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  – There is no financial or other sponsorship of this presentation
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  – Implications and treatments may differ in pediatrics and in pregnancy.
  – Implications and treatment do differ in immunocompromised persons.
Off-label use of medications

- Off-label uses of drugs are included
- A best effort has been made to distinguish between approved and off-label uses of medications, but don’t rely on this presentation as legal guidance!

A few explicit photos

Multiple references in the handout
Parasites in the Academy

Pre-Test
1. Oral ivermectin can be used to treat scabies and is FDA-approved for this indication.

A. True
B. False
2. Tinidazole and metronidazole both carry a warning against concomitant alcohol consumption.
   A. True
   B. False
3. Three weeks ago this student was walking barefoot on a sandy beach in a tropical country. The most likely diagnosis is:

A. Nodular scabies
B. Schistosomiasis
C. Cutaneous larva migrans
D. Tungiasis
4. Two weeks ago this student was doing field research in Costa Rica. Preferred initial intervention is:

A. Petroleum jelly
B. Broad spectrum antibiotics
C. Oral albendazole
D. Topical lindane

2 Bot Fly holes in patient's left elbow.
5. The parasite causing strongyloidiasis lives primarily in the small intestine of its human host but typically enters the host through the foot.

A. True
B. False
6. Oral metronidazole remains the preferred treatment for giardiasis.

A. True
B. False
7. Pediculosis is caused by:  
   A. Mites  
   B. Lice  
   C. Chiggers  
   D. Fleas
8. One day after participating in an outdoor service project at his southeastern college, this student’s rash is most likely caused by:

A. Chigger bites
B. Spider bites
C. Flea bites
D. Contact dermatitis
9. The appearance of this itchy rash is classic for:

A. Chiggers
B. Pediculosis
C. Bedbugs
D. Scabies
10. This rash is described as generalized, scaly, red papules and burrows, suggesting:
   A. Chiggers
   B. Pediculosis
   C. Bedbugs
   D. Scabies
Parasites in the Academy

1 Introduction
Introduction

Parasites

- Ectoparasites
- Protozoa
- Helminths
Introduction

Parasites

- Parasites: Organisms that grow, feed, and are sheltered on or in another organism but contribute nothing to host survival.

- Ectoparasites: Lives on the outer surface of its host.

- Protozoa: Unicellular eukaryotic organisms.

- Helminths: Worm-like parasites.
Parasites in the Academy

Introduction

Parasites

- Organisms that grow, feed, and are sheltered on or in another organism but contribute nothing to host survival

**Parasites**

**Ectoparasites**
- Lives on the outer surface of its host

- Pediculosis
- Scabies
- Laelaps
- Pyemotes
- Myiasis
- Cheyletiella
- House mite
- Avian mite
- Demodex
- Tungiasis
- Bedbugs
- Fleas
- Chiggers

**Protozoa**
- Unicellular eukaryotic organisms

- Malaria
- Chagas disease
- Giardia
- Cryptosporidium
- Entamoeba histolytica
- Cyclospora cayetanensis
- Microsporidiosis
- Babesiosis
- Leishmaniasis
- Trichomonas

**Helminths**
- Worm-like parasites

- Schistosomiasis
- Clonorchiasis
- Echinococcosis
- Trichinosis
- Ascariasis
- Dracunculiasis
- Onchocerciasis
- Strongyloidesis
- Cutaneous larva migrans
- Visceral larva migrans
Parasites in the Academy

1 Introduction

**Parasites**

- Organisms that grow, feed, and are sheltered on or in another organism but contribute nothing to host survival

**Ectoparasites**
- Lives on the outer surface of its host
- Examples:
  - Pediculosis
  - Scabies
  - Laelaps
  - Pyemotes
  - Myiasis
  - Cheyletiella
  - House mite
  - Avian mite
  - Demodex
  - Tungiasis
  - Bedbugs
  - Fleas
  - Chiggers

**Protozoa**
- Unicellular eukaryotic organisms
- Examples:
  - Malaria
  - Chagas disease
  - Giardia
  - Cryptosporidium
  - Entamoeba histolytica
  - Cyclospora cayetanensis
  - Microsporidiosis
  - Babesiosis
  - Leishmaniasis
  - Trichomonas

**Helminths**
- Worm-like parasites
- Examples:
  - Schistosomiasis
  - Clonorchiasis
  - Echinococcusis
  - Trichinosis
  - Ascarisiasis
  - Dracunculiasis
  - Onchocerciasis
  - Strongloidsis
  - Cutaneous larva migrans
  - Visceral larva migrans
**Introduction**

Parasites

Organisms that grow, feed, and are sheltered on or in another organism but contribute nothing to host survival

**Parasites**

- **Ectoparasites**
  - Lives on the outer surface of its host
  - Examples:
    - Pediculosis
    - Scabies
    - Laelaps
    - Pyemotes
    - Myiasis
    - Cheyletiella
    - House mite
    - Avian mite
    - Demodex
    - Tungiasis
    - Bedbugs
    - Fleas
    - Chiggers

- **Protozoa**
  - Unicellular eukaryotic organisms
  - Examples:
    - Malaria
    - Chagas disease
    - Giardia
    - Cryptosporidium
    - Entamoeba histolytica
    - Cyclospora cayetanensis
    - Microsporidiosis
    - Babesiosis
    - Leishmania
    - Trichomonas

- **Helminths**
  - Worm-like parasites
  - Examples:
    - Schistosomiasis
    - Clonorchiasis
    - Echinococcosis
    - Trichinosis
    - Ascariasis
    - Dracunculiasis
    - Onchocerciasis
    - Strongyloidiasis
    - Cutaneous larva migrans
    - Visceral larva migrans
Parasites in the Academy

1 Introduction

• Approach
  – What is the parasite?
  – What is the disease?
  – Doing something about it.
Parasites in the Academy

Introduction

Helminthic Parasites
Parasites in the Academy

Helminthic Parasites

- Strongyloidiasis
- Echinococcosis
- Schistosomiasis
- Cutaneous larva migrans
Helminthic Parasites

Strongyloidiasis
What is the parasite?

