



Normal Flora

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Objectives

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.

Objectives, cont,.

4. Know areas of the body with normal flora (GIT, urogenital tract, and skin) and most common types of organism and relation to Pathogenicity.
5. Know sites of the body with no normal flora eg. sterile body sites and the importance of this fact in relation to interpretation of culture results.

Introduction

- **Normal flora** are a population of microorganisms that are frequently found in the skin , mucous membrane and other particular sites in normal healthy individual.
- **Some are found in association with humans and animals. The Majority are bacteria.**
- Has symbiotic relationship with the host.
- Subject to constant changes.
- Altered by antimicrobial agents.

Types of Normal Flora

- **Commensals:** Microorganisms that have natural relationship with the host.
- **Residents :** Consist of relatively fixed types of microorganisms . Regularly found in a given area at invariable period. If disturbed promptly re-establish itself .

Types of Normal Flora-cont.

- **Transients** : Consist of nonpathogenic or potential pathogenic microorganisms that inhabit the skin or mucous membrane for hours or days. Establish itself briefly , excluded by host defense or competition from residents.
- **Carrier state** : Potentially pathogenic , eg. *Streptococcus pneumoniae*, *Neisseria meningitidis* in throat of healthy individual

Origin of Normal Flora

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

Beneficial Effects of Normal Flora

- 1~ **Immunostimulation** (*antibody production*)
- 2~ **Exclusionary effect** (*vacuum effect*) and protection from external invaders.
- 3~ **Antagonize** other bacteria through the production of substances that inhibit or kill non-indigenous bacteria.
- 4~ **Production of essential nutrients** (Vitamin K & B) by some normal intestinal flora eg. *Eschericia coli* (*E.coli*).

Facts About Normal Flora

- May be a source of **opportunistic infections** in patients with impaired defense mechanisms.
eg. Staphylococcus 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.

