

Fungal and Protozoal Mini-Case History Studies for Courses Involving Medical Microbiology

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Abstract

26 fungal and protozoal mini-case history studies are designed as problem solving exercises to allow students to test their powers of deduction in identifying and treating important human pathogens, using clear cut cases involving "at risk" individuals wherever possible.

Activity

Invitation for User Feedback. If you have used the activity and would like to provide feedback, please send an e-mail to MicrobeLibrary@asmusa.org. Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

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INTRODUCTION

Background.

Mini-case history studies can be used as classroom exercises or given to students to work through as part of a written examination. In this activity, 26 mini-case history studies divided into two sections, fungi and protozoa, are presented. Suggested answer content for each component of the mini-case histories is italicized next to the question.

To incorporate these mini-case history studies into the curriculum, begin by presenting them to the students as a classroom or laboratory exercise. Divide students into groups of two to four individuals, assign one mini-case history study to each group, and allow them 15 to 20 minutes to work through it. This gives adequate time to discuss the problem and determine answers to the questions.

Subsequently, when each new sub-section of mycology and protozoology is covered, use one or two mini-case histories to accompany the lectures as problem-based learning exercises. Assign the mini-case history studies once the sub-section has been completed and give the students a few days to prepare a paragraph, which shows their conclusions and method of arriving at each conclusion, for each mini-case history study.

[Note: My classes are usually a mixture of Physician Assistant, Biology/Pre-Med., and Environmental Science majors and between 80 and 90% of all types of students enjoy these "sleuthing" exercises. All mini-case histories here have also been a component of my students' examinations at some point (usually a maximum of two mini-case histories each for mycology and protozoology) and this has helped in ironing out any confusing descriptions or sayings.]

PROCEDURE

Materials.

[Fungal and Protozoal Mini-Case History Studies for courses involving Medical Microbiology--Answer Key](#)
[Fungal and Protozoal Mini-Case History Studies for courses involving Medical Microbiology](#)—A list of mini-cases provided for each classroom or laboratory exercise, grouped as fungi and protozoa.

Instructor Version.

The mini-case history studies may be used in several ways.

A. Possible applications.

The mini-case histories included in this activity have been utilized successfully as classroom exercises, take home assignments, and examination material. The exercises tend to work best when a time limit is identified and when students are encouraged to try and work from memory rather than scanning through their notes.

Classroom exercise. The classroom exercise is useful, especially to the professor with a big class, since it encourages students' participation and critical thinking without being overly time consuming. Groups of two to four students appear to operate the most effectively for this exercise; lone students may feel somewhat "swamped" by the information, while larger groups may encourage one or two individuals to analyze the mini-case history with the remainder of the group not becoming truly involved. A time limit of 15 to 20 minutes for each mini-case history has been found to be optimal, allowing students sufficient time to digest the data but not too long to make them doubt their conclusions or "over-analyze" the information (often the case with the very bright student). Varying the students within each group and the spokesperson for each group also adds challenge to the exercise.

Take home assignment. Once the students are familiar with the steps needed to work through a mini-case history, they are ready to tackle one on their own. The ability to do this outside class and without help or hindrance from other group members may encourage the quieter student to perform more efficiently. In addition, many students, especially foreign language students, may be more able to put their ideas into writing rather than into an oral presentation. This kind of assignment, unlike the classroom exercise, allows more time and imposes less pressure. Again, it is advisable to encourage students to set some kind of time limit to prevent over-analysis, and to try and work as much from memory as possible to encourage the development of microbiological algorithms.

Examination material. The microbiological algorithms generated by the classroom and take home assignments may be tested as a component of the microbiology examination. Ideally, a student should be able to use the series of steps they have memorized to successfully analyze a mini-case history under examination conditions. However, many students, in the "heat of the moment" have trouble doing this, so a professor might want to allow the use of a limited amount of notes made by the student to be used in the examination (similar to formulae used in mathematics and physics examinations).

B. How I use these studies.

Since the process of working through a mini-case history is a novel skill, I usually begin with the classroom or laboratory exercise; at least 50 to 75% of the group grasp the procedure on the first occasion and can help teach the remaining class members. I give the students guidance as to how the process works by presenting two example mini-case histories and showing them each step taken to answer the associated questions. Each group of two to four students is then given the same two mini-case histories and asked to work through them for 15 to 20 minutes. They are asked to follow four steps:

1. Underline all components of the mini-case history that are important in reaching a diagnosis (e.g. laboratory data and risk factors such as vacations recently taken, occupations, or lifestyle practices).
2. Make a list of all appropriate species that fall into the category being studied and produce diseases of the kind presented in the mini-case history. For example, in the case of a gram-positive coccus causing a skin infection write a list of all gram-positive cocci capable of causing this condition.
3. Take the list and begin to eliminate candidates from it by using the information from the mini-case history. Discuss each candidate with your classmates until you reach a consensus.
4. Once you have identified the responsible organism, go on to determine a treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate.

I ask the students to use their notes as little as possible during this exercise to allow them to develop a "feel" for the subject and improve their critical thinking skills. They are not, however, prevented from using their notes at this point. Once they have seen the method for processing the mini-case history data, each group in the class is assigned a different, third mini-case history analysis and given 15 to 20 minutes to repeat the steps.

When the groups have finished deliberating, each member answers one of the questions associated with their mini-case history. This ensures that all students understand the process and could be assumed to be able to repeat it on their own. In addition, students are asked to comment on the ease with which they could identify the organism: Was the identity obvious? What pieces of information would they take away from the mini-case history to make it more difficult? How would they improve the mini-case history? Asking students to comment on the histories helps them focus on the concepts being demonstrated. Many brighter students generate ideas on the subject even during the first mini-case history session.

Once students understand how to proceed with a mini-case history, they can be encouraged to pursue them alone on a take home assignment. Students are asked to use a similar time limit as during class (15 to 20 minutes) to analyze the mini-case history and then write a paragraph explaining their method of reaching conclusions, any further thoughts they have about the condition the patient is suffering from and the "story" accompanying it. They are essentially asked to critique the mini-case, looking for loopholes, ascertaining the ease with which it could be solved, and sharing any ideas that might improve it.

By the time my students reach the examination stage, they have already processed many of these mini-case histories. For the microbiology course taught at this institution, four microbiology examinations are given each semester with the last two containing a maximum of two mini-case histories in any particular sub-section of microbiology. This has been successful in the past, since the combination of mini-case history analyses, short answer questions, fill-in-the-blank, and multiple matching in my examinations has allowed me to evaluate a wide variety of students' skills.

C. The concept of a mini-case history.

These mini-case histories were generated over a period of six weeks during the summer of 1998 using clinical and microbiological information gleaned from four separate microbiology textbooks. In making each mini-case, I initially focused on the symptoms and manifestation of the disease and the microscopic appearance of the organism causing it—information that the students gained in lectures and from the course textbook. By gradually adding pieces of information—such as the age of the patient, a risk factor, or a laboratory finding—other similar organisms were eliminated as potential causative agents so that the identity of the pathogen became obvious. The only difficulty was to balance how much information to give, so the answer wasn't totally obvious or completely obscure.

In formulating the mini-cases, I used risk factors including lifestyle, vacations, and age as much as possible to try and instill in the students a sense that these could provide real pointers as to the identity of a microorganism in a sick patient. I felt it

was important to make the situations as realistic as possible so that patients used "everyday" language. In addition, I tried to show that diagnostic mistakes are made, e.g. that conditions which appeared to be child abuse, irritable bowel disease, or lactose intolerance may actually be microbial in origin and that all information, no matter how apparently trite, may be important. Finally, the idea of the mini-case history was that it really would appear as a kind of "detective story" with a "plot," so students would enjoy "sleuthing" out the "culprit"—and learn new skills in the process.

Student Version.

1. Classroom Exercise: You have been given a mini-case history in the area of _____, which was covered in your lecture sections during the past week(s). You have been assigned to a group of four students and, as a group, you need to work through mini-case history number ____ from the list given, during the next 15 to 20 minutes. Use the following strategy to diagnose the mini-case. First, underline all components of the mini-case history that you think are important in reaching a diagnosis. Second, make a list of all fungal/protozoal species that fall into the designated category and produce diseases of the kind described in the mini-case history. Third, eliminate organisms from your list by using the additional information presented in the mini-case history. Once you have identified the organism involved, go on to determine treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate. Once you have completed the mini-case history, please raise your hand. As a group, you will be asked to present to the class your list of "suspect" organisms, and explain how you eliminated each one and arrived at the answers to the questions.
2. Homework Exercise: You have been given a mini-case history in the area of _____, which was covered in your lecture sections during the past week(s). Use the following strategy to diagnose the mini-case. First, underline all components of the mini-case history that you think are important in reaching a diagnosis. Second, make a list of all fungal/protozoal species that fall into the designated category and produce diseases of the kind described in the mini-case history. Third, eliminate organisms from your list by using the additional information presented in the mini-case history. Once you have identified the organism involved, go on to determine treatment strategy, other at-risk individuals, and methods of infection prevention, as appropriate. Present, in paragraph form, your list of "suspect" organisms, and explain how you eliminated each one and arrived at the answers to the questions.

Safety Issues. Not applicable.

SUPPLEMENTARY MATERIALS

Possible modifications.

In my course, bacteria, fungi, protozoa, and viruses are taught as separate and sequential subjects in a similar fashion to the way they are set-out in most microbiology textbooks. The mini-case histories are therefore presented in a similar, sequential way and are somewhat easier to diagnose since they are associated with each sub-section. Mini-case history studies could also be assigned at the end of a course as a method of outcome assessment to see how good the students are at going back and identifying the organisms, when presented with a whole series of them.

