

Infection Control Risk Assessment/Microbiology Primer

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Disclosure of Conflicts of Interest

- Barbara DeBaun, MSN, RN, CIC is a clinical consultant to:
 - Magnolia Medical
 - SplashBlocker

Microbiology is the
study of organisms
too small to be
seen by the naked
eye



Clinical microbiology

Bacteria

Viruses

Fungi (molds and yeasts)

Protozoa/Parasites

If a typical size bacterium was placed every second into a 1-mL (0.2 tsp) container, it would take over 30,000 years to fill the container





Antonie van Leeuwenhoek



Bacteria are
named
according to
genus and
species

genus = *Capitalized & italicized*

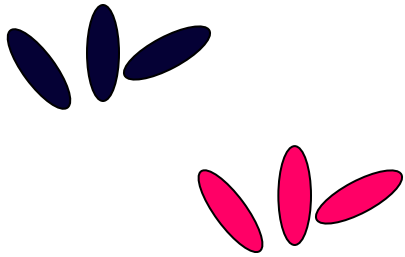
species = *lower case & italicized*

For example:

Staphylococcus aureus

Escherichia coli

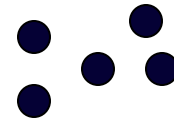
RODS



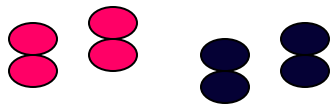
SPIRALS



COCCI



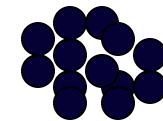
COCCOBACILLI



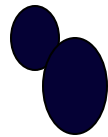
CHAINS



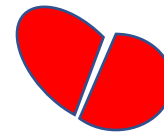
CLUSTERS



YEASTS



Gram negative diplococci



Let's do this together...

- When reviewing the gram stain of a person with a wound infection, the IP sees gram-positive organisms in clusters. Which organism would this most likely represent?
- Streptococcus
- Enterococcus
- Cornebacterium
- Staphylococcus



Memory aid

- Staff and Staph like to cluster together like grapes
- They get 'a-round'

Why is your relationship with the micro lab so critical?



They may be the first to suspect or detect trouble



They can provide a sneak peek into what is likely to 'grow'

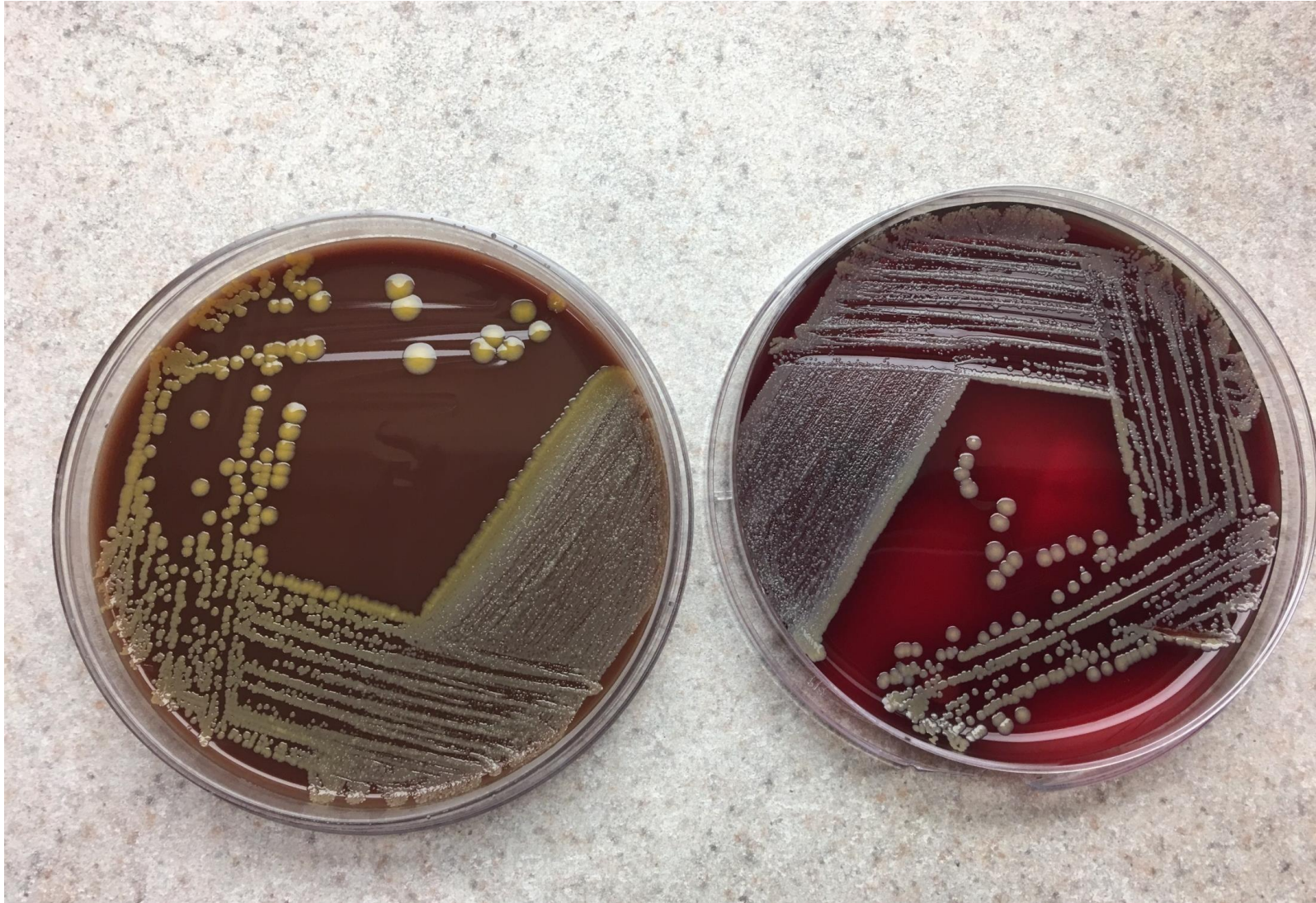


They can support efforts to improve your 'culture of culturing'

What can *you* do to support your micro partners?

- Visit in person as often as possible
- Provide patient information and feedback
- Ask to be educated
- Limit 'critical values' that require them to notify you to things that really matter
- Partner to improve the quality of specimens submitted (e.g., reduce contaminated specimens; improve transfer times)





Listen and
learn

What is
'normal flora'
today could
be a pathogen
tomorrow

Commensals (FKA skin contaminants)

- May be called normal flora or commensals or contaminants BUT they can cause infection
- Coagulase negative Staphylococcus, alpha strep, etc.
- NHSN list of commensals

Pathogens – the “bad guys” or ‘being in the wrong place at the wrong time’

- *Staphylococcus aureus*, *E. coli*

Normal or not?

