

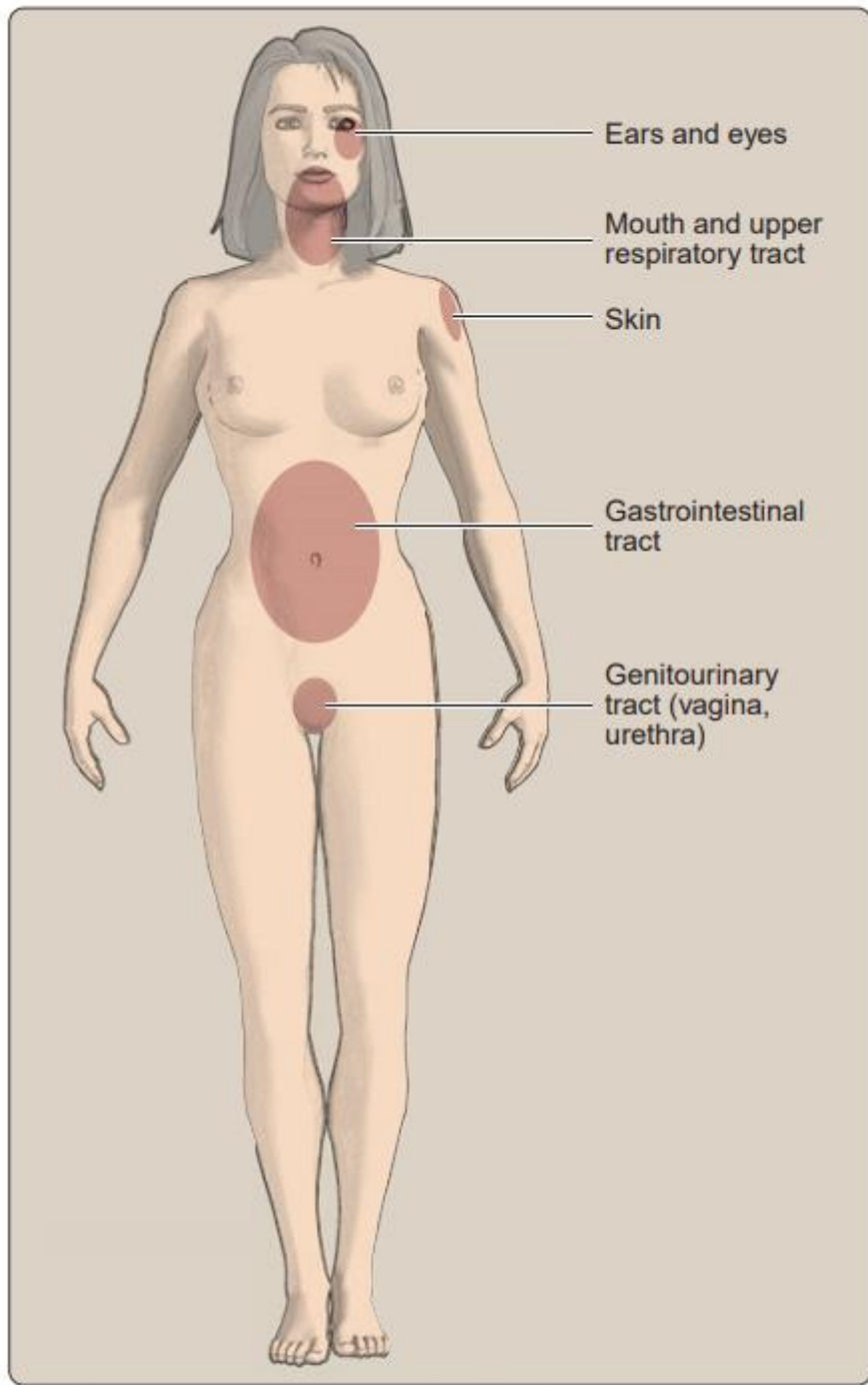


# MICROFLORA OF HUMANS

**Dr.Roongtawan Muangmoon**

# LEARNING OBJECTIVES

- 1. Discuss the beneficial and harmful roles of the indigenous microflora of the human body**
- 2. Describe biofilms and their impact on human health**



## Areas of the body where most of the indigenous microflora reside:

- **Skin**
- **Mouth**
- **Ears**
- **Eyes**
- **Upper respiratory tract**
- **Gastrointestinal tract**
- **Genitourinary tract**

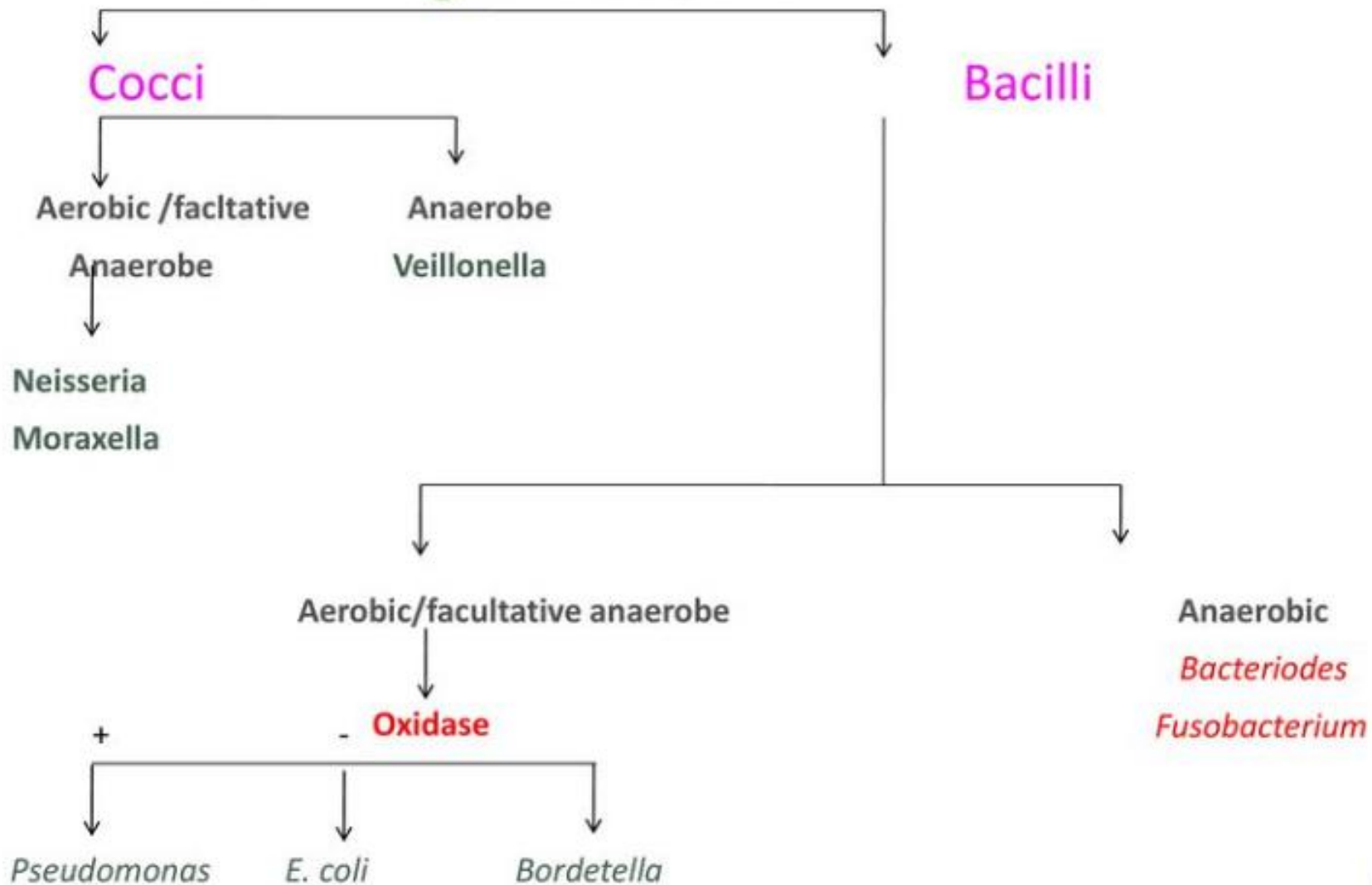
# Anatomic Locations of Bacteria and Yeasts Found as Indigenous Microflora of Humans

	SKIN	MOUTH	NOSE AND NASOPHARYNX	OROPHARYNX	GI TRACT	GU TRACT
Anaerobic Gram-negative cocci	–	+	–	–	–	–
Anaerobic Gram-positive cocci	–	+	–	+	+	+
<i>Bacteroides</i> spp.	±	+	–	+	+	+
<i>Candida</i> spp.	+	±	–	–	–	+
<i>Clostridium</i> spp.	+	–	–	–	+	+
Diphtheroids	+	–	+	+	–	+
Enterobacteriaceae <sup>a</sup>	–	–	–	–	+	±
<i>Enterococcus</i> spp.	–	±	±	–	+	+
<i>Fusobacterium</i> spp.	–	±	±	+	+	–
<i>Haemophilus</i> spp.	–	–	+	+	–	–
<i>Lactobacillus</i> spp.	+	+	–	–	–	+
<i>Micrococcus</i> spp.	+	–	–	–	–	–
<i>Neisseria meningitidis</i>	–	–	±	±	–	–
<i>Prevotella/Porphyromonas</i> spp.	–	+	–	+	–	–
<i>Staphylococcus</i> spp.	+	+	+	+	+	+
<i>Streptococcus</i> spp.	±	+	+	+	–	–

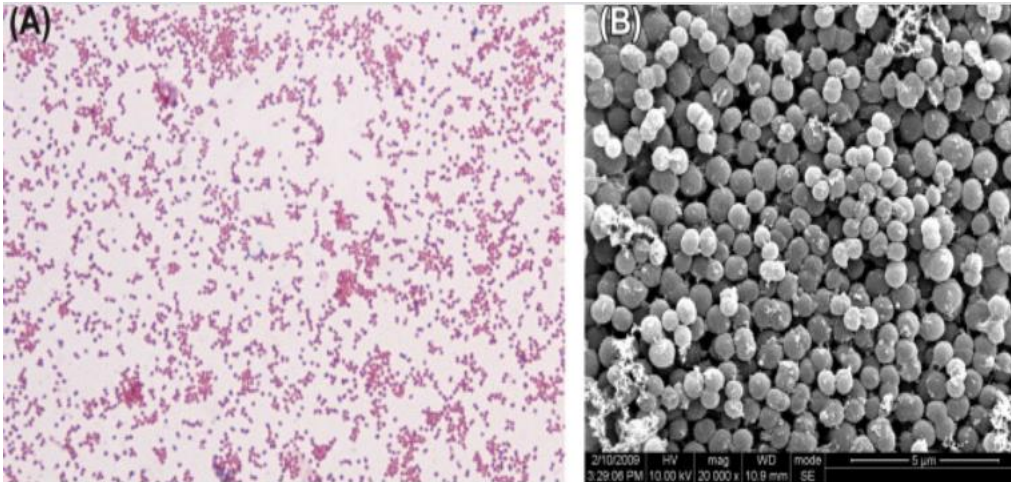
+ , commonly present; ± , less commonly present; – , absent

<sup>a</sup>Sometimes referred to as enteric bacilli (includes *Escherichia*, *Klebsiella*, *Proteus* spp.)

