

# HUMAN NORMAL FLORA (MICROBIOTA)

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# DEFINITION

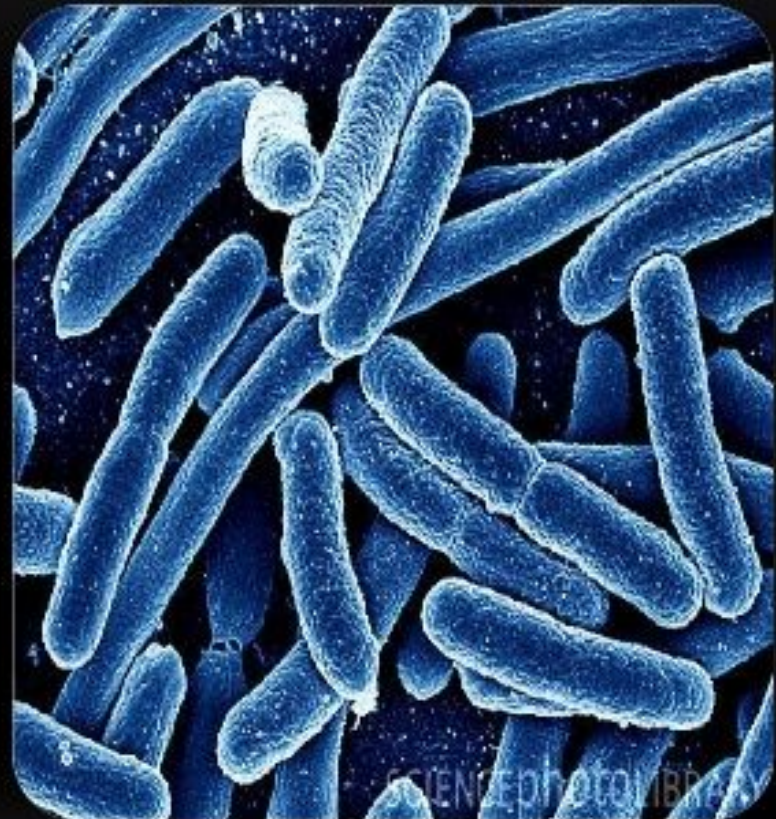
- **Normal flora** are microorganisms that are frequently found in a particular site in normal healthy individual.
- Some are found in association with humans / animals only. The Majority are bacteria.
- Symbiotic relationship with the host.
- Subject to constant changes.
- Altered by antimicrobial agents.

# HUMAN MICROBIOME

- The **human microbiome** (or **human micro biota**) is the aggregate of microorganisms that reside on the surface and in deep layers of skin, in the saliva and oral mucosa, in the conjunctiva, and in the gastrointestinal tracts. They include bacteria, fungi. Some of these organisms perform tasks that are useful for the human host. However, the majority have no known beneficial or harmful effect. Those that are expected to be present, and that under normal circumstances do not cause disease, but instead participate in maintaining health, are deemed members of the ***normal flora***

# NORMAL BACTERIAL FLORA

- **More bacterial than human cells in the body**
  - provide some nutrients (vitamin K)
  - stimulate immune system, immunity can be cross-reactive against certain pathogens
  - Prevent colonization by potential pathogens (antibiotic-associated colitis, *Clostridium difficile*)





# INTRODUCTION OF NORMAL FLORA

1. A diverse microbial flora =>
  - Human body Area: the skin and mucous membranes
  - Time: shortly after birth until death
  - Number:  $10^{14}$  bacteria =>  $10^{13}$  host cells
- 2. Normal flora may:
  - a. Aid the host
  - b. Harm the host (in sometimes)
  - c. Exist as commensals (no effect to the host)
3. **Viruses and parasites** => **NOT normal microbial flora**
  - Most investigators consider that they are not commensals and do not aid the host.