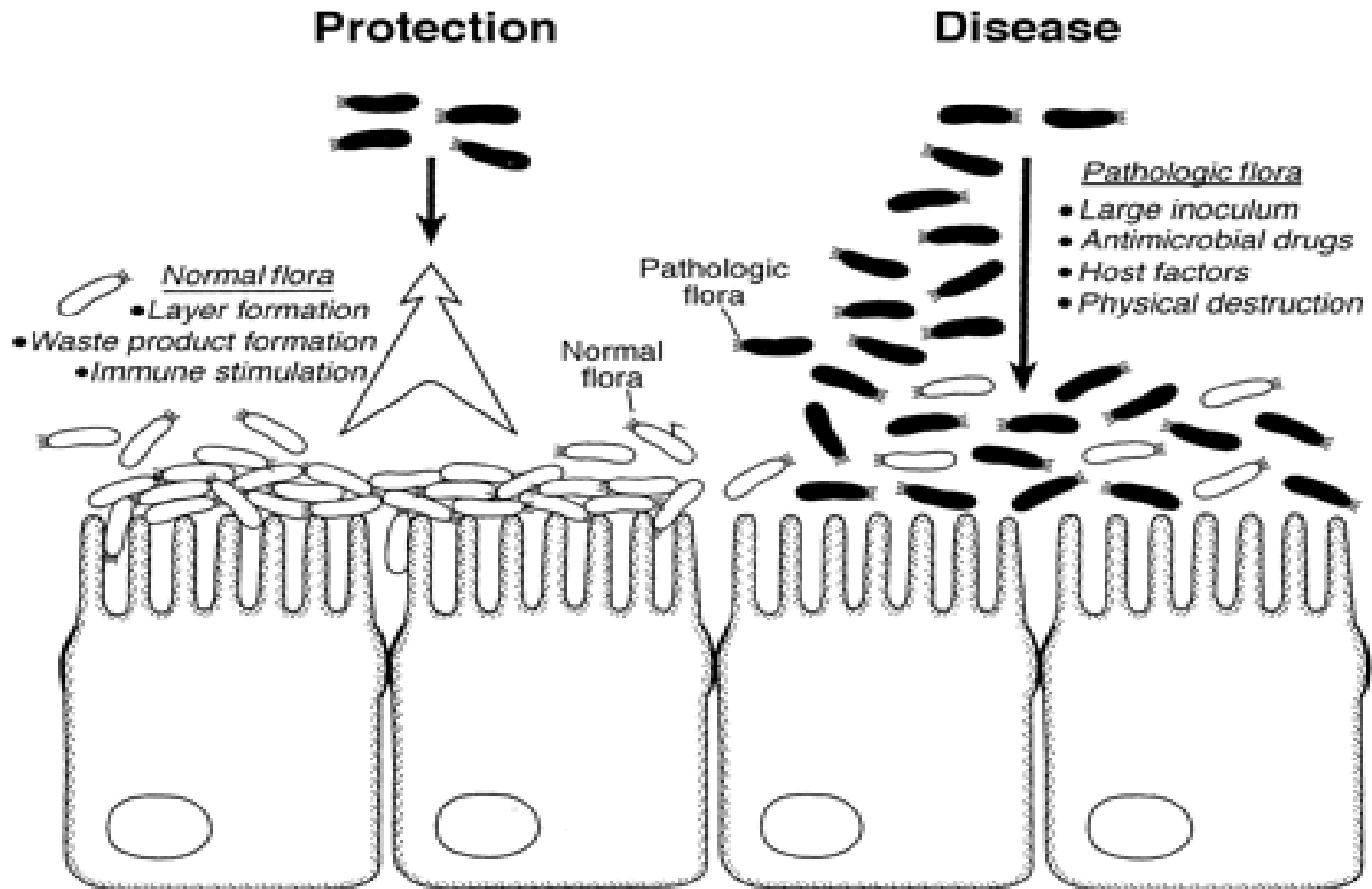
Facts About Normal Flora-cont.,

- **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.

- **Affected by** antibiotics, tissue damage, mechanical procedures and diet change.

Normal Flora vs Pathogenic Flora

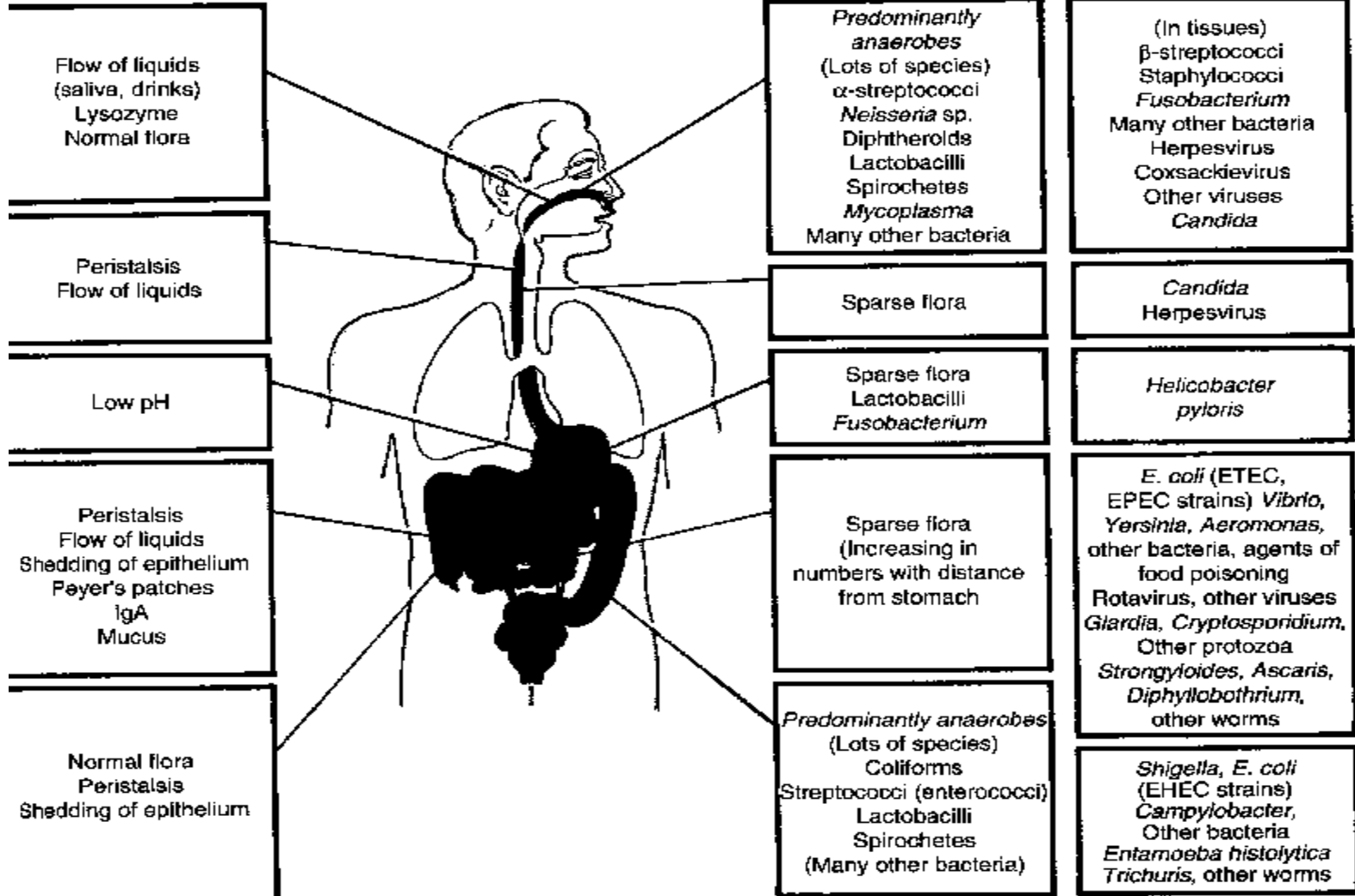


Special Defenses

Microbial Flora (examples)