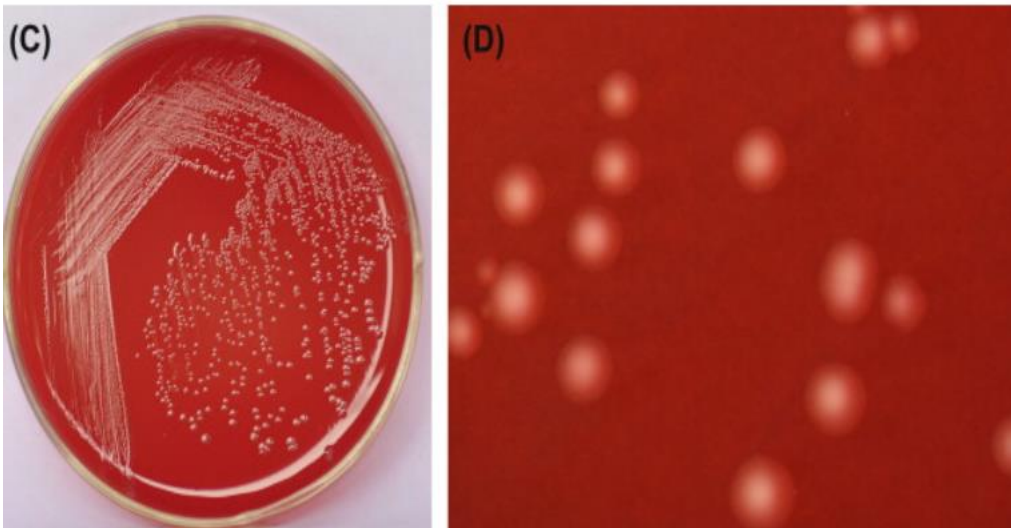
# Gram Negative bacteria



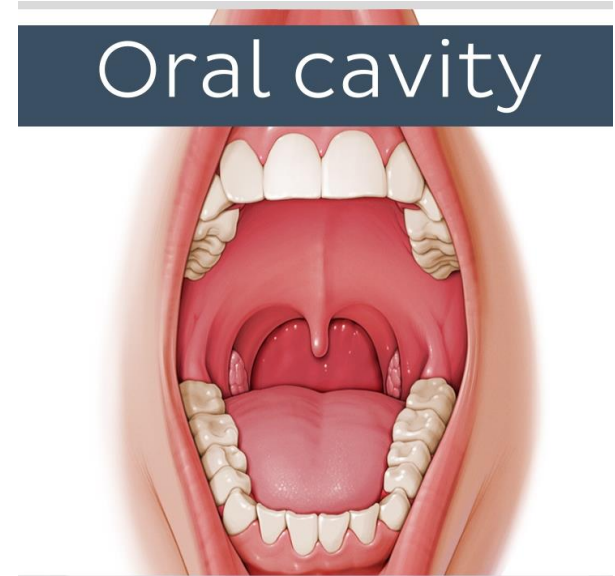
# Gram Negative Anaerobic Cocci



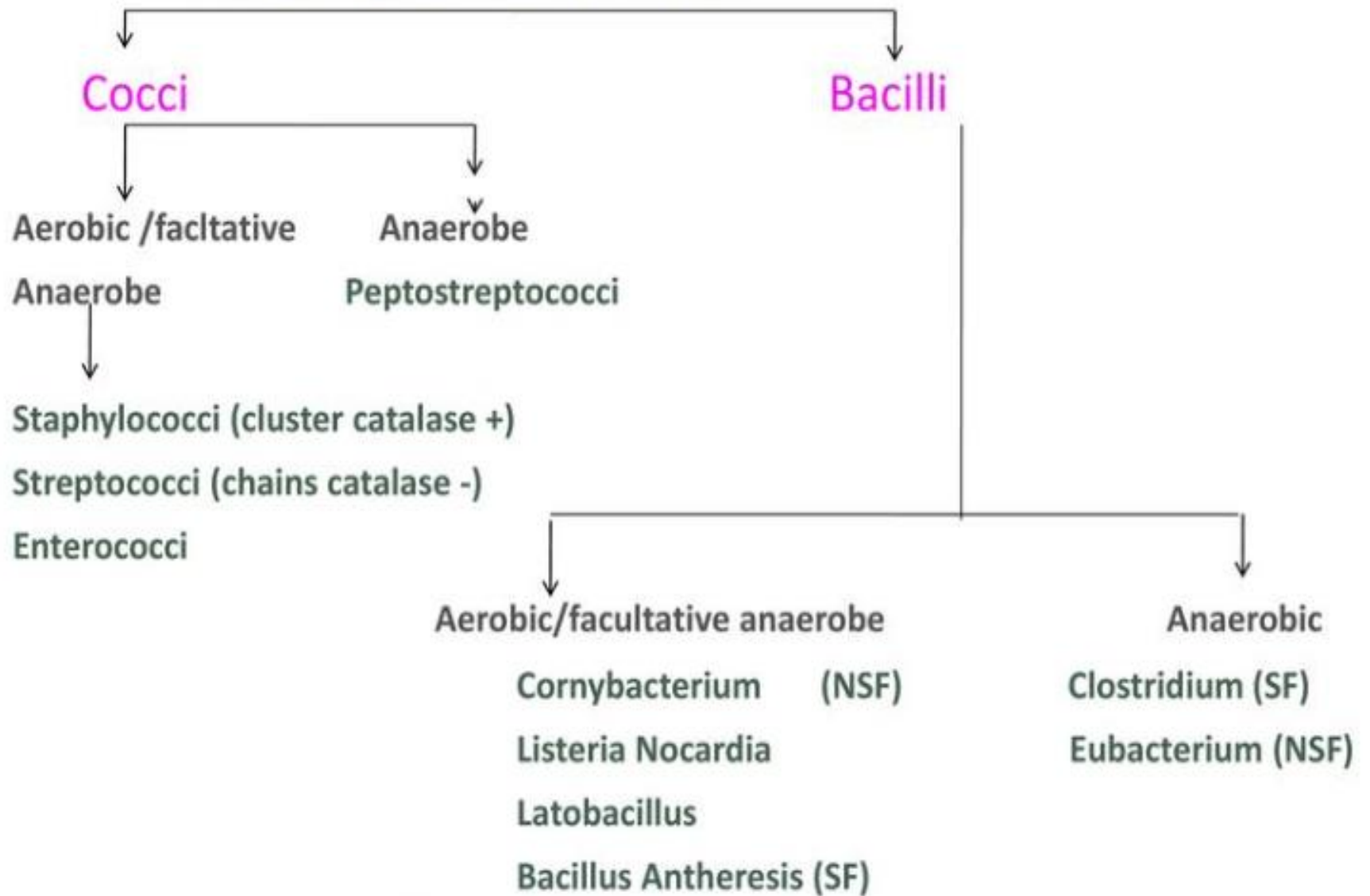
*Veillonella parvula* subsp. *parvula* cells (Gram stain).



