2019

APIC Applied Learning Conference

APIC EDUCATION

Microbiology and the IP

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APIC
Association for Professionals in Infection Control and Epidemiology

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DISCLOSURES

- Sharon Williamson – No disclosures

Objectives

- Identify multi-drug resistant organisms (MDRO) from microbiology susceptibility reports.
- List 4 types of methodologies used for organism identification and susceptibility testing.
- Describe the difference between sensitivity and specificity.
- List examples of normal flora by body site.

How can the Micro Lab help IP?

- **Identification**
  - Surveillance depends upon culture/molecular results
  - Etiologic agent – is it a pathogen or not?
  - Disease stage
  - Treatment (antibiotic susceptibility results)
  - Source of infection
  - Epidemiology
  - Prevention methods

- **Advice**
  - Specimen collection
  - May be able to give you a quick tip for exposure purposes – is this communicable or not?
    - i.e., invasive disease cause by *Neisseria meningitidis*

Specimen Collection and Handling is Key

Collect from purulent material after cleaning wound surface; avoid adjacent skin or tissue

Collect at optimal time (early morning for TB)

Minimize transport time and use preservative if transport is delayed

Collect prior to administration of antibiotic if possible

Collect enough specimen, the correct number of samples and in the appropriate container

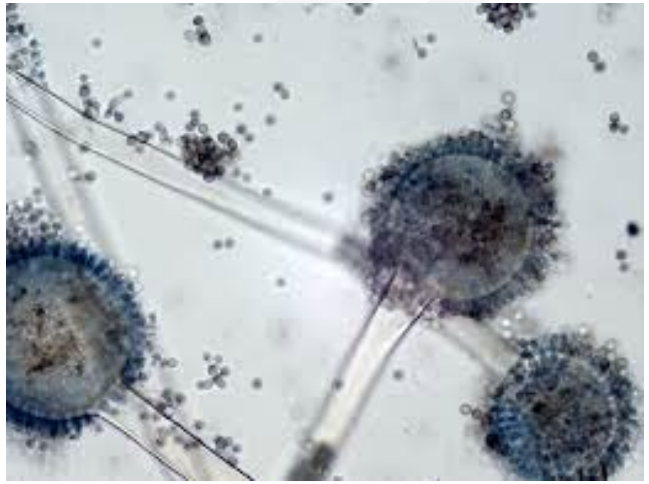
Types of Organisms

- **Bacteria**
  - Free living single-celled organisms
  - Multiply through chromosomal replication and cellular division
  - A group of bacteria forms a colony

- **Parasite**
  - Single-celled organism that lives on or within another organism
  - Two different forms –
    - Trophozoite - feeds, metabolizes and produces effects of disease
    - Cyst – dormant and stable in environment; transmitted between hosts

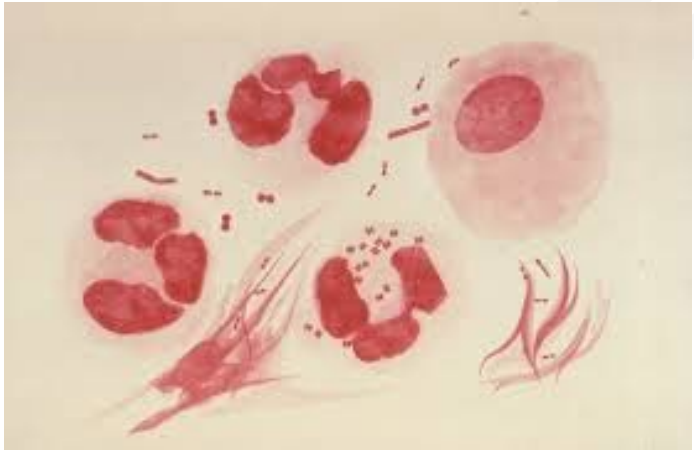
Types of Organisms

- **Fungi – yeast and mold**
  - Yeast reproduce by budding, produce spores, and have a moist, creamy appearance
  - Mold reproduce by elongation and fragmentation of their hyphae (tube-like projections) and have a fluffy, wooly appearance
- **Virus**
  - Obligate intracellular parasites that require living host cells to grow and reproduce
  - Can be made of RNA or DNA plus a protein coat and possibly an envelope made up of viral proteins and host lipid cells
- **Prion**
  - Type of protein that triggers normal proteins in the brain to fold abnormally

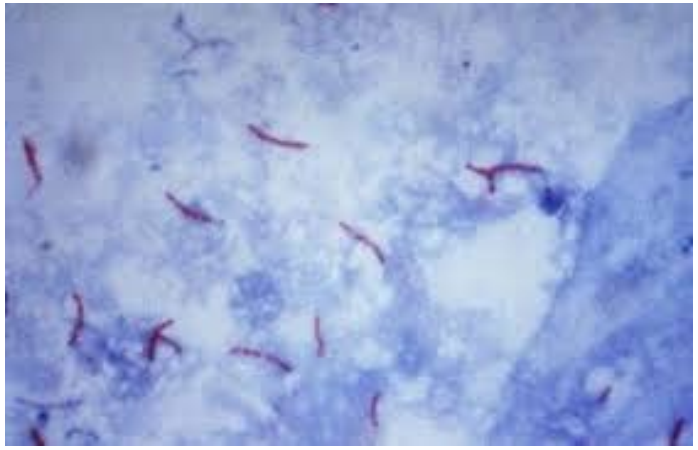


Stains and Microscopy

- **Gram Stain**
  - Stains the cell wall
  - Gram positive vs. gram negative bacteria
  - Visualization of the morphology/shape of the bacteria (cocci, rods, spirochetes, fungal/hyphal elements)
  - Visualization of the presence of white blood cells