Normal Flora - microbes that are normally present in a particular environment and are found in most people, most of the time

Pathogen- an organism that is causing disease

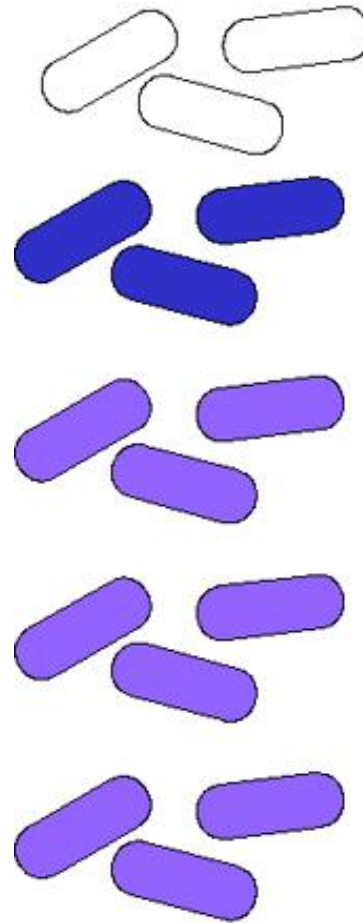
Colonization – when a microbe is present but is not part of the normal flora, but there is no tissue damage and no host response

Contaminant – microorganism is present due to poor handling, poor specimen acquisition or transfer, factors that can't be fixed by good people

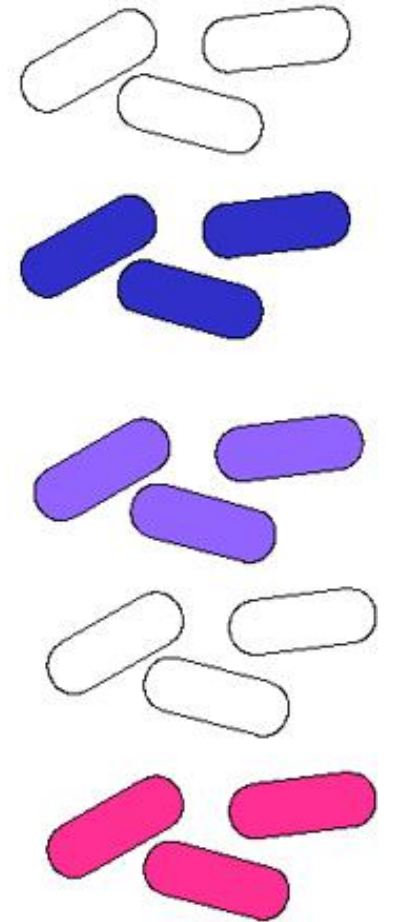
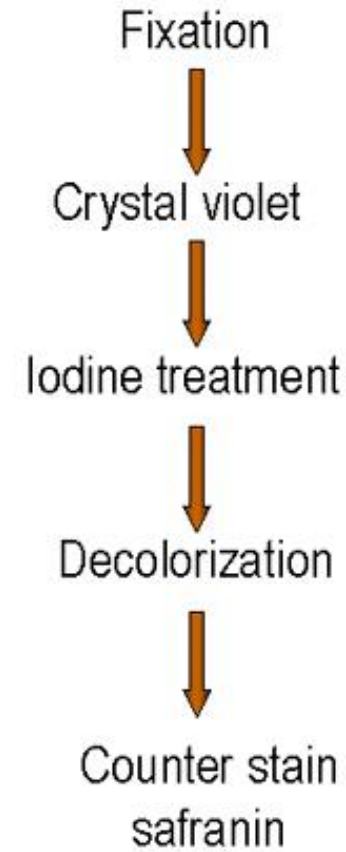
Bacterial Gram Stain

- Apply violet dye
- Decolorize
- Add red dye
- If cell walls retain the first dye (violet) they are gram-positive
- If cell walls lose the first dye and appear red, they are gram-negative

Gram Positive



Gram Negative



What the gram stain can guide us to:

Gram-positive cocci

Staphylococcus epidermidis

Staphylococcus aureus

Enterococcus spp.

Gram-negative rods

- *Escherichia coli*
- *Klebsiella* spp.
- *Enterobacter* spp.
- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii*
- *Serratia* spp.

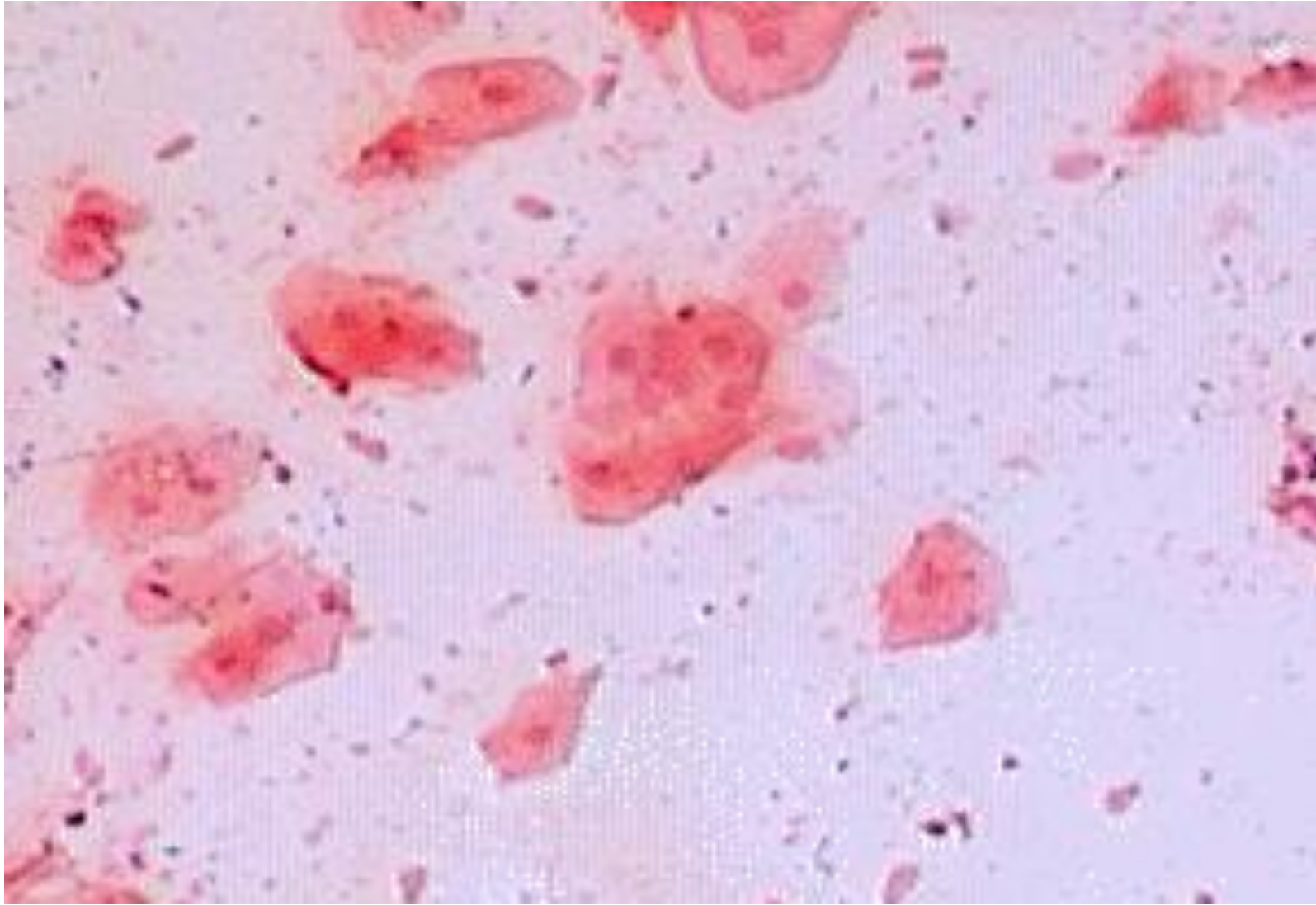
Why is the gram stain an IP's good friend?