Oral cavity

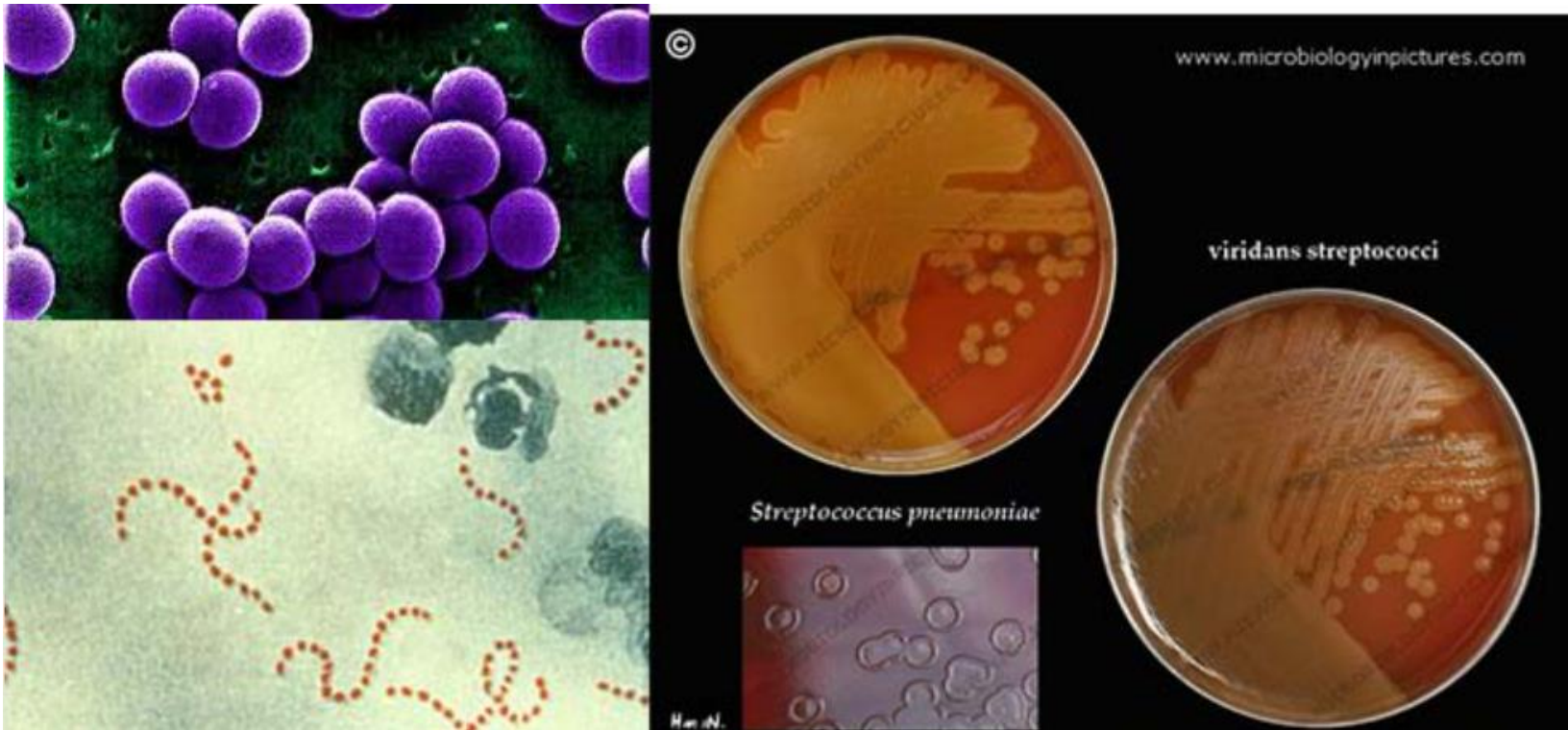


# Gram positive bacteria



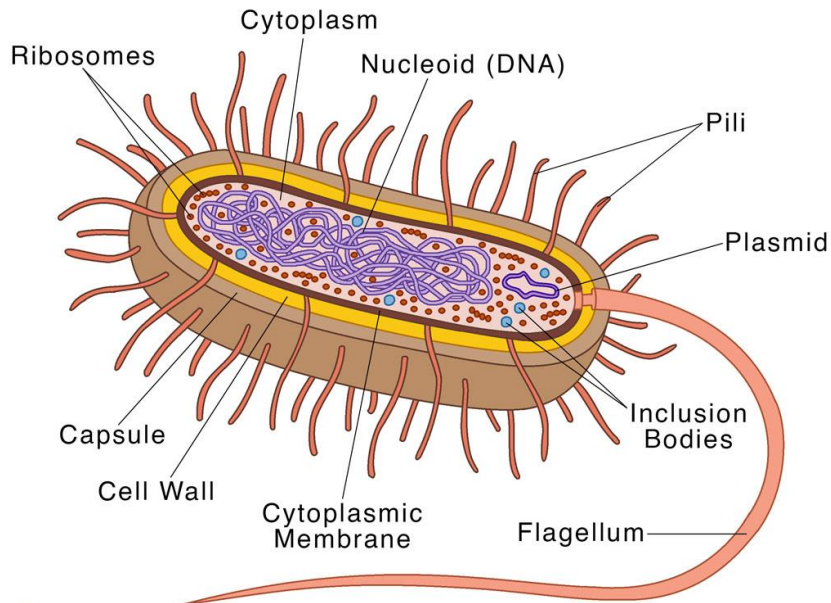
NSF=non-spore forming SF=spore forming

# Gram Negative Anaerobic Cocci



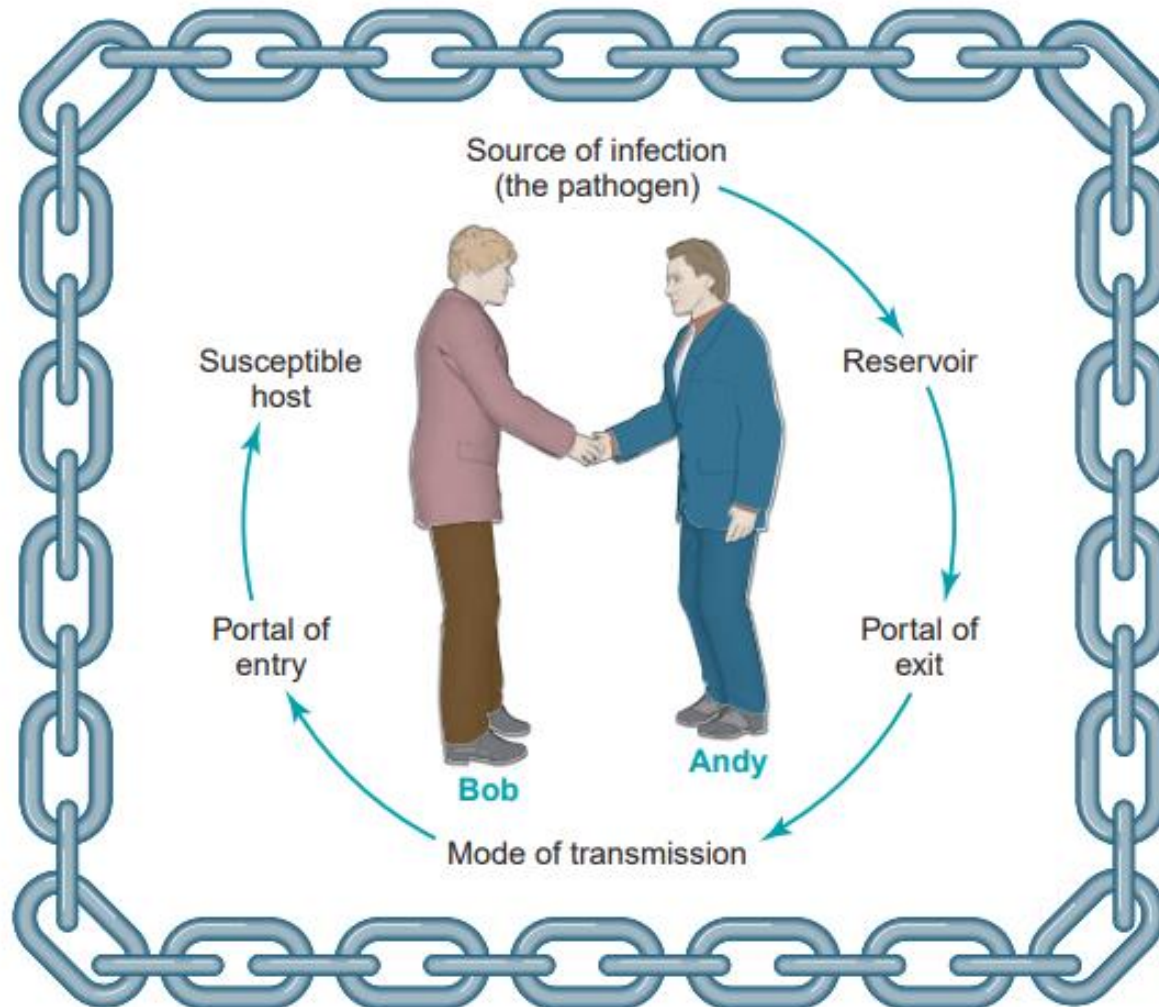


## Bacteria Cell



1. **Bacteria are prokaryote**
2. **The DNA is floating & easily transport to another bacteria (So they easily get resistance to antibiotics)**
3. **Capsule (antiphagocytic)**
4. **Cell Wall (is the site of some antibiotic action such as penicillin)**

# The six components in the infectious disease process; also known as the chain of infection.



# STRATEGIES FOR BREAKING THE CHAIN OF INFECTION

## Hand washing tips



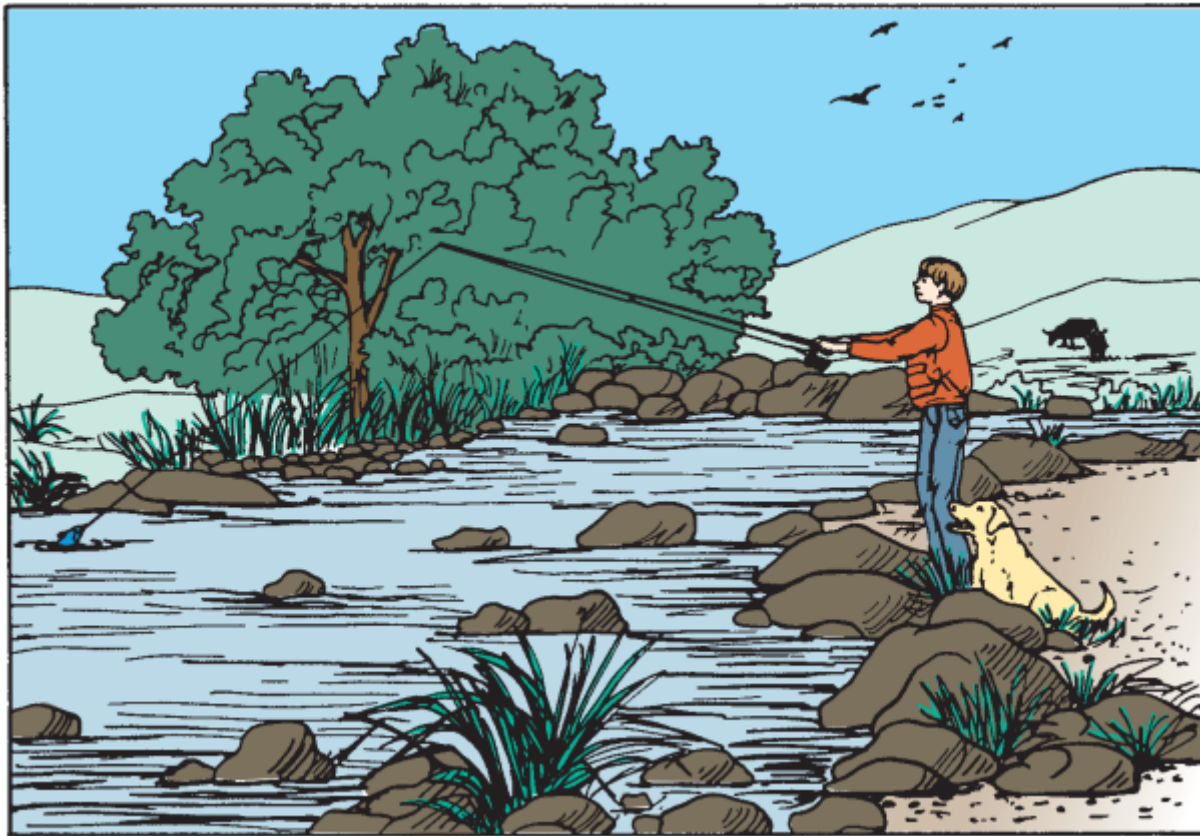
healthdirect

Practice effective hand hygiene procedures

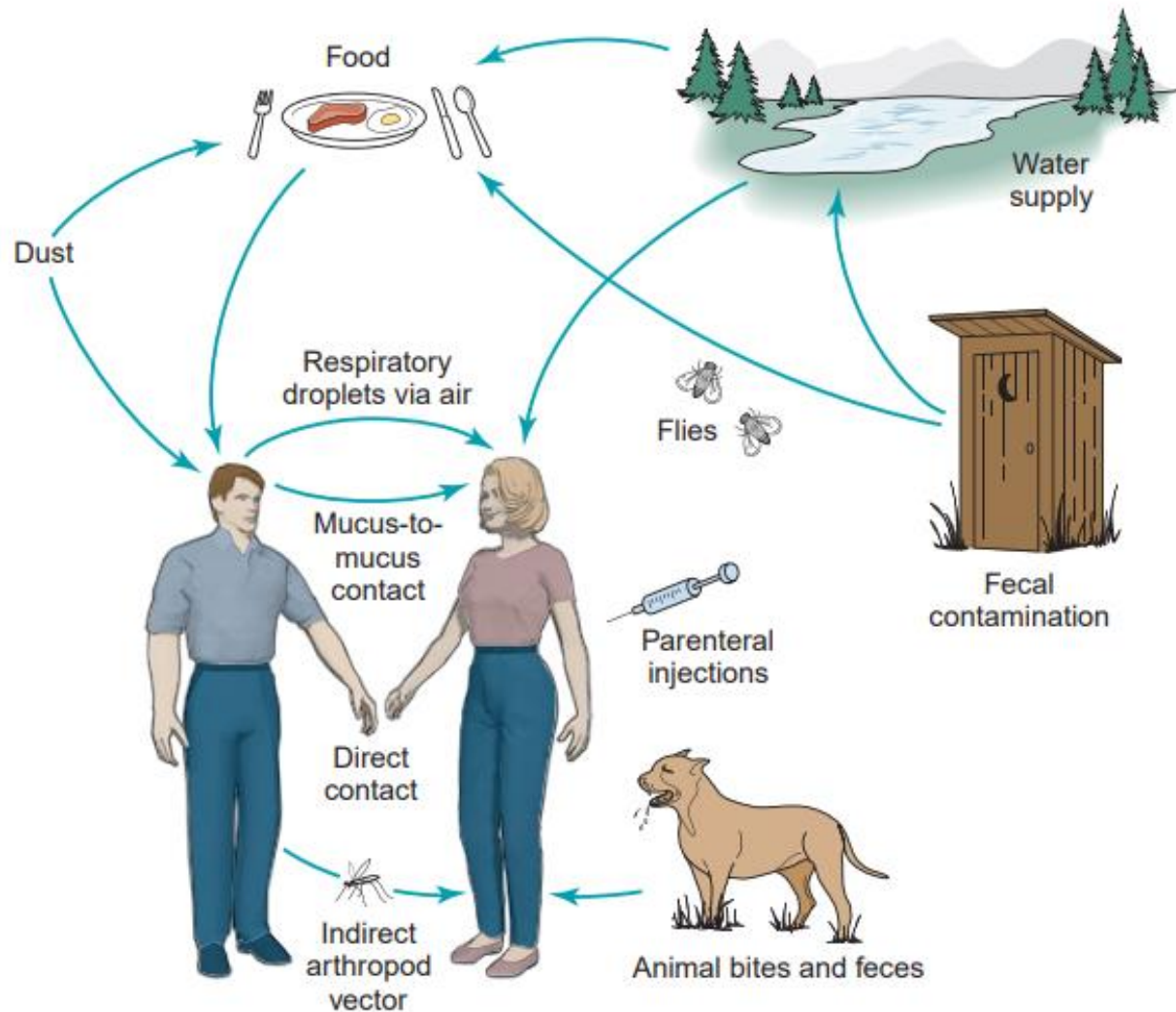
- **Maintain good nutrition and adequate rest and reduce stress**
- **Obtain immunizations against common pathogens**
- **Practice insect and rodent control measures**
- **Practice proper patient isolation procedures**
- **Ensure proper decontamination of surfaces and medical instruments**
- **Dispose of sharps and infectious waste properly**
- **Use gloves, gowns, masks, respirators, and other personal protective equipment, whenever appropriate to do so**
- **Use needle safety devices during blood collection**