- **Strongyloides stercoralis**
  - Transmission occurs mainly in tropical and subtropical regions
  - Current geographic distribution is poorly defined
    - Southeast Asia, Africa, Middle East, Caribbean, tropical Brazil, temperate Spain, Appalachia
    - Very dependent on sewage management
    - Estimated 30–100 million people are infected worldwide
What is the parasite? (continued)

- *Strongyloides stercoralis*
  - Acquired through direct contact with contaminated soil during agricultural, domestic, and recreational activities

*Helminthic Parasites*
Strongyloidiiasis

What is the parasite? (continued)

- *Strongyloides stercoralis*
  - Known for ability to persist and replicate within a host for decades while producing few if any symptoms
  - Without appropriate therapy, the infection does not resolve and may persist for life
  - No evidence for human-to-human transmission
    - Organ transplantation?
What is the disease?

**Strongyloidiasis**

- Immunocompetent host
  - Many are asymptomatic
  - Mild intermittent symptoms
    - GI
      » Watery diarrhea (can be chronic), cramping
    - Pulmonary
      » Cough, wheeze, chronic bronchitis
    - Skin
      » Larva currens - “creeping” urticaria (photos) and pruritus
What is the disease? (continued)

• **Strongyloidiasis**
  - Immunocompromised host
    - Disseminated disease
    - Life-threatening (50%)
    - In US most deaths are iatrogenic when an unknown asymptomatic carrier is treated with immunosuppressants
What is the disease? (continued)

- **Strongyloidiasis**
  - Be suspicious
    - Persistent watery diarrhea
    - History of foot wounds then GI
    - Diarrhea + Cough + Rash
    - Travel to endemic areas
      - Even decades prior
  - Diagnosis is not standardized
    - Most frequent procedure entails direct examination of stool specimens
      - Often does not yield positive results even when the disease is present
    - Alternative tests (serology and polymerase chain reaction) are more efficient
Strongyloidiasis

<table>
<thead>
<tr>
<th>Severity</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild or asymptomatic disease</td>
<td></td>
</tr>
<tr>
<td>ivermectin 200 mcg/kg po times 1-2 days</td>
<td></td>
</tr>
<tr>
<td>Disseminated disease</td>
<td></td>
</tr>
<tr>
<td>Hospitalization/ ICU</td>
<td></td>
</tr>
</tbody>
</table>
Echinococcosis
Helminthic Parasites

Parasites in the Academy

What is the parasite?

• *Echinococcus granulosus*
  – 2-7 mm tapeworm
  – Endemic to sheep-raising areas worldwide
  – Definitive hosts: dogs
  – Human infection through fecal-oral route

• *Echinococcus multilocularis*
  – 1-4 mm tapeworm
  – Central and Eastern Europe, Russia, China, Alaska, others
  – Definitive hosts: foxes, coyotes, dogs
  – Hunting, trapping, and contact with dogs in endemic areas
Echinococcosis

What is the disease?

• *Echinococcus granulosus*
  – Cystic echinococcosis
    • aka, hydatid disease
    • Cysts occur in liver, lung, or both
    • Complication: cyst rupture

• *Echinococcus multilocularis*
  – Alveolar echinococcosis
    • Infection behaves as a slow-growing malignant tumor, with metastases
    • Human cases are rare but are more dangerous than cystic echinococcosis
Echinococcosis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystic echinococcosis</td>
<td></td>
</tr>
<tr>
<td>Percutaneous aspiration, plus albendazole</td>
<td></td>
</tr>
<tr>
<td>Alveolar echinococcosis</td>
<td></td>
</tr>
<tr>
<td>Wide surgical resection, plus albendazole for several years</td>
<td>•</td>
</tr>
</tbody>
</table>
Schistosomiasis
Helminthic Parasites

What is the parasite?

- Trematodes or flukes of the genus Schistosoma
  - Schistosoma mansoni
    - Middle East, Africa, South America
  - S. haematobium
    - Africa, Middle East
  - S. japonicum
    - Indonesia, China, Southeast Asia
- Others
- Usually associated with poor sanitation
What is the parasite? (continued)

- **Schistosoma**
  - Infection occurs when skin comes in contact with contaminated freshwater in which certain types of snails that carry the parasite are living
    - Typically when wading, swimming, bathing, or washing.
  - Over several weeks, the parasites migrate through host tissue and develop into adult worms inside the blood vessels
  - Once mature, the worms mate and females produce eggs
    - Some of these eggs travel to the bladder or intestine and are passed into the urine or stool
Helminthic Parasites

What is the disease?

