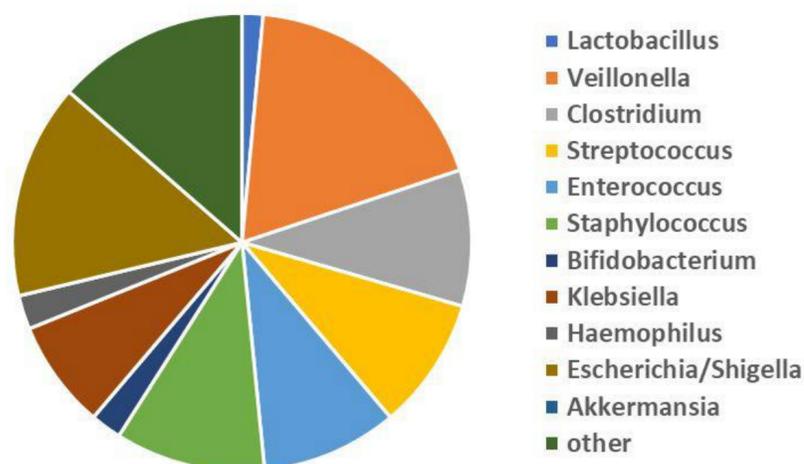


## Contents of human milk

### What type of bacteria are in milk?



### Also contains:

- Antimicrobial compounds
- Antibodies
  - Lactoferrin
- Factors to improve intestinal barrier of infant
  - high endocytic - colostrum coats the digestive system with white blood cells to neutralize bacteria and viruses.

## Bacterial quantification methods

- Liquid culture and agar plates
- quantitative polymerase chain reaction
- Genomic sequencing
- Patient surveys
- Fluorescence microscopy

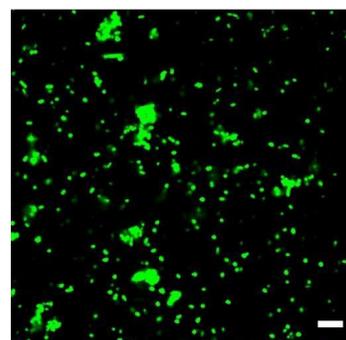
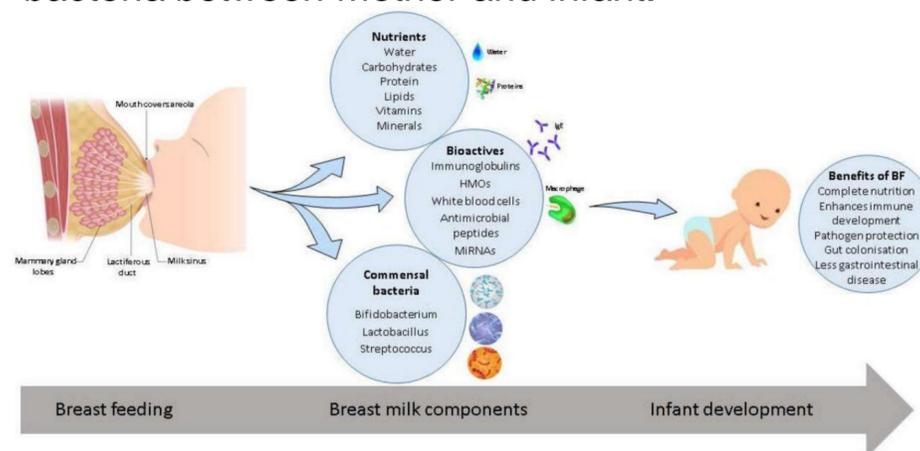


Image of *E. coli* K12 using fluorescence microscopy, a technique often used in microbiom studies. Stained with SYBR Green I. Scale bar: 10um

## Possible theory on the origin of bacteria in human milk

- The origin of human milk bacteria is a result of coming in contact with mother skin and/or infant's oral cavity.
- There is also a back flow from when the infant sucks and releases which the ideal route to exchange bacteria between mother and infant.



### There are three stages of breast milk:

- 1. Colostrum:** is the first liquid coming out of the breast after giving birth. The colostrum helps to coat the infants gut which helps keep harmful bacteria from being absorbed and it has laxative effects. The "gold liquid" as it is known, is rich in antibodies and proteins, and is very concentrated and only produced in small amounts. *Nutrients found in colostrum:* Lactoferrin (protein/infections) currently it can also be found in capsular form (for adults).
  - a. Epidermal growth factor: Protein/cell growth
- 2. Transitional milk:** this can be found 3-4 days after giving birth and it usually lasts for about 2 weeks
- 3. Mature Milk:** Human milk promotes gut colonization and it contains microbes that benefits digestion and the immune system.



## Conclusions

- Human milk contains a diverse microbial community and contains factors critical for infant health.
- The idea of the milk microbiome is still unclear, but it is likely due to contact between mother's skin and the infant's oral cavity

### Future Research:

- What function do these bacteria play in mothers milk and in infants?
- What foods impact mother's milk?
- Development of infant formula that mimics breast milk:
  - production of necessary antibodies and nutrients
- Understanding diseases involving lactation:
  - Staph harms the mother:
  - **Mastitis** is an inflammation of the breast due to an infection. The infection is due to the exchange of the bacteria between mother and baby.
    - female babies: have high levels of estrogen which can cause mastitis and/or vaginitis
    - male babies: is not very common but can occur.

## References/Acknowledgements

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