Normal

Abnormal



Distribution of Normal Flora

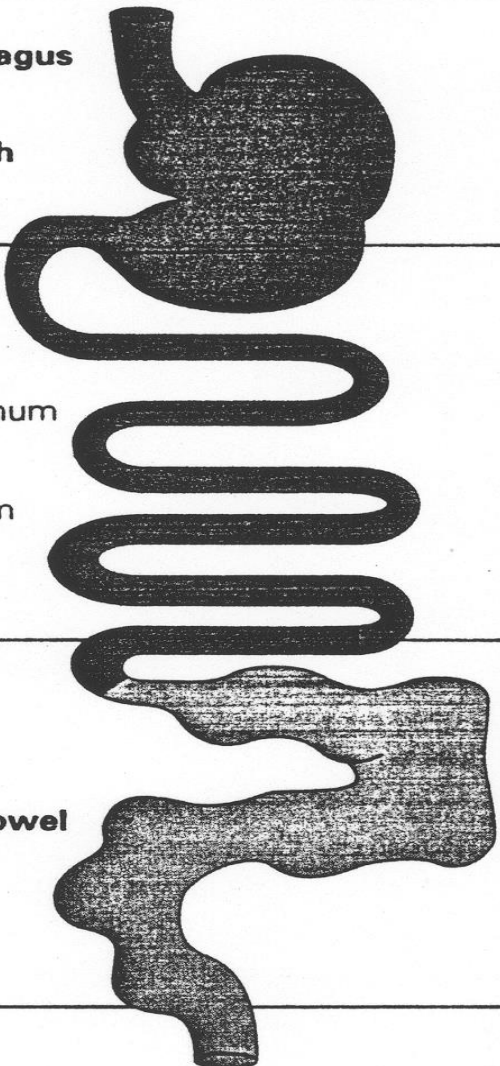
- Normal flora found on external body sites
- **Internal organs are sterile at health** (*except the Gastrointestinal tract*) .
- Sterility of internal organs maintained by :
 - ~ Local defense mechanisms
 - ~ Chemical substances in serum & tissues eg. Complement , antibodies.
 - ~ Phagocytic activity of Polymorphnuclear Monocytes.

Body Sites With Normal Flora

All external body sites contain normal flora:

- **Gastro intestinal tract (GIT):** mouth & large colon
- **Urogenital tract:** vagina & distal one third of the urethra.
- **Skin** (including external ear & conjunctiva)

DISTRIBUTION AND FREQUENCY OF BACTERIA IN THE INTESTINE

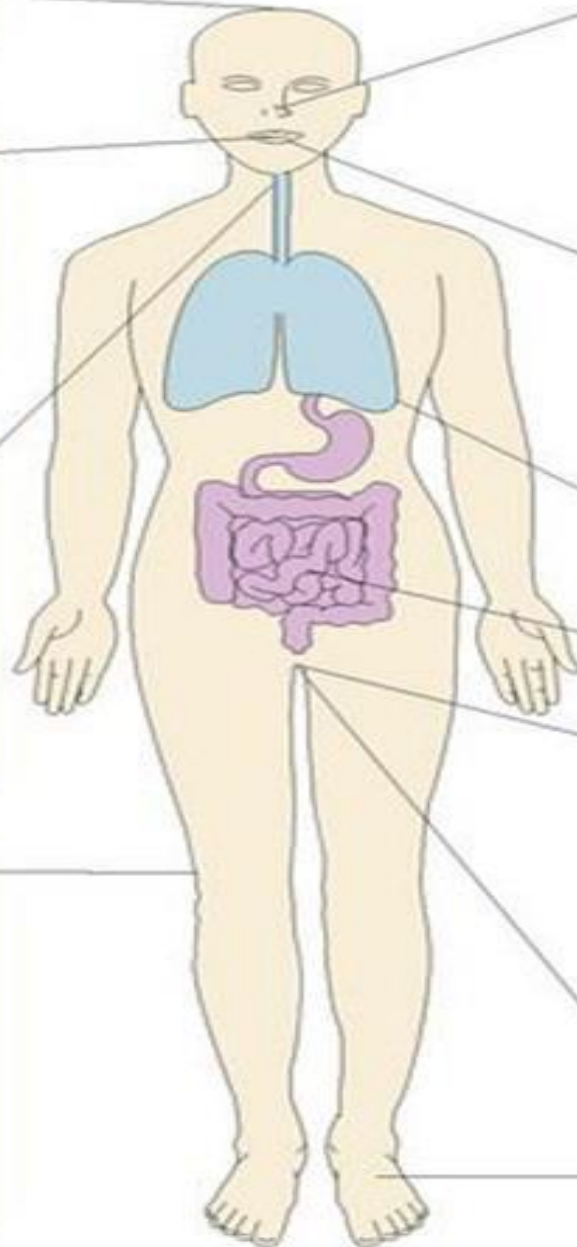
density	frequency of occurrence in population	
<p>oesophagus</p> <p>stomach</p> 	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;">lactobacilli</div>	
<p>small bowel</p> <p>duodenum</p> <p>jejunum</p> <p>ileum</p>	<div style="border: 1px solid black; padding: 5px;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