Is it a good specimen or a bad specimen? (WBC's present?)

What is this likely to be?

Quantify results





Why did
the lab
reject my
sputum?

- >25 Squamous epithelial cells per low power field indicates contamination with oral flora organisms
 - These organisms can mask the presence of important pathogens



More lab 'speak'

- What is the blood WBC count, is there a left shift (Bands, other immature neutrophils)?
- Elevated ESR? Or lactate?
- Protein and glucose levels in the CSF?
- Gross description of the specimen by the lab:
 - Blood in the stool, cloudy CSF, etc.

White blood cell overview

Neutrophils

Eosinophils

Basophils

Lymphocytes

Monocytes



Early in the response to infection, immature forms of neutrophils are seen. These are 'stabs' or 'bands'.



Survive in
air or not?

Aerobe

Obligate anaerobe

Facultative anaerobe

Microaerophilic aerobe

Tips and Tricks



Aerobes “sounds like air” require air (aka oxygen) to grow; think of aerobic exercise...you need ‘air’ or oxygen to breathe



A “Microaerophilic aerobe” needs just a ‘little bit’ or ‘micro’ amount of air (aka oxygen) to grow



Anaerobes “sounds like absence of air” are flexible fellows

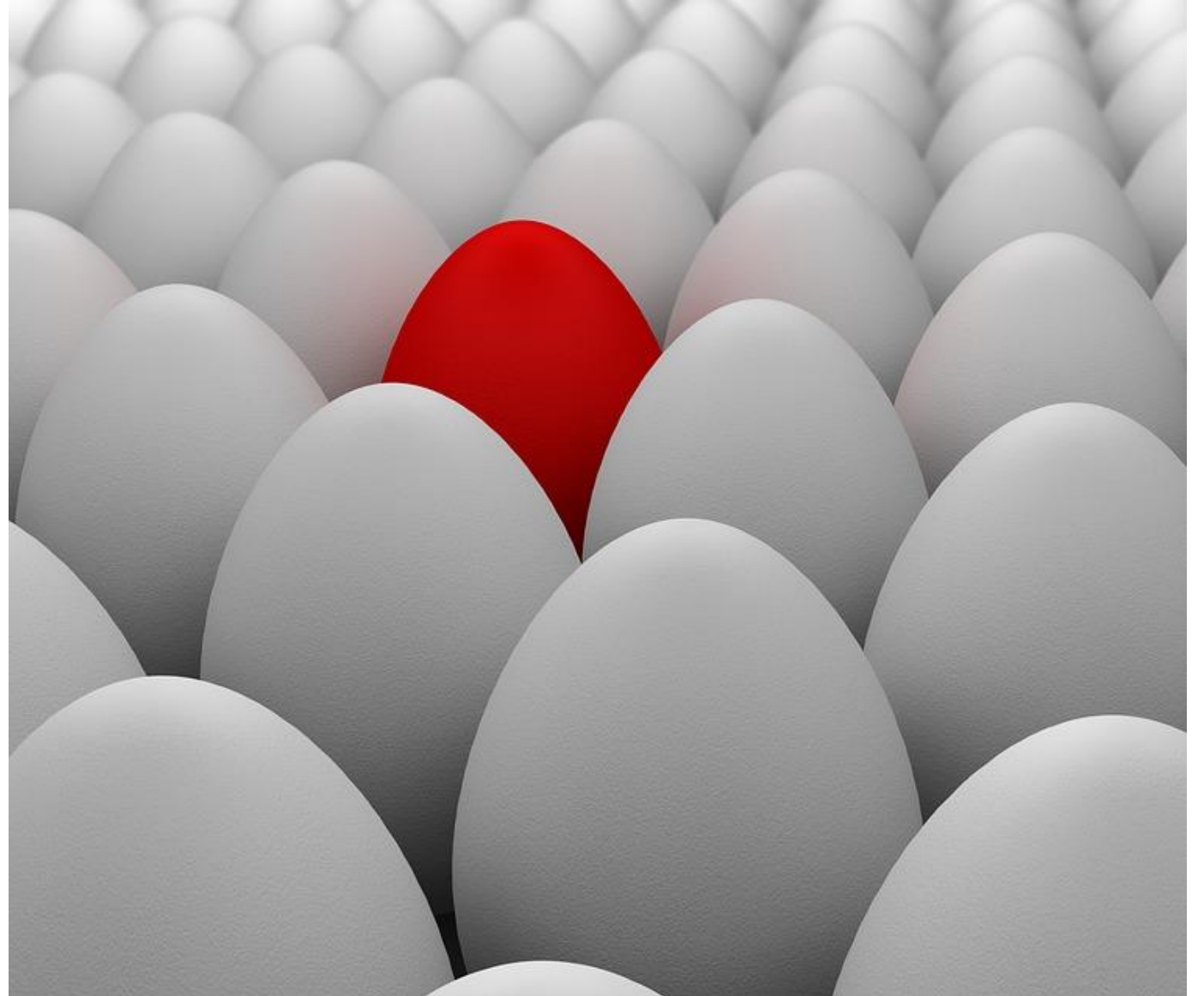


An “obligate’ anaerobe is ‘obligated’ to only survive in the absence of oxygen



A ‘Facultative anaerobe’ can handle oxygen but can still survive in the absence of it. Think of a teacher ‘faculty’ you once had who could handle anything.

