BACTERIA

WHICH BACTERIA?

WHERE DO THEY COME FROM?

WHAT DO THEY DO?



BREAST MILK PROBIOTICS

>200 strains of bacteria in breast milk

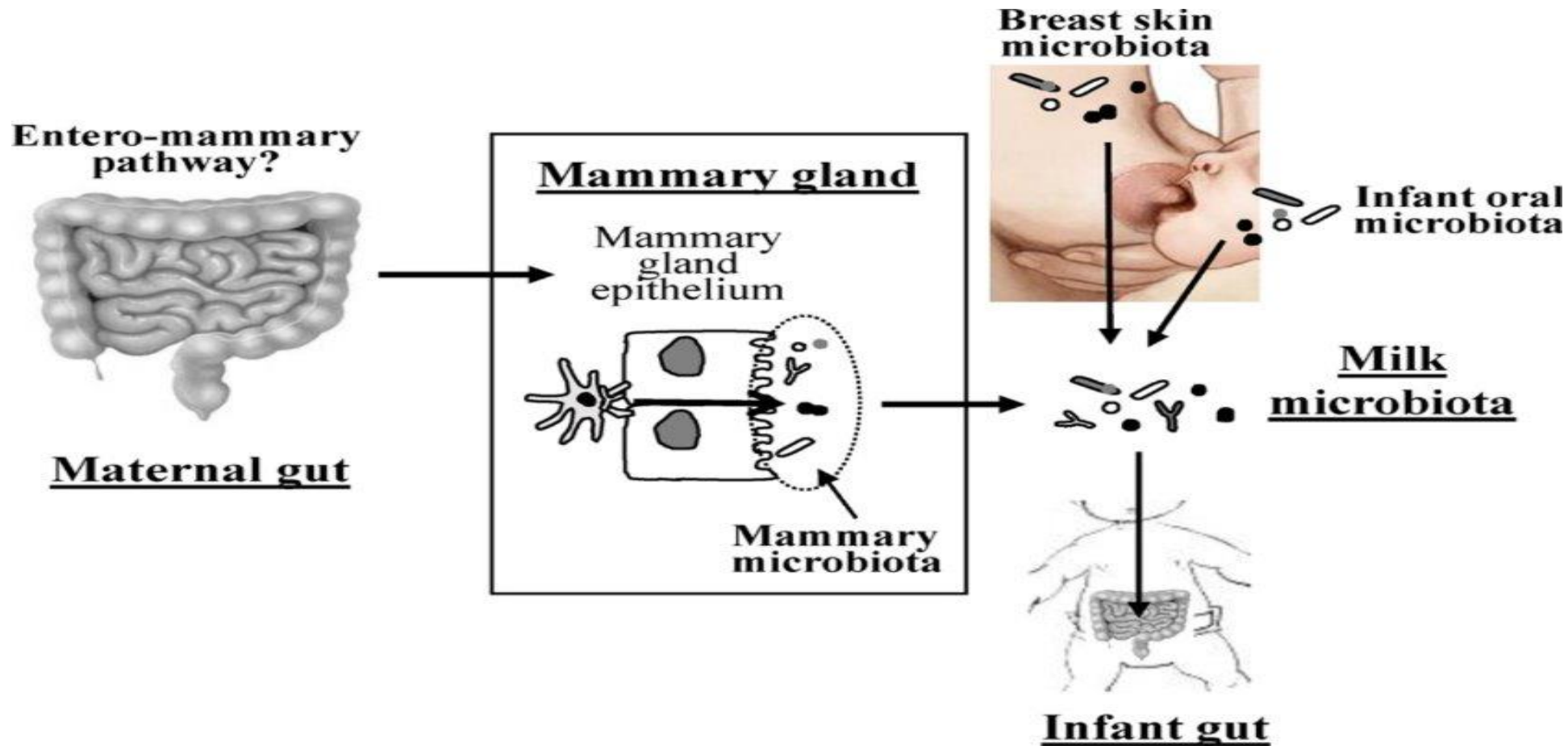
Bifidobacterium, Lactobacilli, Bacteroides

Transfer of *Bifidobacterium* & *Lactobacillus* spp. from breast milk to the neonatal gut has been demonstrated

Bacteria from mother's milk & skin are most prominent in their infants' guts at 4w (=40% GM in primarily breastfed infants)



WHERE DID THEY COME FROM?



**WHAT ARE
THEY DOING?**

**Directly colonise
infant mouth & gut**

**Kill off the
competition (weapons
include bacteriocins &
hydrogen peroxide)**

**Digestion: ability to
break down lactose
and other simple
sugars into lactic acid**

**Immune System
education**

Infant metabolism



FORMULA FEEDING (FF)

Lifesaving
alternative

Provides basic
nutrients

85% UK babies

HMOs &
probiotics
missing

GM FF vs. BF

Higher
prevalence
disease





PREBIOTICS (HMOs) & PROBIOTICS (beneficial bacteria) in Formula Milk

Some modern formulas contain prebiotics; some have even added probiotic bacterial strains.

Recent research using formula with prebiotics & probiotics for infants with Cow's Milk Protein Intolerance demonstrated an increase in *Bifidobacteria* in the infant GM (closer to GM of BF babies).

Research in this area is expanding....



Preterm birth

- **Mainly SVD or emergency C Section**
- **Increased use of antibiotics**
- **More bacteria derived from environment in neonatal unit**
- **Gut Microbiota high in *Clostridia***
- **VLBW: abundance *Staphylococci, Klebsiella, Enterobacter, Enterococcus, Streptococcus***
- **(Healthy infants – abundance of *Escherichia, Bifidobacterium, Bacteroides*)**
- **70% born <27/40 have 1+ chronic diseases**



Shaping the GM post C-Section

- **VAGINAL SEEDING**
- Provides maternal vaginal microbes (not gut)
- Effects short lasting
- Risk infection
- Little long-term data

- **PROBIOTICS**
- *Bifidobacterium infantalis* (SCFA producer, metabolises HMO's)
- Lost over generations of Abx use, CS births & FF
- Prevents erosion of intestinal mucin layer
- Reduces chronic inflammation.
- Changes persist after stopping Rx
- Reduced risk infections



LIFESTYLE MEDICINE OPPORTUNITIES FOR SHAPING THE GUT MICROBIOME

Maternal health & GM

Mode of delivery

C-section: modifications

Breast feeding rates

**Formula feed : modifications with prebiotics &
probiotics**

Antibiotic stewardship



SUMMARY

GM is integral to digestion, immune development & function, metabolism, produces numerous metabolites including butyrate & vitamins.

We inherit our GM

Disrupted inheritance distorts GM composition

Alters immune education, development , metabolism

Increased atopy, allergy, autoimmune disease

Modern society is disrupting this evolutionary passing down of microbial genes (CS, antibiotics , FF)

Impacting the health trajectories of our children



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Lifestyle Medicine perspectives

THANK YOU!

Any questions?



**MICROBIOME MEDICS
PODCAST**

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