Reference Textbooks Used to Generate Mini-Case History Studies

1. **Black, J. G.** 1999. Microbiology principles and explorations, 4th ed., Prentice-Hall Inc., Englewood Cliffs, N.J.
2. **Jensen, M. J. and D. N. Wright.** 1997. Microbiology for the health sciences, 4th ed., Prentice-Hall Inc., Englewood Cliffs, N.J.
3. **Prescott, L. M., J. P. Harley, and D. A. Klein.** 1999. Microbiology, 4th ed., McGraw-Hill Book Co., New York.
4. **Talaro, K. and A. Talaro.** 1999. Foundations in microbiology, 3rd ed., McGraw-Hill Book Co., New York.

Related Activities

[Bacterial Mini-Case History Studies for Courses Involving Medical Microbiology](#)

[Viral Mini-Case History Studies for Courses Involving Medical Microbiology](#)

 Curriculum Resources

Fungal and Protozoal Mini-Case History Studies for Courses Involving Medical Microbiology -- Answer Key

Fungal diseases

1. A birdwatcher, returning from a visit to the Ozarks in Missouri, complains to his primary care physician of weakness and lethargy. On examination, he is found to have lymphadenopathy and a distended abdomen. Blood work reveals that the patient is anemic and an X-ray confirms hepatosplenomegaly. A mass, which was not nodular, was observed in both the liver and spleen as were a series of lesions. A few days later, the patient was admitted to the hospital in a confused state and with severe shortness of breath. X-rays revealed a "bird shot" appearance to the lungs and sputum and bone marrow cultures were positive for small budding intracellular yeasts. (4 points)

The related image is from a room temperature culture of the _____ organism - [View a related image](#)

What do you think that the patient is suffering from? *Histoplasma capsulatum*.

How did he contract it? *Contact with bird guano.*

Name another group of individuals who are at risk? *Any individuals with defective cellular immunity.*

Name another U.S. state in which the disease is common. *Illinois, Tennessee, Michigan, and Ohio.*

2. A male patient is admitted to the emergency room in a weakened state with a persistent fever and weight loss. His history includes the fact that he is HIV-positive and, until recently, lived in Panama. Blood work demonstrates reduced white cell, platelet, and red cell numbers. Bone marrow examination reveals a decreased number of white cells and the presence of an ascomycete yeast. The yeast produces numerous macroconidia when cultured on an agar plate. (5 points)

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What is wrong with this patient? Explain your reasoning. (3 points) *Histoplasma capsulatum. The patient is HIV-positive; plus blood and bone marrow work suggests severe immunocompromisation. An ascomycete means the organism could be Histoplasma or Blastomyces, both of which can cause disseminated infection in this patient group. The fact that he lived in Panama, however, points towards H. capsulatum.*

With what environmental source would you associate this organism? *Bird guano.*

Name two states in the U.S. in which this organism commonly causes infection? (2 points) *Illinois, Tennessee, Michigan, and Ohio.*

3. A male patient returns from a fall trip to southern Canada, where he went to visit his African-American relatives. He presents at the clinic with "flu-like" symptoms of hoarseness and coughing

but is also experiencing chest pain. A chest X-ray reveals small nodules in his lungs that may represent tumors, sputum specimens stained with calcofluor dye showed large broad-based yeast. (10 points)

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What organism do you think this patient may be infected with based on the above events? (3 points) *Blastomyces dermatitidis*. Of the four true pathogens possibly causing these symptoms, the patient is at risk of *Histoplasma capsulatum* because he is an adult male. But, the area suggests *B. dermatitidis*, plus he is African-American, a second risk factor. Nodules in the lungs also suggests *B. dermatitidis*, as do the ovoid yeast (*H. capsulatum* is a fish-eye yeast). It is also unlikely to be *C. immitis* since this is dormant during cooler times of the year, i.e. fall.

Which states of the U.S. would you associate with this organism? *It has been seen mostly in Illinois and the Ohio River basin area.*

Name a group of people at risk of infection with this organism? *African-Americans, pregnant women, middle-aged people, and males.*

What would you expect to see if you cultured the yeast from the lung nodules in the laboratory? *If grown at 25°C you would see fungi, and if grown at 37°C yeast.*

Name two other dimorphic yeasts and explain how they differ in appearance from the organism responsible for this case. (4 points) *Histoplasma are usually small, intracellular yeasts while Coccidioides are large spherule yeasts.*

4. A 45-year-old African-American man from Georgia was in good health until 2 months ago when he developed a low grade fever, myalgia, and a non-productive cough. On admission to the hospital, he was feverish, had breathing difficulties, and stated he had lost 5 pounds in weight over the past 2 months. The patient tested as HIV-negative, had not traveled recently, and was a non-smoker. He worked as a gardener for a local city park. A chest X-ray showed that the patient had consolidation of the middle lobe of his right lung with a small TB-like mass at the same location. An observant physician also noticed that the patient had a raised lesion on the bridge of the nose, which was tender to the touch. Bronchoscopy yielded a biopsy sample, which contained a large, round, budding yeast. Culture of the yeast yielded an ascomycete producing numerous macro- and microconidia. (6 points)

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What is wrong with this patient? What led you to this diagnosis? (3 points) *Blastomyces dermatitidis infection. Several risk factors are identified; the patient is a middle-aged African-American male living in Georgia who deals with plants, soil, and wood in a city park where he may also encounter animal feces from pigeons, ducks, geese, etc. The culture yielded an ascomycete which is either Histoplasma or Blastomyces. Histoplasma could also come from bird feces but does not produce ovoid yeast.*

What complications of this disease can occur? (2 points) *Abscesses, nodules, bone lesions, prostate and epididymis infection.*

How would you treat this patient? *Dihydroxystilbamine therapy.*

5. A 25-year-old male presents to his primary care physician with a neck mass. He has moved around the U.S. a lot, most recently from Arizona. Samples of purulent material drained from the

mass contained fungal arthrospores and giant sporangia (spherules). Culture of the arthrospores yielded a fluffy, white mold. (4 points)

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What is wrong with this patient? What led you to this diagnosis? (2 points) *Coccidioides immitis*. The finding of spherules and arthrospores and also the patient's most recent residence in Arizona, where the organism is common, points to this diagnosis.

A technician did not notice the mold immediately on the culture plates and opened them to look for bacteria. Was this dangerous and if so, why? (2 points) *Yes, opening the plates could release the arthrospores for inhalation.*

6. A male patient arrived back in the United States from a tour of Australia a week ago after a short vacation. He presents to his primary care physician with a small, hard, non-tender nodule on his hand. He thinks he may have "something in it" but doesn't remember how. He woke up and noticed it after a particularly extended 48-hour drinking session. The patient is a self-confessed alcoholic. (5 points)

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What organism is this? *Sporothrix schenckii*. This organism lives in warm climates and is associated with roses ("rose gardener's disease").

How did the patient contract it? *Came into contact with rose bark or thorns.*

How could he have prevented it? *Covered up bare skin.*

How would you treat it? *Iodine, heat packs.*

Can you anticipate any long-term problems? *Since the patient is an alcoholic, the organism could invade the lymphatics after the nodule necroses.*

7. A 29-year-old, HIV-positive male was admitted to the hospital with a two-week history of non-productive cough, fever, and shortness of breath. On examination, he had a mild fever, was breathing rapidly, and had significantly reduced arterial oxygen levels. A chest X-ray demonstrated bilateral pulmonary infiltration. A sample of sputum was obtained by bronchoalveolar lavage (BAL). An unusual organism was obtained from the BAL, which displayed the characteristics of both a protozoan and a fungus. This organism has cyst and trophozoite phases but is genetically similar to the yeast *Saccharomyces*. (5 points)

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What is wrong with this patient? *Pneumocystis carinii*.

How did he contract this organism? *Exposure is thought to occur during childhood with the healthy immune system holding it in check. Immunocompromisation due to HIV has allowed it to re-emerge.*

What kinds of patients are at risk from infection by this organism? *Any patients with defective cell-mediated immunity either genetic or acquired.*

How would you treat this patient? *Pentamidine and cotrimoxazole for 10 days.*

What is the outlook for his condition? *Untreated patients have a 50-100% mortality; treated much better.*

8. A female patient underwent surgery to clear a blocked ureter 3 days ago and is now experiencing vaginal discomfort, with a milky white discharge, local inflammation, and ulceration. An ovoid yeast recovered from the discharge produced white colonies on sheep blood agar, reproduced by budding, and subsequently produced germ tubes. (5 points)

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What is wrong with this patient? What led you to this diagnosis? (2 points) *Candida albicans*. *C. albicans* is the yeast most commonly causing vulvovaginal infection, plus the production of germ tubes indicates *albicans* yeast.