Meningitis:
viral or
bacterial?





Bacterial meningitis: a cloudy and not at all sweet night

- This is bad news...this is where the Pro's show up (as in Protein, which is usually elevated)
- Usually, cloudy
- WBC elevated
- Mostly neutrophils
- Low glucose...so not a sweet situation

What type of precautions for meningitis?

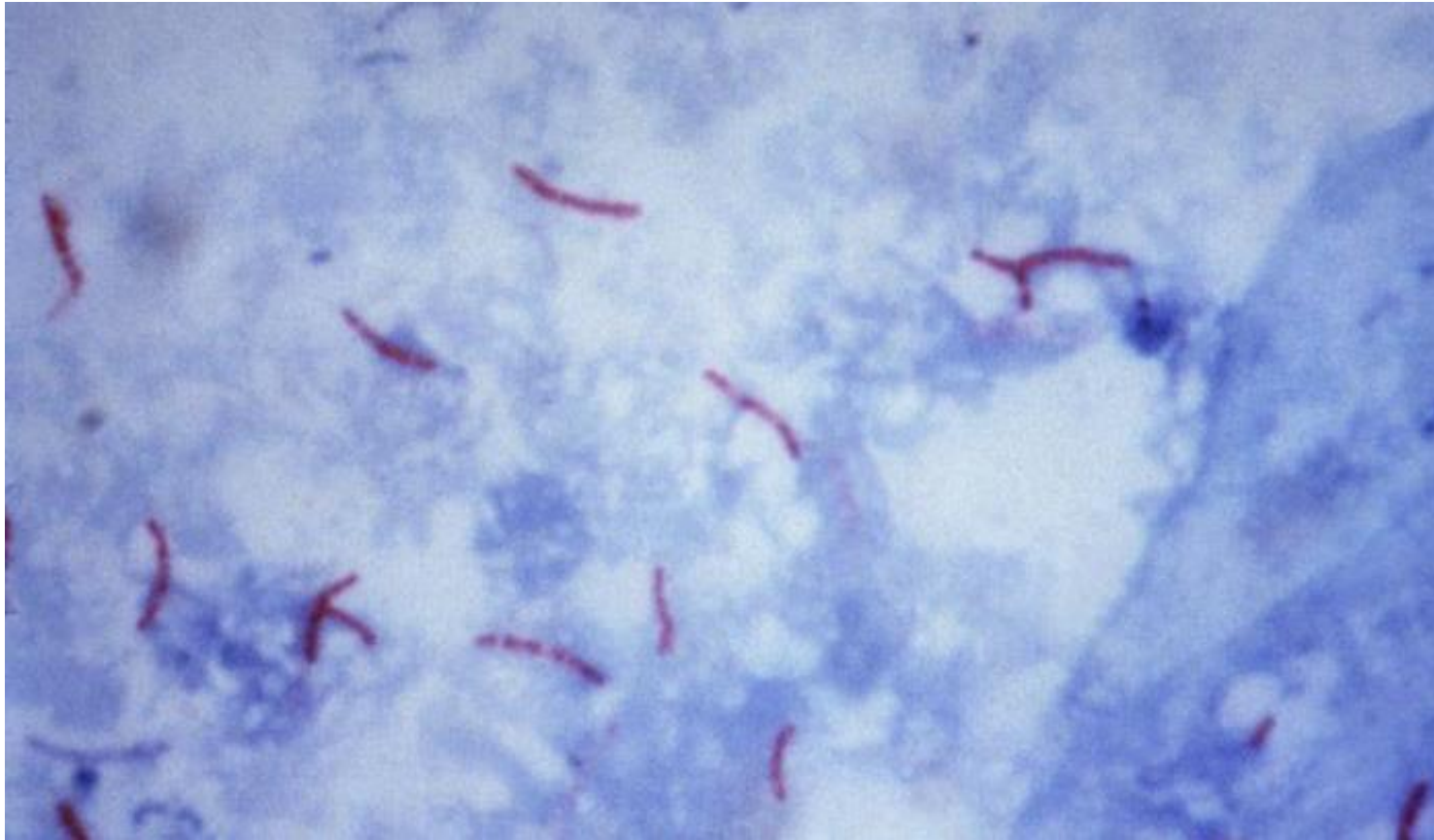
- Viral
- Fungal
- Bacterial
 - *Neisseria meningitidis*
 - *Haemophilus influenzae*, type B (HIB)
 - Group B *Streptococcus*
 - *Streptococcus pneumoniae*
 - *Listeria monocytogenes*



Bacterial Meningitis

Pathogen	Type of Precautions	Duration
<i>Neisseria meningitidis</i>	Standard and Droplet	24 hours after start of effective therapy
<i>Haemophilus influenzae</i> , type B	Standard and Droplet	24 hours after start of effective therapy
<i>Streptococcus agalactiae</i> (Group B Streptococcus/GBS)	Standard	
<i>Streptococcus pneumoniae</i>	Standard	
<i>Listeria monocytogenes</i>	Standard	

