

Environmental plate

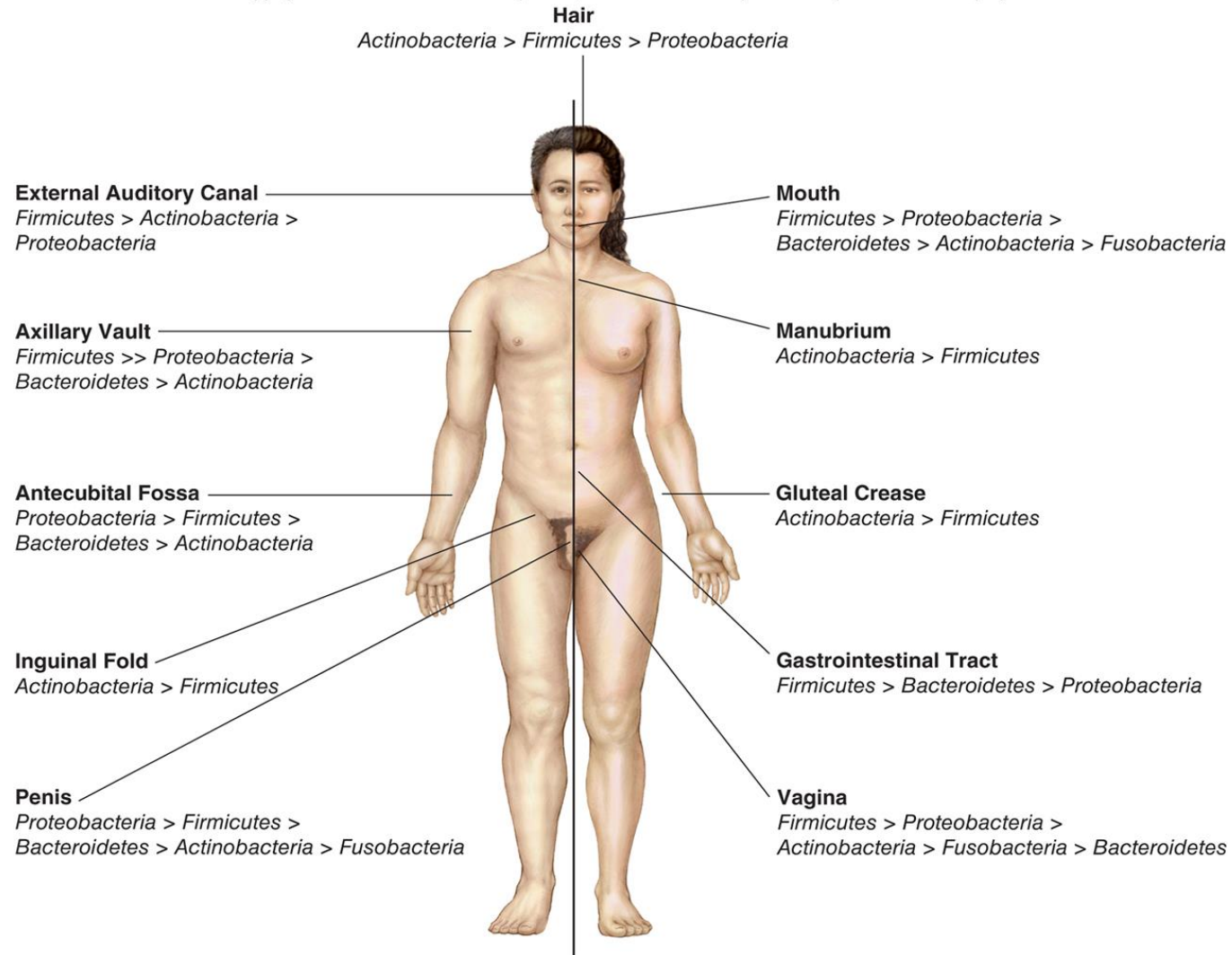
Lab 2 BIOL 230

Microorganisms

- Microorganisms can be found on/in all environments. They are also associated with living organisms and can be found on their surface, secretions, and waste.
- There are organisms adapted to live under all types of conditions (high salinity, low/high pH, low/high temperature)