**Reservoirs of infection include soil, dust, contaminated water, contaminated foods, insects, and infected humans, domestic animals, and wild animals.**

(Reproduced courtesy of Engelkirk PG, et al. Principles and Practice of Clinical Anaerobic Bacteriology. Belmont, CA: Star Publishing Co., 1992.)



# Modes of disease transmission.



# Common Routes of Transmission of Infectious Diseases

## Common Routes of Transmission of Infectious Diseases

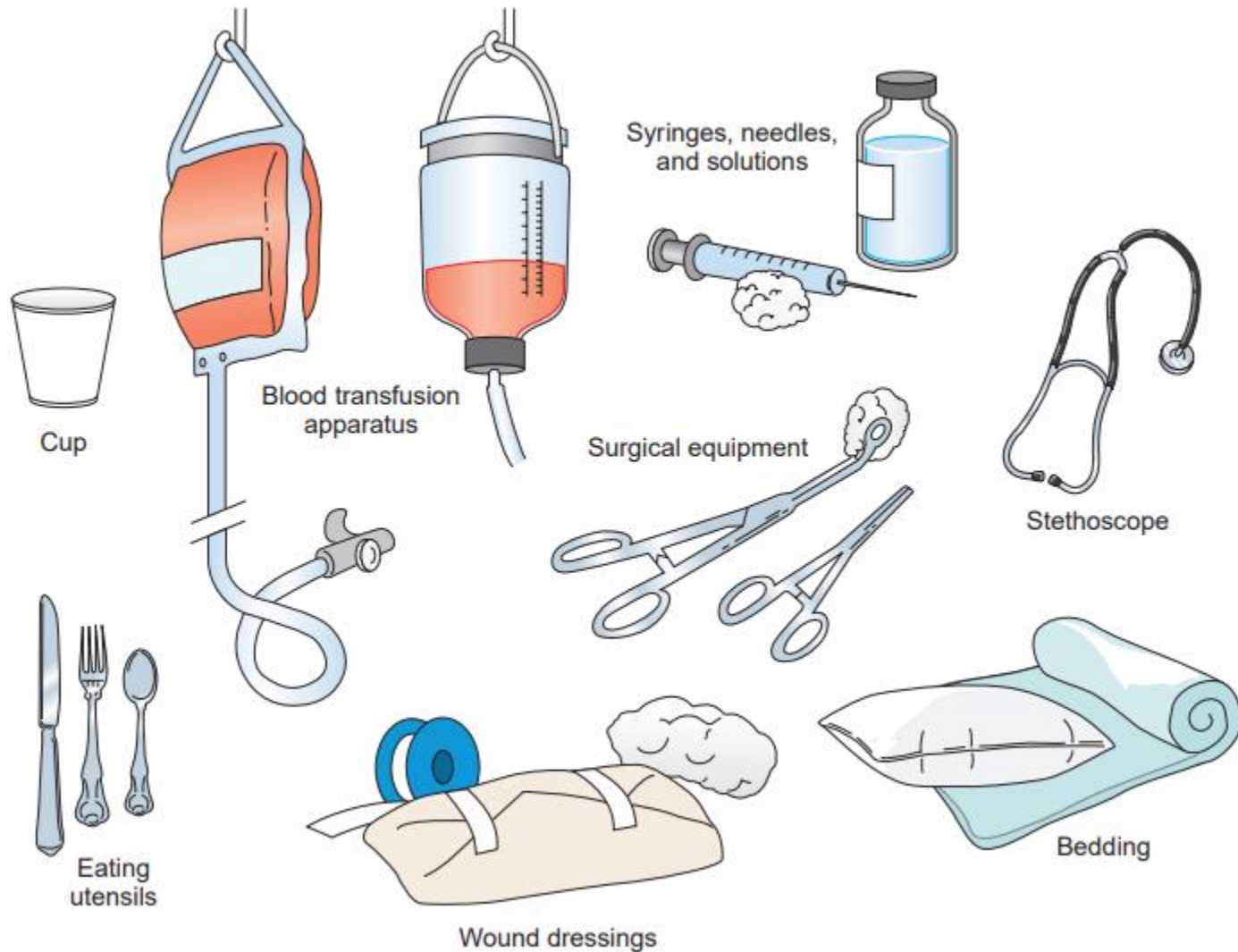
Skin	Skin discharge → air → respiratory tract	Chickenpox, colds, influenza, measles, staph and strep infections
	Skin to skin	Impetigo, eczema, boils, warts, syphilis
Respiratory	Aerosol droplet inhalation Nose or mouth → hand or object → nose	Colds, influenza, pneumonia, mumps, measles, chickenpox, tuberculosis
Gastrointestinal	Feces → hand → mouth Stool → soil, food, or water → mouth	Gastroenteritis, hepatitis, salmonellosis, shigellosis, typhoid fever, cholera, giardiasis, amebiasis
Salivary	Direct salivary transfer	Herpes cold sore, infectious mononucleosis, strep throat

# Common Routes of Transmission of Infectious Diseases

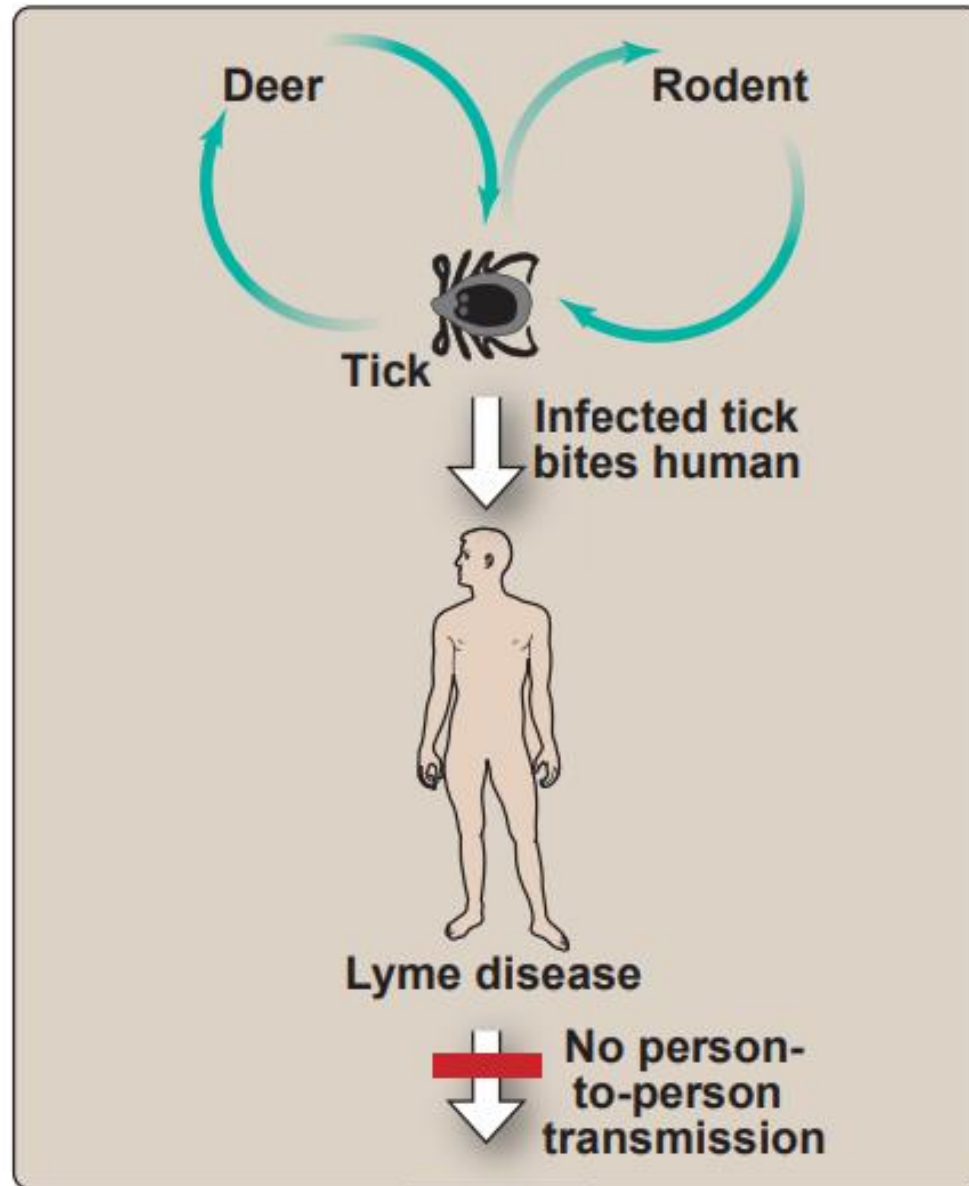
Genital secretions	Urethral or cervical secretions Semen	Gonorrhea, herpes, <i>Chlamydia</i> infection Cytomegalovirus infection, AIDS, syphilis, warts
Blood	Transfusion or needlestick injury Insect bite	Hepatitis B, cytomegalovirus infection, malaria, AIDS Malaria relapsing fever
Zoonotic	Animal bite Contact with animal carcasses	Rabies Tularemia, anthrax
	Arthropod	Rocky Mountain spotted fever, Lyme disease, typhus, viral encephalitis, yellow fever, malaria, plague

