

# Basic Microbiology Part 2



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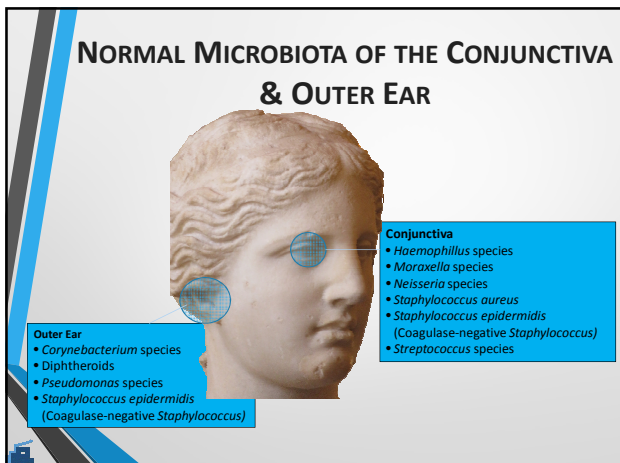
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# Basic Microbiology Part 2

## NORMAL MICROBIOTA OF THE MOUTH, NOSE, OROPHARYNX

- *Acinetobacter* species
- *Actinomyces* species
- *Bacteroides* species
- *Candida albicans*
- *Corynebacterium* species
- *Fusobacterium* species
- *Haemophilus* species
- *Lactobacillus* species
- *Leptotrichia* species
- *Moraxella* species
- *Mycoplasma* species
- *Neisseria* species
- *Peptostreptococcus* species
- *Staphylococcus aureus*
- *Staphylococcus epidermidis* (Coagulase-negative *Staphylococcus*)
- *Streptococcus pneumoniae*
- *Streptococcus* species
- *Veillonella* species



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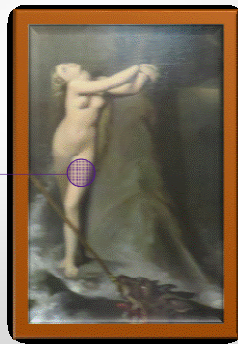
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## NORMAL MICROBIOTA OF THE SKIN

- *Bacillus* species
- *Candida* species
- *Corynebacterium* species
- Diphtheroids
- *Micrococcus* species
- *Mycobacterium* species
- *Pityrosporum ovale*
- *Propionibacterium acnes*
- *Staphylococcus aureus*
- *Staphylococcus epidermidis* (Coagulase-negative *Staphylococcus*)
- *Streptococcus pyogenes*
- *Streptococcus* species



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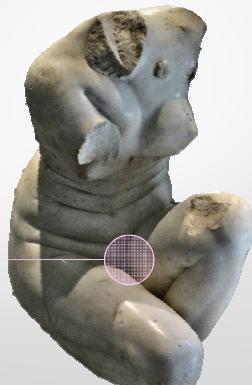
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## NORMAL MICROBIOTA OF THE VAGINA

- Alpha-hemolytic *Streptococcus*
- *Bacteroides* species
- *Streptococcus* species
- Diphtheroids
- *Candida albicans*
- *Candida* species
- *Clostridium* species
- *Lactobacillus* species
- *Gardnerella vaginalis*
- *Peptostreptococcus* species
- *Staphylococcus epidermidis* (Coagulase-negative *Staphylococcus*)
- Yeast



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# Basic Microbiology Part 2

## NORMAL MICROBIOTA OF THE GI TRACT

### Large and Small Intestine

- *Achromobacter* species
- *Acinetobacter calcoaceticus*
- *Actinomyces* species
- *Aeromonas* species
- *Bacillus* species
- *Bacteroides* species
- *Clostridium* species
- *Enterococcus* species
- *Enterobacteriaceae*
- *Escherichia coli*
- *Flavobacterium* species
- *Fusobacterium* species
- *Klebsiella* species
- *Lactobacillus* species
- *Mycobacterium* species
- *Peptostreptococcus* species
- *Proteus* species
- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
- *Streptococcus viridans*
- *Vibrio* species
- *Yersinia enterocolitica*

### Stomach

- *Clostridium sordellii*
- *Lactobacillus* species
- *Peptostreptococcus* species
- *Streptococcus* species
- *Staphylococcus aureus*



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## NORMAL MICROBIOTA OF THE URETHRA



- *Bacillus* species
- *Bacteroides* species
- *Candida albicans*
- *Corynebacterium* species
- *Diphtheroids*
- *Fusobacterium* species
- *Mycobacterium* species
- *Peptostreptococcus* species
- *Staphylococcus aureus*
- *Staphylococcus epidermidis*  
(Coagulase-negative *Staphylococcus*)
- *Streptococcus* species

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## Pathogens



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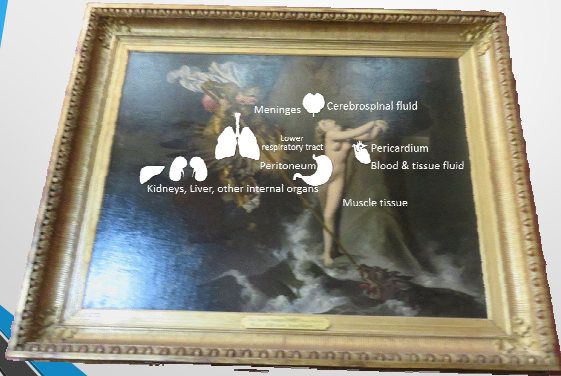
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# Basic Microbiology Part 2

## NO NORMAL FLORA – STERILE SITES



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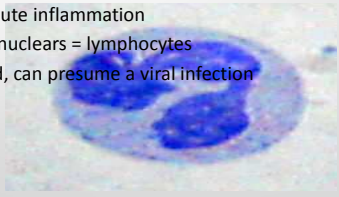
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## DEFINITIONS