Is this organism life-threatening? *Yes, for AIDS or other immunocompromised patients.*

How did the patient contract the infection? *The likelihood is that the in-dwelling cannula allowed the endogenous yeast to invade the body.*

9. A male patient presents with a 3-year history of pain and itching of the toes of both feet and of his left palm and fingers. Small red lesions were visible on his left fingers. He is currently in good health, otherwise, and in training for his college baseball, volleyball, and swimming teams. During the 3 years, he has been stopping and starting with his medication and has now returned to the clinic since the condition does not appear to be responding to his current medication any more. Direct examination of skin scrapings with the calcofluor dye revealed what is seen in the related image below. A culture of skin scrapings from the patient's feet grew a white, fuzzy fungus, which demonstrated thin-walled macroconidia and numerous microconidia. (5 points)

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What is wrong with this patient? *Athlete's foot.*

How is he likely to have contracted it? (2 points) *Contact with infected skin or hair. The organism survives in moist environments, e.g., pool decks and shower rooms.*

To which group of organisms does the fungus belong? Why is this group so named? (2 points) *Dermatophytes. Organisms that live on the non-living tissues of keratin (nails, skin, hair).*

10. A patient is admitted to the emergency room with seizures and in a confused state. His wife tells the physicians that he has had a fever and cough for the past week but was convinced it was just the "flu" and so did not consult anyone. The physician tests for HIV but the patient is HIV-negative. (3 points)

One of the other things the patient's wife told the physicians is that her husband keeps pigeons as a hobby. What disease does this now suggest he has? *Cryptococcus neoformans, pigeon fancier's disease.*

Why did the physician suggest testing for HIV? (2 points) *The disease is a hallmark of AIDS and causes death in these patients. Finding of infection is usually associated with bird contact or immunocompromisation.*

11. A male with full-blown AIDS is admitted to the emergency room in a confused state, disoriented, and lethargic. The patient had a one-week history of progressively worsening headache, photophobia, lethargy, and fever. On admission, CT scans and chest X-rays were performed. Both appeared normal, however a lumbar puncture revealed aseptic meningitis. Direct examination of the cerebrospinal fluid (CSF) with India ink showed encapsulated yeasts. Putting the CSF sample on sheep blood agar revealed pink colonies of a round yeast which was gram-variable. (5 points)

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What organism is causing the patient's illness? What led you to this diagnosis? (2 points) *In AIDS, mental changes are usually associated with either Toxoplasma or Cryptococcal infection. This is a fungal infection, therefore Cryptococcus neoformans.*

How is the patient likely to have become infected? *Bird guano, especially pigeons.*

How would you treat this patient? *Amphotericin B, flucytosine or miconazole for weeks or months.*

What is the outlook for the patient? *Usually fatal.*

12. A 60-year-old woman with noninsulin-dependent diabetes mellitus (NIDDM) presents with a 4-day history of left eye swelling and frontal headache. On examination, she has a fever and a severely distended left eye. A CT scan of the nasal sinuses and eye shows fluid accumulation. Following surgery to drain the fluid, a fungus was isolated from it which demonstrated broad, aseptate hyphae with right angle branching. The fungus showed characteristic zygote fruiting bodies. (5 points)

What is wrong with this patient? What led you to this diagnosis? (3 points) *Rhinocerebral zygomycosis. Zygote formation means a zygomycete. Infection occurs in immunocompromised and NIDDM.*

How is the disease managed? (2 points) *Debridement and IV antifungals. Can be fatal.*

Protozoa

1. A young, male university student returned from a trip to Hawaii at the end of October and was admitted to the emergency room with convulsions. The student had been on vacation with a number of his classmates and had been ill with cold-like symptoms and headaches since his return. The vacation consisted of a hiking tour inland and visits to a number of wooded areas. When questioned, his classmates said they had all eaten and drunk roughly the same things on vacation. One of the female students said that the male patient had been "acting strange" ever since they visited an inland pool, which had its own underground spring as a water supply, where he showed off his diving skills. (The patient was a member of the university diving team.) Spinal fluid was cultured on non-nutrient media with a lawn of *E. coli*. Organisms were visualized with a methylene blue stain on the agar. (5 points)

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Based on the above history, what do you think was wrong with the male patient? *Naegleria fowleri or Acanthamoeba infection of the brain (primary acute meningoencephalitis).*

How did he acquire the infection? *Diving into contaminated water forced the amoeba through the nasal passages and they then attacked the brain.*

What treatment would you have prescribed? (2 points) *Miconazole and/or Amphotericin B. Usually cases are too far advanced to do anything however.*

What other steps would you take to prevent additional cases of infection with this organism? *Clean out water and don't dive in any water that is contaminated.*

2. A male patient, recently returned from a year spent with the Peace Corps in Kenya, presents to

his primary care physician with fever and a distended abdomen. On examination the young man is jaundiced and an X-ray of his abdomen reveals opaque, nodular growths in the large intestine. Liver biopsy recovers large trophozoites containing a prominent and distinctive nucleolus called a karyosome. (4 points)

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Which organism is this patient infected with? *Entamoeba histolytica*.

How did he contract it? *Food or water contaminated by cysts which then hatched and invaded his large intestine.*

What other bodily targets does this organism have? *Cecum, appendix, colon, and rectum.*

Could this infection have been prevented? How? *Yes, by using boiled, chlorinated or filtered water.*

3. A female patient presents to her primary care physician with pain radiating from her groin and a low-grade fever. On examination she is found to have a purulent vaginal discharge, which is green, foul smelling and contains motile, flagellated protozoa. Her physician tells her he suspects an STD but she denies this, saying that her boyfriend has "no problems" and she is "faithful to him." (4 points)

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What disease does this patient have? Is it an STD? *Trichomonas vaginalis infection; yes.*

Where has the organism come from? Explain your answer. (2 points) *Trichomonas infection can be either asymptomatic or sub-clinical. The woman's boyfriend may have such an infection or she may herself have had the infection for some time without realizing it.*

How would you treat this patient? *To avoid "ping-pong" infections both partners must be treated with metronidazole for at least one week.*

4. A 24-year-old woman is referred to a public health clinic as a result of contact tracing from a case of gonorrhea. She recently had unprotected sex with her infected male partner but showed no symptoms. A pelvic examination recovers a greenish discharge containing protozoa with characteristic "jerky" motility. The woman tested negative for gonorrhea. (6 points)

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What is wrong with this patient? How common is her infection? *Trichomonas vaginalis. This organism affects between 3 and 15% of the U.S. population as a sub-clinical infection.*

What symptoms does it produce in women and men? (2 points) *Women can have dysuria or discharge with some being asymptomatic. Men can have prostate or seminal vesicle infection with most being asymptomatic.*

What treatment would you prescribe for this patient? (2 points) *To avoid "ping-pong" infections both partners must be treated with oral and vaginal metronidazole for at least one week.*

5. An anthropologist has just returned to Philadelphia after an extensive study of the Native American peoples of New Mexico. He presents at his primary care physician with diarrhea, abdominal pain, and fever. Stool samples reveal protozoal cysts and motile trophozoites and gastroscopy reveals more protozoa attached to the jejunum. Further confirmation of the diagnosis

is obtained by performing an ELISA on the stool to detect specific antigen. (4 points)

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Which organism is this? Explain your answer. (3 points) *Giardia lamblia*. *Gastroenteritis* suggests either *Entamoeba histolytica* or *G. lamblia*. *E. histolytica* would have attacked the large intestine, however, and this is attacking the small intestine suggesting *G. lamblia* as a more likely candidate.

How did the anthropologist get the infection? *Water contaminated with cysts and/or trophozoites.*

What treatment would you recommend? *Metranidazole.*

6. A male patient, recently returned from a visit to Africa (two weeks ago), is admitted to the hospital with an intermittent fever, swollen lymph nodes, and joint pain. His wife brings him to the emergency room and says she is having trouble "waking him during the day" whereas he "stays awake all night." The admitting physician notices that the man is slurring his words and his hands are shaking. Tests reveal the presence of a tropomastigote in the patient's bloodstream together with IgM raised against the organism. (5 points)

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What do you think is wrong with this man? *Trypanosoma brucei*. *This is rhodesiense due to the speed of attack of the organism on the brain.*

What area of the body is affected by the disease? *It has attacked the brain affecting speech and coordination.*

How and where did he contract the disease and what is its prognosis? *Bitten by a tsetse fly and will probably die in 2 to 3 months because of speed of onset of brain involvement.*

What is the life cycle of this organism? *Natural hosts are wild animals. It is transmitted from an infected host to man via the bite of a tsetse fly.*

How would you treat this condition? *Metapryosol or pentamidine.*

7. A young male patient, who has just returned from 2 years of service in the Peace Corps in Brazil, presents at his primary care physician with fever, chest pain, breathlessness, and a distended abdomen. He was in a car accident about 6 months ago, while on active duty, and received a blood transfusion in a local Rio de Janeiro hospital. The physician refers him to the hospital where he is admitted for observation. A chest X-ray shows both hepatosplenomegaly and heart enlargement and an EKG shows a systolic murmur. The patient does not remember being bitten by anything during his time in the Peace Corps, as all Peace Corps volunteers were advised by their commanding officers to use netting and insect repellents and to remain "covered up" whenever possible. The patient has also had no sexual intercourse over the past 6 months. The patient died 2 years later from heart damage caused by the hemoflagellate trypanosomal protozoa infecting him. (5 points)

What is wrong with this patient? How did you arrive at this diagnosis? (2 points) *Chagas disease caused by Trypanosoma cruzi. This disease targets the heart.*

How can this disease be contracted? (2 points) *Through a blood transfusion or from being bitten by reduviid bugs.*

How do you think this patient contracted the disease? *Probably from the blood transfusion associated with his car accident.*

8. A recent immigrant to the United States from Brazil, who has been in the country for 3 months, presents to his primary care physician suffering from an intense spiking fever. His weight has dropped from 170 to 120 pounds and he shows a distended stomach. On X-ray, his spleen and liver are enlarged and he is also somewhat anemic. The physician also notes that the man's skin is extensively scarred as a result of ulcers, which have subsequently healed. The patient is prescribed amphotericin B and his physician notes that unless the situation improves he will need to be given pentamidine or pentavalent antimony. (4 points)

Which disease and organism are causing the patient's condition? (2 points) *Leishmania donovani, kala azar.*

Name another area of the world to which it is endemic. *China, Latin America.*

How likely is it that the patient will die, in spite of the physician's best efforts? *75-100%*

9. Simon, a student, presents with ulcerated, raised lesions on his neck, calves, and feet. These lesions have drained, ulcerated, healed, and then broken open again. He traveled to the Middle East last summer (4 months ago) and spent June and July in Israel followed by several weeks in Egypt. During this time he remembers being bitten by numerous "small black flies." While in Egypt, he noticed the first neck lesion. Blood work shows a normal white cell count and culture of the neck lesion reveals a hemoflagellate protozoan. (5 points)