Microbiome (Microbial flora)

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Skin

- Commensal microbes include both resident and transient microbiota
- Mechanically strong barrier
- Inhospitable environment
 - slightly acidic pH
 - high concentration of NaCl
 - many areas low in moisture
- Inhibitory substances (e.g., lysozyme, cathelicidins)

Nose and Nasopharynx

- *Staphylococcus aureus* and *S. epidermidis*
 - predominant bacteria present
 - found just inside nostrils
- Nasopharynx may contain low numbers of potentially pathogenic microbes
 - e.g., *Streptococcus pneumoniae*, *Neisseria meningitidis*, and *Haemophilus influenzae*

Respiratory Tract

- No normal microbiota
- Microbes moved by:
 - continuous stream of mucous generated by ciliated epithelial cells
 - phagocytic action of alveolar macrophages
 - lysozyme in mucus

Mouth

- Contains organisms that survive mechanical removal by adhering to gums and teeth
 - contribute to formation of dental plaque, dental caries, gingivitis, and periodontal disease
- Within hours of birth, the oral cavity is colonized by microorganisms from the surrounding environment

Stomach

- Most microbes killed by acidic conditions
 - some survive if pass through stomach very quickly
 - some can survive if ingested in food particles

Small Intestine

- Divided into three areas
 - duodenum
 - contains few organisms
 - jejunum
 - ileum
 - flora present becoming similar to that in colon
 - pH becomes more alkaline

Large Intestine (Colon)

- Largest microbial population of body
 - eliminated from body by peristalsis, desquamation, and movement of mucus
 - replaced rapidly because of their high reproductive rate
 - most of the microbes present are anaerobes
 - *Bacteroides thetaiontaomicron*
 - colonizes exfoliated host cells, food particles, and sloughed mucus

Genitourinary Tract

- Kidneys, ureter, and bladder
 - normally free of microbes
- Distal portions of urethra
 - few microbes found
- Female genital tract
 - complex microbiota in a state of flux due to menstrual cycle
 - acid-tolerant lactobacilli predominate

Nosocomial Infections

- Infections acquired in hospitals 48 hours (or more) after admission .
- Often caused by MRSA, VRE, *Candida*, Gram negative bacilli.
- Extends period of hospitalization, cost of care, use of antibiotics.
- Severity of the infection depends on what was the primary cause of hospitalization.

Case study 1

- A 67 yo female with poorly controlled hypertension was admitted because of a right-sided stroke. She had confusion, limitation of mobility of her left leg, and urinary incontinence. A urinary (Foley) catheter was placed and she was evaluated for rehabilitation.
- 4 days later she developed a temp to 103° F and blood pressure of 90/60 and was transferred to the ICU. Blood and urine cultures grew resistant *Klebsiella*.

Case study 1

- Up to 25% of hospitalized patients are catheterized at some time during their hospital stay. 15% colonized (bacteruria)
 - 5-10% per day of catheterization
 - 50% after 14 days
- Frequent cause of infection Gram negative bacilli and (*E. coli*, *Klebsiella*, *Enterobacter*, *Pseudomonas*, *Serratia*, *Acinetobacter*) antibiotic resistance to broad spectrum ampicillin, cephalosporins, aminoglycosides, quinolones.

Nosocomial UTI prevention

- Avoid catheterization if possible.
 - minimize duration of catheterization
 - intermittent (“in and out”) catheterization
- aseptic insertion technique
- silver-coated catheters