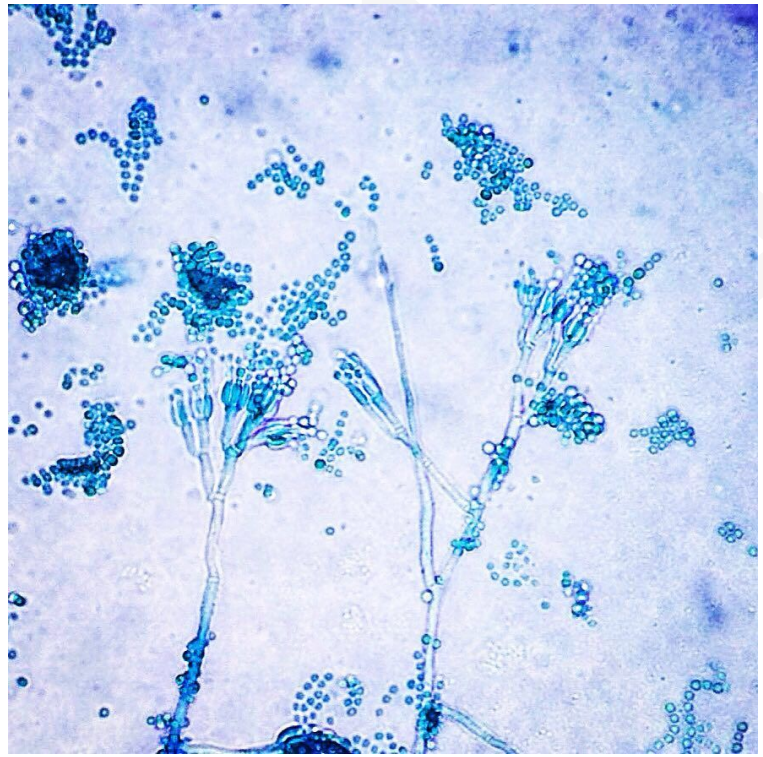


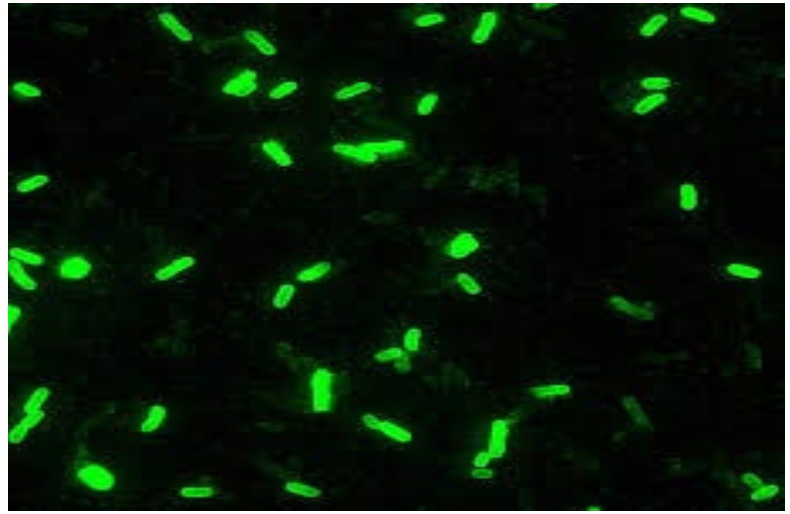
- **Acid Fast Bacilli (AFB) Stain**
  - Stains acid fast bacilli (Mycobacteria) and partially acid fast bacilli (Nocardia)
  - Kinyoun and Ziehl-Neelsen
  - Auramine-Rhodamine (fluorescent)



Stains and Microscopy

- **Wet Prep**
  - Saline mixed with vaginal secretions
  - Used to identify trichomonas and yeast
- **Potassium Hydroxide (KOH)/Lactophenol Cotton Blue**
  - Used to identify fungus
- **Direct Fluorescent Antibody**
  - Fluorescent marker is attached to antibody
  - Fluorescent markers are specific for an organism
  - Helpful to visualize organisms that are difficult to see using other staining techniques





Culture Media

- Nutrient
  - Basic, all-purpose
  - Grows a wide range of organisms
  - Not good for organisms that have specific nutritional requirements (i.e., fastidious organisms)
- Enrichment
  - Contains additional nutrients for fastidious organisms
  - Examples: blood agar, chocolate agar, tryptic soy broth

Culture Media

- Selective
  - Selects for the growth of some organisms while inhibiting the growth of others
  - Examples: MacConkey for Enterobacteriaceae, CNA for gram positives, Lowenstein Jensen for AFB
- Differential
  - Organisms can be recognized by the color of their growth
  - Examples: alpha and beta strep on blood agar, lactose-fermenting Enterobacteriaceae on MacConkey

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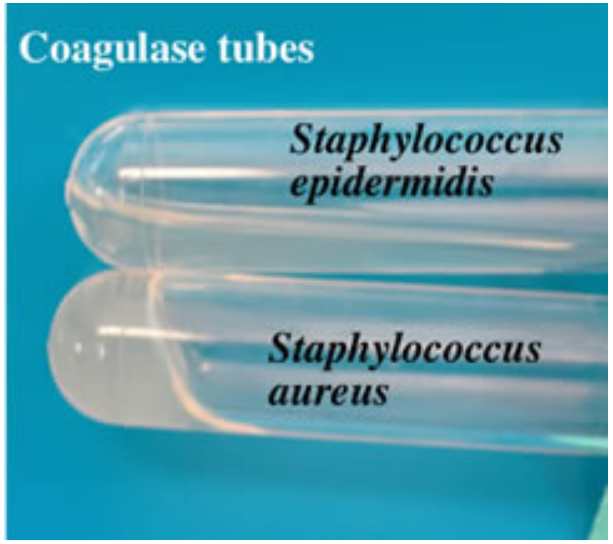
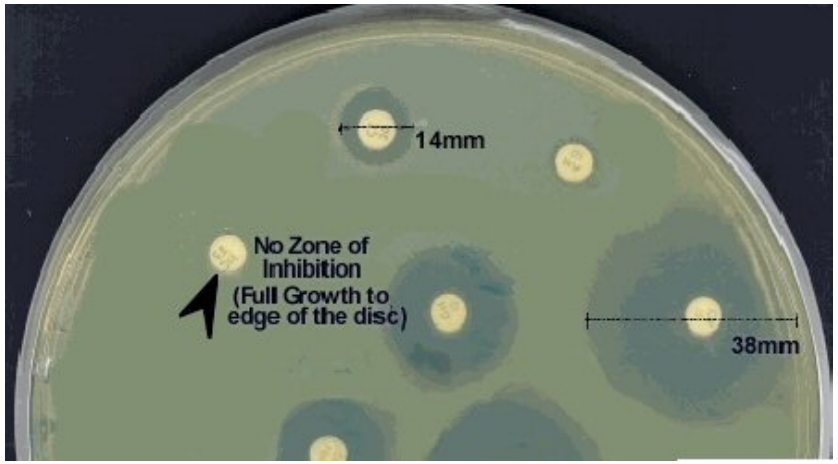
The Future of Specimen Processing, Identification, and Susceptibility

Manual Identification and Susceptibility Testing

- Tube biochemical testing for identification
  - Catalase
  - Coagulase
  - Oxidase
  - Urease
  - Sugar fermentation
- Disk diffusion for susceptibility
  - Kirby-Bauer
  - E-Test