Schistosomiasis

• Schistosomiasis
  – Acute = Katayama fever
    • 2-8 weeks after exposure
    • Acute hypersensitivity reaction
    • Fever, myalgia, lethargy, cough, wheeze, dypsnea
Helminthic Parasites

What is the disease? (continued)

Schistosomiasis

• Schistosomiasis
  – Chronic

• Symptoms arise from prolonged granulomatous inflammatory response to schistosome eggs trapped in various host tissues
  – Noncirrhotic portal hypertension
  – Hydronephrosis
  – Renal failure
  – Liver and bladder cancer
Helminthic Parasites

Parasites in the Academy

Doing something about it.

Schistosomiasis

<table>
<thead>
<tr>
<th>Infection</th>
<th>Praziquantel</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Schistosoma mansoni</em></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td><em>S. haematobium</em></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td><em>S. japonicum</em></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Katayma fever</td>
<td>✔ Plus steroids</td>
<td></td>
</tr>
</tbody>
</table>
Helminthic Parasites

Cutaneous
larva migrans
Helminthic Parasites

Parasites in the Academy

What is the parasite?

Cutaneous larva migrans

• Nematodes of the hookworm family
  – Most common: Ancylostoma braziliense

Ancylostoma braziliense
Image: petmedmobile.com
What is the parasite? (continued)

- Nematodes of the hookworm family
  - Human infestation occurs after skin contact with soil or objects contaminated with feces from infected animals
  - These larvae cannot penetrate the basement membrane of human skin
    - Cannot complete lifecycle
    - Thus, self-limiting disease

Cutaneous larva migrans
Helminthic Parasites

Parasites in the Academy

Cutaneous larva migrans

What is the disease?

- Cutaneous larva migrans
  - Larvae migrate in the epidermis for several months
  - Severe itching
  - Sleep disturbance is common
  - Secondary infection is common

Source: Am Fam Physician 81(2):203, 2010
What is the disease?

- **Cutaneous larva migrans**
  - Has been reported as the most common skin disease in returning travelers

Source: emedicine.com
Helminthic Parasites

Cutaneous larva migrans

Doing something about it.

<table>
<thead>
<tr>
<th>Option</th>
<th>Off-label</th>
</tr>
</thead>
<tbody>
<tr>
<td>ivermectin 200 mcg/kg single dose</td>
<td>•</td>
</tr>
<tr>
<td>albendazole 400 mg po bid x 3-7 days</td>
<td></td>
</tr>
</tbody>
</table>

- Ultimately self-limiting, but symptoms may persist for months if not treated
- Pruritis typically resolves within 48 hours
  - Skin lesions within a week
- Consider antibiotics for secondary bacterial infections
Protozoal Parasites
Protozoal Parasites

Protozoan Infections of the Gastrointestinal Tract

- Chagas disease
- Giardiasis
- Cryptosporidiosis
- Cyclosporiasis
- Microsporidiosis
- Amebiasis
- Trichomonas
Protozoal Parasites

Chagas disease
Protozoal Parasites

What is the parasite?

• *Trypanosoma cruzi*
  
  — Parasite is restricted to Central and South America, Mexico and southern US
  
  — Transmission
  
  • Feces of certain bloodsucking triatomine (Reduviidae family) bugs
    
    — Via the bug bite or into another break in the skin
  
  • Possible: uncooked food
  
  • Rarely: blood transfusion, transplants, mother-to-fetus, or laboratory accident
What is the disease?

- Chagas disease
  - aka, American trypanosomiasis
  - Has been found in pre-Columbian Andean mummies from 9000 years ago
  - Major public health challenge in Latin America
  - Now has spread to other continents
    - Prevalence in US has increased substantially in past 20 years
    - Immigration status keeps some in US from seeking medical attention
Chagas disease

What is the disease? (continued)

- Chagas disease (continued)
  - WHO estimates
    - 7.7 to 10 million people chronically infected
    - 10,000 to 14,000 deaths per year
What is the disease? (continued)

- Chagas disease (continued)
  - Acute phase
    - Most are asymptomatic, or
    - Prolonged fever, malaise enlargement of the liver, spleen, and lymph nodes, and subcutaneous edema
      - ECG might show sinus tachycardia, first-degree AV-block, low QRS voltage, or primary T-wave changes
      - Chest radiograph might show variable degrees of cardiomegaly
Chagas disease (continued)

- Chronic phase
  - Begins 2 to 3 months after initial infection
  - Indeterminate form
    - 60% to 70% of patients
    - No clinical symptoms
  - Determinate form
    - 30%–40% of patients
    - Cardiac, digestive (mainly megaesophagus and megacolon), or cardiodigestive forms
    - Usually 10 to 30 years after initial infection

- Reactivation of Chagas disease can also occur in chronically infected patients who become immunologically compromised
Chagas disease

What is the disease? (continued)

<table>
<thead>
<tr>
<th>Chagas similar to HIV</th>
<th>Chagas different than HIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute and chronic phases</td>
<td>Parasite</td>
</tr>
<tr>
<td>Can be infected for years without knowing it</td>
<td>Most transmission occurs through bug bite or contaminated food</td>
</tr>
<tr>
<td>Transmission though transfusions and in utero</td>
<td>Primarily affects heart and GI tract</td>
</tr>
<tr>
<td>Disproportionate burden on the poor</td>
<td>Most people never develop chronic symptoms</td>
</tr>
<tr>
<td>Prolonged treatment, ideally started during acute phase</td>
<td>Prevalence limited primarily to habitat of certain bugs</td>
</tr>
</tbody>
</table>
Protozoal Parasites

Parasites in the Academy

Chagas disease

Doing something about it.