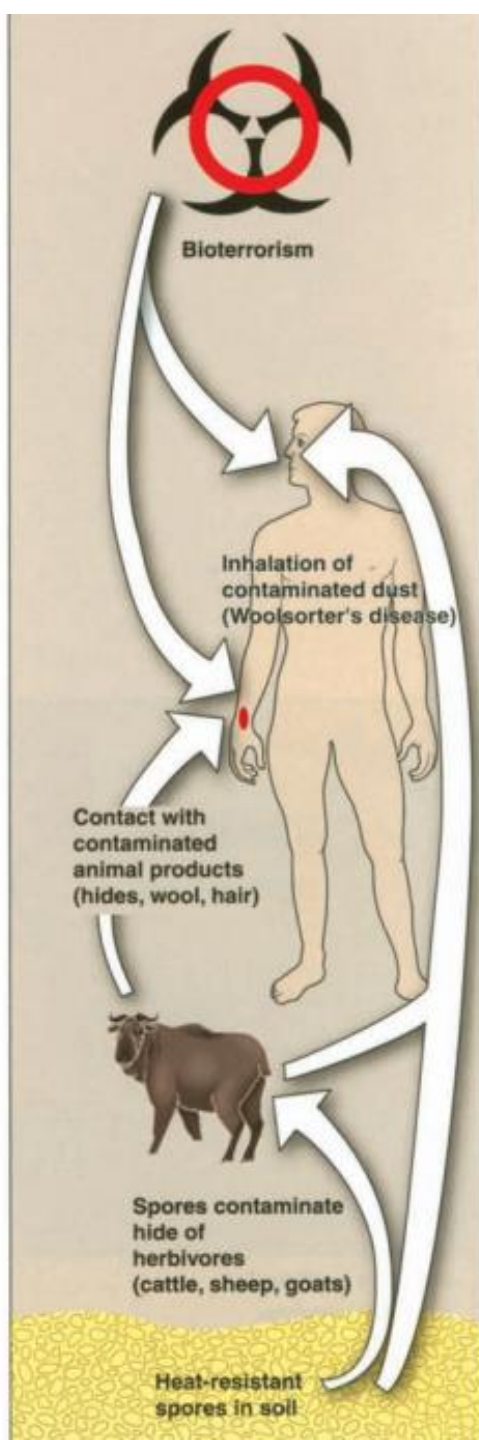


**Various medical instruments and apparatus that may serve as inanimate vectors of infection (fomites).**



**Transmission of Lyme disease.** (From Harvey RA, et al. Lippincott's Illustrated Reviews: Microbiology. 2nd ed. Philadelphia: Lippincott Williams & Wilkins, 2007.)





## Anthrax transmission.

(From Harvey RA, et al. Lippincott's Illustrated Reviews: Microbiology. 2<sup>nd</sup> ed. Philadelphia: Lippincott Williams & Wilkins, 2007.)



**Black anthrax lesion**



**Child with smallpox**

(Courtesy of Dr. Stan Foster and the CDC)



**Gangrenous hand (A) and foot (B) of patients with plague.** ([A] Courtesy of Dr. Jack Poland and the CDC. [B] Courtesy of William Archibald and the CDC.)

## Critical Biological Agent Categories for Public Health Preparedness<sup>a</sup>

### CATEGORY

Category A—Agents having the greatest potential for adverse public health impact; most require broad-based public health preparedness efforts

### BIOLOGICAL AGENT(S)

*Variola major*  
*Bacillus anthracis*  
*Yersinia pestis*  
*Clostridium botulinum*  
*Francisella tularensis*  
Filoviruses and arenaviruses  
(e.g., Ebola virus, Lassa virus)

### DISEASE

Smallpox  
Anthrax  
Plague  
Botulism (botulinal toxins)  
Tularemia  
Viral hemorrhagic fevers

Category B—Agents having a moderate to high potential for large-scale dissemination or a heightened general public health awareness that could cause mass public fear and civil disruption

*Coxiella burnetii*

*Brucella* spp.

*Burkholderia mallei*

*Burkholderia pseudomallei*

Alphaviruses (Venezuela equine, eastern equine, and western equine encephalitis viruses)

*Rickettsia prowazekii*

Toxins (e.g., ricin [from the castor oil plant], staphylococcal enterotoxin B)

*Chlamydomphila psittaci*

Food safety treats (e.g., *Salmonella* spp., *Escherichia coli* O157:H7)

Water safety treats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)

Q fever

Brucellosis

Glanders

Melioidosis

Encephalitis

Typhus fever

Toxic syndromes

Psittacosis



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Category C—Agents currently not believed to present a high bioterrorism risk to public health, but could emerge as future threats

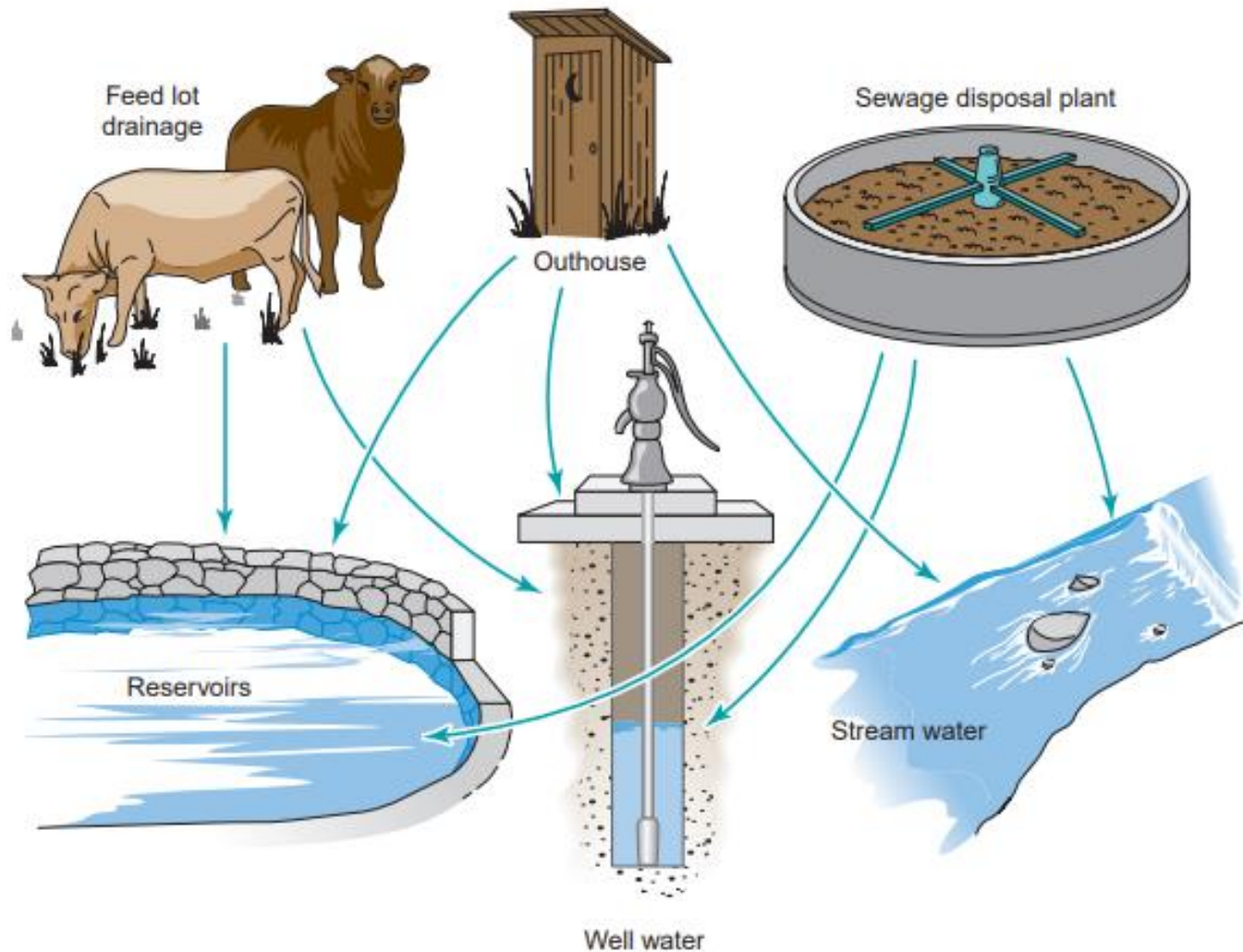
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Emerging threat agents  
(e.g., Nipah virus, hantavirus)

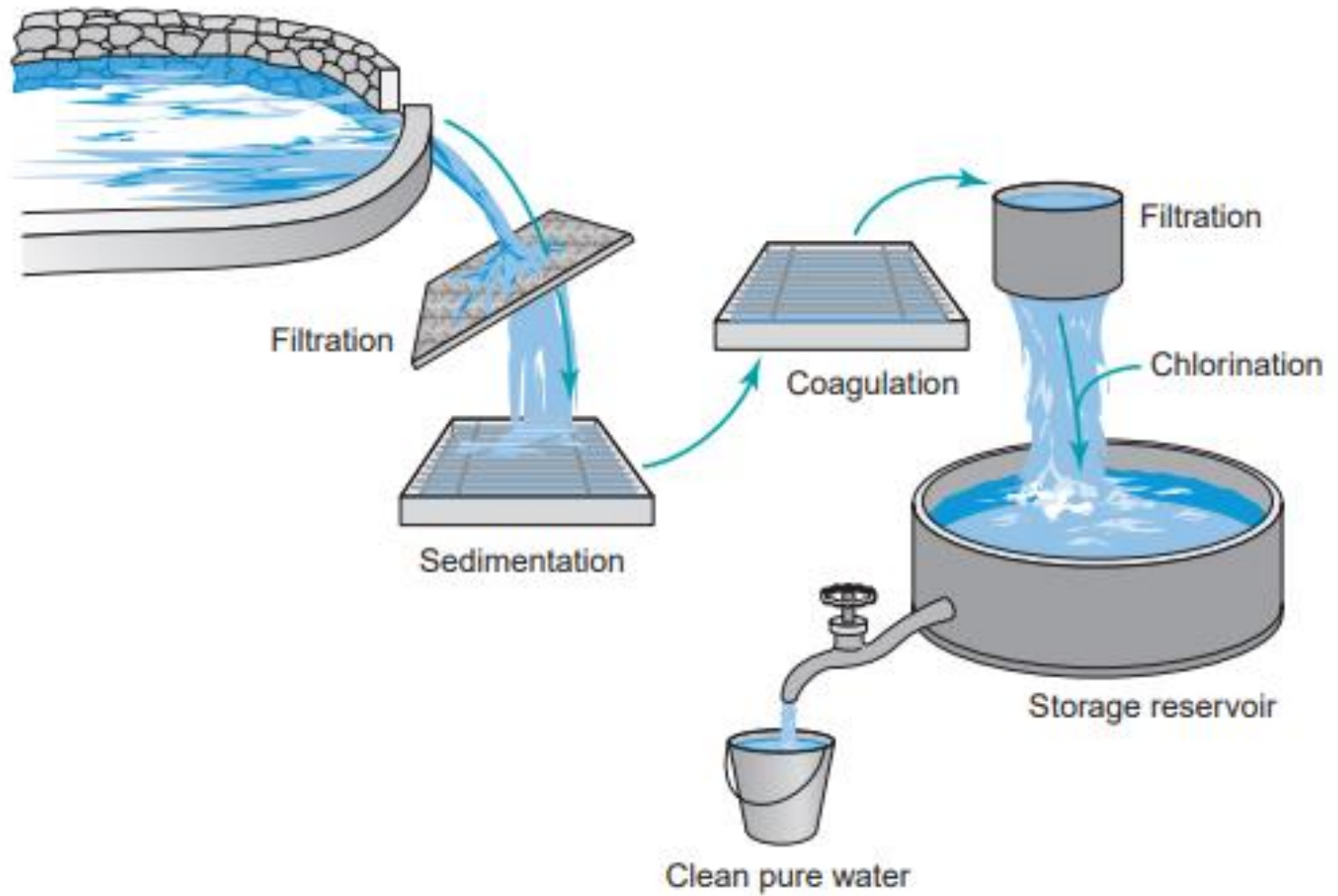
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<sup>a</sup>From Rotz LD, et al. Public health assessment of potential biological terrorism agents. *Emerg Infect Dis* 2002;8:225–230 (prepared and published by the National Center for Infectious Diseases, Centers for Disease Control and Prevention, based on unclassified information)