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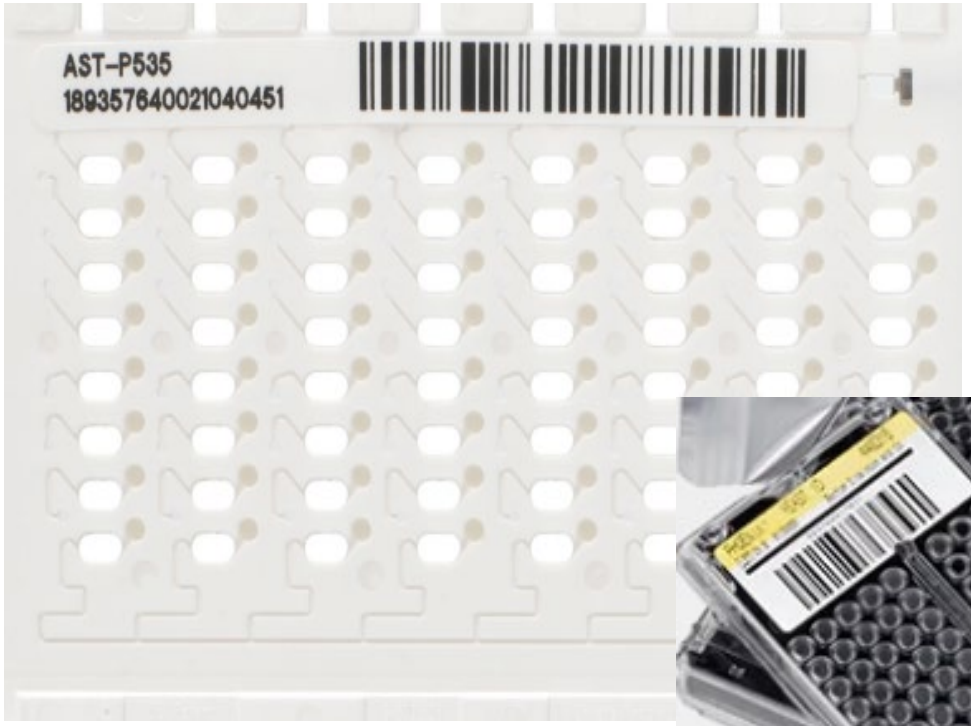
Automated Identification and Susceptibility Testing



Non-Culture Based Technologies

- **Enzyme Immune Assay (EIA) or Enzyme-linked Immunosorbent Assay (ELISA)**
  - Uses an enzyme-labeled antigen/antibody complex to produce a visual result (i.e., color change, line/no line, agglutination)
  - Used to identify RSV, Rotavirus, C. diff, HIV, Group A Strep, Influenza

- **IgM/IgG Serological Testing**
  - Use serum to detect presence of IgM and IgG antibodies
  - Draw “acute” sample during illness and draw “convalescent” sample 2-4 weeks later and look for rise in titers of IgM and IgG
  - IgM=active infection, IgG=past infection (IgGone)

Molecular Technologies

- **Fluorescent *in situ* Hybridization (FISH)**
  - Culture of organism not required
  - Binding of short fluorescence-labeled DNA or RNA probes to chromosome of infectious agents and seen on fluorescent microscopy
  - Not just for Microbiology – used in identification of chromosomal abnormalities, genetic mutations and tumors

- **Polymerase Chain Reaction (PCR)/Nucleic Acid Amplification Test (NAAT)**
  - Culture of organism not required
  - Can identify bacteria, virus, and toxins
  - Short sequences of DNA called primers are used for selective amplification of specific regions of DNA if present
  - Primers bind to and amplify the region's DNA to a level that can be detected by the instrument

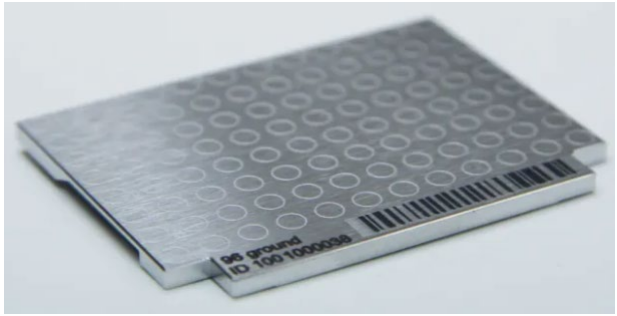
More Molecular Technologies

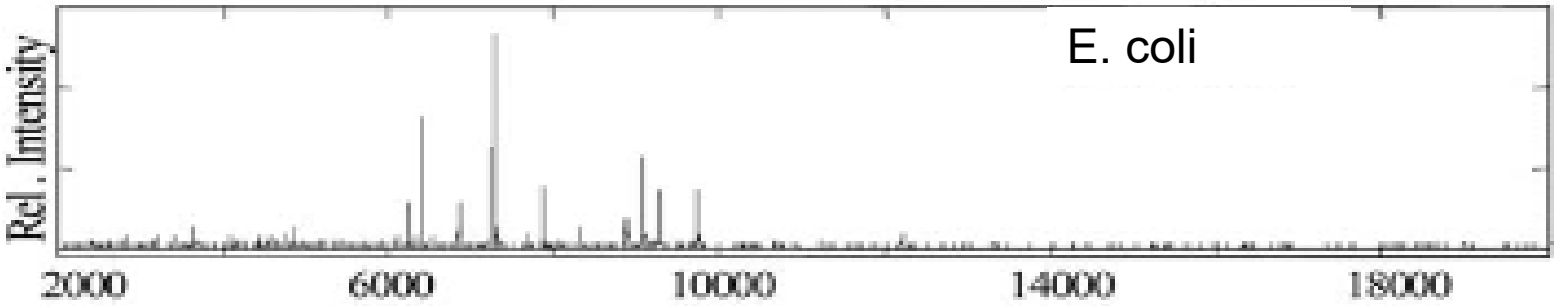
- **Pulse Field Gel Electrophoresis (PFGE)**
  - Culture of organism required
  - Used to determine DNA of a bacterial isolate
  - DNA segments of bacteria are loaded on a gel and exposed to an electric field that separates DNA according to its size. Like banding patterns indicate relatedness of bacteria.

- **DNA Sequencing**
  - Culture of organism may or may not be required
  - All DNA from sample sequenced, human genetic material removed, and remaining non-human DNA compared to a database of thousands of organisms

More Molecular Technologies

- **Matrix-Assisted Laser Desorption Ionization-Time of Flight (MALDI-TOF)**
  - Culture of organism required
  - Bacteria fixed to a crystalline matrix on a slide and bombarded by laser
  - Molecules vaporize into a vacuum while being ionized
  - Mass spectrometry (TOF) separates ions by mass to charge ratio and measures the ratio by the time it takes the ions to reach a detector
  - Mass spectral fingerprint is generated and compared to fingerprints in the computer database





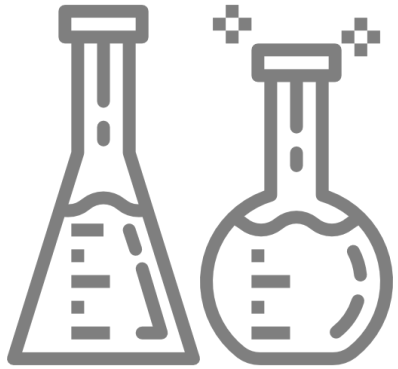
Comparison of Methodologies

Methodology	Advantages	Disadvantages
Conventional biochemicals	• Sensitive • Inexpensive	• Time-consuming • 24-48 hours for result
Immunology/Serology	• Faster than conventional biochemicals • Detects organisms and toxins	• Not as specific, rapid, or sensitive as molecular • Require large amounts of antigen • Developed for a small number of organisms
FISH	• Rapid detection and identification from slides of specimens • Ease-of-use of conventional staining combined with specificity of molecular	• Limited availability of specific antigens for organism detection

Comparison of Methodologies

Methodology	Advantages	Disadvantages
PCR	• Specific, sensitive, rapid and accurate • Closed system reduces risk of contamination • Detects multiple pathogens simultaneously	• Expensive • Specially trained laboratory personnel required • Meticulous cleaning required to prevent contamination
DNA Sequencing	• Gold standard for organism identification • Can identify fastidious and uncultivable organisms	• Expensive • Specially trained laboratory personnel required • Powerful interpretation software required
MALDI-TOF	• Fast • Accurate • Less expensive than molecular	• High initial equipment cost • Organism identification requires fingerprint already in database

Sensitivity and Specificity



Sensitivity

- The ability of a test to correctly identify those with the disease (the true positives)
- Low sensitivity = false negatives

Specificity

- The ability of a test to correctly identify those without the disease (the true negatives)
- Low specificity = false positives

Sensitivity and Specificity Quiz

If a test is performed on 100 people with C. diff and the test has a 90% sensitivity, how many people will be incorrectly identified as negative for C. diff?