# WHERE TO FIND MICROBE? EVERYWHERE!



# Normal Flora and Pathogenesis

1. Transient colonization
2. Permanent colonization
3. Disease

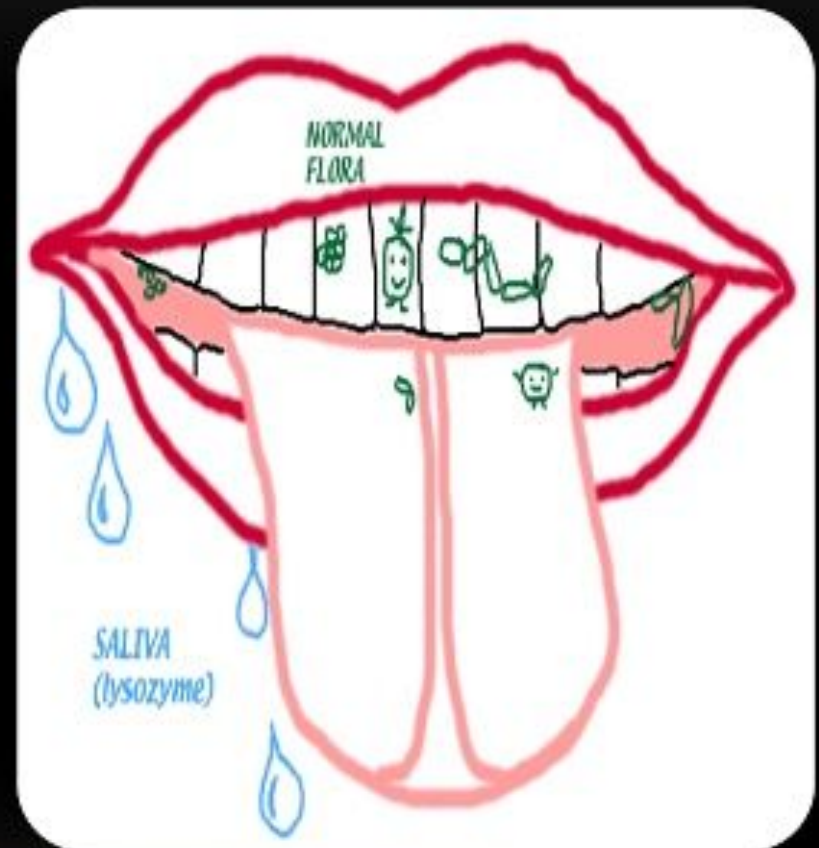
## Colonization vs. Infection

Colonization: establishment of a site of reproduction of microbes on a person without necessarily resulting in tissue invasion or damage.

Infection: growth and multiplication of a microbe in or on the body of the host with or without the production of disease.

# FACTORS INFLUENCING NORMAL FLORA

1. Local Environment (pH, temperature, redox potential, O<sub>2</sub>, H<sub>2</sub>O, and nutrient levels...).
2. Diet
3. Age
4. Health condition (immune activity...)
5. Antibiotics,.....etc

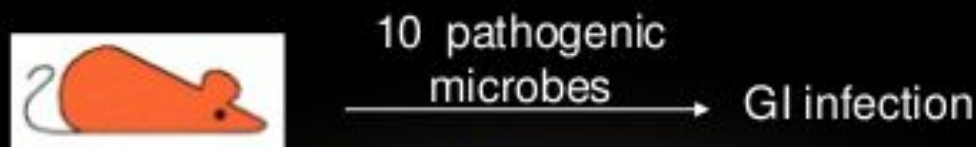




# Significance of Normal Flora

Normal flora may aid the host in several ways:

- Aid in digestion of food
- Help the development of mucosa immunity
- Protect the host from colonization with pathogenic microbes.



**Nose**

*Staphylococcus aureus*  
*Staphylococcus epidermidis*  
*Corynebacterium* species

**Mouth**

*Streptococcus* species  
*Fusobacterium* species  
*Actinomyces* species  
*Leptotrichia* species  
*Veillonella* species

**Throat**

*Streptococcus* species  
*Branhamella catarrhalis*  
*Corynebacterium* species  
*Haemophilus* species  
*Neisseria* species  
*Mycoplasma* species