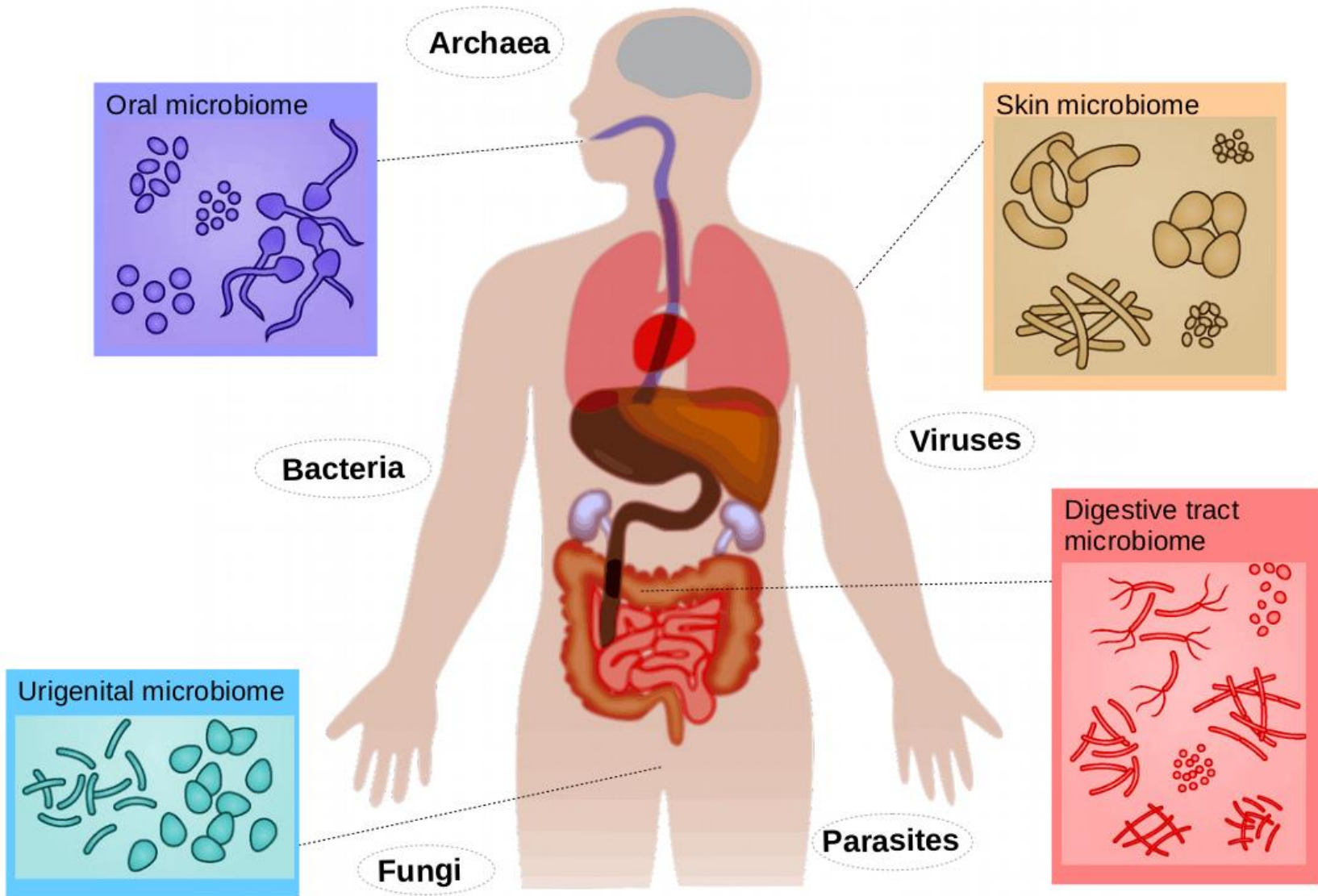
# Sources of water contamination.



# Steps in water treatment.



# Human Microbiome





# flora

flo·ra

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01  
plant, bacterial, or fungal life  
especially : such life characteristic of a  
region, period, or special environment

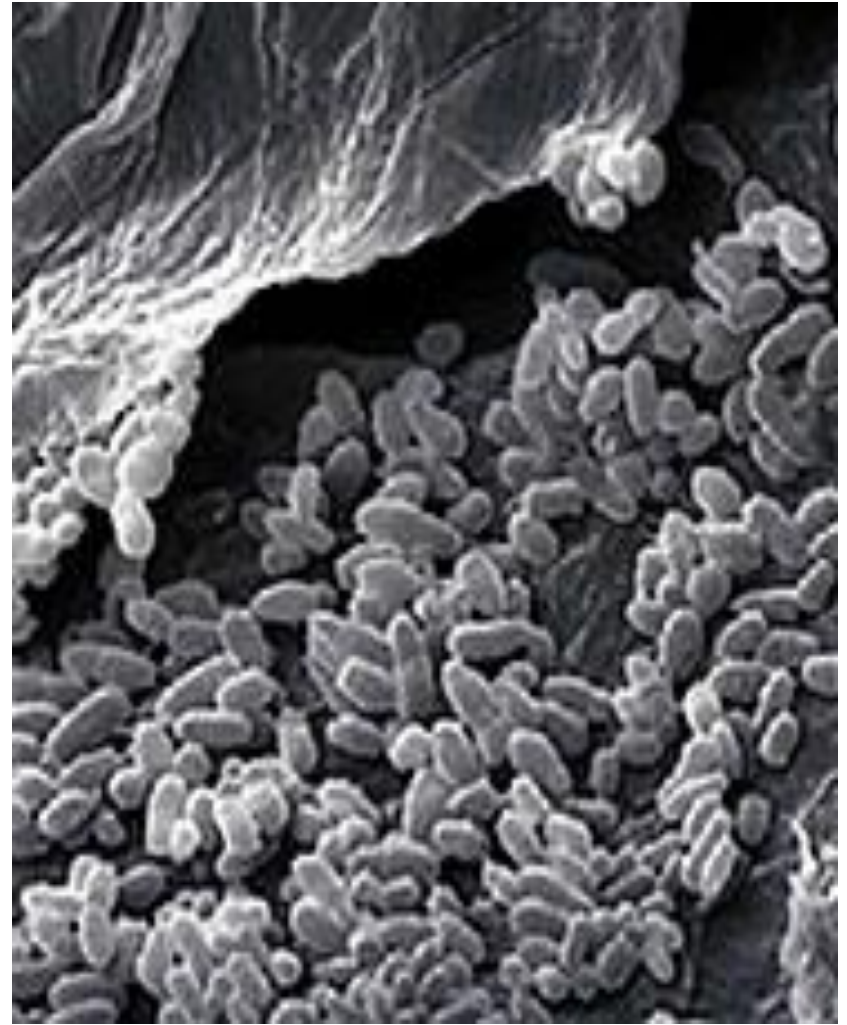
# microflora

mi·cro·flo·ra

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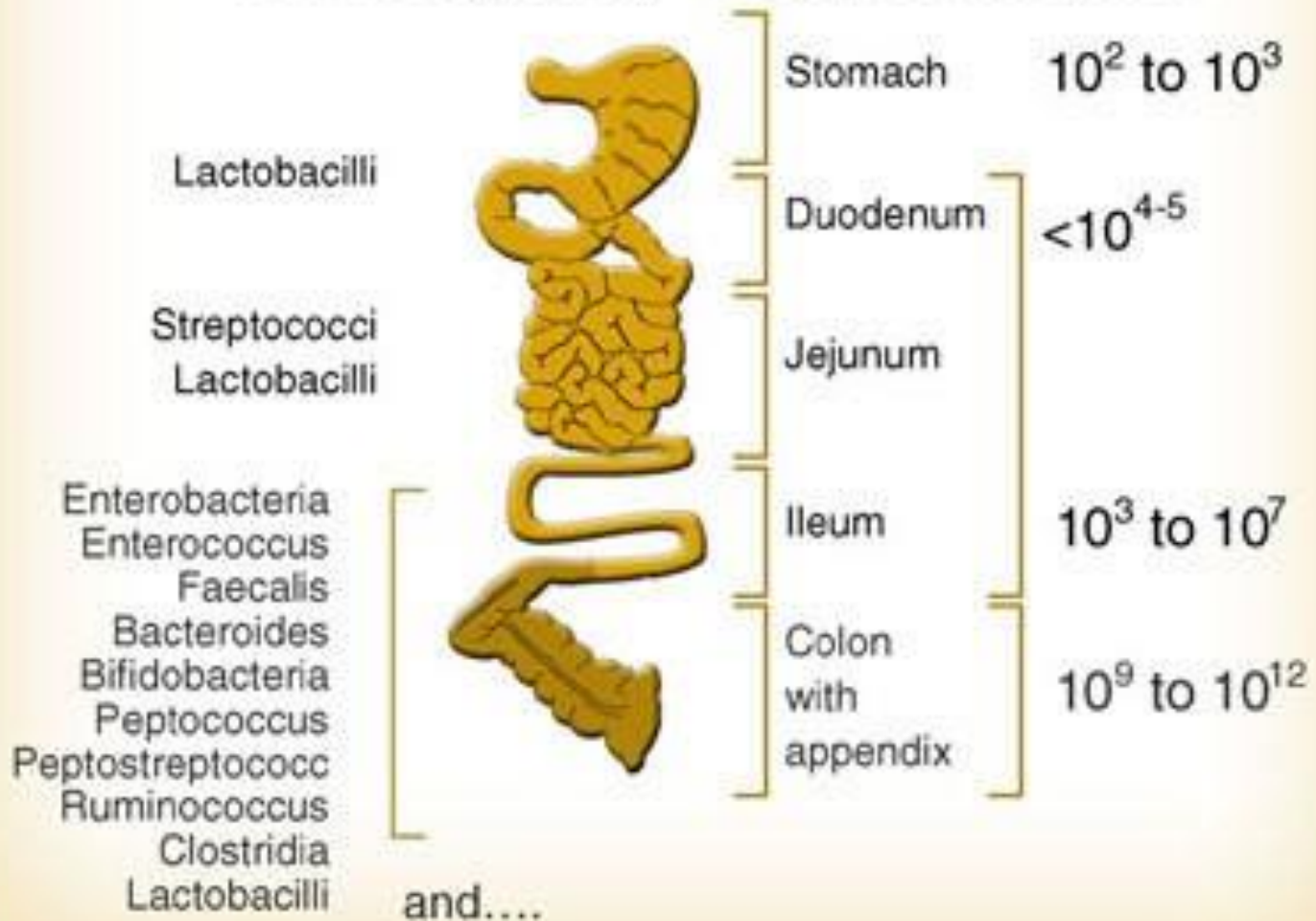
microscopic flora