What is wrong with Simon? What has led you to this diagnosis? (2 points) *Hemoflagellates mean Trypanosomes or Leishmania. Trypanosomes do not produce skin lesions, therefore it is cutaneous Leishmania. Given the region of world it is Leishmania tropicana.*

What are the "black flies" the patient referred to? *Sandflies.*

Why are infections typically seen on the head and neck? (2 points) *The fly can't bite through clothing.*

10. A man returned two weeks ago from a vacation in Africa and presents in the emergency room with a severe, spiking fever and chills. Observation in the hospital shows that he exhibits these symptoms every 2 to 3 days, thereafter appearing to recover. His liver and spleen are enlarged and the patient also demonstrates a reduced red cell count due to hemolytic anemia. Blood analysis confirms the presence of trophozoite forms of a sporozoan protozoan. (8 points)

[View a related image](#)

What tropical disease is the patient suffering from? *Malaria/Plasmodium.*

What aspects of the disease are causing his symptoms? *Erythrocytic bursting every 2 to 3 days.*

The patient remembers being bitten by an insect while in Africa. What kind of insect acts as a vector for this disease? Are there any other ways of being infected? *The Anopheles mosquito acts as a vector for this disease. Contaminated needles are another way of becoming infected.*

This is a mild form of the disease. What kind of prognosis can the patient expect? *Recovery in 5 years or so.*

How would you recommend treating this patient? *Quinine derivatives (mepacrine/ chloroquine).*

What two simple methods could this man have used to reduce his risk of contracting this disease?
Select from: Used insect repellent, stayed indoors at night, or used netting over windows.

11. David returned from Africa 12 days prior to his admission to the hospital. He had been in Africa for 6 months working as a civil engineer on road building projects in Rwanda, Zaire, and Uganda. Seven days prior to admission he began suffering from fevers with chills, cough, and myalgia. Three days ago he had episodes of fevers and chills, three times a day. On admission, the patient was stuporous and showed mental changes. Blood work showed lowered white cell and platelet counts. He also had a hematocrit of approximately half that of normal levels with grossly prolonged bleeding times. A sporozoan parasite was recovered from the blood, which had a characteristic "ring" form. Despite treatment, the patient eventually went into a coma and died. (6 points)

[View a related image](#)

What was wrong with David? What led you to this diagnosis? You should be able to identify this organism to the species level. (2 points) *Symptoms point to malaria. Severity and speed of attack suggests falciparum. Sporozoans mean Toxoplasma or Plasmodium.*

Why is the observation of mental changes significant? *Cerebral malaria.*

What treatment would you prescribe for David, if I told you he has parasitemia levels of 25%?
Exchange transfusion of his red blood cells (RBC).

Could David's condition have been prevented? (2 points) *Prophylaxis by use of anti-malarials and insect repellents; currently there is no vaccine.*

12. Andrea, a one-week-old child, has hydrocephalus, hepatosplenomegaly, and is blind. Blood and tissue analyses from affected sites show no evidence of protozoa. (4 points)

What caused the baby's condition? *Toxoplasma gondii exposure during pregnancy.*

What is this kind of effect on a fetus called? *Teratogenic.*

How could Andrea's condition have been prevented? *Get rid of the cat or don't clean the litter box during pregnancy.*

Name one source of infection from this organism. *Cats and birds.*

13. A HIV-positive male with a T-helper cell count of 60/ml presents with headaches, weakness, and difficulty maintaining his balance when walking. His friend who brought him to the emergency room stated that the patient had been quite agitated over the previous few days and that his speech was slurred and "rambling." On physical examination, the patient was afebrile, but not oriented towards space or time, and unable to recognize his friend. Imaging of the brain revealed multiple ring-enhancing lesions containing oocysts of a sporozoan parasite. (5 points)

What organism do you think is causing the patient's condition? How do you arrive at this diagnosis? (2 points) *Toxoplasma gondii. Brain lesions in an HIV-positive patient means Cryptococcus or Toxoplasma.*

How is he likely to have become infected? *Contact with oocysts via cats.*

Name another group of patients at risk of serious infection from this organism. *Pregnant women and their fetuses.*

What is the outlook for this patient? *Poor, the disease is usually fatal.*

14. Nicola, a 3-year-old child who began attending a day care center two weeks ago, was admitted to the hospital following a 3-day history of increasingly severe diarrhea with episodes of vomiting. In the previous 24 hours she had 12 bowel movements. Prior to this, the child had been healthy and no other illnesses were reported for any other members of the family. The child's mother, who accompanied her, was concerned that it might be *Salmonella* infection since the pets in the day care center included turtles and an iguana. On examination, the child was lethargic, dehydrated, and had an elevated heart rate. A stool specimen contained no white or red cells, but yeast-like, non-motile, oocyst sporozoan parasites were recovered. Her diarrhea resolved after a further week. (6 points)

[View a related image](#)

What protozoa are able to cause diarrhea? (3 points) *Entamoeba histolytica, Giardia lamblia, and Cryptosporidium parvum.*

Of these, which is the most likely to be causing Nicola's diarrhea and why? (2 points) *C. parvum is most likely to be causing the diarrhea. G. lamblia and C. parvum are most likely in the U.S., since E. histolytica is tropical. G. lamblia does not have oocysts and is motile.*

How is Nicola likely to have contracted the infection? Is there any significance to the day care center's choice of pets? *Day-care, oral-fecal spread; yes, both pets carry the organism in their intestines.*

Curriculum Resources

Fungal and Protozoal Mini-Case History Studies for Courses Involving Medical Microbiology

Fungal diseases

1. A birdwatcher, returning from a visit to the Ozarks in Missouri, complains to his primary care physician of weakness and lethargy. On examination, he is found to have lymphadenopathy and a distended abdomen. Blood work reveals that the patient is anemic and an X-ray confirms hepatosplenomegaly. A mass, which was not nodular, was observed in both the liver and spleen as were a series of lesions. A few days later, the patient was admitted to the hospital in a confused state and with severe shortness of breath. X-rays revealed a "bird shot" appearance to the lungs and sputum and bone marrow cultures were positive for small budding intracellular yeasts. (4 points)

The related image is from a room temperature culture of the _____ organism - [View a related image](#)

What do you think that the patient is suffering from?

How did he contract it?

Name another group of individuals who are at risk?

Name another U.S. state in which the disease is common.

2. A male patient is admitted to the emergency room in a weakened state with a persistent fever and weight loss. His history includes the fact that he is HIV-positive and, until recently, lived in Panama. Blood work demonstrates reduced white cell, platelet, and red cell numbers. Bone marrow examination reveals a decreased number of white cells and the presence of an ascomycete yeast. The yeast produces numerous macroconidia when cultured on an agar plate. (5 points)

[View a related image](#)

What is wrong with this patient? Explain your reasoning. (3 points)

With what environmental source would you associate this organism?

Name two states in the U.S. in which this organism commonly causes infection? (2 points)

3. A male patient returns from a fall trip to southern Canada, where he went to visit his African-American relatives. He presents at the clinic with "flu-like" symptoms of hoarseness and coughing but is also experiencing chest pain. A chest X-ray reveals small nodules in his lungs that may represent tumors, sputum specimens stained with calcofluor dye showed large broad-based yeast. (10 points)

[View a related image](#)

What organism do you think this patient may be infected with based on the above events? (3 points)

Which states of the U.S. would you associate with this organism?

Name a group of people at risk of infection with this organism?

What would you expect to see if you cultured the yeast from the lung nodules in the laboratory?

Name two other dimorphic yeasts and explain how they differ in appearance from the organism responsible for this case. (4 points)

4. A 45-year-old African-American man from Georgia was in good health until 2 months ago when he developed a low grade fever, myalgia, and a non-productive cough. On admission to the hospital, he was feverish, had breathing difficulties, and stated he had lost 5 pounds in weight over the past 2 months. The patient tested as HIV-negative, had not traveled recently, and was a non-smoker. He worked as a gardener for a local city park. A chest X-ray showed that the patient had consolidation of the middle lobe of his right lung with a small TB-like mass at the same location. An observant physician also noticed that the patient had a raised lesion on the bridge of the nose, which was tender to the touch. Bronchoscopy yielded a biopsy sample, which contained a large, round, budding yeast. Culture of the yeast yielded an ascomycete producing numerous macro- and microconidia. (6 points)

[View a related image](#)

What is wrong with this patient? What led you to this diagnosis? (3 points)

What complications of this disease can occur? (2 points)

How would you treat this patient?

5. A 25-year-old male presents to his primary care physician with a neck mass. He has moved around the U.S. a lot, most recently from Arizona. Samples of purulent material drained from the mass contained fungal arthrospores and giant sporangia (spherules). Culture of the arthrospores yielded a fluffy, white mold. (4 points)

[View a related image](#)

What is wrong with this patient? What led you to this diagnosis? (2 points)

A technician did not notice the mold immediately on the culture plates and opened them to look for bacteria. Was this dangerous and if so, why? (2 points)

6. A male patient arrived back in the United States from a tour of Australia a week ago after a short vacation. He presents to his primary care physician with a small, hard, non-tender nodule on his hand. He thinks he may have "something in it" but doesn't remember how. He woke up and noticed it after a particularly extended 48-hour drinking session. The patient is a self-confessed alcoholic. (5 points)

[View a related image](#)

What organism is this?

How did the patient contract it?

How could he have prevented it?

How would you treat it?

Can you anticipate any long-term problems?

7. A 29-year-old, HIV-positive male was admitted to the hospital with a two-week history of non-productive cough, fever, and shortness of breath. On examination, he had a mild fever, was breathing rapidly, and had significantly reduced arterial oxygen levels. A chest X-ray demonstrated bilateral pulmonary infiltration. A sample of sputum was obtained by bronchoalveolar lavage (BAL). An unusual organism was obtained from the BAL, which displayed the characteristics of both a protozoan and a fungus. This organism has cyst and trophozoite phases but is genetically similar to the yeast *Saccharomyces*. (5 points)

[View a related image](#)

What is wrong with this patient?