Prevention: Advise travelers to avoid dirt-floored jungle huts near a beach.
Protozoal Parasites

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis

Protozoan Infections of the Gastrointestinal Tract
Protozoal Parasites

Parasites in the Academy

Protozoan Infections of the Gastrointestinal Tract

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis

What is the parasite?

- *Giardia lamblia*
  - Worldwide
  - Infecting dose as low as 10 cysts
    - Pool chlorination does not kill
  - Transmission: fecal-oral

- *Cryptosporidium hominis*
- *Cryptosporidium parvum*
- Others
  - Temperate and tropical regions
  - Transmission: fecal-oral
PROTOZOAL PARASITES

What is the parasite? (continued)

- *Cyclospora cayetanensis*
  - Peru and Nepal
  - Transmission: infected uncooked foods, such as basil, raspberries and snow peas

- *Encephalitozoon intestinalis*
- *Enterocytozoon bieneusi*
- 1200 others
  - Worldwide
  - Transmission:
Protozoal Parasites

What is the parasite? (continued)

• *Entamoeba histolytica*
  • Mostly Far East
  • Transmission: fecal-oral

Protozoan Infections of the Gastrointestinal Tract
Protozoal Parasites

What is the disease?

• Giardiasis
  – Incubation period 8 days
  – Sudden onset watery diarrhea with yellow foul-smelling stools and flatus
  – Abdominal distension
  – Anorexia
  – Malabsorption can occur
  – Fecal microscopy ± antigen detection
Parasites in the Academy

Protozoal Parasites

What is the disease? (continued)

- Cryptosporidiosis
  - Small bowel infection
  - Mild, watery diarrhea lasting 1-40 days
  - Systemic upset is uncommon

Protozoan Infections of the Gastrointestinal Tract
Protozoal Parasites

Parasites in the Academy

What is the disease? (continued)

• Cyclosporiasis
  – Incubation period 12 days
  – Acute watery diarrhea
  – Mild systemic upset

Protozoan Infections of the Gastrointestinal Tract

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis
Protozoal Parasites

What is the disease? (continued)

• **Microsporidiosis**
  – Worldwide
  – Most immunocompetent hosts are asymptomatic for years
  – Most interest resolves around effects on hosts with immune compromise
    • Diarrhea and malabsorption

Parasites in the Academy

Protozoan Infections of the Gastrointestinal Tract

- Giardiasis
- Cryptosporidiosis
- Cyclosporiasis
- Microsporidiosis
- Amebiasis
Parasites in the Academy

Protozoal Parasites

What is the disease? (continued)

• Amebiasis
  – Amebic dysentery
    • Large bowel-type diarrhea
    • Bloody stools
    • Mild to life-threatening

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis

Protozoan Infections of the Gastrointestinal Tract
Protozoal Parasites

What is the disease? (continued)

• Common features
  – Diarrhea
  – Worse in HIV and other immune compromise
  – Mostly oral-fecal transmission
• Potential for sexual transmission

Protozoan Infections of the Gastrointestinal Tract

Parasites in the Academy

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis
Protozoal Parasites

Parasites in the Academy

Giardiasis
Cryptosporidiosis
Cyclosporiasis
Microsporidiosis
Amebiasis

Protozoan Infections of the Gastrointestinal Tract

<table>
<thead>
<tr>
<th>Disease</th>
<th>Treatment for uncomplicated cases in immunocompetent patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giard</td>
<td>metronidazole 250 mg po tid x 10 d, or metronidazole 2 g po daily for 3 d, or tinidazole 2 g po single dose</td>
</tr>
<tr>
<td>Crypto</td>
<td>nitazoxanide 500 mg po bid x 3 days</td>
</tr>
<tr>
<td>Cyclo</td>
<td>TMP-SMZ DS 1 po bid for 7 days</td>
</tr>
<tr>
<td>Micro</td>
<td>albendazole 400 mg po bid x 21 d</td>
</tr>
<tr>
<td>Ameb</td>
<td>metronidazole 750 mg po bid x 5-10 d, or Tinidazole 2 g daily for 3 d</td>
</tr>
</tbody>
</table>
Protozoal Parasites

Trichomonas
Trichomonas

- OSOM...Affirm VP III...APTIMA...PRC...none are approved for use with males
- Males: consider in prostatitis, epididymitis, and balanitis, in addition to urethritis
- Has not been isolated form oral sites
- Very low rectal prevalence in MSM
- Oral metronidazole remains drug of choice
  - Tinidazole (2 g po) is alternative

Source: pathobio.sdu.edu.cn
Ectoparasites
Ectoparasites

Pediculosis
Scabies
Myiasis
Tungiasis
Bed bugs
Chiggers
Ectoparasites

Pediculosis
Ectoparasites

Pediculosis

What is the parasite?