WBC = white blood cells = leukocytes

- Major types of WBC
  - PMN, Polys = polymorphonuclear leukocytes
    - If elevated, likely to indicate bacterial infection
  - Segs, Neuts = segmented neutrophils – are the landmark of acute inflammation
  - Lymphs/mononuclears = lymphocytes
    - If increased, can presume a viral infection



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## COMMON LOWER RESPIRATORY PATHOGENS

*Streptococcus pneumoniae*

- Primarily community acquired infection (CAP)
- Uncommon as HAI pneumonia

*Haemophilus influenzae*

- Primarily CAP

*Pseudomonas aeruginosa*

- Often ventilator or ICU related

*Moraxella catarrhalis*

- Most often CAP, but can be HAI

*Staphylococcus aureus*

- CAP and HAI
- High mortality, must be recognized quickly



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## BLOOD CULTURES

- A single blood culture consists of two bottles:
  - Bottles are designed to recover aerobes (blue) and anaerobes (red)
- If ordered "blood cultures x2" they should be drawn 15-30 minutes apart
  - Irrelevant which bottle has growth or if both or only one bottle has growth
- If other lab tests ordered for same time, make certain the blood cultures are drawn first



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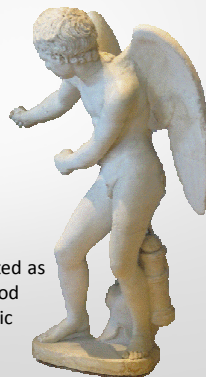
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## BLOOD CULTURE CONTAMINANTS

- Coagulase negative staph
- Diphtheroids
- Bacillus
- Propionibacteria
- Viridans strep
- Aerococcus
- Micrococcus

For these bacteria to be interpreted as causing infection, two sets of blood cultures are required PLUS specific signs and symptoms (fever)



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## COMMON UTI PATHOGENS



- Gram negatives
  - *E. coli*: causes 80% of all UTIs
  - *Proteus*, *Klebsiella*, *Enterobacter*, *Pseudomonas*, *Gardnerella*, 5-10%
- Gram Positives
  - MRSA, *Enterococcus*, *Staph saprophyticus*, 10-20%
- Positive leukocyte esterase and/or nitrite positive on UA can be helpful in determining infection status
- Remember, presence of an organism in the urine may not be infection, may be colonization

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# Basic Microbiology Part 2

## URINE COLONIZATION IN LTC RESIDENTS

Up to 38% of male residents

Up to 57% of female residents

Simao L, Bahr GT. Urinary tract infections in older adults residing in Long-term care facilities. Ann Longterm Care. 2012 Apr; 20(4): 33-38

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## CLINICAL MICROBIOLOGY

**Physician's perspective:**

- What's growing?
- What antibiotic can be used?
- Determine either by predictive value of the organism type (i.e., gram negative or positive bacillus) or by completed result with sensitivities

**IP or Epidemiologist's perspective:**

- Conduct Surveillance
  - Need both the organism's genus and species (i.e., *Pseudomonas aeruginosa*) and sensitivity pattern
  - Microbiology results used to detect clusters/outbreaks and assessing for trends

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## RULE OF THUMB #1

Keep in mind that **no lab test is 100% accurate 100% of the time!**

- Interpret all results carefully
- Compare results to clinical condition of the resident
- Diagnosis of infection is based on clinical condition of resident and laboratory findings

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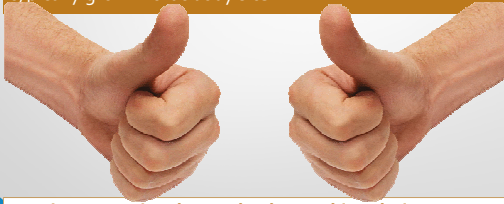
# Basic Microbiology Part 2

## RULE OF THUMB #2

For normally sterile body sites, growth on cultures may indeed be an infection

Interpret all cultures knowing what pathogens would typically grow in that body site

*Just because a bug is growing in a resident it does not mean it's causing disease – it could mean colonization*



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## COMMON BOWEL FLORA

- Normal mix of bacterial flora keeps numbers of yeast, *C. difficile* and other potential pathogens in the gut in check
  - With altered flora (which can happen with antibiotic treatment)
    - Yeast can proliferate
    - *Clostridium difficile* can proliferate
    - *Pseudomonas* can proliferate
    - VRE can proliferate
    - Etc., etc., etc.

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## COMMON PATHOGENS OF SUPERFICIAL SURGICAL SITE INFECTIONS (SSI)



- Not usually caused by anaerobes
- Generally skin flora, but not necessarily
- Can be gram negative rods (GNR)

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## DID YOU ALSO KNOW?

- Studies have found that 25-75% of all antibiotics used, both systemic and topical, were unnecessary or used inappropriately<sup>1</sup>
- 50-70% of residents in LTC will receive an ATB during the year<sup>1</sup>



<sup>1</sup>Nimelle Stone, MD, MS, "Managing MOROs in LTCF: Practical Tips for Preventing Transmission," December, 15, 2011

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## ROLE OF MICROBIOLOGY IN HAI PREVENTION

Critical for:

- Infection surveillance
- Interpretation of microbiological results
- Knowledge of new microbes or unusual resistance patterns
- Create antibiograms for design of antibiotic formulary
- Education of health care staff
- Outbreak management and investigation
- Performing additional tests for epidemiologic analyses

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## ROLE OF MICROBIOLOGY IN HAI PREVENTION



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# Basic Microbiology Part 2



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