Mycobacteria
Fungi-Yeast and Molds
Viruses
Parasites
Prions

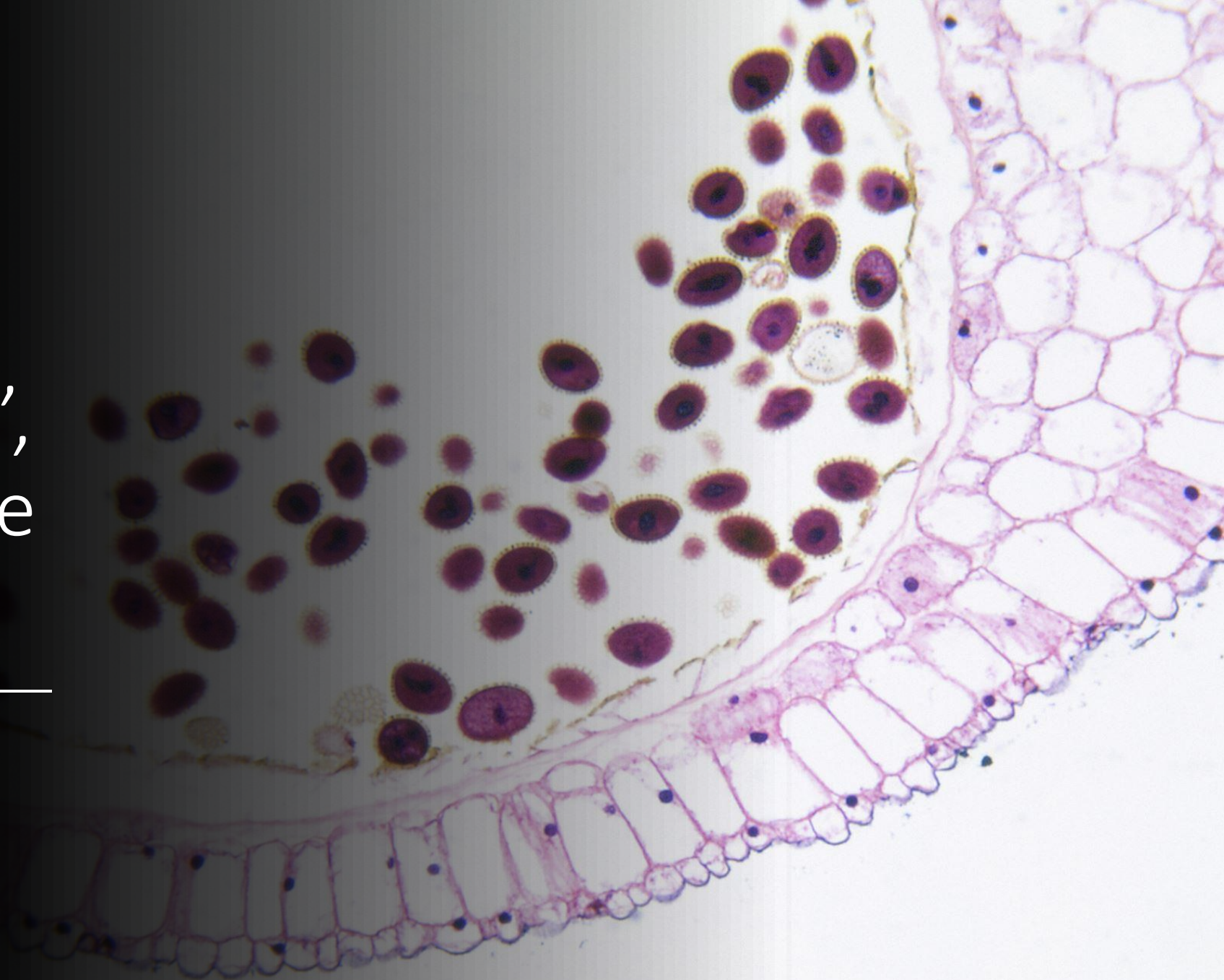


Acid Fast Bacillus (AFB) Stain

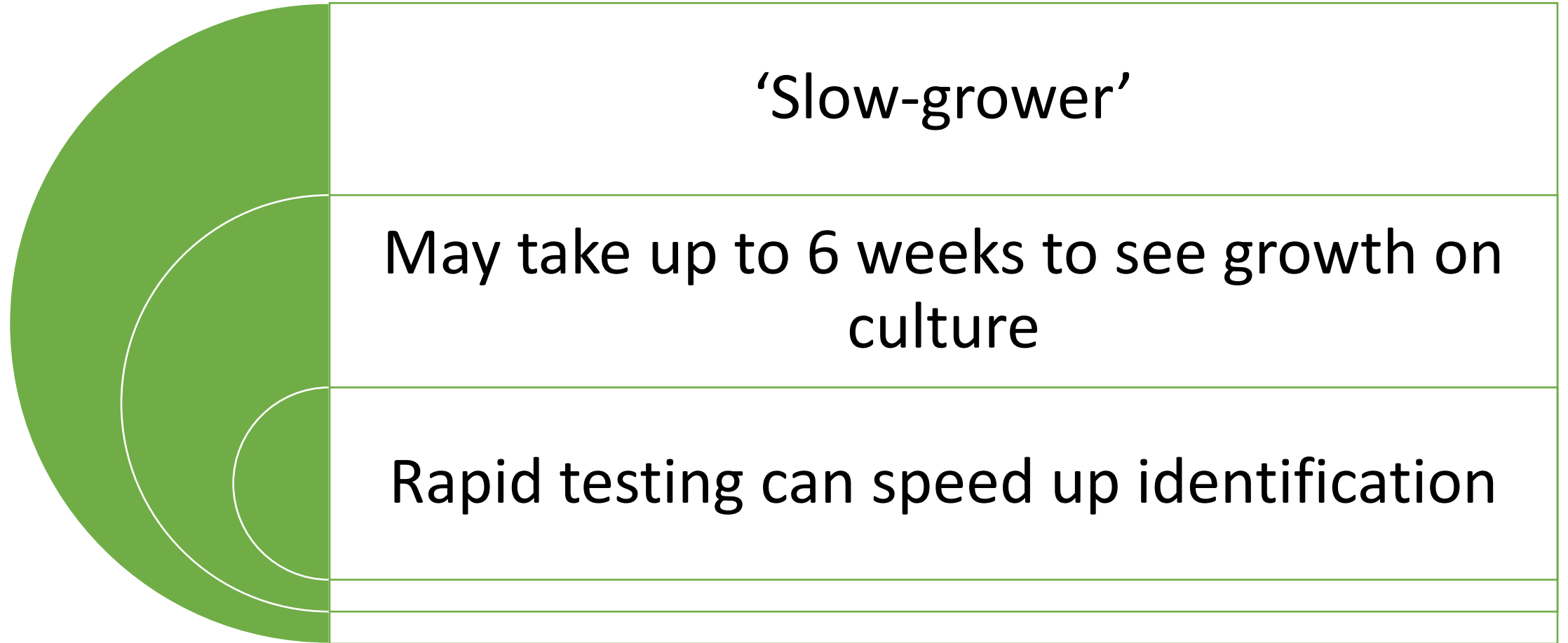
- Used to stain *Mycobacteria species*

—


If a patient's sputum AFB stain is 'positive', does it mean the patient has TB?