**Skin**

*Staphylococcus epidermidis*  
*Propionibacterium acnes*  
*Pityrosporum ovale*

**Large intestine**

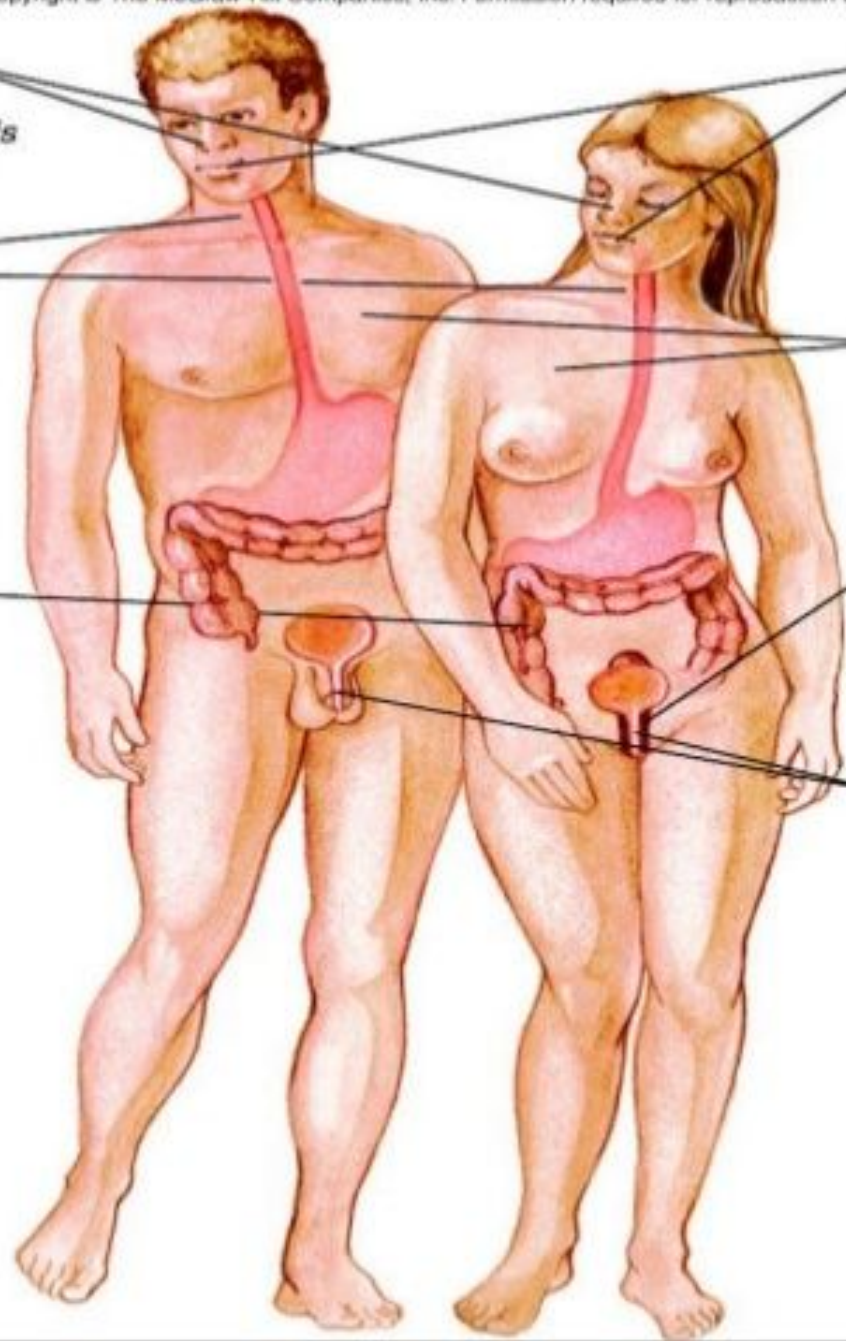
*Bacteroides fragilis*  
*Escherichia coli*  
*Proteus mirabilis*  
*Klebsiella* species  
*Lactobacillus* species  
*Streptococcus* species  
*Candida albicans*  
*Clostridium* species  
*Pseudomonas* species  
*Enterococcus* species

**Vagina**

*Lactobacillus* species  
*Streptococcus* species  
*Candida albicans*  
*Gardnerella vaginalis*

**Urethra**

*Streptococcus* species  
*Mycobacterium* species  
*Escherichia coli*  
*Bacteroides* species





# WHEN WE GET COLONIZED WITH NORMAL FLORA

- A human first becomes colonized by a normal flora at the moment of birth and passage through the birth canal. In utero, the fetus is sterile, but when the mother's water breaks and the birth process begins, so does colonization of the body surfaces. Handling and feeding of the infant after birth leads to establishment of a stable normal flora on the skin, oral cavity and intestinal tract in about 48 hours.