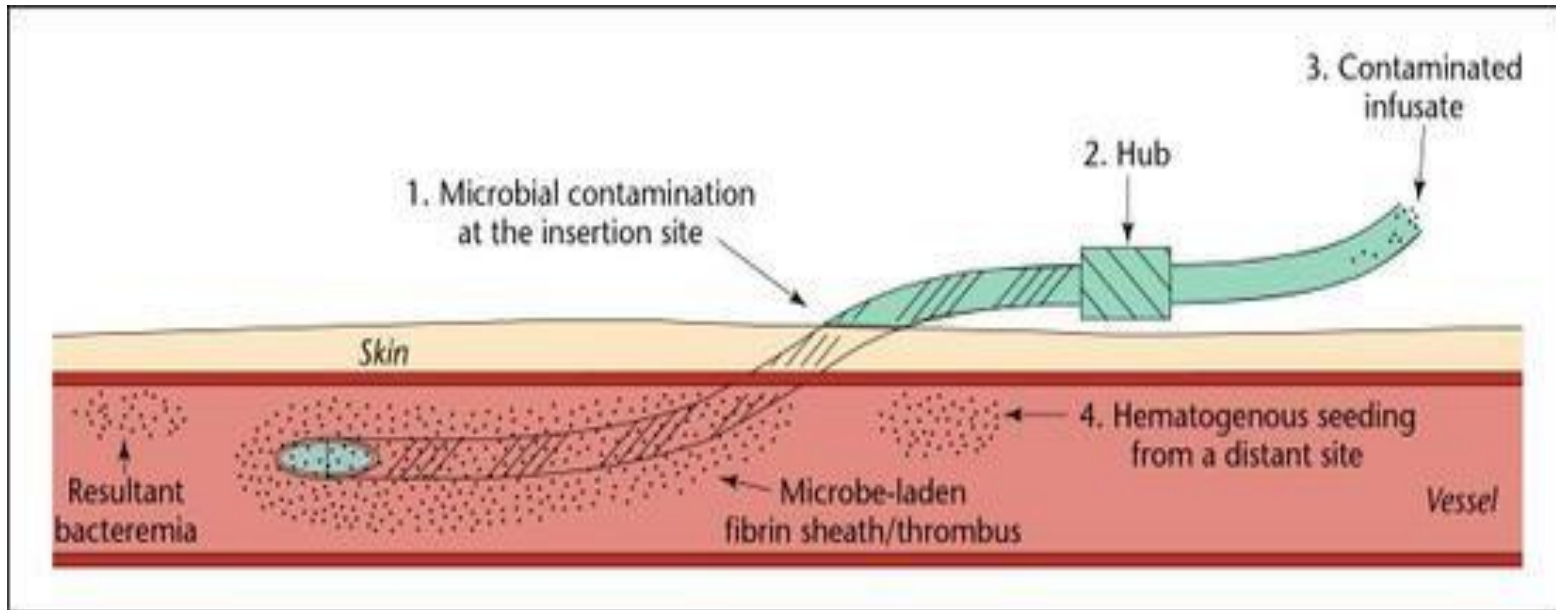
Case study 2

- A 45 yo male is admitted for community-acquired pneumonia. He has a long history of iv drug use, but has not used in several years. The intern has difficulty starting a peripheral iv so places a femoral venous catheter. His cough and fever begin to improve.
- On hospital day 3 he has fever, chills and a WBC of 18,000. Blood cultures are positive for vancomycin-resistant *Enterococcus*

Case study 2

- Vascular Device-Associated Bacteremia
- major cause of morbidity and mortality in hospitalized patients
- estimated 50,000-100,000 intravascular device- related bacteremias in U.S./year
- – non-cuffed central venous catheters account for 90% of vascular catheter- related bacteremias .

Case study 2



Prevention

- minimize duration of catheterization
- meticulous insertion technique
 - drapes, gown/gloves/mask
- antibiotic impregnated catheters
- impregnated dressing (Biopatch)

Other possible types of nosocomial infections

- Ventilator-associated pneumonia
- Surgical Site Infection (SSI)

Good practice

- routinely consider all body fluids and moist surfaces as potentially infectious
- airborne precautions
- droplet precautions
- contact precautions

Handwashing

- **most important means to prevent spread of nosocomial pathogens**
- Example from culture of medical personnel samples:
- random sample 45% Gram Negative bacilli
11% *S. aureus*