Mycobacterium tuberculosis ('M-TB')




Mycobacteria other than 'M-TB'

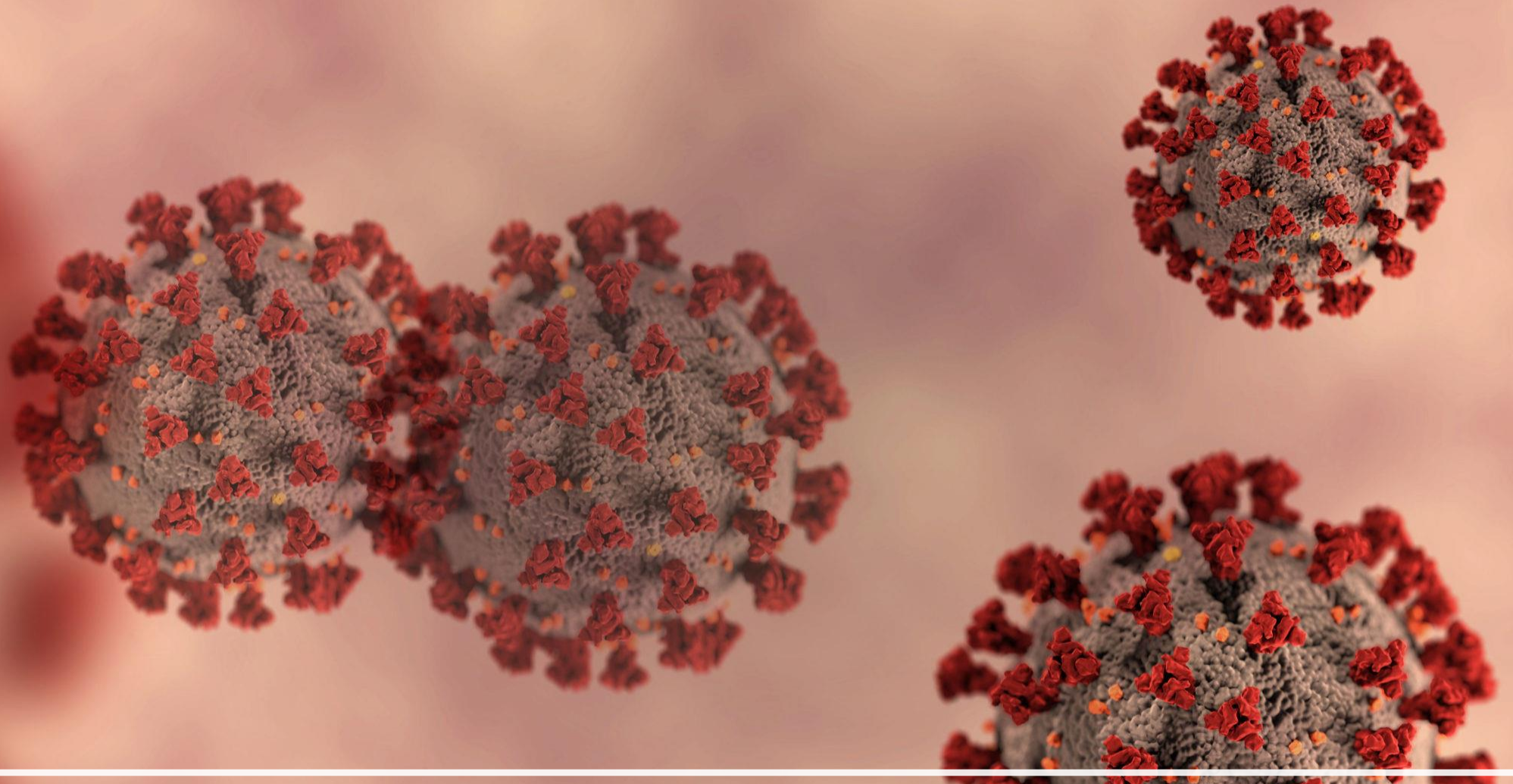


Referred to as 'atypical'
Like to live in water and soil
Majority are not spread person-to-person
<i>Mycobacterium avium-complex</i> (MAC)
<i>M. gordoniae</i> , <i>M. abscesses</i> , <i>M. kansasii</i>