A. 90

B. 10

C. 0

Sensitivity and Specificity Quiz

If a test is performed on 100 people without Hepatitis C and the test has a 60% specificity, how many people will be incorrectly identified as positive for Hepatitis C?

A. 40

B. 60

C. 0

C. difficile Testing

Test	Sensitivity	Specificity
EIA Toxin A/B	75-80%	97-98%
EIA Glutamate Dehydrogenase (GDH)	95-100%	70-80%
EIA GDH + Toxin A/B	95-100%	97-98%
PCR or NAAT	>98%	80-99%
Culture	>95%	80-90%
Cytotoxin Assay	95%	90-95%

What Does C. diff Result Tell You?

- Enzyme Immunoassay toxin (EIA toxin)
  - C diff organism is producing toxin
- Glutamate dehydrogenase/ EIA toxin (GDH/EIA toxin)
  - GDH positive = C diff organism is present
  - EIA toxin positive = C diff organism is producing toxin
- Nucleic acid amplification test (NAAT)
  - NAAT positive = C diff organism is present and contains toxin-producing gene
  - NAAT positive does not tell you whether the organism is producing the toxin, only that it has the capability to produce a toxin
- Cytotoxin Assay
  - Positive = C diff organism is present and is producing the toxin

Matching Quiz

1. Sensitivity
2. Selective media
3. Specificity
4. PCR
5. Kinyoun

A. Stain used to identify AFB

B. Ability of a test to identify the true positives

C. MacConkey agar

D. Ability of a test to identify the true negatives

E. Molecular technology used to identify organisms

Who Am I?

- The next several slides will review most commonly isolated organisms
- Clues will be revealed one at a time until a table raises their hand and guesses the correct answer
- If all the clues have not already been revealed, the remaining clues will be revealed

Who Am I?

- Gram negative rod
- Member of Enterobacteriaceae family
- Normal flora in the gut
- Transmitted fecal-oral route
- Common cause of UTI and Traveler's Diarrhea
- Produces O157:H7 toxin

Who Am I?

- Gram positive cocci in clusters
- Can be pathogenic and frequent colonizer of skin and nares
- Most common gram positive causing healthcare-associated infections (HAI)
- Only coagulase positive species of its genus
- Causes bloodstream infections, pneumonia, and food poisoning

Who Am I?

- Spore-forming gram positive rod
- Difficult to grow in the lab
- Produces a toxin
- Associated with antibiotic use
- Causes colitis and pseudomembranous enterocolitis

Who Am I?

- Gram positive cocci in pairs, chains, or clusters
- Alpha hemolytic, beta hemolytic, or nonhemolytic
- Normal flora in GI tract and female genital tract as well as in the environment
- Opportunistic organism causing UTI, intra-abdominal infections, and endocarditis
- Some species (gallinarum and casseliflavus/flavescens) are intrinsically resistant to Vancomycin and do not require contact isolation precautions

Who Am I?

- Gram negative rod transmitted by contaminated water
- Found in sink traps, hydrotherapy and respiratory equipment
- Smells like grapes or tortillas when growing on agar plate
- Leading cause of respiratory tract HAI
- Other HAI infections include UTI, wound infections and bacteremia, particularly in burn patients
- Common community-acquired infection is “swimmer’s ear”

Who Am I?

- Gram positive cocci in clusters
- Forms biofilm
- Commonly considered normal flora of the skin and mucous membranes
- Causes infections associated with prosthetic devices, UTI, and sepsis
- The most common coagulase negative species of its genus

Who Am I?

- Organism that requires special staining techniques
- Slow-grower (up to 4-6 weeks), although more rapid identification techniques are available
- Exposure occurs through airborne transmission
- Cavitary lesions on chest x-ray are indicative of pulmonary infection

Definitions

- **Normal Flora** –
  - Microbes that are normally present in a particular environment and are found in most people, most of the time; can also be referred to as “common commensals”
  - Coagulase negative Staphylococcus, Streptococcus viridans or alpha Streptococcus
  - Refer to NHSN list of common commensals
- **Pathogen** - an organism that is causing disease
  - Staphylococcus aureus, Escherichia coli, Streptococcus pyogenes (Group A), Neisseria meningitidis
- **Colonization** – when a microbe is present but no disease
- **Contaminant** – microorganism is present due to poor handling or poor specimen acquisition.

Normal Flora

Blood, CSF, Body Fluids, Bone, Deep Tissue, Urine, Bladder, Lower Resp Tract, Sinus, Eye, Inner Ear	• None
Skin, Decubiti, Burns, Abscesses	• Coagulase negative Staph • Staph aureus • Group A Strep • Corynebacterium • Anaerobes, including Propionibacterium acnes

Normal Flora

Vagina, Cervix, female external genitalia

- *Staph aureus*
- Coagulase negative *Staph*
- *Strep* species
- Corynebacterium
- Enterococcus
- Enterobacteriaceae
- Anaerobic gram positive and gram negative

Upper Respiratory Tract

- *Staph aureus*
- Coagulase negative *Staph*
- *Strep* species
- *Neisseria/Moraxella*
- Enterobacteriaceae
- Anaerobic gram positive and gram negative

The ABCs of S, I, and R

- **Minimum Inhibitory Concentration (MIC)** - lowest concentration of an antimicrobial that will inhibit the visible growth of a microorganism
- **Sensitive** – organism is inhibited by the serum concentration of the drug that is achieved by using the usual dosage
- **Intermediate** – organism is only inhibited by the maximum recommended dosage; MIC is near level of antimicrobial that can be safely achieved in vivo; Clinical response not as likely as when MIC is susceptible.
- **Resistant** – organism is not inhibited by the usually achievable serum drug levels

The ABCs of S, I, and R

- **MIC Breakpoint**
  - MIC level at which a drug is sensitive, intermediate, or resistant
  - Published by Clinical and Laboratory Standards Institute (CLSI) and European Committee on Antimicrobial Susceptibility Testing (EUCAST)
  - Requires 3 types of data:
    - a comparison of MICs and zone sizes on a large number of bacterial strains
    - pharmacokinetic and pharmacodynamic data
    - clinical study results obtained during studies prior to FDA approval and marketing of an antibiotic