• Lice

  – *Pediculosis humanus* var. *capitas*
    
    • 2-3.3 mm
    
    • Most transmission is probably head-to-head
      – Louse can survive off of host for up to 55 hours
    
    • Lays eggs (nits) close to scalp
      – Hatch within 12 days

Head louse (original magnification x 40)
Int J Derm 2012, 51, 131–141
Ectoparasites

Pediculosis

What is the parasite? (continued)

• Lice
  – *Pediculus humanus* var. *corporis*
  • Live in the seams of clothing and attach to skin only to feed
What is the parasite? (continued)

• Lice
  – *Phthirus pubis*
    • 1.1-1.8 mm
    • Typically found attached to hair in the pubic area
    • Sometimes are found on coarse hair elsewhere on the body
      – Eyebrows, eyelashes, beard, mustache, chest, axillae, etc.
    • Usually spread through sexual contact

Source: cdc.gov
What is the disease?

- Pediculosis capitis
  - *Pediculosis humanus var. capitas*
  - “Head lice”
  - Live lice (tiny black dots) and nits
  - Infestation can cause pruritus and rash
    - Red papules, typically found in the posterior scalp and neck and behind ears
    - Possible cervical adenopathy
  - Often asymptomatic
  - Chronic infestation has been associated with superinfection with MRSA or nephritogenic strains of strep
What is the disease? (continued)

- Pediculosis corporis
  - *Pediculus humanus var. corporis*
  - “Body lice”
- Characteristic skin lesions include erythematous macules and wheals
  - Most common on the shoulders, buttocks and abdomen
  - Furunculosis is an occasional complication
Pediculosis

What is the disease? (continued)

• Pediculosis pubis
  – *Phthirus pubis*
  – Pubic lice = “crabs”
    • Infestation tends to be limited to pubic hair
      – Occasionally affects axillae, eyelashes, or other hairy parts
    • Examination reveals lice attached to the skin and lice eggs attached to the hair shafts
## Pediculosis

### Doing something about it.

<table>
<thead>
<tr>
<th>Head Lice</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical</strong></td>
<td></td>
</tr>
<tr>
<td>Pyrethrin 0.3% shampoo (e.g., RID), apply for 10 min and rinse, repeat in 7-10 d, or</td>
<td></td>
</tr>
<tr>
<td>Permethrin 1% rinse (e.g., Nix), apply for 10 min, repeat in 7-10 d, or</td>
<td></td>
</tr>
<tr>
<td>Malathion 0.5% lotion (e.g., Ovide), apply to dry hair for 8-12 hr daily for 1 wk, or</td>
<td></td>
</tr>
<tr>
<td>Spinosad – very expensive, or</td>
<td></td>
</tr>
<tr>
<td>Ivermectin 200 mcg/kg po, repeat in 7-10 d, or</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental and Physical</strong></td>
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</tr>
<tr>
<td>Nit combing; dry bedding and clothes at 60 C for 10 min; boil hair combs etc; vacuum furniture; bag non-launderables for 3 d</td>
<td></td>
</tr>
</tbody>
</table>
Ectoparasites

Pediculosis

Doing something about it.

<table>
<thead>
<tr>
<th>Body Lice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
</tr>
<tr>
<td>Antiparasitic medications generally not required</td>
</tr>
<tr>
<td><strong>Clothing</strong></td>
</tr>
<tr>
<td>Discard, or</td>
</tr>
<tr>
<td>Treat with 1% malathion powder or 5% permethrin powder (pesticides)</td>
</tr>
</tbody>
</table>
Pediculosis

**Doing something about it.**

<table>
<thead>
<tr>
<th>Public Lice</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pubic and Other Coarse Hair</strong>&lt;br&gt;Permethrins or malathion, same as for head lice</td>
<td></td>
</tr>
<tr>
<td><strong>Eyelashes and Eyebrows</strong>&lt;br&gt;Fine comb is preferred&lt;br&gt;If additional treatment is needed, careful application of ophthalmic-grade petrolatum ointment (Rx) to the eyelid margins 2-4 times a day for 10 days is usually effective; avoid regular petrolatum</td>
<td>•</td>
</tr>
<tr>
<td>Also, treatment of intimate partners from the past month, clothing, bedding, etc</td>
<td></td>
</tr>
</tbody>
</table>
Ectoparasites

Scabies
Ectoparasites

What is the parasite?

- *Sarcoptes scabei* var. *hominis*
  - Mite (arthropod)
  - Obligate parasite
    - Completes its entire life cycle on humans
  - Females 0.3-0.4 mm
  - Feed on human skin
    - Often burrow into the skin while doing so
    - Adult female lays her eggs inside the burrows
  - Not able to fly or jump
    - Transmission predominantly through direct skin-to-skin contact
    - Able to live on bedding, clothes, or other surfaces at room temperature for < 48 hours
Scabies

What is the disease?