scalp
as skin

teeth
Streptococcus mutans
Bacteroides
Fusobacterium
streptococci
actinomyces

throat
Strep. viridans
Strep. pyogenes
Strep. pneumoniae
Neisseria spp.
Staphylococcus
epidermidis
Haemophilus
influenzae

skin
Staph. epidermidis
Staph. aureus
diphtheroids
streptococci
Pseudomonas
aeruginosa
anaerobes, *Candida*
Torulopsis
Pityrosporum



nose
Staph. aureus
Staph. epidermidis
diphtheroids
streptococci

mouth
Strep. mitis and
other streptococci
Trichomonas tenax
Candida

lung
? *Pneumocystis jirovecii*

intestine*

urethra and vagina
Staphylococcus
epidermidis
diphtheroids
streptococci
Gram-negative rods

groin and perineum
as skin

feet
as skin

Normal Flora Of The Respiratory Tract

- Upper respiratory tract colonized by normal flora as in mouth & nasopharynx
- Lower respiratory tract is sterile
- Nose Flora :
 - ~ *Staphylococcus epidermidis*
 - ~ *Staphylococcus aureus*
 - ~ *Corynebacteria*

Normal Flora Of The Oropharynx

- Viridance streptococci
- Commensal neisseriae
- Corynebacteria
- Bacteroides
- Fusobacteria , Veillonella, Actinomyces, Spirochaetes.
- *Haemophilus influenzae* & *Pneumococcus* are potential pathogens.
- Less common potential pathogens : *Streptococcus pyogenes* , *Neisseria meningitidis*

Normal Flora Of The GIT

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

Feces (Stool)

- 1/3 of feces weight is bacteria , mainly dead.
- Living bacteria about 10^{10} /gm
- **99% anaerobes**
- Anaerobic environment maintained by aerobic bacteria utilizing free O₂.
- ***Bacteroides fragilis*** group is the dominant anaerobes, Bifidobacteria , Lactobacilli...etc.
- **Less common aerobics: *E.coli* ,*Proteus*,...etc.**

Normal Flora Of The Genital Tract

- Female genital tract heavily colonized , why ?
- 10^8 /ml flora in normal vaginal secretion.
- In both sexes *Mycobacterium smegmatis* in secretions which contaminate urine and leads to confusion / misdiagnosis.
- Male & Female distal urethra:
 - ~ *S.epidermidis*
 - ~*Corynebacteria*
 - ~*Mycoplasma species*

Normal Flora Of The Female Genital Tract

- **Vulva** : *S. epidermidis* , *Corynebacteria*, *E.coli* and other coliforms & *Enterococcus faecalis*.
- **Vagina** :
 - ~ *Lactobacillus* (Doderlein's bacilli)
 - ~ *Bacteroides melaninogenicus*
 - ~ *Enterococcus faecalis*
 - ~ *Corynebacteria*
 - ~ *Mycoplasma*
 - ~ Yeasts.

Normal Flora Of The Skin

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

Main Skin Flora:

- *Propionibacterium acnes*
- Anaerobic cocci
- *Staphylococcus epidermidis*
- Corynebacteria
- *Staphylococcus aureus* (potential pathogen)
- Coliforms

Normal Flora Of The External Auditory Meatus

External ear has the following normal flora:

- *S. epidermidis*
- Corynebacteria
- Acid fast bacilli (AFB) (occasionally in wax).

Middle and inner ear are sterile.

Normal Flora Of The Conjunctival Sac

Conjunctiva has normal flora eg.

- *Corynebacterium xerosis*
- *Staphylococcus epidermidis*

Internal eye is sterile.

Reference Book

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