Intrinsic vs. Acquired Resistance

- **Intrinsic resistance**
  - "Born that way"
  - Resistance is not caused by previous antibiotic exposure or genetic transfer from another resistant organism
  - Generally, organisms that are intrinsically resistant do not require contact precautions
  - Examples: Stenotrophomonas maltophilia, Enterococcus gallinarum, Enterococcus casseliflavus

- **Acquired Resistance**
  - Decreased cell permeability (drug can't get in)
  - Efflux pump (drug pumped out)
  - Enzymatic inactivation of the antibiotic
  - Altered target, modification of the drug receptor site
  - Synthesis of resistant metabolic pathway

Antibiotic Classes – Beta Lactams

Penicillins

- Penicillin G
- Ampicillin
- Amoxicillin
- Nafcillin

Pencillin/beta-lactamase inhibitor

- Ampicillin-sulbactam (Unasyn)
- Amoxicillin-clavulanate (Augmentin)
- Piperacillin-tazobactam (Zosyn)

Antibiotic Classes – Beta Lactams

1st generation Cephalosporins	• Cefazolin (Ancef) • Cephalexin (Keflex)
2nd generation Cephalosporins	• Cefoxitin (Mefoxin) • Cefotetan • Cefuroxime (Zinacef)
3rd generation Cephalosporins	• Cefotaxime (Claforan) • Ceftazidime (Fortaz) • Ceftriaxone (Rocephin)

Antibiotic Classes – Beta Lactams

4th generation Cephalosporin	• Cefepime (Maxipime)
Carbapenems	• Ertapenem • Imipenem • Meropenem • Doripenem

Antibiotic Classes

Fluoroquinolones

- Ciprofloxacin
- Moxifloxacin
- Levofloxacin

Aminoglycosides

- Gentamicin
- Tobramycin
- Amikacin

Multi-drug Resistant Organism (MDRO)

- Microorganisms, predominately bacteria, resistant to one or more classes of antimicrobials of antimicrobial agents
- Although the names of certain MDROs describe resistance to only one agent (e.g., MRSA, VRE), these pathogens are frequently resistant to most available antimicrobial agents

https://www.cdc.gov/infectioncontrol/guidelines/mdro/

Beta-lactamase Resistance

Beta- Lactamase

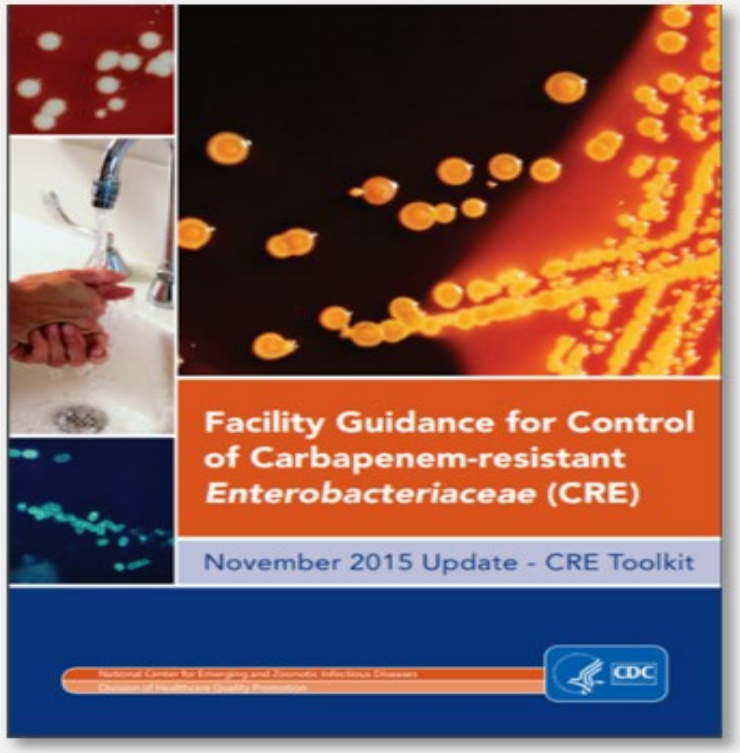
- Organisms produce beta lactamase enzyme that hydrolyzes beta lactam antibiotics
- Causes resistance to beta-lactam antibiotics (penicillins & cephalosporins)

Extended Spectrum Beta-Lactamase

- Causes resistance in extended-spectrum antibiotics (3rd generation cephalosporins and monobactams (aztreonam)
- Do not affect cephamycins (cefoxitin, cefotetan) or carbapenems

Carbapenem Resistance

Carbapenem-Resistant Enterobacteriaceae (CRE)



Enterobacteriaceae that are:

- Resistant to doripenem, meropenem, imipenem, or ertapenem

OR

- Documentation that the isolate possess a carbapenemase

CDC 2015 CRE Toolkit - Guidance for Control of Carbapenem-resistant Enterobacteriaceae (CRE)

MDRO or Not?

Blood Culture	Staph aureus
Drug	Interpretation
Clindamycin	R
Doxycycline	S
Linezolid	S
Oxacillin	R
Tetracycline	S
Trimethoprim/Sulfamethoxazole	S
Vancomycin	S

MDRO or Not?

Urine Culture	>100,000 cfu/ml *E. coli*
Drug	Interpretation
Amikacin	S
Amoxicillin/clavulanate	S
Ampicillin	R
Cefazolin	R
Cefepime	R
Ceftazidime	R
Ceftriaxone	R
Ciprofloxacin	S
Ertapenem	S
Gentamicin	R
Imipenem	S
Levofloxacin	S
Nitrofurantoin	S
Tobramycin	I
Trimethoprim/Sulfa	S

MDRO or Not?

Urine Culture	>100,000 cfu/ml *Klebsiella pneumoniae*
Drug	Interpretation
Amikacin	S
Cefepime	R
Ceftazidime	R
Ceftriaxone	R
Ciprofloxacin	S
Ertapenem	R
Gentamicin	S
Imipenem	I
Levofloxacin	S
Meropenem	S
Nitrofurantoin	R
Tobramycin	S
Trimethoprim/Sulfa	S

MDRO or Not?