How did he contract this organism?

What kinds of patients are at risk from infection by this organism?

How would you treat this patient?

What is the outlook for his condition?

8. A female patient underwent surgery to clear a blocked ureter 3 days ago and is now experiencing vaginal discomfort, with a milky white discharge, local inflammation, and ulceration. An ovoid yeast recovered from the discharge produced white colonies on sheep blood agar, reproduced by budding, and subsequently produced germ tubes. (5 points)

[View a related image](#)

[View a related image](#)

What is wrong with this patient? What led you to this diagnosis? (2 points)

Is this organism life-threatening?

How did the patient contract the infection?

9. A male patient presents with a 3-year history of pain and itching of the toes of both feet and of his left palm and fingers. Small red lesions were visible on his left fingers. He is currently in good health, otherwise, and in training for his college baseball, volleyball, and swimming teams. During the 3 years, he has been stopping and starting with his medication and has now returned to the clinic since the condition does not appear to be responding to his current medication any more. Direct examination of skin scrapings with the calcofluor dye revealed what is seen in the related image below. A culture of skin scrapings from the patient's feet grew a white, fuzzy fungus, which demonstrated thin-walled macroconidia and numerous microconidia. (5 points)

[View a related image](#)

What is wrong with this patient?

How is he likely to have contracted it? (2 points)

To which group of organisms does the fungus belong? Why is this group so named? (2 points)

10. A patient is admitted to the emergency room with seizures and in a confused state. His wife tells the physicians that he has had a fever and cough for the past week but was convinced it was just the "flu" and so did not consult anyone. The physician tests for HIV but the patient is

HIV-negative. (3 points)

One of the other things the patient's wife told the physicians is that her husband keeps pigeons as a hobby. What disease does this now suggest he has?

Why did the physician suggest testing for HIV? (2 points)

11. A male with full-blown AIDS is admitted to the emergency room in a confused state, disoriented, and lethargic. The patient had a one-week history of progressively worsening headache, photophobia, lethargy, and fever. On admission, CT scans and chest X-rays were performed. Both appeared normal, however a lumbar puncture revealed aseptic meningitis. Direct examination of the cerebrospinal fluid (CSF) with India ink showed encapsulated yeasts. Putting the CSF sample on sheep blood agar revealed pink colonies of a round yeast which was gram-variable. (5 points)
- [View a related image](#)

What organism is causing the patient's illness? What led you to this diagnosis? (2 points)

How is the patient likely to have become infected?

How would you treat this patient?

What is the outlook for the patient?

12. A 60-year-old woman with noninsulin-dependent diabetes mellitus (NIDDM) presents with a 4-day history of left eye swelling and frontal headache. On examination, she has a fever and a severely distended left eye. A CT scan of the nasal sinuses and eye shows fluid accumulation. Following surgery to drain the fluid, a fungus was isolated from it which demonstrated broad, aseptate hyphae with right angle branching. The fungus showed characteristic zygote fruiting bodies. (5 points)

What is wrong with this patient? What led you to this diagnosis? (3 points)

How is the disease managed? (2 points)

Protozoa

1. A young, male university student returned from a trip to Hawaii at the end of October and was admitted to the emergency room with convulsions. The student had been on vacation with a number of his classmates and had been ill with cold-like symptoms and headaches since his return. The vacation consisted of a hiking tour inland and visits to a number of wooded areas. When questioned, his classmates said they had all eaten and drunk roughly the same things on vacation. One of the female students said that the male patient had been "acting strange" ever since they visited an inland pool, which had its own underground spring as a water supply, where he showed off his diving skills. (The patient was a member of the university diving team.) Spinal fluid was cultured on non-nutrient media with a lawn of *E. coli*. Organisms were visualized with a methylene blue stain on the agar. (5 points)

[View a related image](#)

Based on the above history, what do you think was wrong with the male patient?

How did he acquire the infection?

What treatment would you have prescribed? (2 points)

What other steps would you take to prevent additional cases of infection with this organism?

2. A male patient, recently returned from a year spent with the Peace Corps in Kenya, presents to his primary care physician with fever and a distended abdomen. On examination the young man is jaundiced and an X-ray of his abdomen reveals opaque, nodular growths in the large intestine. Liver biopsy recovers large trophozoites containing a prominent and distinctive nucleolus called a karyosome. (4 points)

[View a related image](#)

Which organism is this patient infected with?

How did he contract it?

What other bodily targets does this organism have?

Could this infection have been prevented? How?

3. A female patient presents to her primary care physician with pain radiating from her groin and a low-grade fever. On examination she is found to have a purulent vaginal discharge, which is green, foul smelling and contains motile, flagellated protozoa. Her physician tells her he suspects an STD but she denies this, saying that her boyfriend has "no problems" and she is "faithful to him." (4 points)

[View a related image](#)

What disease does this patient have? Is it an STD?

Where has the organism come from? Explain your answer. (2 points)

How would you treat this patient?

4. A 24-year-old woman is referred to a public health clinic as a result of contact tracing from a case of gonorrhea. She recently had unprotected sex with her infected male partner but showed no symptoms. A pelvic examination recovers a greenish discharge containing protozoa with characteristic "jerky" motility. The woman tested negative for gonorrhea. (6 points)

[View a related image](#)

What is wrong with this patient? How common is her infection?

What symptoms does it produce in women and men? (2 points)

What treatment would you prescribe for this patient? (2 points)

5. An anthropologist has just returned to Philadelphia after an extensive study of the Native American peoples of New Mexico. He presents at his primary care physician with diarrhea, abdominal pain, and fever. Stool samples reveal protozoal cysts and motile trophozoites and gastroscopy reveals more protozoa attached to the jejunum. Further confirmation of the diagnosis is obtained by performing an ELISA on the stool to detect specific antigen. (4 points)

[View a related image](#)

[View a related image](#)

Which organism is this? Explain your answer. (3 points)

How did the anthropologist get the infection?

What treatment would you recommend?

6. A male patient, recently returned from a visit to Africa (two weeks ago), is admitted to the hospital with an intermittent fever, swollen lymph nodes, and joint pain. His wife brings him to the emergency room and says she is having trouble "waking him during the day" whereas he "stays awake all night." The admitting physician notices that the man is slurring his words and his hands are shaking. Tests reveal the presence of a tropomastigote in the patient's bloodstream together with IgM raised against the organism. (5 points)

[View a related image](#)

What do you think is wrong with this man?

What area of the body is affected by the disease?

How and where did he contract the disease and what is its prognosis?

What is the life cycle of this organism?

How would you treat this condition?

7. A young male patient, who has just returned from 2 years of service in the Peace Corps in Brazil, presents at his primary care physician with fever, chest pain, breathlessness, and a distended abdomen. He was in a car accident about 6 months ago, while on active duty, and received a blood transfusion in a local Rio de Janeiro hospital. The physician refers him to the hospital where he is admitted for observation. A chest X-ray shows both hepatosplenomegaly and heart enlargement and an EKG shows a systolic murmur. The patient does not remember being bitten by anything during his time in the Peace Corps, as all Peace Corps volunteers were advised by their commanding officers to use netting and insect repellents and to remain "covered up" whenever possible. The patient has also had no sexual intercourse over the past 6 months. The patient died 2 years later from heart damage caused by the hemoflagellate trypanosomal protozoa infecting him. (5 points)

What is wrong with this patient? How did you arrive at this diagnosis? (2 points)

How can this disease be contracted? (2 points)

How do you think this patient contracted the disease?

8. A recent immigrant to the United States from Brazil, who has been in the country for 3 months, presents to his primary care physician suffering from an intense spiking fever. His weight has dropped from 170 to 120 pounds and he shows a distended stomach. On X-ray, his spleen and liver are enlarged and he is also somewhat anemic. The physician also notes that the man's skin is extensively scarred as a result of ulcers, which have subsequently healed. The patient is prescribed amphotericin B and his physician notes that unless the situation improves he will need to be given pentamidine or pentavalent antimony. (4 points)

Which disease and organism are causing the patient's condition? (2 points)

Name another area of the world to which it is endemic.

How likely is it that the patient will die, in spite of the physician's best efforts?

9. Simon, a student, presents with ulcerated, raised lesions on his neck, calves, and feet. These lesions have drained, ulcerated, healed, and then broken open again. He traveled to the Middle East last summer (4 months ago) and spent June and July in Israel followed by several weeks in Egypt. During this time he remembers being bitten by numerous "small black flies." While in Egypt, he noticed the first neck lesion. Blood work shows a normal white cell count and culture of the neck lesion reveals a hemoflagellate protozoan. (5 points)

What is wrong with Simon? What has led you to this diagnosis? (2 points)

What are the "black flies" the patient referred to?

Why are infections typically seen on the head and neck? (2 points)

10. A man returned two weeks ago from a vacation in Africa and presents in the emergency room with a severe, spiking fever and chills. Observation in the hospital shows that he exhibits these symptoms every 2 to 3 days, thereafter appearing to recover. His liver and spleen are enlarged and the patient also demonstrates a reduced red cell count due to hemolytic anemia. Blood analysis confirms the presence of trophozoite forms of a sporozoan protozoan. (8 points)

[View a related image](#)

What tropical disease is the patient suffering from?

What aspects of the disease are causing his symptoms?

The patient remembers being bitten by an insect while in Africa. What kind of insect acts as a vector for this disease? Are there any other ways of being infected?

This is a mild form of the disease. What kind of prognosis can the patient expect?

How would you recommend treating this patient?

What two simple methods could this man have used to reduce his risk of contracting this disease?