# A NEW BORN CHILD'S FLORA IS DEPENDENT ON MOTHER

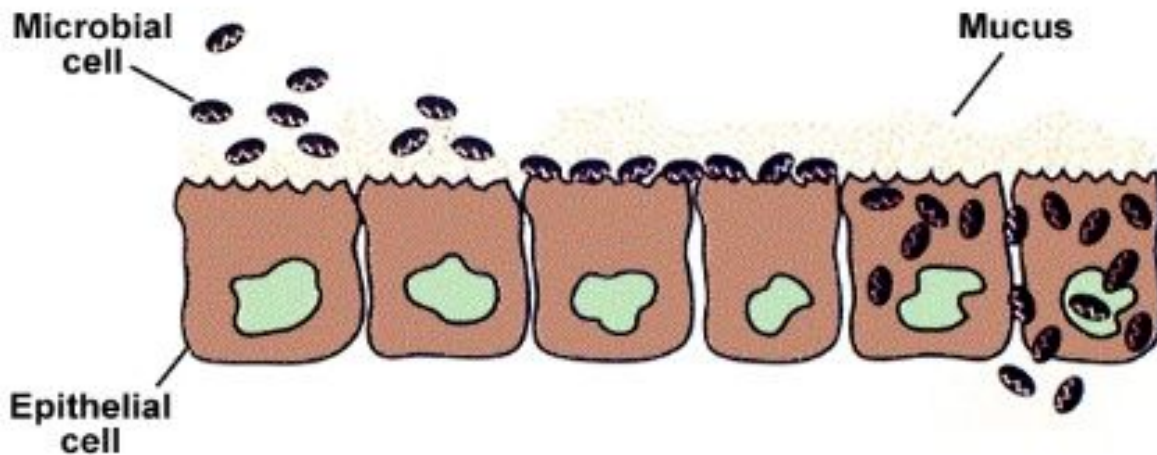


- The composition of a child's bacterial flora is dependent on the mother's micro flora, since she is the primary source for the child's bacteria at the outset



# HUMANS AS HABITATS

- Colonization (and infection) frequently begin at **mucous membranes**
  - These are found throughout the body. Consist of single or multiple layers of **epithelial cells**, tightly packed cells in direct contact with the external



