Appendix 1. Additional Case Studies

Note to instructors: Slides, laboratory media and other materials are available through Carolina Biological, Fisher Scientific and other suppliers. Instructors can contact authors for additional information.

List of vector slides

1. *Xenopsylla cheopis*
2. *Borrelia burgdorferi*
3. *Anopheles gambiae*
4. *Pediculus corporis*
5. *Taenia solium*

Case Study 4

A family with a four- year old daughter and a seven-year old son arrive at the doctor. The parents notice that both children have been scratching in their buttocks region. A sample was taken and is shown on this slide.

Slide: Sample from children *(Slide with eggs from Enterobius vermicularis)*

Q1. Diagnosis: _____
Answer: Pinworm

Q2. Scientific name of pathogen: _____
Answer: Enterobius vermicularis

Q3. Is this pathogen a bacterium, a protist, a helminth or a fungus? _____
Answer: helminth

Q4. How is the pathogen transmitted? _____
Answer: fecal-oral route

Q5. How was this sample obtained? _____
Answer: tape test

Q6. What part of the life cycle does the sample represent? _____
Answer: eggs

Topics covered: clinical aspects of E. vermicularis infection; test for E. vermicularis infection

Case Study 5

A 22 year old female from a rural area around Socorro, New Mexico came to the hospital in Albuquerque complaining of a fever, chills, a headache and weakness. Upon examination, the patient was found to have very swollen and tender lymph glands. The patient had chest pain and was coughing up bloody sputum.

Slide: Sputum sample ***(slide with Yersinia pestis)***
Medium: Mueller-Hinton agar plate ***(with multiple antibiotic disks; some indicating resistance; 150mm plates may be used).***
Set-up includes CCLI charts to look up RIS results for antibiotic disks and metric rulers for measuring zones of inhibition. E. coli can be used to simulate Yersinia pestis.

Q1. Diagnosis:

_____

Answer: plague

Q2. Scientific name of pathogen: _____
Answer: Yersinia pestis

Q3. Is this pathogen a bacterium, a protist, a helminth or a fungus? _____
Answer: bacterium

Q4. How is this disease transmitted? _____
Answer: vector

Q5. If it is transmitted by a vector, which slide is the correct vector?
Vector slide number _____
Answer: 1

Q6. Name of vector (both scientific and common name) _____
Answer: Xenopsylla cheopis—rat flea

Q7. Should the patient be placed in isolation? Explain your answer.

_____

Answer: Yes—pneumonic plague spreads person-to-person and is highly contagious

Q8. Based on the results of the antibiotic-susceptibility testing (see Kirby-Bauer plate), which antibiotic should be used to treat this patient? _____
Answer: Will depend on plate results. Students need to use ruler and charts to determine antibiotic susceptibility

Q9. Name one antibiotic that would **not** be effective against this pathogen. _____
Answer: Will depend on plate results. Students need to use ruler and charts to determine antibiotic susceptibility

Topics covered: Identification of Yersinia pestis and its vector Xenopsylla cheopis; ability to use charts to interpret Kirby-Bauer antibiotic sensitivity test; clinical aspects of plague, including symptomology and geographic distribution

Case Study 6

A pig farmer from Central America has several relatives from the US visit his farm. A few days after they arrive, his relatives develop severe gastroenteritis, including stomach pain, nausea and vomiting. Stool samples are found to contain blood, and a smear from one stool sample is shown here. Based on this outbreak, the local health authorities tested the well water used at the farm. The EMB plate shown here is the result of this water testing.

Slide: Stool sample *(slide showing Balantidium coli)*
Medium: Eosin Methylene Blue (EMB) plate with water sample *(EMB plate with characteristic green-metallic sheen indicating presence of E. coli)*

Q1. Diagnosis: _____
Answer: Balantidiasis

Q2. Scientific name of pathogen: _____
Answer: Balantidium coli

Q3. Is this pathogen a bacterium, a protist, a helminth or a fungus? _____
Answer: protist

Q4. How is this disease transmitted? _____
Answer: contaminated food or water

Q5. If it is transmitted by a vector, which slide is the correct vector?
Vector slide number _____
Answer: N/A

Q6. EMB plate: What type of organism is found here? _____
Answer: Fecal coliform bacteria (E. coli)

Q7. What does this result indicate about the patient's water source? _____
Answer: Contains feces (possibly from pigs)

Topics covered: identification of B. coli; interpretation of results of EMB plate, presence of E. coli as an indicator bacterium for fecal contamination; mode of transmission

Case Study 7

An adult male patient arrives at the hospital with a fixed grin on his face, clenched teeth, and muscle stiffness. A conversation with a relative of the patient reveals that he had recently been bitten by a wild dog.
Unfortunately his treatment is delayed, and the patient does not survive. Autopsy samples are used to inoculate the plates shown here. A bacterial colony from the plate that shows growth is used for simple staining and is shown on the slide you are viewing.

Slide: Autopsy sample- simple stained *(Slide with Clostridium tetani)*
Media: 2 TSA plates, one incubated aerobically, one incubated anaerobically
(Anaerobic plate shows growth; aerobic plate has no growth)

Q1. Diagnosis: _____
Answer: Tetanus

Q2. Scientific name of pathogen: _____
Answer: Clostridium tetani

Q3. Is this pathogen a bacterium, a protist, a helminth or a fungus? _____
Answer: bacterium

Q4. How is this disease transmitted? _____
Answer: Puncture wound, bite, etc.