02  
a small or strictly localized flora  
(as of a microenvironment)



# INTESTINAL MICROFLORA

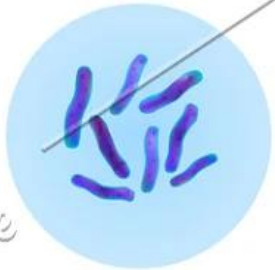
$10^{14}$  micro-organisms, >500 differentes species



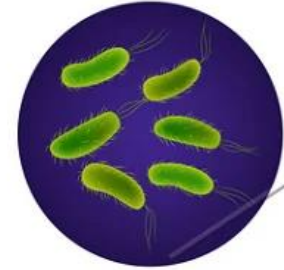
# INTESTINAL MICROFLORA



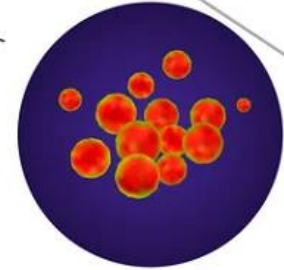
BIFIDOBACTERIA



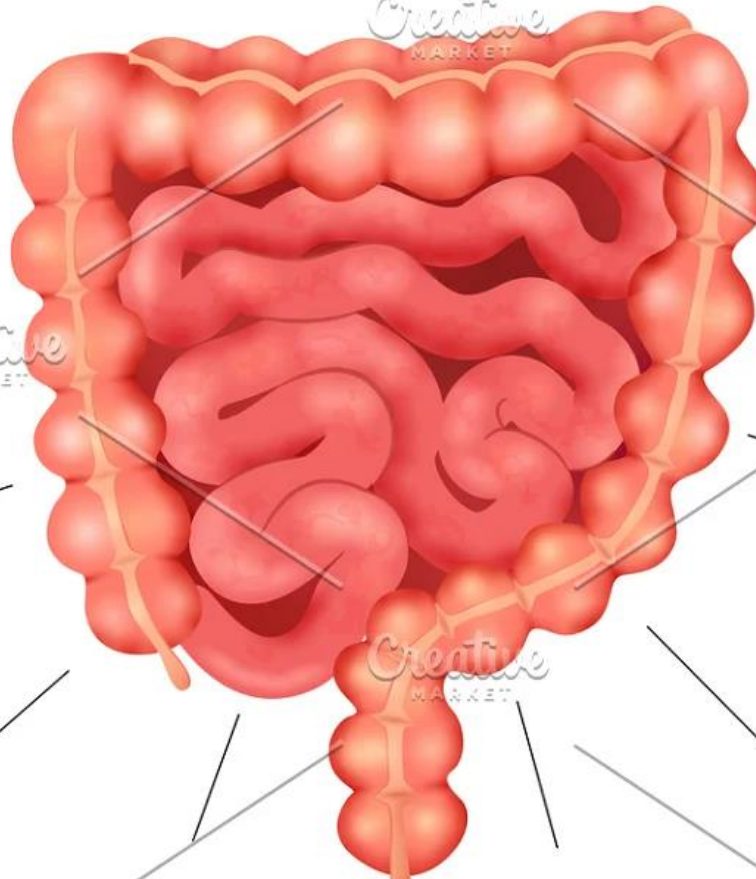
LACTOBACILLUS  
BULGARICUS



ESCHERICHIA COIL



STAPHYLOCOCCUS

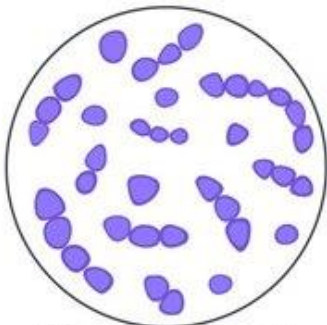




# Normal Flora



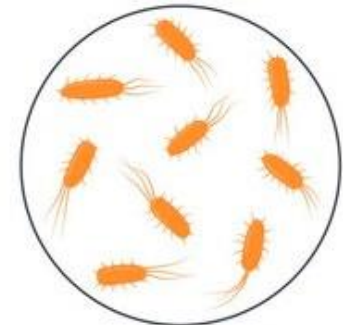
Bifidobacterium



Enterococcus Faecalis



Lactobacillus



Escherichia coli

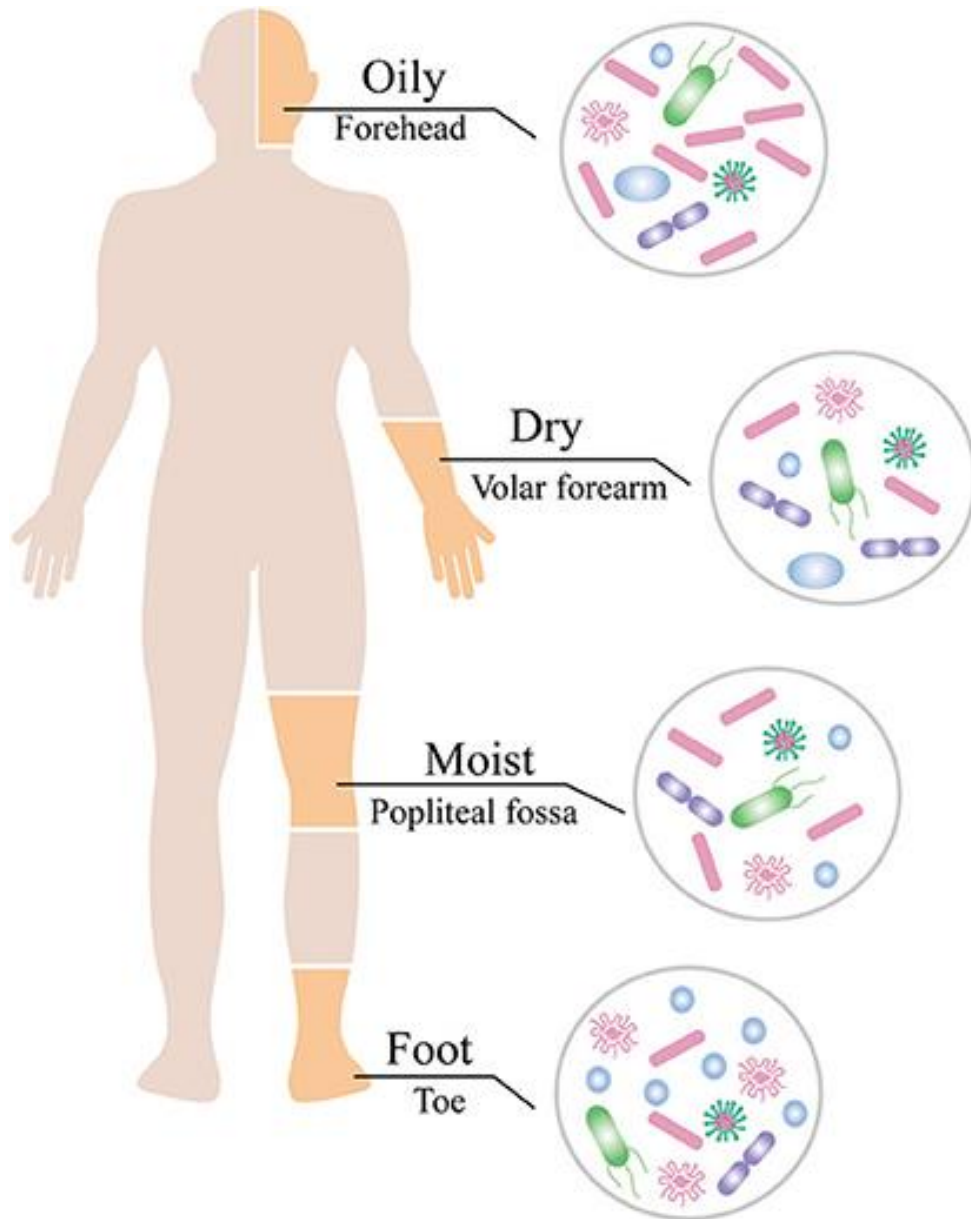
## *Important functions of the gut microflora for the organism*

- Digestion and absorption of nutrients
- Metabolism of xenobiotics<sup>1</sup> and endogeneous<sup>2</sup> toxins
- Direct inhibition of pathogens
- Epithelial function
- Action on the immune system within the gut

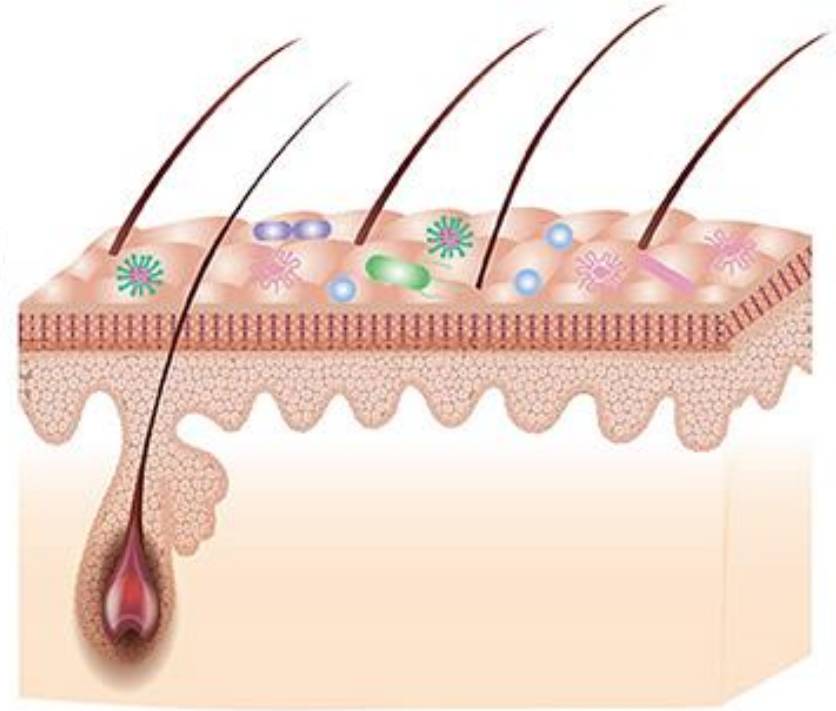
<sup>1</sup> Is a chemical which is found in an organism but which is not normally produced or expected to be present in it