• Classic scabies
• Crusted scabies
• Nodular scabies
Scabies

What is the disease? (continued)

• Classic scabies
  – Intensely pruritic and highly contagious skin infestation
    • Described by Aristotle
    • First human disease recognized to be caused by a specific pathogen (1687)
  – Affects all socioeconomic status and ethnic groups
  – Estimated 300 million cases per year worldwide
What is the disease? (continued)

- Classic scabies (continued)
  - Typically only 5-15 mites
  - Little evidence of infection exists during the first month
  - After 4 weeks and with subsequent infections, a delayed-type IV hypersensitivity reaction to the mites, eggs, feces occurs
    - In re-infestation, the sensitized individual may develop a rapid reaction (within hours)
  - The resultant skin eruption, and its associated intense pruritus, is the hallmark of classic scabies
What is the disease? (continued)

- Classic scabies (continued)
  - The resultant skin eruption, and its associated intense pruritus, is the hallmark of classic scabies
    - Burrows may be seen as an irregular zigzag line in the stratum corneum
    - Secondary lesions represent immunologic reactions and usually appear as small erythematous papules and vesicles
    - Pruritis is often worse in the evening
    - Areas most commonly involved are the interdigital web spaces of the hands, the flexor surfaces of the wrists, the periumbilical skin, and genitalia

Source: picturesofscabies.org
What is the disease? (continued)

• Classic scabies (continued)
  – Diagnosis
    • Usually based on history and skin findings
    • Microscopy of burrow scraping
    • Skin biopsy
What is the disease? (continued)

- **Crusted scabies**
  - aka, Norwegian scabies
  - Distinctive and highly contagious
  - Hundreds to millions of mites infest the host individual, who is usually immunocompromised, elderly, or physically or mentally disabled and impaired
  - Easily confused with severe dermatitis or psoriasis because widespread, crusted lesions appear with thick, hyperkeratotic scales over the elbows, knees, palms, and soles
What is the disease? (continued)

• Nodular scabies
  – Pruritic, persistent nodules for months even after specific treatment of scabies
  – Probably represents the hypersensitivity reaction to retained mite parts or antigens
  – Genital skin and scrotal skin are the commonest sites for such lesions.
## Scabies

<table>
<thead>
<tr>
<th>Classic scabies</th>
<th>Off-label</th>
</tr>
</thead>
<tbody>
<tr>
<td>permethrin cream 5% (apply to all skin from chin down, to include under nails, leave on 8-14 hrs, repeat in 1-2wks), or ivermectin 200 mcg/kg po (± repeat in 2 weeks)</td>
<td>•</td>
</tr>
</tbody>
</table>

Postscabies itch can persist for months

Consider re-check at 4 weeks

Important to trim nails and to reapply cream to hands and under finger nails after washing hands during treatment period
Scabies

Doing something about it.

<table>
<thead>
<tr>
<th>Crusted scabies</th>
<th>Off-label</th>
</tr>
</thead>
<tbody>
<tr>
<td>permethrin cream 5% daily for 7 days, then twice weekly until cured, plus ivermectin 200 mcg/kg po on days 1, 2, 8, 9, 15, 22, 29</td>
<td>•</td>
</tr>
</tbody>
</table>

Address underlying medical issues
### Ectoparasites

#### Scabies

Doing something about it.

<table>
<thead>
<tr>
<th>Nodular scabies</th>
<th>Off-label</th>
</tr>
</thead>
<tbody>
<tr>
<td>intralesional steroids</td>
<td></td>
</tr>
<tr>
<td>topical steroids</td>
<td></td>
</tr>
<tr>
<td>pimecrolimus (Elidel)</td>
<td></td>
</tr>
<tr>
<td>tacrolimus (Protopic)</td>
<td></td>
</tr>
</tbody>
</table>

- •
- •
Ectoparasites

Furuncular Myiasis
Ectoparasites

Furuncular Myiasis

What is the parasite?

- Larvae of *Dermatobia hominis*
  - Human “botfly”
  - Endemic to tropical Mexico, South America, Central America, Trinidad
- *Cordylobia anthropophaga*
  - “Tumbu fly”
  - Endemic to sub-Saharan Africa
- Others

Myiasis: infestation of maggots
What is the parasite? (continued)

- **Mode of transmission**
  - Eggs from an adult female become attached to the abdomen of a blood-sucking arthropod
    - Typically a mosquito
  - While the mosquito is feeding, the victim’s body heat causes the egg to hatch and the larva falls onto the victim’s skin
  - The larva enters the skin through the bite wound or through some other small break in the skin
  - The larva grows to 1.5-2 cm and emerges from the host in 6-7 weeks
What is the disease?

- Furuncular myiasis
  - aka, warble
  - Usually presents as a slowly growing nodule that resembles a pustule or papule with a central punctum
  - Punctum
    - May exude serosanguinous or purulent fluid
    - Posterior part of the larva can sometimes be visualized
  - Pruritis, pain, movement sensation
  - Disease from tumbu fly is generally much more extensive than from botfly

Botfly myiasis
Source: emedicine.com
Ectoparasites
Ectoparasites

Furuncular Myiasis

Doing something about it.

<table>
<thead>
<tr>
<th>Method</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suffocation</td>
<td>Place petroleum jelly, tape, bacon, or similar over the punctum – larva will</td>
</tr>
<tr>
<td></td>
<td>back out of the hole as breathing becomes difficult, plus Topical antibiotic</td>
</tr>
<tr>
<td>Extraction</td>
<td>Simple forceps or formal excision – take care not to damage the larva in the</td>
</tr>
<tr>
<td></td>
<td>process, plus Topical antibiotic</td>
</tr>
</tbody>
</table>

Remain watchful for secondary bacterial infection.
 Parasites in the Academy

 Ectoparasites

 Tungiasis
What is the parasite?