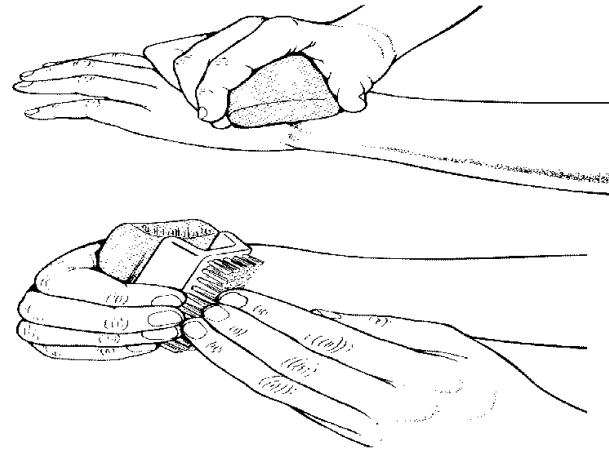
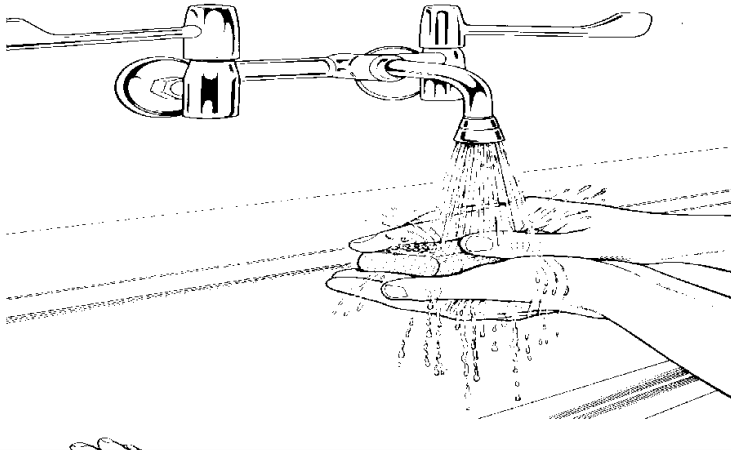
Operating rooms

- **Anyone entering the operating room, for whatever reason, should first put on:**
 - **Clean clothes**
 - **An impermeable mask to cover the mouth and nose**
 - **A cap to cover all the hair on the head and face**
 - **A clean pair of shoes or clean shoe-covers.**
- **Caps, gowns and masks are worn to decrease the risk of patient exposure to contamination or infection from the surgical team.**
- **Sterile instruments, gloves and drapes are also key elements in the fight against contamination.**

Operating room - counting

- **Count supplies (instruments, needles and sponges)**
 - before beginning a case
 - before final closure
 - on completing the procedure
- **Aim is to ensure that materials are not left behind or lost.**
- **Pay special attention to small items and sponges**
- **Create standard list of equipment for use as a checklist.**
- **Also make a check list of the instruments for a specific case.**