**Bacteria may  
associate loosely  
or firmly  
Breaches in the**

**barrier can result  
in infection  
(pathogenesis) by  
opportunistic  
pathogens** <sup>18</sup>

# UPPER RESPIRATORY TRACT – AND LOWER RESPIRATORY TRACT

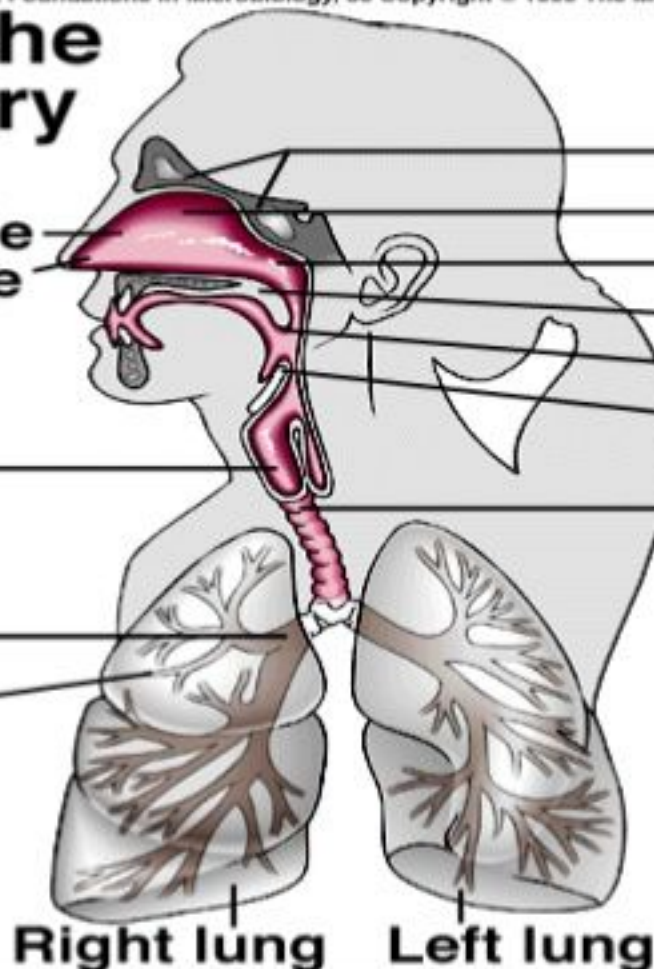
Kathleen Park Talaro and Arthur Talaro, *Foundations in Microbiology*, 3e Copyright © 1999 The McGraw-Hill Companies, Inc. All rights reserved.