11. David returned from Africa 12 days prior to his admission to the hospital. He had been in Africa for 6 months working as a civil engineer on road building projects in Rwanda, Zaire, and Uganda. Seven days prior to admission he began suffering from fevers with chills, cough, and myalgia. Three days ago he had episodes of fevers and chills, three times a day. On admission, the patient was stuporous and showed mental changes. Blood work showed lowered white cell and platelet counts. He also had a hematocrit of approximately half that of normal levels with grossly prolonged bleeding times. A sporozoan parasite was recovered from the blood, which had a characteristic "ring" form. Despite treatment, the patient eventually went into a coma and died. (6 points)

[View a related image](#)

What was wrong with David? What led you to this diagnosis? You should be able to identify this organism to the species level. (2 points)

Why is the observation of mental changes significant?

What treatment would you prescribe for David, if I told you he has parasitemia levels of 25%?

Could David's condition have been prevented? (2 points)

12. Andrea, a one-week-old child, has hydrocephalus, hepatosplenomegaly, and is blind. Blood and tissue analyses from affected sites show no evidence of protozoa. (4 points)

What caused the baby's condition?

What is this kind of effect on a fetus called?

How could Andrea's condition have been prevented?

Name one source of infection from this organism.

13. A HIV-positive male with a T-helper cell count of 60/ml presents with headaches, weakness, and difficulty maintaining his balance when walking. His friend who brought him to the emergency room stated that the patient had been quite agitated over the previous few days and that his speech was slurred and "rambling." On physical examination, the patient was afebrile, but not oriented towards space or time, and unable to recognize his friend. Imaging of the brain revealed multiple ring-enhancing lesions containing oocysts of a sporozoan parasite. (5 points)

What organism do you think is causing the patient's condition? How do you arrive at this diagnosis? (2 points)

How is he likely to have become infected?

Name another group of patients at risk of serious infection from this organism.

What is the outlook for this patient?

14. Nicola, a 3-year-old child who began attending a day care center two weeks ago, was admitted to the hospital following a 3-day history of increasingly severe diarrhea with episodes of vomiting. In the previous 24 hours she had 12 bowel movements. Prior to this, the child had been healthy and no other illnesses were reported for any other members of the family. The child's mother, who accompanied her, was concerned that it might be *Salmonella* infection since the pets in the day care center included turtles and an iguana. On examination, the child was lethargic, dehydrated, and had an elevated heart rate. A stool specimen contained no white or red cells, but yeast-like, non-motile, oocyst sporozoan parasites were recovered. Her diarrhea resolved after a further week. (6 points)

[View a related image](#)

What protozoa are able to cause diarrhea? (3 points)

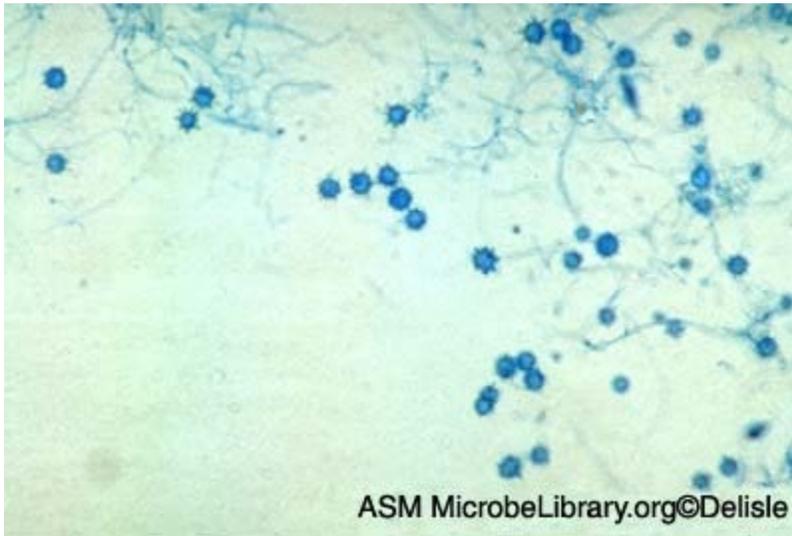
Of these, which is the most likely to be causing Nicola's diarrhea and why? (2 points)

How is Nicola likely to have contracted the infection? Is there any significance to the day care center's choice of pets?

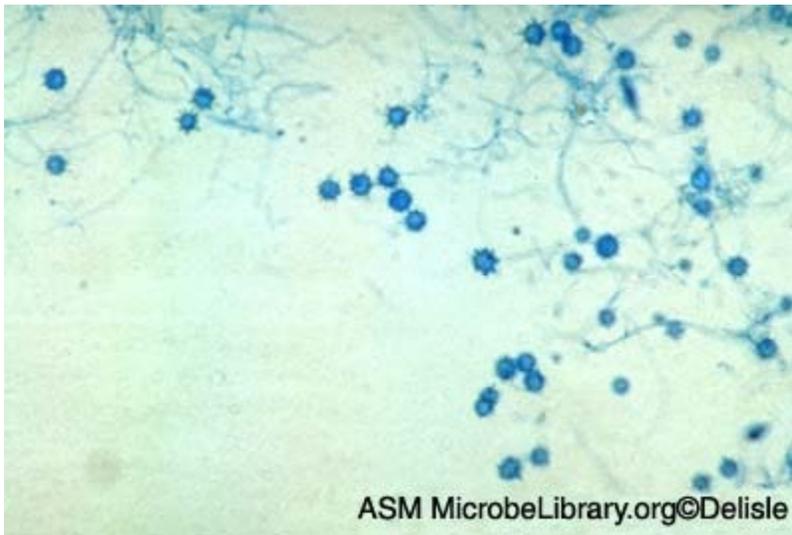
Fungal and Protozoal Mini-Case History Studies for Courses Involving Medical Microbiology -- Answer Key

Fungal diseases

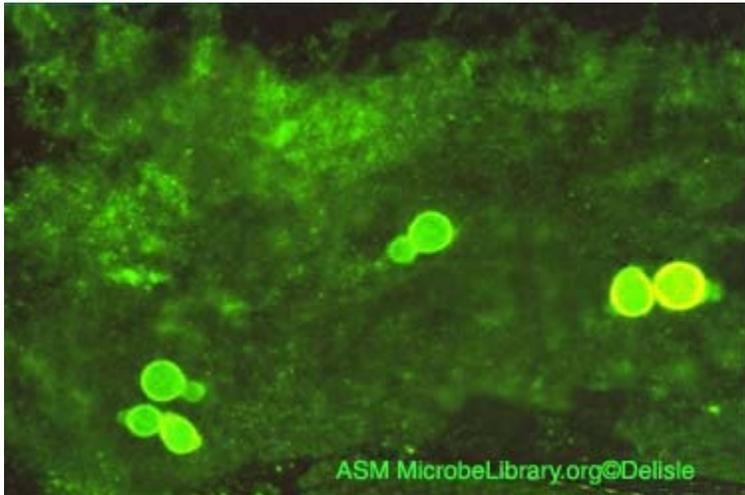
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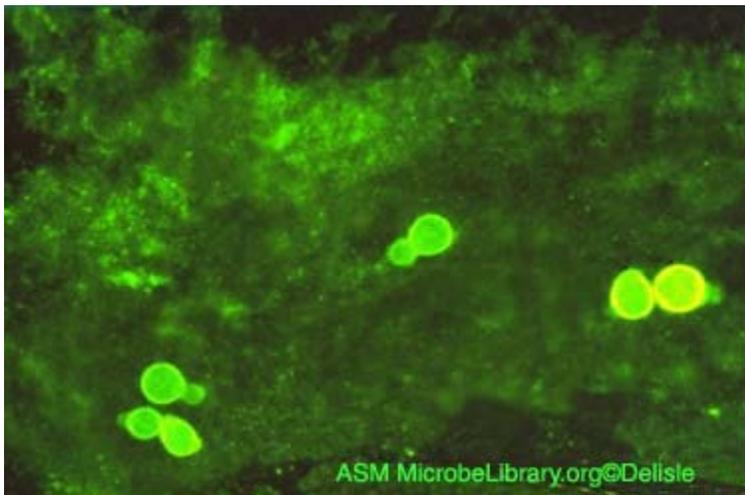
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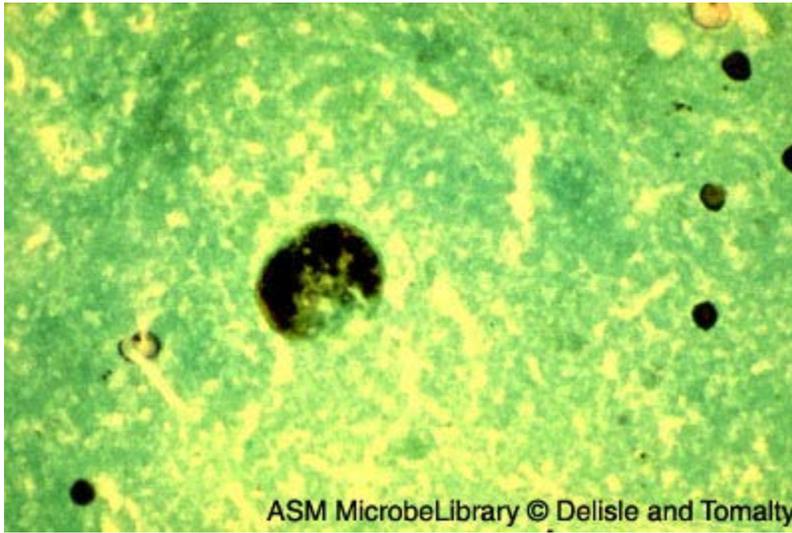
Q. 3