Scrubbing



Scrubbing

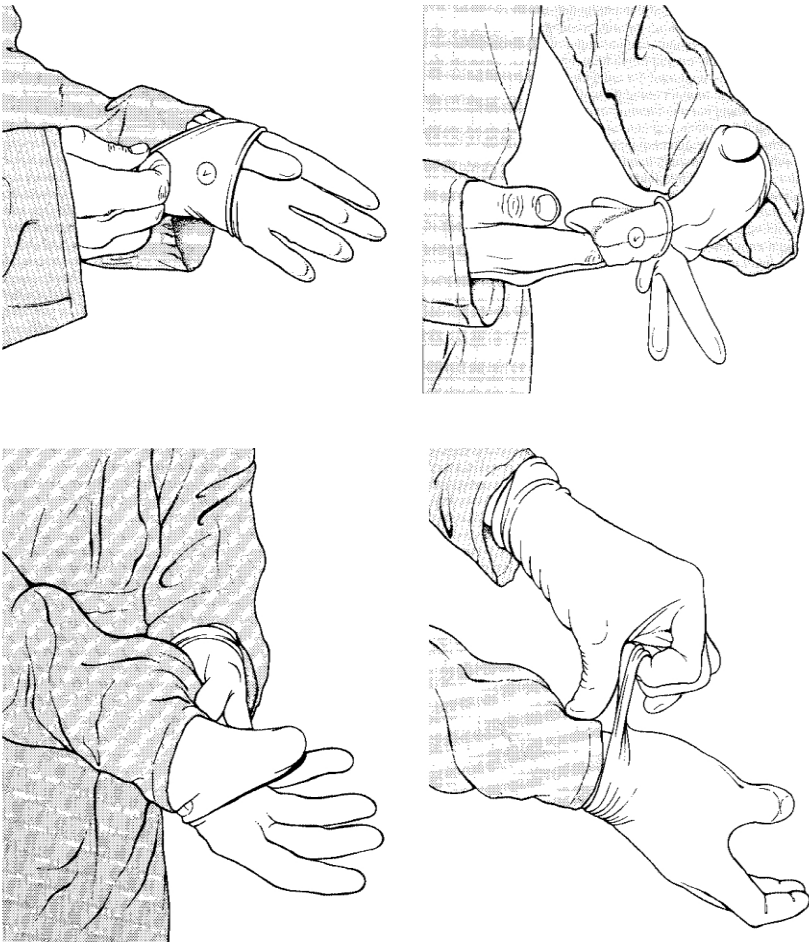


Figure 2.5

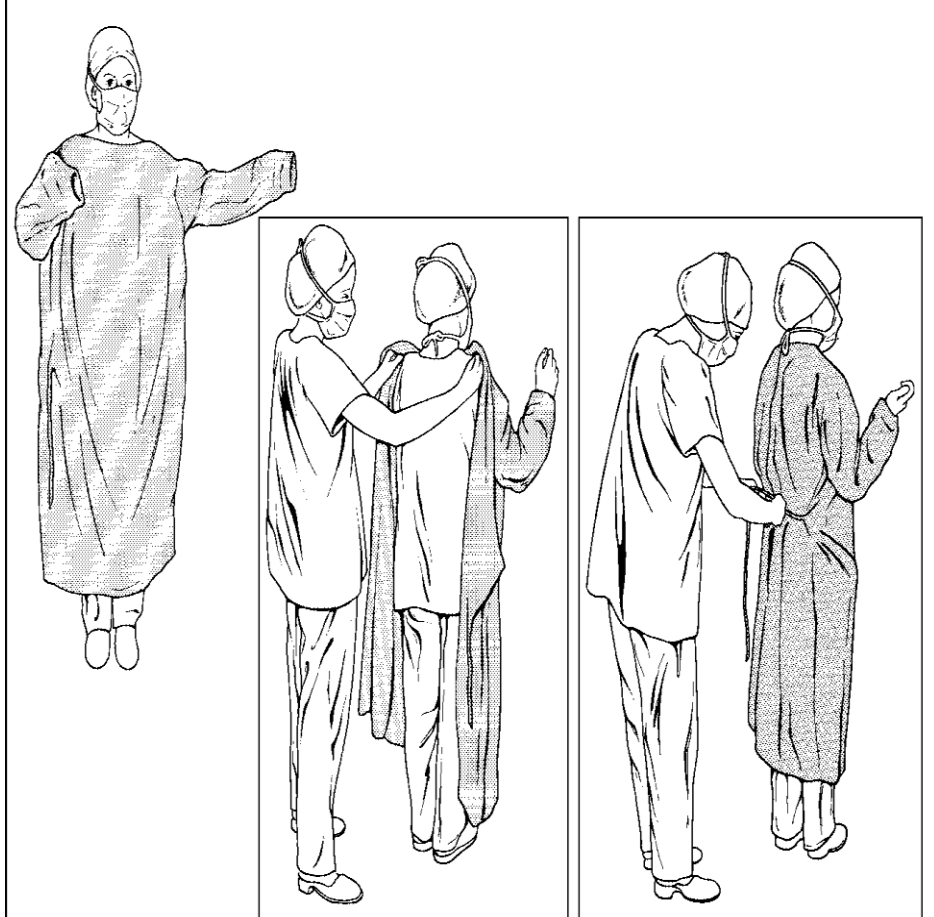


Figure 2.6