## Flora of the respiratory tract

Nasal vestibule  
Nasal entrance

Larynx

Bronchus  
Bronchiole



Sinuses

Nasal cavity

Internal naris

Soft palate

Nasopharynx

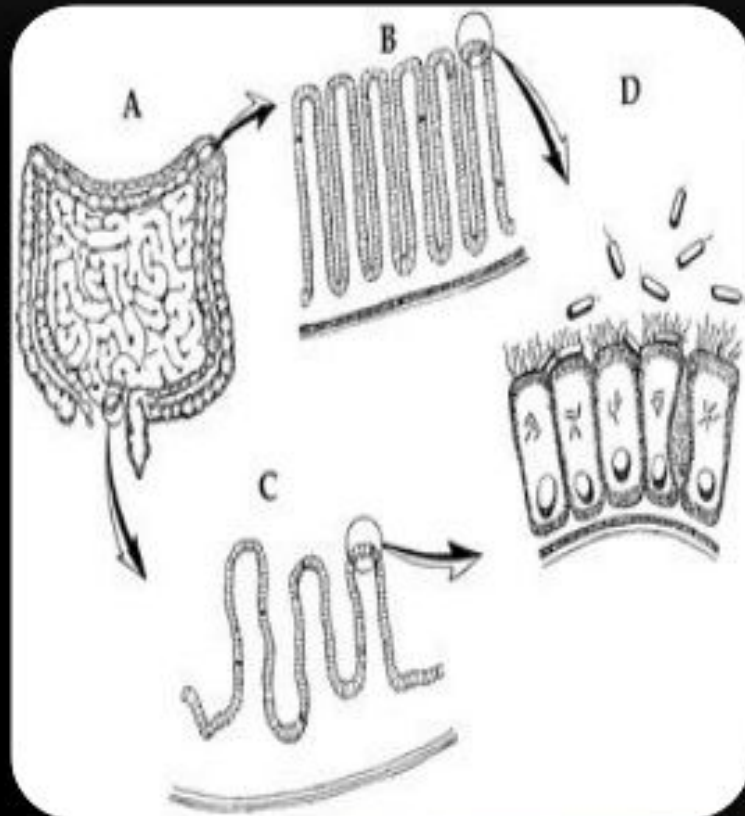
Epiglottis

Trachea

Right lung

Left lung

# ASSOCIATIONS BETWEEN HUMANS AND THE NORMAL FLORA

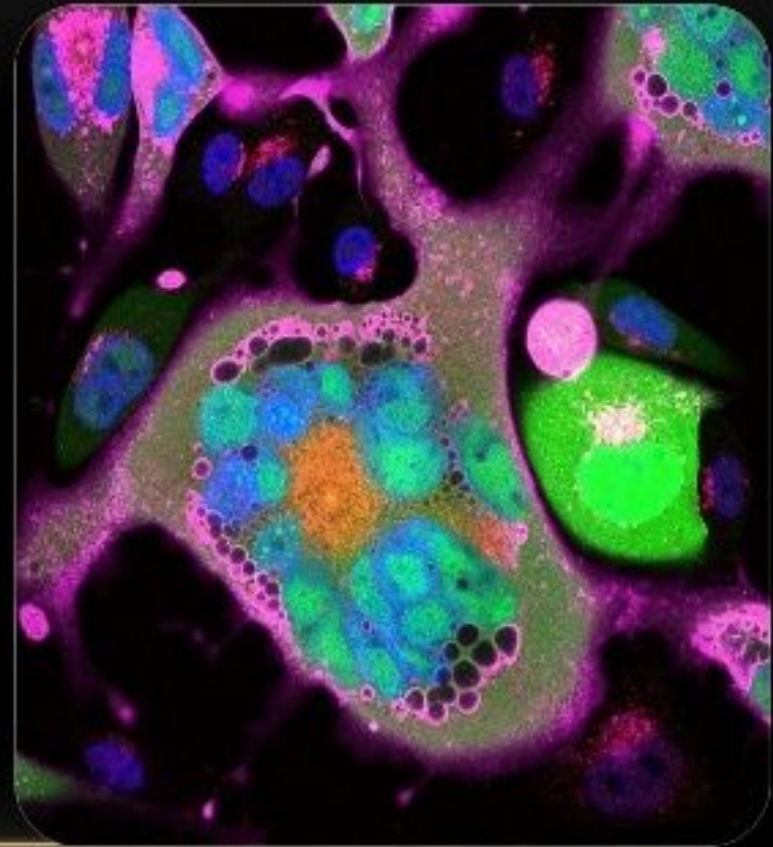


- *E. coli* is the best known bacterium that regularly associates itself with humans, being an invariable component of the human intestinal tract. Even though *E. coli* is the most studied of all bacteria, and we know the exact location and sequence of 4,288 genes on its chromosome, **we do not fully understand its ecological relationship with humans**



# NORMAL FLORA MAY ACT AS OPPORTUNISTIC PATHOGENS

- Especially in hosts rendered susceptible by:
  1. Immuno-suppression (AIDS & SCID)
  2. Radiation therapy & Chemotherapy
  3. Perforated mucous membranes
  4. Rheumatic heart disease...etc.





# Normal Flora absent in ...



## Sterile tissues

In a healthy human, the internal tissues such as:

- **blood**
- brain
- muscle
- cerebrospinal fluid (csf.)

are normally free of microorganisms.

# NORMAL FLORA

- Resident flora
  - Acquired rapidly during & after birth
- 1- Reflects age of person
- 2- genetics of person
- 3- environment of person
- 4- Sex of person
- 5- Nutrition of person



# NORMAL FLORA

Resident flora

Changes continuously  
through out life



# Importance of The Normal Flora (Advantages)



1. They constitute a protective host defense mechanism by occupying ecological niches.



# IMPORTANCE OF THE NORMAL FLORA (ADVANTAGES)

2. The oral bacteria flora exert microbial antagonism against nonindigenous species by production of inhibitory fatty acids, peroxides, bacteriocins, etc.

3. The normal flora may antagonize other bacteria through the production of substances which inhibit or kill nonindigenous species.

# IMPORTANCE OF THE NORMAL FLORA (DISADVANTAGES)

1. They can cause disease in the following:

a) When individuals become immunocompromised or debilitated.

b) When they change their usual anatomic location.



The oral flora of humans may harm-2 their host since some of these bacteria are pathogens or opportunistic pathogens

## PRODUCTION OF CARCINOGENS -3

- Some normal flora may modify through their enzymes chemicals in our diets into carcinogens. eg. artificial sweeteners may be enzymatically modified into bladder carcinogens.

# NORMAL FLORA OF THE SKIN

- The most important sites are:

1. Axilla
2. Groin
3. Areas between the toes





# NORMAL FLORA - RISKS

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- 1- Dental plaque
- 2- Dental caries: destruction of enamel, dentin or cementum of teeth
- 3- Periodontal disease
  - 4- Inflammatory bowel disease
  - 5- Obesity