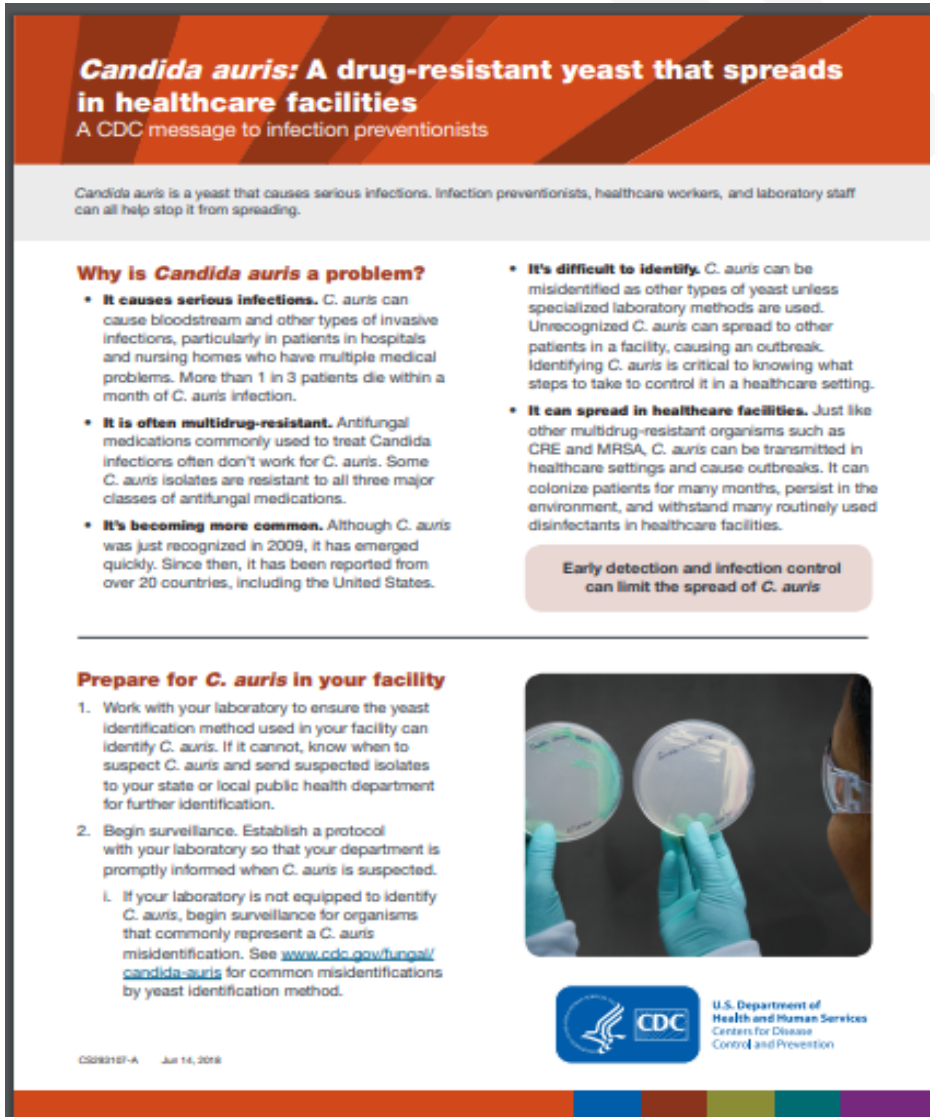
Foot culture	*Acinetobacter baumanii*
Drug	Interpretation
Amikacin	I
Ampicillin/sulbactam	R
Cefepime	S
Ceftazidime	R
Ceftriaxone	R
Ciprofloxacin	R
Ertapenem	R
Gentamicin	I
Imipenem	R
Levofloxacin	I
Meropenem	R
Tobramycin	I
Trimethoprim/Sulfa	R

MDRO or Not?

Urine culture	>100,000 cfu/ml *E. coli*
Drug	Interpretation
Ampicillin	R
Ampicillin/sulbactam	S
Cefazolin	R
Cefepime	S
Ceftazidime	S
Ceftriaxone	S
Ciprofloxacin	R
Gentamicin	S
Levofloxacin	R
Nitrofurantoin	S
Piperacillin/tazobactam	S
Tobramycin	S
Trimethoprim/Sulfa	R

Candida auris – Why It's a Problem

- Often multi-drug resistant
- Difficult to identify in the lab and can be misidentified
- Becoming more common
- Cause of outbreaks in healthcare settings



***Candida auris:* A drug-resistant yeast that spreads in healthcare facilities**

A CDC message to infection preventionists

Candida auris is a yeast that causes serious infections. Infection preventionists, healthcare workers, and laboratory staff can all help stop it from spreading.

Why is *Candida auris* a problem?

- **It causes serious infections.** *C. auris* can cause bloodstream and other types of invasive infections, particularly in patients in hospitals and nursing homes who have multiple medical problems. More than 1 in 3 patients die within a month of *C. auris* infection.
- **It is often multidrug-resistant.** Antifungal medications commonly used to treat Candida infections often don't work for *C. auris*. Some *C. auris* isolates are resistant to all three major classes of antifungal medications.
- **It's becoming more common.** Although *C. auris* was just recognized in 2009, it has emerged quickly. Since then, it has been reported from over 20 countries, including the United States.
- **It's difficult to identify.** *C. auris* can be misidentified as other types of yeast unless specialized laboratory methods are used. Unrecognized *C. auris* can spread to other patients in a facility, causing an outbreak. Identifying *C. auris* is critical to knowing what steps to take to control it in a healthcare setting.
- **It can spread in healthcare facilities.** Just like other multidrug-resistant organisms such as CRE and MRSA, *C. auris* can be transmitted in healthcare settings and cause outbreaks. It can colonize patients for many months, persist in the environment, and withstand many routinely used disinfectants in healthcare facilities.

Early detection and infection control can limit the spread of *C. auris*

Prepare for *C. auris* in your facility

1. Work with your laboratory to ensure the yeast identification method used in your facility can identify *C. auris*. If it cannot, know when to suspect *C. auris* and send suspected isolates to your state or local public health department for further identification.
2. Begin surveillance. Establish a protocol with your laboratory so that your department is promptly informed when *C. auris* is suspected.
   i. If your laboratory is not equipped to identify *C. auris*, begin surveillance for organisms that commonly represent a *C. auris* misidentification. See www.cdc.gov/fungal/candida-auris for common misidentifications by yeast identification method.

CS293107-A Jun 14, 2019

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

https://www.cdc.gov/fungal/candida-auris/pdf/C-Auris-Infection-Factsheet-H.pdf

Candida auris – When do I worry?

- High Risk Patient
  - Received care in post-acute healthcare facility (nursing home), especially those on a ventilator
  - Received care in an area with a history of C. auris transmission (refer to CDC website)

- Laboratory identifies a yeast as C. auris or misidentifies C. auris as another yeast
  - MALDI-TOF and DNA sequencing are the most reliable methods for identifying C. auris
  - Depending on the identification method used by the laboratory, C. auris can be misidentified as other Candida species
  - Refer to “Common Misidentifications by Yeast Identification Method” on the CDC website:
    https://www.cdc.gov/fungal/candida-auris/recommendations.html#diagnosis

Candida auris – Infection Prevention

- Report possible or confirmed C. auris to public health **immediately**
- Place patient in contact precautions in single room
- Assess and enhance gown and glove use
- Reinforce hand hygiene
- Coordinate with Environmental Services to clean room with approved disinfectant (those effective against C. diff)
- Same precautions for colonized or infected
- Notify receiving facility if patient is being transferred

Candida auris on CHROMagar Candida, displaying multiple color morphs.

Reviewing Laboratory Results

- **Organisms requiring isolation/IP intervention**
  - MDRO
  - C. diff
  - TB
  - Maternal Hep B Surface Ag
  - Stains – GNDC from CSF, AFB from sputum
  - Bug/Drug mismatch

- **Communicable Diseases/State-reported Notifiable Conditions**
  - Know your state's reporting requirements

- **Referral Labs** – how do you get your referral lab results?