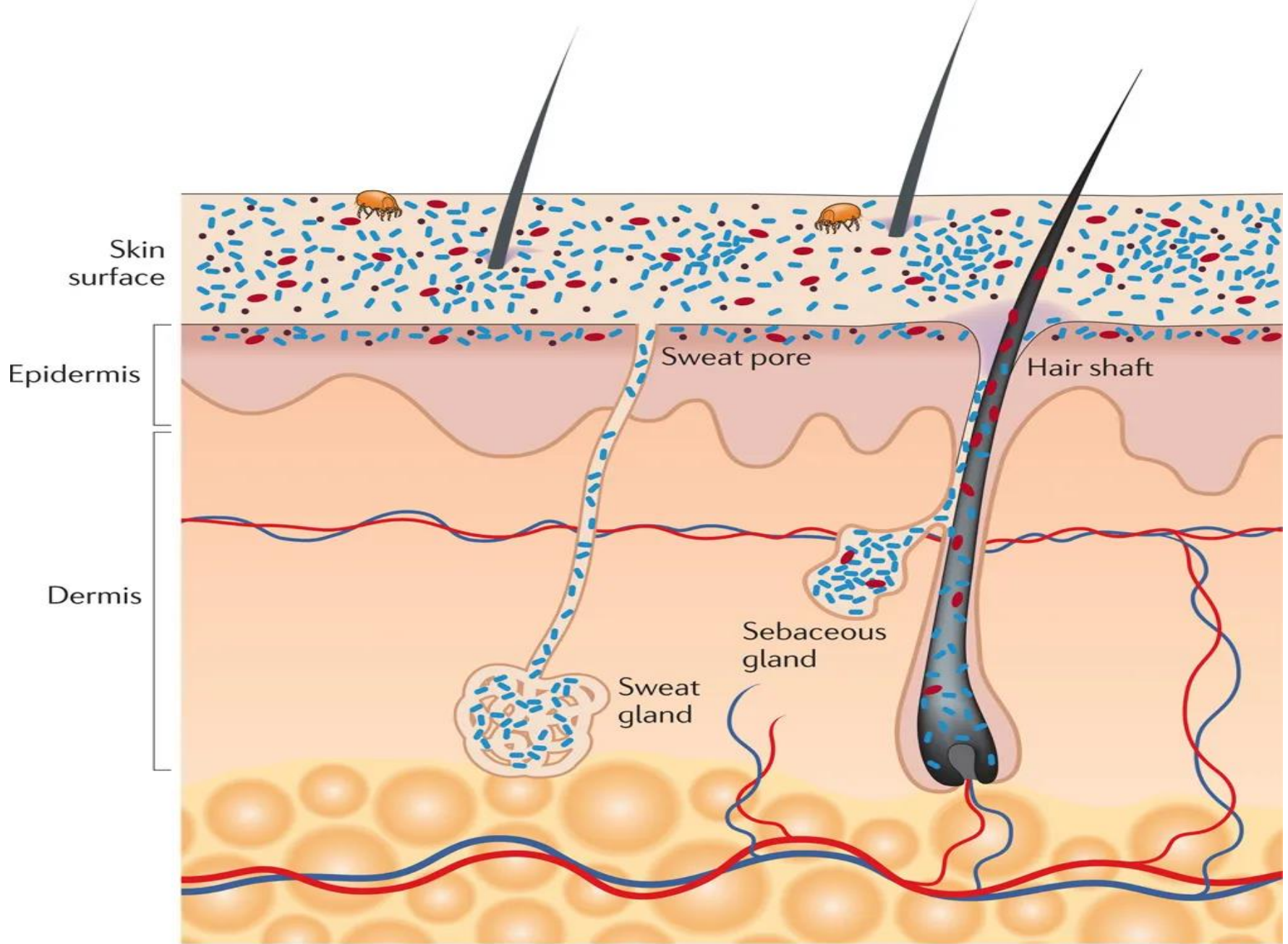
<sup>2</sup> Produced within or caused by factors within the organism.



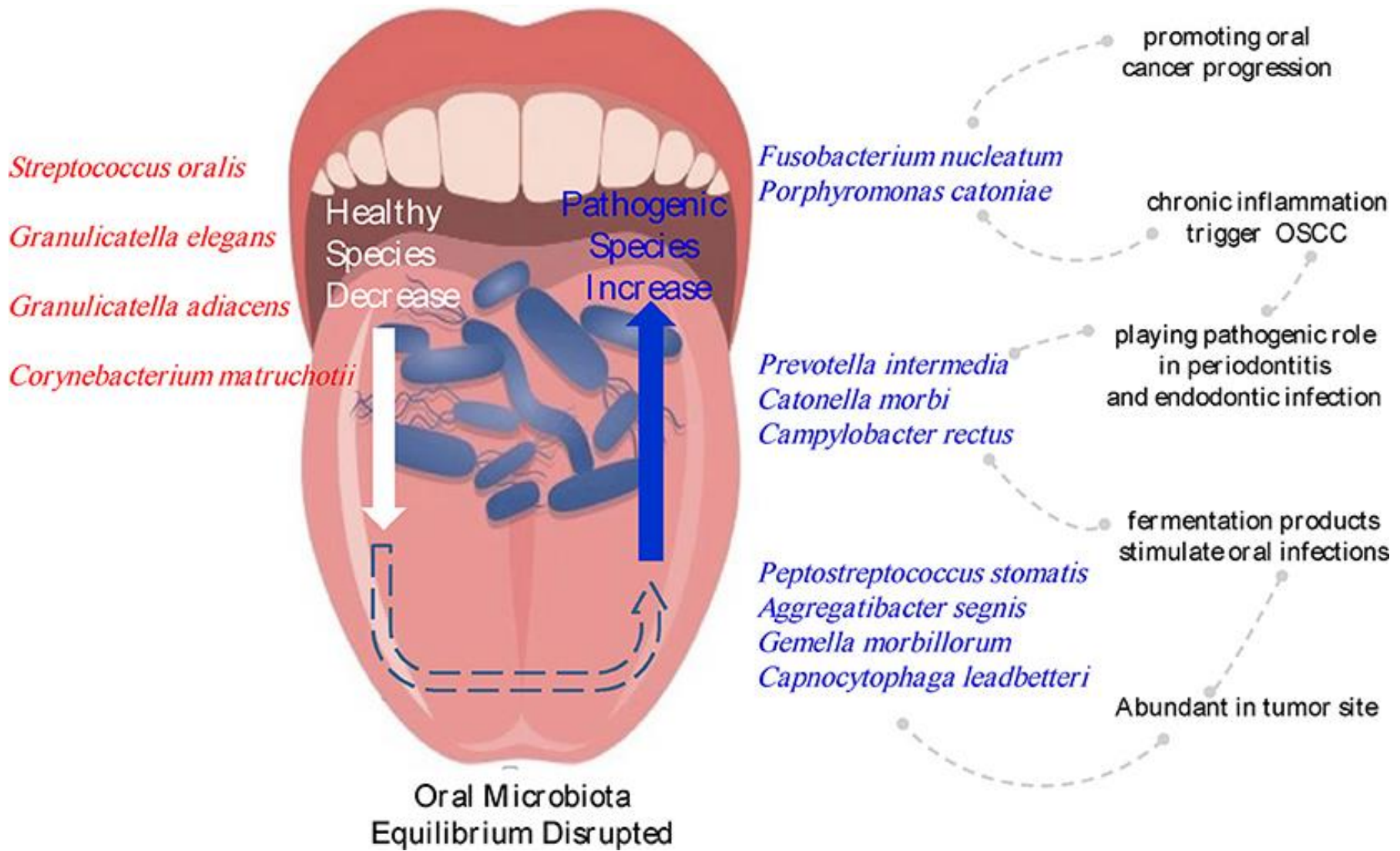


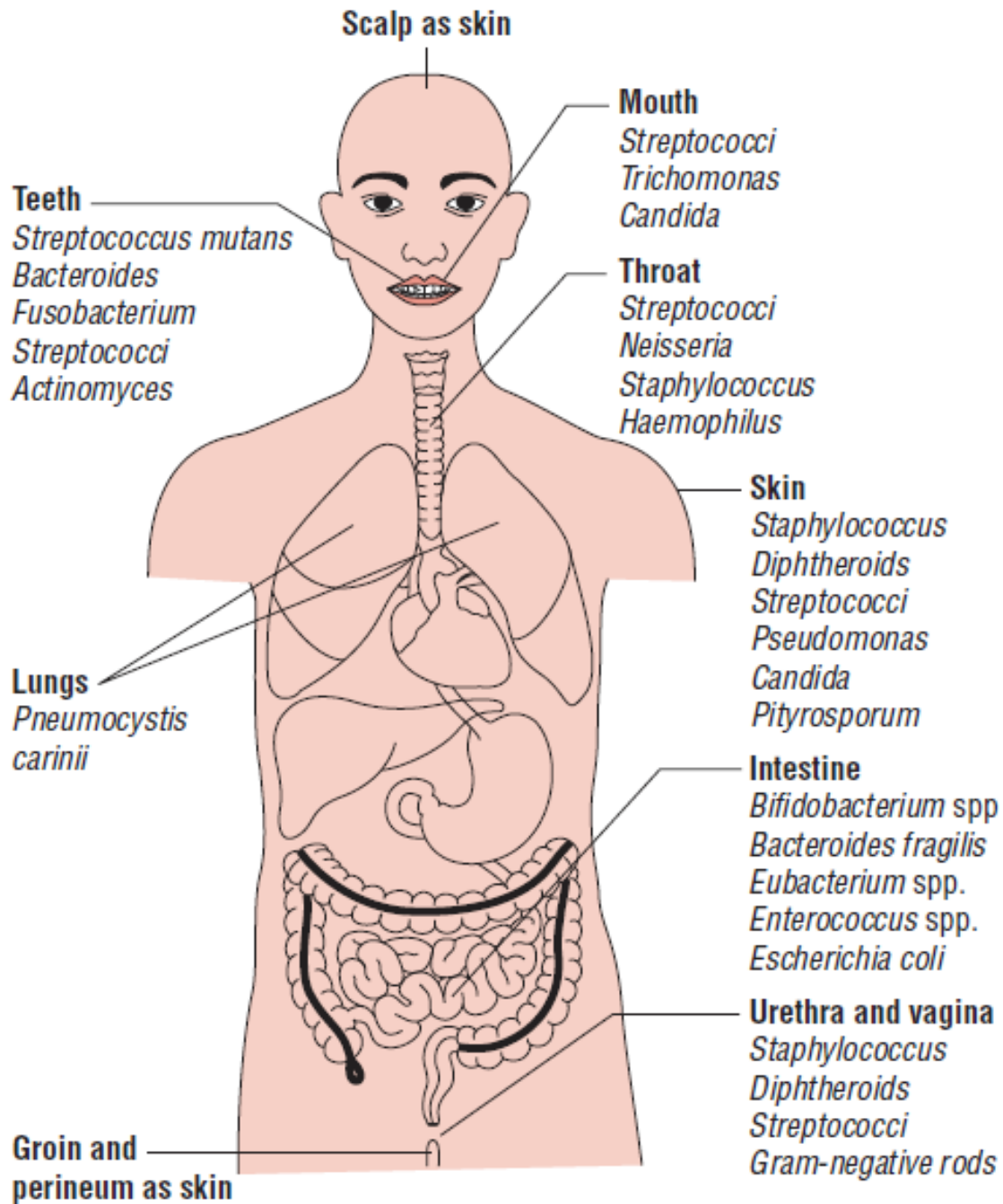
## Human skin landscape





● Virus    ● Bacterium    ● Fungus    🐛 Mite





Sites of microbial flora.