- *Tunga penetrans* or related species
  - Burrowing flea
  - Smallest known flea (1 mm)
  - Warm, dry soil and sand of beaches, stables, and stock farms
  - West Indies, Caribbean, Central America, Africa, India, Pakistan, and South America
  - Many common names
    - chigger flea, sand flea, chigoe, jigger, nigua, pigue, or le bicho de pe
  - Flea requires a warm-blooded host
    - Humans, pigs, dogs, cats, cattle, sheep, horses, mules, rats, mice, and other wild animals

**Tungiasis**

Source: dimusbahia.files.wordpress.com
What is the disease?

- **Tungiasis**
  - aka, nigua, pio, bicho de pie, and pique
  - Flea invades unprotected skin
    - Most common site of involvement is the feet (interdigital skin and subungual area)
    - Can occur on any area of the body to which the flea has access
What is the disease? (continued)

- **Tungiasis**
  - Pain or itching and papular or nodular eruptions
    - typically forms a punctum or an ulceration
    - Often described as a white patch with a black dot
  - Over ≈2 weeks the flea feeds, becomes engorged, and expels eggs
    - Afterwards, the flea dies and is slowly sloughed by the host
  - Uncomplicated infestation results in pain, swelling, tenderness
    - Potential complications include secondary infections and tetanus
Doing something about it.

## Tungiasis

<table>
<thead>
<tr>
<th>Goal</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Travelers to affected countries should be advised to wear shoes (not sandals) when walking along sandy areas in affected regions and to refrain from sitting or lying in the sand Insect repellant Zanzarin</td>
</tr>
<tr>
<td>Treatment</td>
<td>Surgical excision plus topical antibiotic</td>
</tr>
<tr>
<td>Secondary infection</td>
<td>Tetanus prophylaxis Antibiotics as needed</td>
</tr>
</tbody>
</table>
Parasites in the Academy

Ectoparasites

Bed bugs
Ectoparasites

What is the parasite?

- *Cimex lectularius*
  - Worldwide
- *Cimex hemipterus*
  - Tropical
- 5-8 mm, reddish-brown insect
- Wingless
- Avoid light
- Relies mostly on humans for survival
  - Attracted by warmth and carbon dioxide
  - Feed on blood for a few min at a time
  - Mostly during the night in the dark
- Speculated to be a vector for other pathogens but vector competence not proven
What is the disease?

- Bed bug bites
- Bed bug infestation
Ectoparasites

Bed bugs

What is the disease? (continued)

• Bed bug bites
  – Can be asymptomatic
  – Papular urticaria, macules, bullous lesions
    • Reaction to bug’s saliva
    • Often in clusters and lines
    • Reactions develop over minutes to days
    • Decreased latency on repeated exposure
  – Difficult to distinguish from bite of fleas, spiders, and other insects

Source: bedbugle.com
Parasites in the Academy

Ectoparasites

Bed Bug Bites
Bed bugs

What is the disease? (continued)

- Bed bug infestation
  - Fundamentally an environmental problem
  - Requires an experienced exterminator

Source: orovidermagazine.com

Source: Clin Microbiol Rev 2012;25:164-192
Bed bugs

**Bed bug bites**
Pruritis – antihistamines and topical steroids
Secondary infection (rare) – antibiotics as needed
Assess psychological distress

**Bed bug infestation**
Professional disinestation
Environmental controls
Ectoparasites

Chiggers
Chiggers

**What is the parasite?**

- *Eutrombicula alfreddugesi*
  - Most common species in the United States
  - Trombiculid mite
  - Adult mite is not a human parasite
  - Larval form
    - Adult female lays eggs in the soil
    - Larval form hatches after 1-2 weeks
      - Known as a chigger, red bug, or harvest mite
      - Lives in the grass, soil, and weeds and requires a meal from a vertebrate host to mature
    - Does not feed on blood
      - Rather, it crawls onto the host, anchors itself to the skin, injects proteolytic enzymes, and ingests the degraded tissue
    - May remain attached to the host for 3-4 days, then drops off into the soil to complete its maturation
What is the parasite? (continued)

- *Eutrombicula alfreddugesi*
  - Worldwide distribution (many species)
  - In US
    - Particularly abundant in southeastern and south central states
    - Bites most common late summer and early autumn
What is the disease?

• Chigger bites
  – Painless
  – Produce a 2- to 3-mm pale macule
  – Initially, the larva may still be attached, appearing as a 1-mm red dot in the center of a macule
  – Over time, the lesions enlarge and become erythematous and intensely pruritic grouped papules or papulovesicles
    • Lesions typically are found on the ankles and lower extremities but also appear on moist areas of the body (eg, axillae, genitalia, popliteal and antecubital fossae)
  – Pruritus starts within a few hours of a bite and ceases in a few days
  – Lesions heal in 1 to 2 weeks
What is the disease? (continued)

- In the Far East, chiggers can be a vector for transmission of *Rickettsia tsutsugamushi*, the infectious agent of scrub typhus.
Chiggers

Doing something about it.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Strategy</th>
<th>Off Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Avoidance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protective clothing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insect repellents</td>
<td></td>
</tr>
<tr>
<td>Reduce pruritus (all anecdotal)</td>
<td>Topical steroids</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Topical anesthetics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Topical counterirritants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ex: deodorant sticks containing propylene glycol</td>
<td></td>
</tr>
<tr>
<td>Secondary infection</td>
<td>Treat as needed</td>
<td></td>
</tr>
</tbody>
</table>

Note: by the time the itching starts the mite has long since left the skin.
Pruritus