Q. 4



Q. 5



Q. 6 A

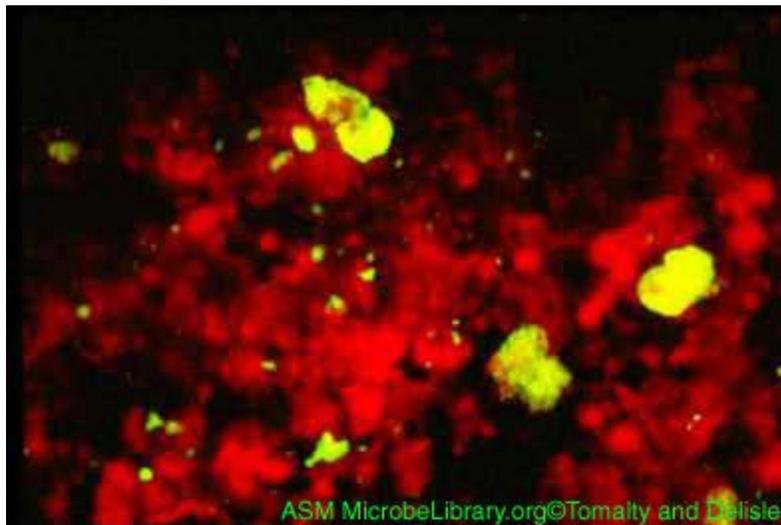


Q. 6 B

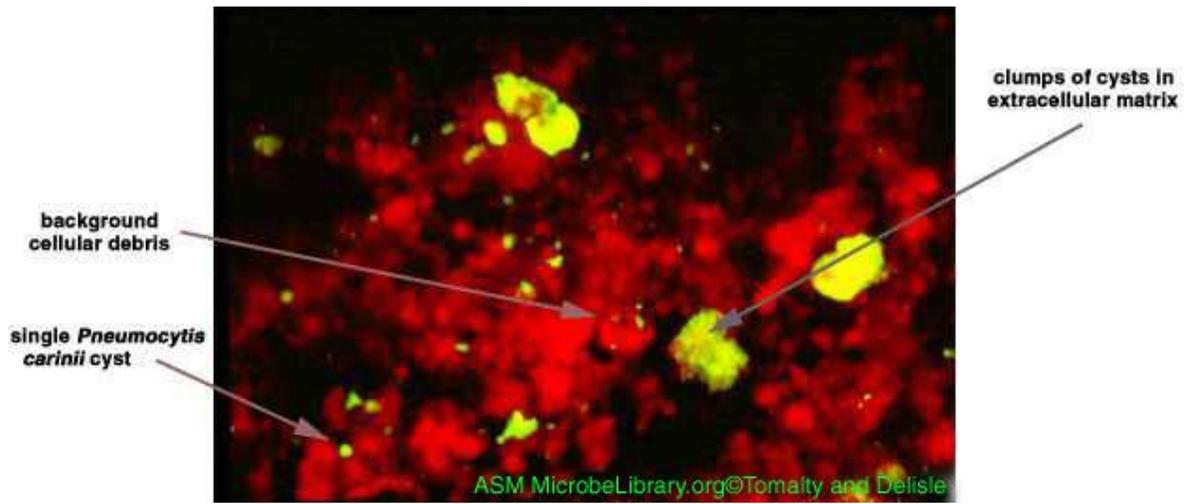


"Flowerettes", hyphae and conidia,
diagnostic of *Sporothrix*

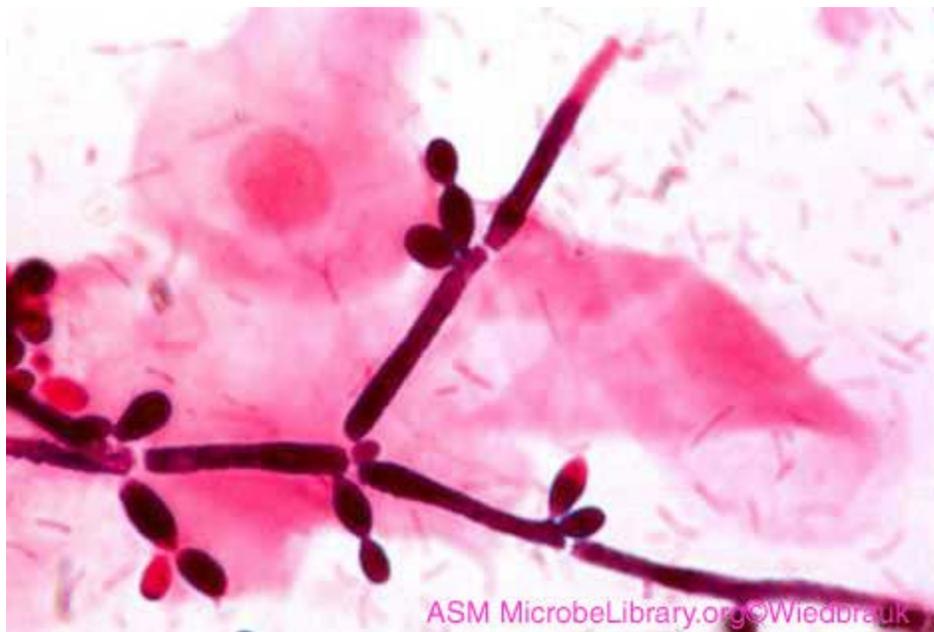
Q. 7 A



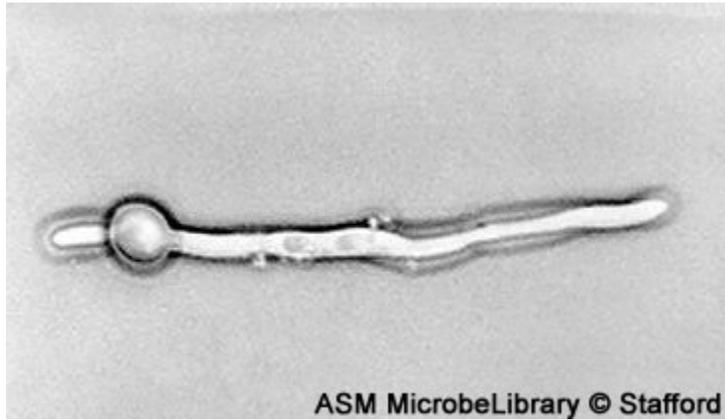
Q. 7 B



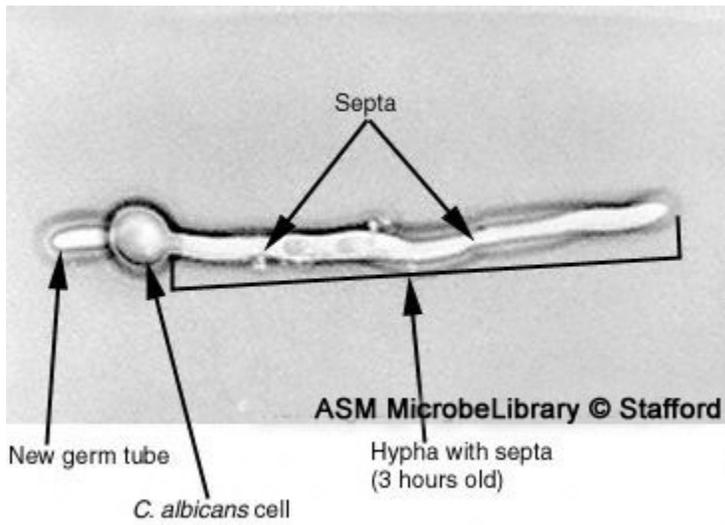
Q. 8 A



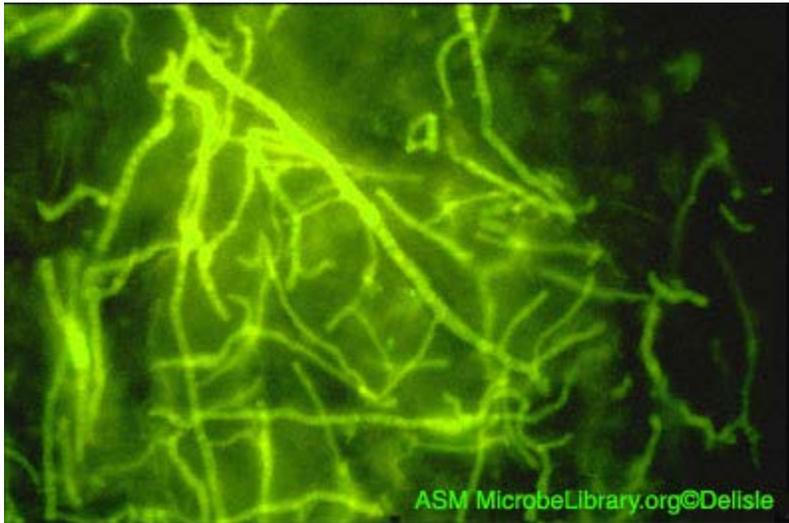
Q. 8 B



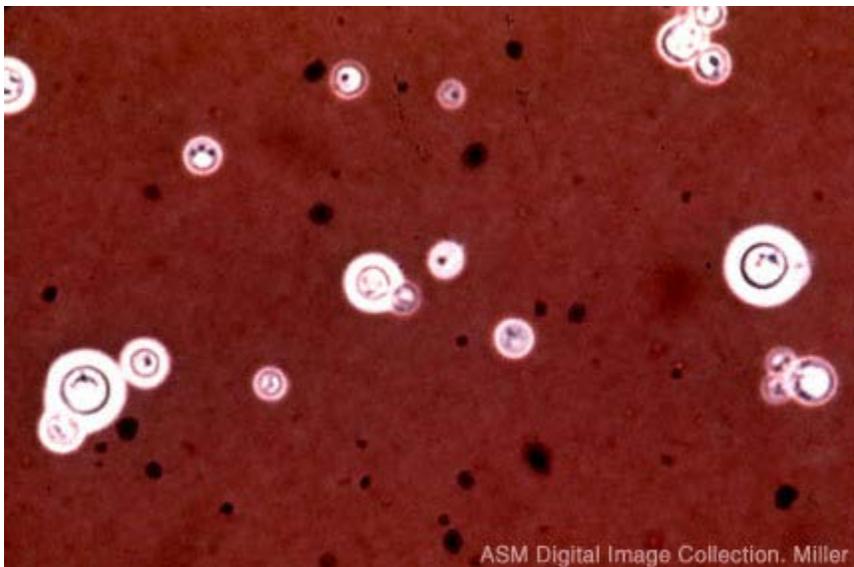
Q. 8 C



Q. 9

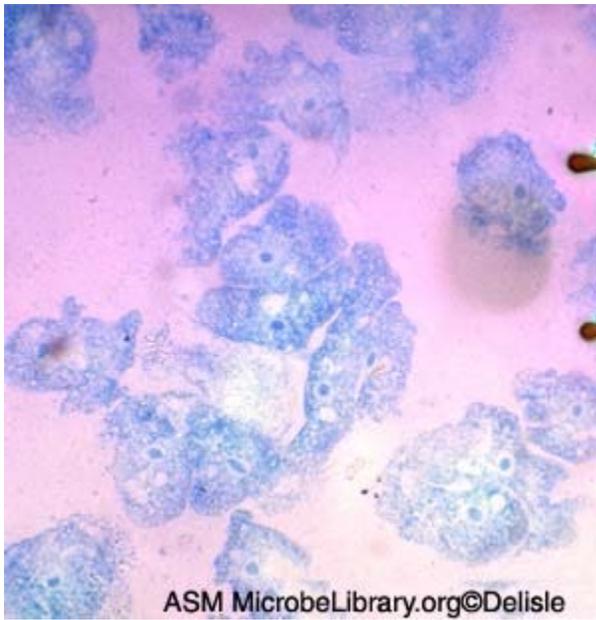


Q. 11