Fungi

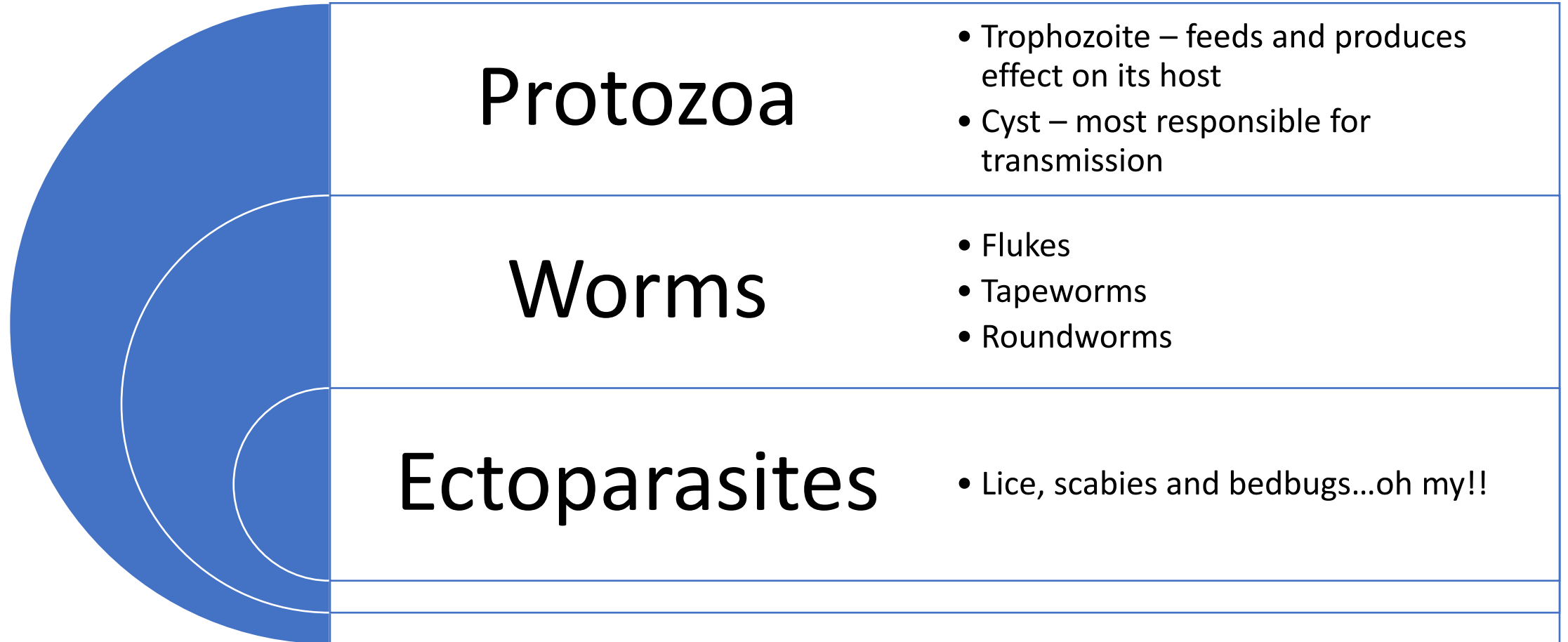


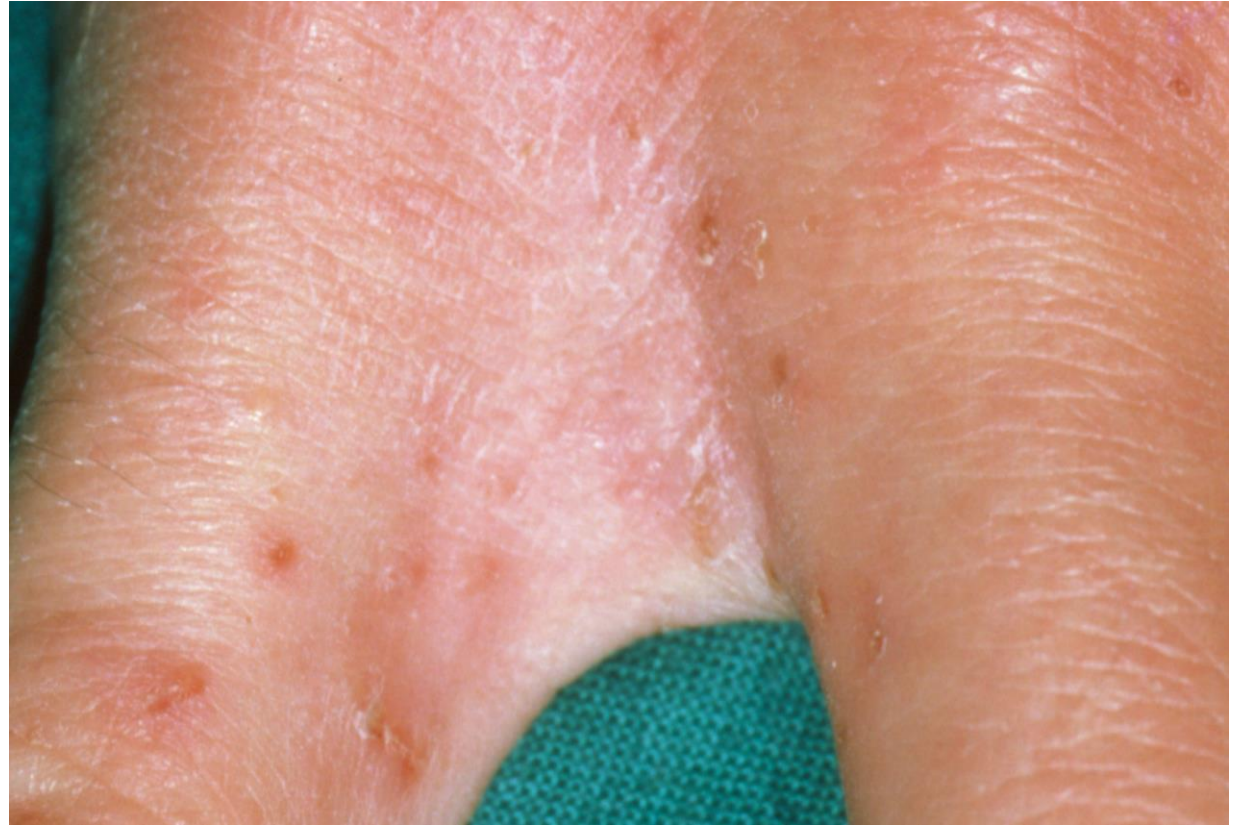
<h2>Yeast</h2>	<ul style="list-style-type: none">• Single celled; reproduce by budding or fission• <i>Candida, Cryptococcus</i>
<h2>Molds</h2>	<ul style="list-style-type: none">• Long, branching filaments called hyphae• May be spore producers
<h2>Dimorphic</h2>	<ul style="list-style-type: none">• Can grow as a yeast or a mold depending on temperature• 25° C = mold; 37° = yeast• <i>Pneumocystis, Coccidioides, Histoplasma, Blastomyces</i>



Viruses

Parasites






Lice/Scabies

CDC - Lice - Head Lice - Treatment

The screenshot shows the CDC website page for Head Lice Treatment. At the top left is the CDC logo and the text "Centers for Disease Control and Prevention CDC 24/7: Saving Lives, Protecting People™". At the top right is a search bar with the text "Search" and a magnifying glass icon. Below the logo is a blue navigation bar with the word "Parasites" in white. Underneath is a breadcrumb trail: "Parasites Home > Lice > Head Lice". On the left side, there is a table of contents for the "Lice" section, with "Head Lice" selected and highlighted in blue. The "Head Lice" section is expanded to show sub-sections: "General Information", "Epidemiology & Risk Factors", "Disease", "Biology", "Diagnosis", "Treatment" (highlighted in blue), and "Prevention & Control". The main content area is titled "Treatment" and includes a link for "Español (Spanish) | Print". Below the title is the "General Guidelines" section, which contains two paragraphs of text. The first paragraph discusses the recommendation for treatment of active infestation and the need to check household members and close contacts. The second paragraph discusses the use of pediculicides and the importance of retreatment. The third paragraph discusses supplemental measures that can be combined with recommended medicine.

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Search 

Parasites

Parasites Home > Lice > Head Lice

🏠 Lice

Head Lice	—
General Information	+
Epidemiology & Risk Factors	
Disease	
Biology	
Diagnosis	
Treatment	
Prevention & Control	

Treatment

[Español \(Spanish\)](#) | [Print](#)

General Guidelines

Treatment for head lice is recommended for persons diagnosed with an active infestation. All household members and other close contacts should be checked; those persons with evidence of an active infestation should be treated. Some experts believe prophylactic treatment is prudent for persons who share the same bed with actively-infested individuals. All infested persons (household members and close contacts) and their bedmates should be treated at the same time.

Some pediculicides (medicines that kill lice) have an ovicidal effect (kill eggs). For pediculicides that are only weakly ovicidal or not ovicidal, routine retreatment is recommended. For those that are more strongly ovicidal, retreatment is recommended only if live (crawling) lice are still present several days after treatment (see recommendation for each medication). To be most effective, retreatment should occur after all eggs have hatched but before new eggs are produced.