- Oral medications
  - Antihistamines
    - Efficacy data are limited, but inexpensive and generally safe
    - No direct effect on pruritus except in urticaria
    - Typically diphenhydramine (OTC) or hydroxyzine (Rx)

- Topical medications
  - Topical corticosteroids
    - Not indicated for pruritus without evidence of skin inflammation
    - Typically hydrocortisone (OTC) or triamcinalone (Rx)
  - Consider topical capsaicin* lotion (OTC) and topical doxepin (Rx)

- Many additional options
- Most important: remove inciting cause

* = off-label
• tinidazole (Tindamax)
  – Approved indications: amebiasis, bacterial vaginosis, giardiasis, trichomonas
  – Available generic and branded
  – Available as 250 and 500 mg tablet
  – Take with food
  – Chemical structure similar to metronidazole
    • Potential for disulfiram-type reaction in some patients
    • Alcoholic beverages should not be consumed for at least one day after completion of metronidazole therapy and for 3 days after completion of tinidazole therapy.
• ivermectin (Stromectol)
  – Approved uses: onchocerciasis & intestinal strongyloidiasis
  – Off-label uses: many
  – Available as 3 mg tablet
  – Typical dose = 200 mcg/kg
  – Example for 175 lb patient
    • 200 mcg/kg x 1 mg/1000 mcg x 175 lb x 1 kg/2.2 lb = 15.9 mg
    • 15.9 mg ÷ 3 mg tab ≈ 5 tablets

<table>
<thead>
<tr>
<th>ivermectin dose</th>
<th>≈ # ivermectin tablets (3 mg) based on weight (lbs)</th>
</tr>
</thead>
</table>
• **permethrins**
  
  – 1% lotion/cream rinse (OTC: Nix, others)
    • Approved use: head lice
  
  – 1% liquid/shampoo (OTC: RID, others)
    • Approved use: head lice
  
  – 5% cream (Rx: Elimite, Acticin, generics)
    • Approved use: scabies
Parasites in the Academy

Hints

• Diarrhea
  – Stool Culture
  – Stool for Ova & Parasites
  – Basic vs. comprehensive
  – Specific serology

• Skin scrapings
  – KOH prep vs. scabies prep vs. other
• Unexplained jaundice in a traveler
  – Consider protozoal and helminthic infections
• Unexplained eosinophilia in a traveler
  – Consider helminthic infection
• Papular urticaria
  – Consider ectoparasites
Post-Test
1. Oral ivermectin can be used to treat scabies and is FDA-approved for this indication.

A. True  
B. False
1. Oral ivermectin can be used to treat scabies and is FDA-approved for this indication.

A. True
B. False
2. Tinidazole and metronidazole both carry a warning against concomitant alcohol consumption.

A. True
B. False
2. Tinidazole and metronidazole both carry a warning against concomitant alcohol consumption.

A. True
B. False
3. Three weeks ago this student was walking barefoot on a sandy beach in a tropical country. The most likely diagnosis is:

A. Nodular scabies
B. Schistosomiasis
C. Cutaneous larva migrans
D. Tungiasis
3. Three weeks ago this student was walking barefoot on a sandy beach in a tropical country. The most likely diagnosis is:

A. Nodular scabies  
B. Schistosomiasis  
C. Cutaneous larva migrans  
D. Tungiasis
4. Two weeks ago this student was doing field research in Costa Rica. Preferred initial intervention is:

A. Petroleum jelly
B. Broad spectrum antibiotics
C. Oral albendazole
D. Topical lindane

2 Bot Fly holes in patient's left elbow.
4. Two weeks ago this student was doing field research in Costa Rica. Preferred initial intervention is:

A. Petroleum jelly
B. Broad spectrum antibiotics
C. Oral albendazole
D. Topical lindane
5. The parasite causing strongyloidiasis lives primarily in the small intestine of its human host but typically enters the host through the foot.

A. True
B. False
5. The parasite causing strongyloidiasis lives primarily in the small intestine of its human host but typically enters the host through the foot.

A. True
B. False
Oral metronidazole remains the preferred treatment for giardiasis.

A. True
B. False
6. Oral metronidazole remains the preferred treatment for giardiasis.

A. True
B. False
7. Pediculosis is caused by:
   A. Mites
   B. Lice
   C. Chiggers
   D. Fleas
7. Pediculosis is caused by:

A. Mites
B. Lice
C. Chiggers
D. Fleas
8. One day after participating in an outdoor service project at his southeastern college, this student’s rash is most likely caused by:

A. Chigger bites  
B. Spider bites  
C. Flea bites  
D. Contact dermatitis
8. One day after participating in an outdoor service project at his southeastern college, this student’s rash is most likely caused by:

A. Chigger bites
B. Spider bites
C. Flea bites
D. Contact dermatitis
9. The appearance of this itchy rash is classic for:

A. Chiggers
B. Pediculosis
C. Bedbugs
D. Scabies
9. The appearance of this itchy rash is classic for:

A. Chiggers
B. Pediculosis
C. Bedbugs
D. Scabies
10. This rash is described as generalized, scaly, red papules and burrows, suggesting:

A. Chiggers
B. Pediculosis
C. Bedbugs
D. Scabies
10. This rash is described as generalized, scaly, red papules and burrows, suggesting:

A. Chiggers
B. Pediculosis
C. Bedbugs
D. Scabies