TEXAS Health and Human Services | Texas Department of State Health Services

Texas Notifiable Conditions - 2019

Report all Confirmed and Suspected cases

24/7 Number for Immediately Reportable – 1-800-705-8868

Unless noted by *, report to your local or regional health department using number above or find contact information at http://www.dshs.texas.gov/idcu/investigation/conditions/contacts/

A – L	When to Report	L – Y	When to Report
*Acquired immune deficiency syndrome (AIDS) [1]	Within 1 week	Legionellosis [2]	Within 1 week
Amebiasis [2]	Within 1 week	Leishmaniasis [2]	Within 1 week
Amebic meningitis and encephalitis [2]	Within 1 week	Listeriosis [2, 5]	Within 1 week
Anaplasmosis [2]	Within 1 week	Lyme disease [2]	Within 1 week
Anthrax [2, 3]	Call Immediately	Malaria [2]	Within 1 week
Arboviral infections [2, 4, 5]	Within 1 week	Measles (rubeola) [2]	Call Immediately
*Asbestosis [6]	Within 1 week	Meningococcal infection, invasive (Neisseria meningitidis) [2, 5]	Call Immediately
Ascariasis [2]	Within 1 week	Multidrug-resistant *Acinetobacter* (MDR-A) [2, 7]	Within 1 work day
Babesiosis [2]	Within 1 week	Mumps [2]	Within 1 work day
Botulism (adult and infant) [2, 3, 8]	Call Immediately [9]	Paragonimiasis [2]	Within 1 week
Brucellosis [2, 3]	Within 1 work day	Pertussis [2]	Within 1 work day
Campylobacteriosis [2]	Within 1 week	*Pesticide poisoning, acute occupational [6]	Within 1 week
*Cancer [10]	See rules [10]	Plague (*Yersinia pestis*) [2, 3]	Call Immediately
Carbapenem-resistant *Enterobacteriaceae* (CRE) [2, 11]	Within 1 work day	Poliomyelitis, acute paralytic [2]	Call Immediately
Chagas disease [2, 5]	Within 1 week	Poliovirus infection, non-paralytic [2]	Within 1 work day
*Chancroid [1]	Within 1 week	Prion disease such as Creutzfeldt-Jakob disease (CJD) [2, 12]	Within 1 week
*Chickenpox (varicella) [13]	Within 1 week	Q fever [2]	Within 1 work day
*Chlamydia trachomatis infection [1]	Within 1 week	Rabies, human [2]	Call Immediately
*Contaminated sharps injury [14]	Within 1 month	Rubella (including congenital) [2]	Within 1 work day
*Controlled substance overdose [15]	Call Immediately	Salmonellosis, including typhoid fever [2, 5]	Within 1 week
Coronavirus, novel [2, 16]	Call Immediately	Shiga toxin-producing *Escherichia coli* [2, 5]	Within 1 week
Cryptosporidiosis [2]	Within 1 week	Shigellosis [2]	Within 1 week
Cyclosporiasis [2]	Within 1 week	*Silicosis [17]	Within 1 week
Cysticercosis [2]	Within 1 week	Smallpox [2]	Call Immediately
Diphtheria [2, 5]	Call Immediately	*Spinal cord injury [18]	Within 10 work days
*Drowning/near drowning [18]	Within 10 work days	Spotted fever group rickettsioses [2]	Within 1 week
Echinococcosis [2]	Within 1 week	Streptococcal disease [groups A[2], B[2]; *S.pneumo.* [2, 5]] invasive	Within 1 week
Ehrlichiosis [2]	Within 1 week	*Syphilis – primary and secondary stages [1, 19]	Within 1 work day
Fascioliasis [2]	Within 1 week	*Syphilis – all other stages [1, 19]	Within 1 week
*Gonorrhea [1]	Within 1 week	*Taenia solium* and undifferentiated *Taenia* infection [2]	Within 1 week
Haemophilus influenzae, invasive [2, 5]	Within 1 week	Tetanus [2]	Within 1 week
Hansen's disease (leprosy) [20]	Within 1 week	*Traumatic brain injury [18]	Within 10 work days
Hantavirus infection [2]	Within 1 week	Trichinosis [2]	Within 1 week
Hemolytic uremic syndrome (HUS) [2]	Within 1 week	Trichuriasis [2]	Within 1 week
Hepatitis A [2]	Within 1 work day	Tuberculosis (*Mycobacterium tuberculosis* complex) [5, 21]	Within 1 work day
Hepatitis B, C, and E (acute) [2]	Within 1 week	Tuberculosis infection [22]	Within 1 week
Hepatitis B infection identified prenatally or at delivery (mother) [2]	Within 1 week	Tularemia [2, 5]	Call Immediately
Hepatitis B, perinatal (HBsAg+ < 24 months old) (child) [2]	Within 1 work day	Typhus [2]	Within 1 week
Hookworm (ancylostomiasis) [2]	Within 1 week	Vancomycin-intermediate *Staph aureus* (VISA) [2, 5]	Call Immediately
*Human immunodeficiency virus (HIV), acute infection [1, 23]	Within 1 work day	Vancomycin-resistant *Staph aureus* (VRSA) [2, 5]	Call Immediately
*Human immunodeficiency virus (HIV), non-acute infection [1, 23]	Within 1 week	*Vibria* infection, including cholera [2, 5]	Within 1 work day
Influenza-associated pediatric mortality [2]	Within 1 work day	Viral hemorrhagic fever (including Ebola) [2]	Call Immediately
Influenza, novel [2]	Call Immediately	Yellow fever [2]	Call Immediately
*Lead, child blood, any level & adult blood, any level [24]	Call/Fax Immediately	Yersiniosis [2]	Within 1 week

In addition to specified reportable conditions, any outbreak, exotic disease, or unusual group expression of disease that may be of public health concern should be reported by the most expeditious means available. This includes any case of a select agent [25]

See select agent list at https://www.selectagents.gov/SelectAgentsandToxins/list.html

*See condition-specific footnotes for reporting contact information

ESR-11364 (Rev. 1/3/19)Expires 1/31/20—Go to http://www.dshs.texas.gov/idcu/investigation/conditions/ or call your local or regional health department for updates.

Reviewing Laboratory Results

- **Potential HAIs**
  - Positive blood cultures
  - Urine cultures growing >100,000 cfu/ml of ≤2 organisms
  - Positive cultures from potential surgical sites (abdominal fluid, knee tissue, etc.)
  - Cultures positive collected >48 hours after admission
  - Organisms/locations involved in past outbreaks

- **Environmental Concerns**
  - Legionella – contaminated water supply
  - Fungus - construction

https://www.cdc.gov/legionella/wmp/toolkit/index.html

Matching Quiz

1. Candida auris
2. Colonization
3. MIC
4. CRE
5. Pathogen

A. lowest concentration of an antimicrobial that will inhibit the visible growth of an organism

B. Organism resistant to meropenem

C. Organism present in the body and causing disease

D. MDRO difficult to identify in the lab and can be misidentified

E. Organism present in the body but not causing disease

Scenarios

- Move to a table based on your Microbiology knowledge – novice, intermediate, or advanced.
- Each table has 2 scenarios based on their knowledge level.
- For each scenario, determine the following:
  - Identification – what is the organism/disease?
  - Isolate – does the patient need isolation?
  - Inform – who needs to be notified?
  - Additional actions – what actions need to be taken? What references/sources are available to assist?

