

# Lecture Title:

## NORMAL FLORA

(Foundation Block, Microbiology)

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# Lecture Objectives..



By the end of this lecture the student is expected to be able to:

1. Define the terms: *Normal Flora*, *Resident flora*, *Transient flora* and carrier state
2. Know the origin of normal flora.
3. Know the importance of normal flora with examples, including importance as:
  - A. Source of opportunistic infection.
  - B. Immunostimulation.
  - C. Nutrition: Vitamins production.
  - D. Production of Carcinogens.
  - E. Protection against external invaders.
4. Know areas of the body with normal flora (GIT, Urogenital tract, and skin) and most common types of organism in these areas and relation to pathogenicity of these organism.
5. Know sites of the body with no normal flora e.g. sterile body sites and the importance of this fact in relation to interpretation of culture results.



# 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.**
- **Symbolic relationship with the host.**
- Subject to constant changes.
- Altered by antimicrobial agents.

# Types of Normal Flora

- *Commensals*: natural relationship with host.
- *Residents* : present for invariable period .
- *Transients* : establish itself briefly , excluded by host defence or competition from residents.
- *Carrier state* : potentially pathogenic , eg. *S.pneumoniae*, *N. meningetidis* in throat of healthy individual.

# Origin of Normal Flora



- Newborn sterile in utero
- After birth ,exposed to flora of mother's genital tract,skin, respiratory tract flora of those handling him ,and organisms in the environment.





# Beneficial effects of normal flora

- 1~ **Immunostimulation** (antibody development)
- 2~ **Exclusionary effect** (vacuum effect ) and protection from external invaders..
- 3~ **Production of essential nutrients** (vit. **K & B**) by some normal intestinal flora eg. *E.coli*.

# Other facts regarding normal flora



- **May be a source of opportunistic infections.**  
eg . In patients with impaired defense mechanisms. eg *S.epidermidis*, *E.coli*.
- **Some may cross react with normal tissue components,**eg, antibodies to various ABO group arise because of cross reaction between intestinal flora and the antigens of A &B blood substances.



# Continue:

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



# Distribution of normal flora



- **Internal organs** (except alimentary tract) are sterile at health.
- Sterility maintained by :
  - ~ local defence mechanisms
  - ~ chemical substances in serum & tissues eg. Complement , antibodies.
  - ~ phagocytic activity of PMN

# Areas of the body with normal flora



- **GIT:** mouth & large colon
- **Urogenital tract:** vagina & distal 1/3 of the urethra
- **Skin**

## DISTRIBUTION AND FREQUENCY OF BACTERIA IN THE INTESTINE

density	frequency of occurrence in population
oesophagus  stomach	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">lactobacilli</div>
small bowel duodenum  jejunum  ileum	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         lactobacilli streptococci                     </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         Enterobacteria <i>Bacteroides</i> spp.                     </div>
large bowel	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <i>Bacteroides</i> spp. <i>Fusobacterium</i> spp. <i>E. faecalis</i> <i>Escherichia coli</i> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         Enterobacteria <i>Klebsiella</i> spp. Eubacteria Bifidobacteria                     </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         Lactobacillus <i>Staph. aureus</i> <i>Clostridium</i> spp                     </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         Streptococci <i>Pseudomonas</i> <i>Salmonella</i> </div>
faecal material	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <i>Bacteroides</i> spp. Bifidobacteria Eubacteria                     </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                         Coliforms <i>E. faecalis</i> </div>



## Distribution of Intestinal Flora

Predominant organisms	Concentration (per gram)
Obligate anaerobes Streptococci Staphylococci Neisseria	$>10^6$
None	$10^2$
Lactobacilli Streptococci	$<10^4$
Anaerobes Bacteroides	$10^6$
Coliforms E. coli	$10^9$
Streptococci Candida Protozoa	$10^{11}$



# Normal flora of the respiratory tract



- Upper resp.tract colonizes by flora as in mouth & nasopharynx
- Lower respiratory tract is sterile
- NOSE: ~ *Staph. epidermidis*
- ~ *Staph. aureus*
- ~ *Corynebacteria*



# Oropharynx flora

- Viridance streptococci
- Commensal neisseriae
- Corynebacteria
- Bacteroides
- Fusobacteria , Veillonella, actinomyces, spirochaetes.
- Haemophilus influenzae & Pneumococcus are potential pathogens.
- Less common: *S.pyogenes* ,*N.meningitidis*



# Gastrointestinal tract flora



- Saliva contains  $10^8$  bact/ml
- Gingival margin debris & dent. Plaque continually colonized by bacteria.
- Oesophagus flora as pharyngeal flora.
- Empty stomach sterile due to gastric acid.
- Duodenum, jejunum & upper ileum have scanty flora
- Large intestine heavily colonized by bacteria.



# Faeces

- 1/3 of faeces wt. is bacteria , mainly dead,
- Living bacteria  $\sim 10^{10}$ /gm
- 99% anaerobes
- Anaerobic environment maintained by aerobic bacteria utilizing free O<sub>2</sub>.
- Bacteroides fragilis group the dominant anaerobes, bifidobact. Lactobacilli...etc.
- Less common: E.coli ,Proteus,...etc.



# Genital tract flora



- Female genital tract heavily colonized , why ?
- $10^8$ /ml in normal vaginal secretion.
- In both sexes Mycob. Smegmatis (AFB) in secretions which contaminate urine~leads to confusion / misdiagnosis.
- M & F distal urethra: ~ S.epidermidis  
~ corynebacteria  
~Mycoplasma.

# Female Vulva



- *S. epidermidis* , *corynebacteria*, *E.coli* and othe coliforms & *St. faecalis*.
- Vagina :
- ~*lactobacilli* (Doderlein's bacilli)
- ~ *Bacteroides melaninogenicus*
- ~*S.faecalis*
- ~ *corynebacteria*
- ~*Mycoplasma*
- ~ Yeasts.



# Normal Skin Flora

- Skin has rich resident bacterial flora ( $10^4/cm^2$ ).
- Exist as microcolonies.
- Anaerobic organisms predominate in areas with sebaceous glands.
- Moist skin, often colonized by coliforms.



# Main Skin Flora

- *Propionibacterium acnes*
- Anaerobic cocci
- *S. epidermidis*
- *Corynebacteria*
- *S. aureus* (less common, potential pathogen)
- Coliforms

# External auditory meatus



- *S. epidermidis*
- *Corynebacteria*
- AFB occasionally in wax.

## CONJUNCTIVAL SAC FLORA

- ~ *Corynebacterium xerosis*
- ~ *S. epidermidis*

# Reference book and the relevant page numbers..



- SHERRIS MEDICAL MICROBIOLOGY, AN INTRODUCTION TO INFECTIOUS DISEASES. KENNETH RYAN /GEORGE RAY. LATEST EDITION. PUBLISHER MC GRW HILL.
- CHAPTER 9,PAGE 141~148

# Thank You 😊

(Foundation Block, Microbiology)

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