Q5. If it is transmitted by a vector, which slide is the correct vector?
Vector slide number _____
Answer: N/A

Q6. How did the plates assist you with your diagnosis?_____
Answer: Indicated anaerobic pathogen

Q7. Would this same pathogen cause respiratory infections? Why or why not? _____
Answer: No, since it is an obligate anaerobe

Q8. How could this type of infection be prevented? _____
Answer: vaccination (TDaP or DTaP)

Q9. What type of treatment is appropriate for this infection? _____
Answer: antibiotics, antitoxins, patient kept in quiet room

Q10. Should this patient have been isolated? Why or why not? _____
Answer: No need for isolation; tetanus is a non-communicable infectious disease

Topics covered: clinical aspects of tetanus, including symptoms, transmission and prevention; identification of C. tetani as anaerobic pathogen

Case Study 8

Two patients visit the same hospital ER on the same day. One is currently undergoing chemotherapy, the other has an advanced HIV infection). Samples were taken from each patient and observed microscopically. The results are shown here.

Q1. The two slides seen here share a common bond. What is it? _____
Answer: Both are fungi

Q2. Name the pathogens A. _____ B. _____
Answer: A. Candida albicans
B. Aspergillus niger

Q3.What type(s) of people are typically most susceptible to this type of pathogen? _____
Answer: immunosuppressed

Q4. Why do these organisms appear so different even though they are closely related?
Answer: one is a yeast and one is a mold

Q5. Which of these organisms (A or B) is more likely to cause infection in a person taking antibiotics? _____
Answer: A

Topics covered: identification of fungi and recognition of the two forms (yeast vs. mold); fungal infections as opportunistic infections

Case Study 9

A 46 year old woman came to her doctor complaining of dysuria, urgency when urinating, and pelvic pain. The urine sample she provided was cloudy with a slight pink tinge. A dilution of a urine sample as spread on an EMB plate, and a colony from this plate was gram stained (Slide 1) and used to inoculate a urea slant. A different staining procedure was done on Slide 2.

Slide 1: From urine sample *(Slide with Gram stained Proteus vulgaris)*
Slide 2: From urine sample *(Slide with silver stained P. vulgaris, showing flagella)*
Media: Inoculated urea slant *(Slant shows hot pink positive color)*
EMB plate *(Plate shows pink colonies indicative of lactose fermentation; dilution of sample indicated on plate; plate has countable number of colonies)*

Q1. Diagnosis: _____
Answer: Urinary tract infection

Q2. Scientific name of pathogen:_____
Answer: Proteus vulgaris

Q3. Describe the pathogen in terms of morphology, arrangement and Gram reaction.
_____
Answer: Gram negative bacilli; no arrangement

Q4. Did you get enough information from the Slide 1 alone to make your diagnosis? Explain. _____
Answer: No—many bacteria have the same appearance

Q5. What structures are seen on Slide 2? _____
Answer: flagella

Q6. What is the function of these structures? _____
Answer: motility

Q7. What staining procedure was used to detect these structures? _____
Answer: Silver nitrate staining used to make flagella appear larger

Q8. How is this disease transmitted? _____
Answer: fecal route, catheters

Q9. Explain how the urea slant and the EMB plate assisted you in your diagnosis. _____
Answer: P. vulgaris is urease positive lactose fermenter (no green metallic sheen on plate indicates that the organism is not E. coli)

Q10. How many organisms/ml are in the urine? _____
Answer: will depend on plate results

Q11. What does this tell you about the patient's condition? _____
Answer: UTI count should be over 100,000 cells/ml to indicate infection

Q12. What other organism is a common cause of this type of infection? _____
Answer: E. coli

Topics covered: identification of Gram reaction, morphology and arrangement, interpretation of urease test and EMB plate results; identification of silver-stained flagella; ability to calculate total number of organisms based on dilution factor; definition of UTI based on organisms/ml

Case Study 10

Three young women visit a gynecology clinic. The clinician who exams them takes vaginal swabs from each patient and examines them microscopically. The results are shown here.

Slide A *(Treponema pallidum; silver stained)*
Slide B *(Trichomonas vaginalis)*
Slide C *(Neisseria gonorrhea; Gram stained)*

Q1. The 3 slides that are shown here share a common bond. Can you figure out what that bond is? _____
Answer: All cause sexually transmitted infections

Q2. What types of organisms (bacteria, fungi, protozoa, helminths) are they?

A _____ B _____ C _____

Answer A: bacteria
Answer B: protist
Answer C: bacteria

Q3. Which of these slides (A, B, or C) appears to have been Gram stained? _____
Answer: C

Q4. Give the morphology, gram reaction and arrangement for this slide _____
Answer: Gram negative diplococci

Q5. Which of these slides (A, B, or C) was prepared with a special stain? Give the morphology of the organism on this slide. _____
Answer: A--spirochete

Q6. Which slide (A, B, or C) shows an organism that would give similar symptoms to a vaginal yeast infection? _____
Answer: B

Q7. Identify the pathogens (species names)
A. _____ B. _____ C. _____
Answer A: Treponema pallidum
Answer B: Trichomonas vaginalis
Answer C: Neisseria gonorrhea

Topics covered: identification of Gram reaction, morphology and arrangement; identification of silver stained T. pallidum; identification of T. vaginalis and N. gonorrhea