Scenario #1

The microbiology lab reports the following on a 68-year-old female who has been a patient in your medical ICU for the past 6 days.

Specimen: Sputum

Gram Stain: Many WBC, few epithelial cells, moderate gram negative rods

Culture: Many Klebsiella pneumoniae with few mixed normal respiratory flora

Susceptibility:

Amox/Clav	S	Gentamicin	S
Ampicillin	R	Imipenem	R
Cefazolin	R	Levofloxacin	S
Cefepime	S	Meropenem	S
Ceftriaxone	S	Trimeth/Sulfa	S
Ertapenem	R		

Scenario #2

- 18-year-old female college freshman is admitted to the Emergency Room with fever, headache, and stiff neck.
- A CSF sample is sent for WBC, protein, glucose, gram stain and culture.
- The following results are received:
  - WBC = 5,000 cells/µL (high)
  - Glucose = 30 mg/dL (low)
  - Protein = 200 mg/dL (high)
  - Gram stain = many WBC, few gram negative diplococci

Scenario #3

- 76-year-old female admitted to oncology unit for chemotherapy.
- On hospital day 4, patient spikes a temp of 101 F and develops a cough. CXR shows new bilateral infiltrates.
- Routine sputum cultures and urinary antigen for *Legionella* are collected.
- The urinary antigen is reported as positive and sputum culture shows normal flora.

Scenario #4

- 3-year-old male presents to Emergency Room on 8/15/19 with fever of 102.5. Patient discharged with diagnosis of viral illness.
- Patient readmitted 8/17/19, still running fever of 101 and now has cough and runny nose. Mother of patient reports patient is up-to-date on all immunizations. Patient discharged with sinus infection and given prescription for oral cephalosporin.
- Patient readmitted on 8/20/19 with vesicular rash that appeared 8/19/19. Patient discharged with diagnosis of allergic reaction to antibiotics, but physician orders Measles PCR…just to make sure.
- 8/22/19 – Measles PCR reported as positive

Scenario #5

Patient #1

7/1/19 – Hip replacement procedure in OR room #1

7/25/19 – Returns to ED with pain and swelling at incision site

7/26/19 – I&D performed showing purulence in deep tissue. Cultures of deep hip tissue grow Pseudomonas aeruginosa.

Patient #2

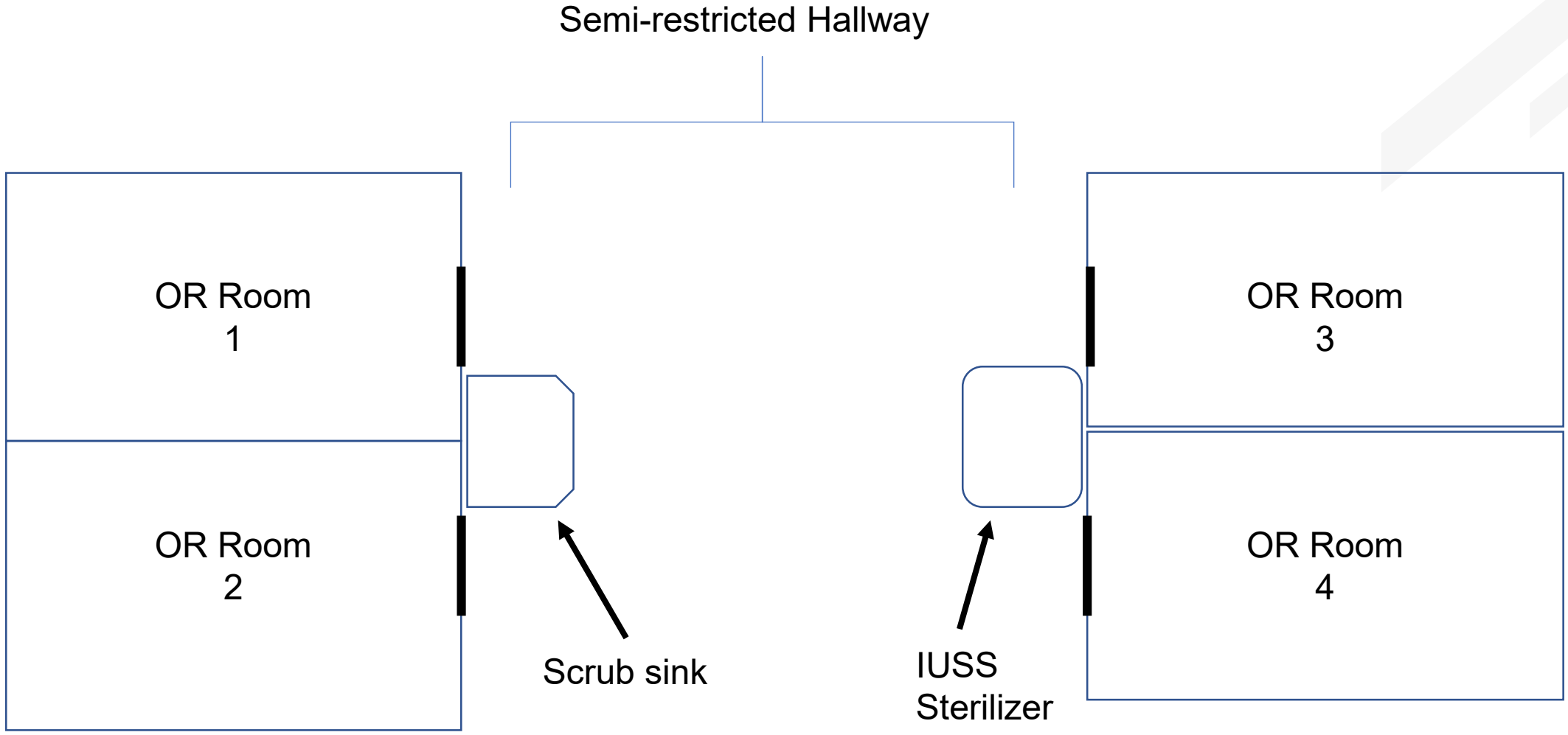
8/30/19 – Abdominal hysterectomy in OR room #3

9/20/19 – Returns to ED with severe abdominal pain.

9/20/19 – CT shows pelvic abscess.

9/20/19 – Abscess drained surgically and abscess cultures growing Pseudomonas aeruginosa.

Scenario #5


Semi-restricted Hallway
OR Room
1
OR Room
2
OR Room
3
OR Room
4
Scrub sink
IUSS
Sterilizer

Scenario #6

6/4/19 – 42-year-old male admitted to ED. Patient just returned from a 2-week work trip to Saudi Arabia. While there, he took a day off for sight-seeing and enjoyed a camel ride. Patient reported the camel spit in his eye before the ride. After the ride, his eye was hurting so badly he went to an ER to have it evaluated.

6/4/19 - Patient now has fever, shortness of breath, and cough; CXR shows opacities.

QUESTIONS?

APIC

Association for Professionals in
Infection Control and Epidemiology