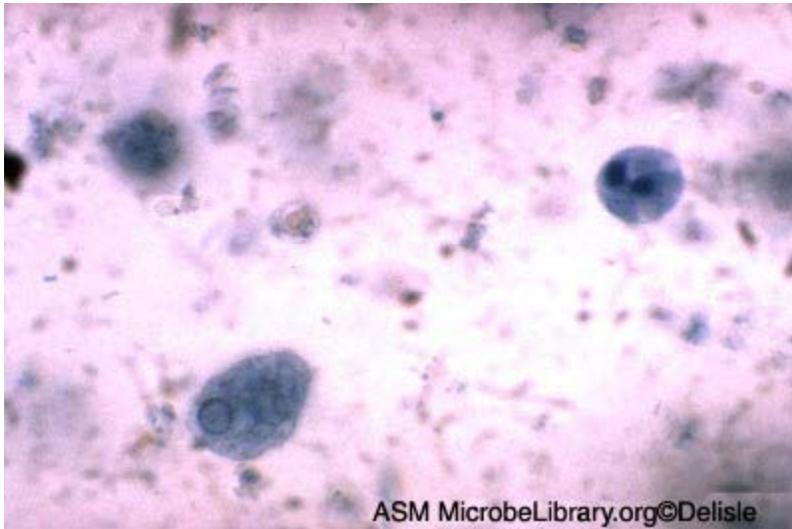


Protozoa

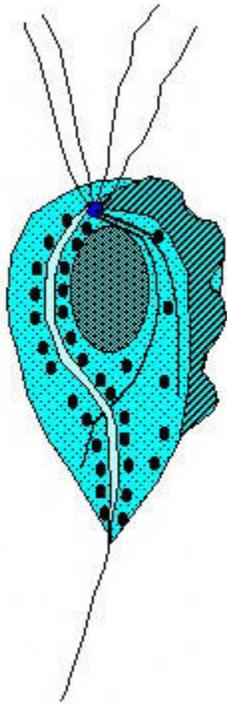
Q. 1



Q. 2

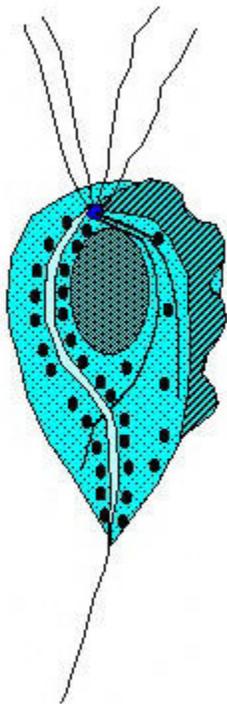


Q. 3



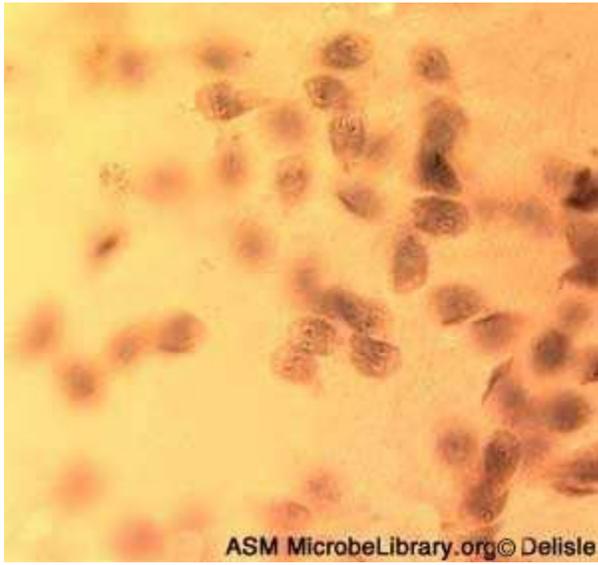
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Q. 4



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Q. 5 A



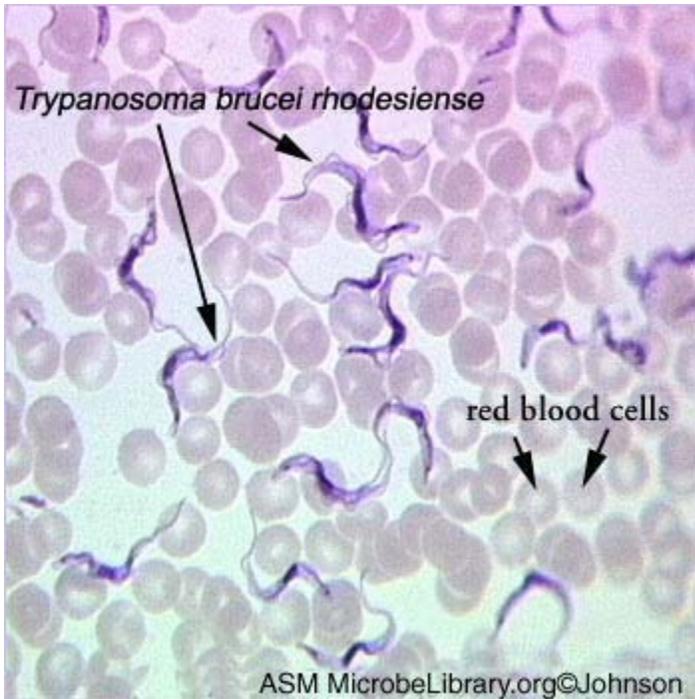
Q. 5 B



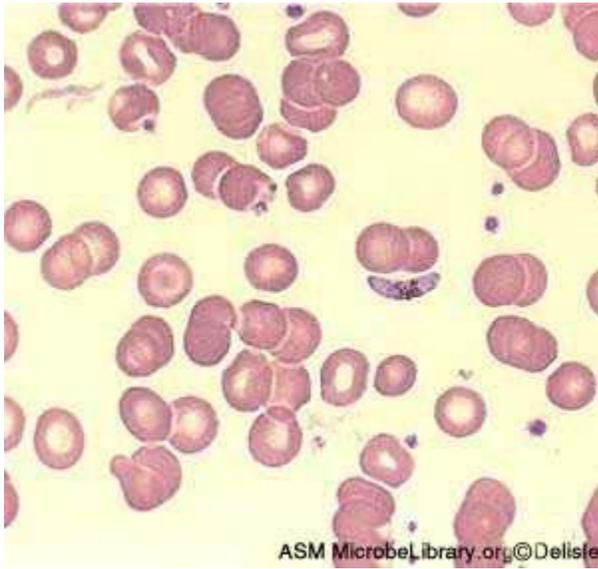
Q. 6 A



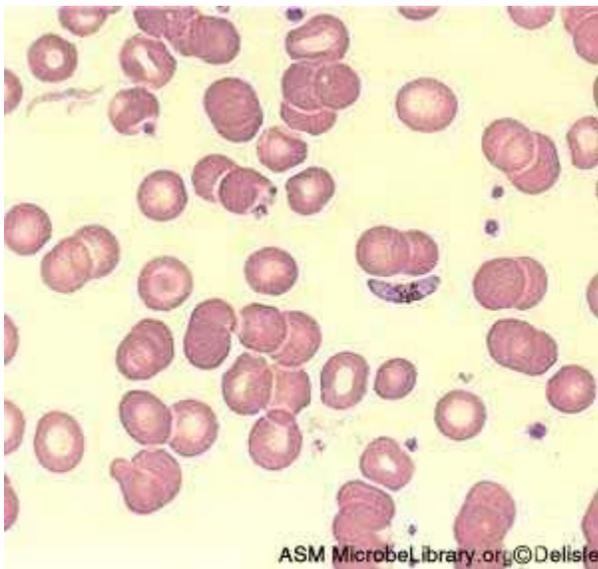
Q. 6 B



Q. 10



Q. 11



Q. 14