When treating head lice, supplemental measures can be combined with recommended medicine (pharmacologic treatment); however, such additional (non-pharmacologic) measures generally are not required to eliminate a head lice infestation. For

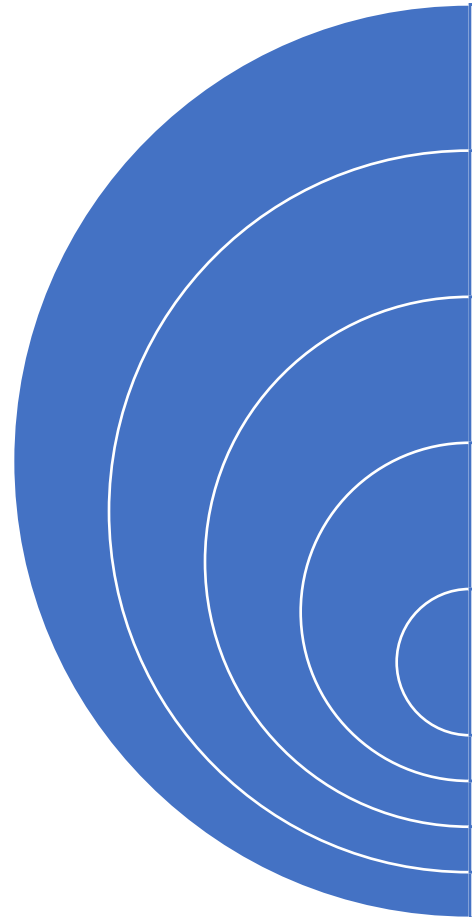
<https://www.cdc.gov> Resources for Health Professionals

Scabies

- [CDC - Scabies - Resources for Health Professionals – Medications](#)
- 4-8 week incubation when a person is infested the first time
- Spread via direct skin-to-skin



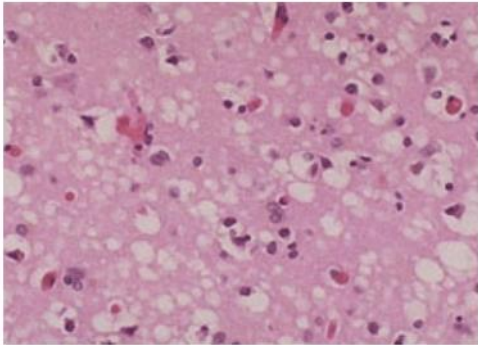
Prions



Proteinaceous infectious particles with no DNA or RNA present
Creutzfeld-Jakob Disease (CJD)
CJ Variant – Mad Cow Disease
Kuru
Scrapie

Prion Diseases | CDC

CJD (Creutzfeldt-Jakob Disease, Classic)



Classic CJD is a human prion disease. It is a neurodegenerative disorder with characteristic clinical and diagnostic features.

vCJD (Variant Creutzfeldt-Jakob Disease)



vCJD has a different clinical and pathologic characteristics from classic CJD. Each disease also has a particular genetic profile of the prion protein gene.

BSE (Bovine Spongiform Encephalopathy)

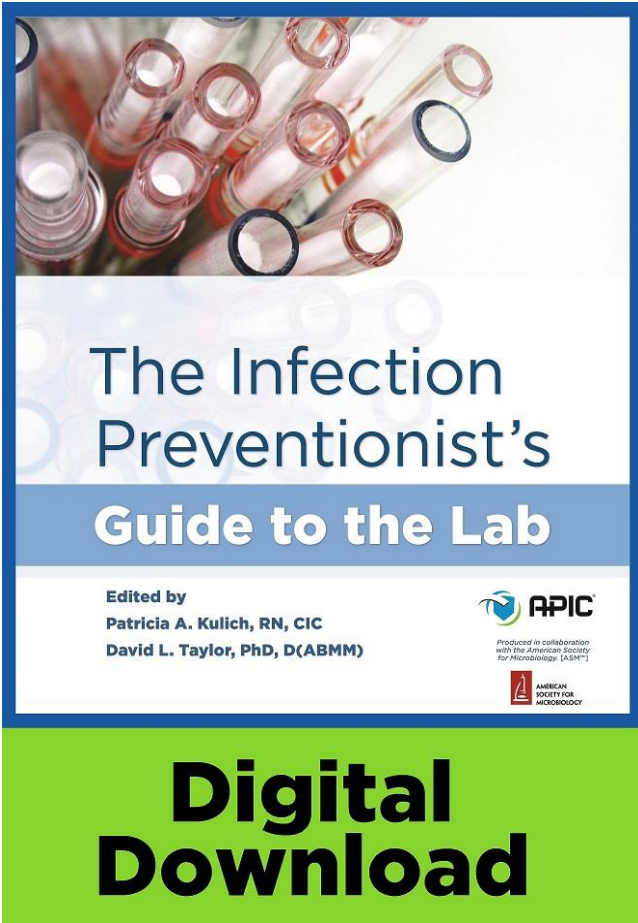


BSE also known as Mad Cow Disease is a progressive neurological disorder of cattle that results from infection by an unusual transmissible agent called a prion.

CWD (Chronic Wasting Disease)





CWD is a prion disease that affects deer, elk and moose in some areas of North America, South Korea and Norway. In North America, it has been found in both free-ranging and captive deer populations.




The Infection
Preventionist's
Guide to the Lab

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Some additional good resources

Infection
Control Risk
Assessment: the
foundation of
your IP program



Infection
Control Risk
Assessment is
a fluid
document



Infection Control Assessment Tools | HAI | CDC



Healthcare-Associated Infections (HAIs)

CDC > Healthcare-associated Infections (HAI) > Preventing HAIs

🏠 Healthcare-associated Infections (HAI)

HAI Data +

Types of Infections +

Diseases and Organisms +

Infection Control Assessment Tools

[Print](#)

The basic elements of an infection prevention program are designed to prevent the spread of infection in healthcare settings. When these elements are present and practiced consistently, the risk of infection among patients and healthcare personnel is reduced.

Infection Control Risk Assessment (ICRA)

Calendar Year 2017

Event	Probability of Occurrence				Potential Risk of Severity				Required Response Needed to Address Risk				Preparedness to Address Risk at this Time				Risk Level
	High	Med	Low	None	Life Threat	Perm Harm	Temp Harm	None	High	Mod	Low	None	Poor	Fair	Good	Excel	
Score:	3	2	1	0	3	2	1	0	3	2	1	0	3	2	1	0	
Geography and Community																	
Hurricane/Tornado		2			3					2						0	7
Increasing identification of communicable diseases			1			2				2				2			7
Potential Infection																	
Colon & Hysterectomy Infections		2			3					2				2			9
C-section SSIs		2					1			2				2			7
CABG Sternal Infections			1		3					2						0	6
Ventilator-Associated Conditions			1		3						1				1		6
Central Line Related Blood Stream Infections			1		3						1				1		6
C. Difficile Infections			1				1		3						1		6
MRSA (hospital-acquired) Infection			1			2				2					1		6
ESBL-Producers and other MDROs		2				2				2					1		7
Catheter-Associated UTI	3						1		3					2			9
Health Care Team																	
Non-compliance with Hand Hygiene		2			3					2					1		8
Non-compliance with use																	

Risk Level ≥ 9 requires action plan.

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