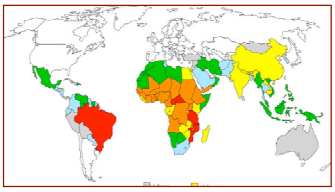
Welcome to MICROBIO590S

Parasitology

Dr. Michele M. Klingbeil
Office: Morrill IVN Room 222
By appointment only
klingbeil@microbio.umass.edu

GLOBAL NETWORK
NEGLECTED TROPICAL DISEASES



Just 50 Cents Campus Challenge

Global Network Launches Signature Grassroots Campaign, Just 50 Cents, with Campus Challenge Contest
Published on 11.2.09

Just 50 Cents Campus Challenge
Act Now, Make Change, and Win

The Just 50 Cents Campus Challenge is designed to give students like YOU the opportunity to make a meaningful impact by becoming a Student Ambassador and fighting the world's most neglected tropical diseases.

http://globalnetwork.org/just50cents

Controlling NTDs is considered a "best buy" in public health because of the availability of extremely low-cost interventions and the resulting high return on investment. For approximately 50 cents per person per year, the seven most common NTDs – which together represent 90% of the global NTD burden – can be effectively treated.

Infectious Diseases

- Emerging Infectious Diseases
  - New diseases (mainly viral agents)
- Re-emerging Infectious Diseases
  - Tuberculosis, Poliomyelitis
- Neglected Diseases
  - AIDS, Malaria, Tuberculosis
  - Typically called the big 3.
- Most ("The Great") Neglected Diseases
  - Many tropical parasitic diseases

Neglected Tropical Diseases

Box 1. The Thirteen Neglected Tropical Diseases in Africa and Their Major Etiologic Agents

Protozoan Infections	
African trypanosomiasis	*Trypanosoma gambiense, T. rhodesiense*
Kala-azar (visceral leishmaniasis)	*Leishmania donovani*
Helminth Infections	
STH Infections	
Ascariasis	*Ascaris lumbricoides*
Trichuriasis	*Trichuris trichiura*
Hookworm infection	*Necator americanus*
Schistosomiasis	
Urinary schistosomiasis	*Schistosoma haematobium*
Hepatobiliary schistosomiasis	*Schistosoma mansoni*
Lymphatic filariasis	*Wuchereria bancrofti*
Onchocerciasis	*Onchocerca volvulus*
Dracunculiasis	*Dracunculus medinensis*
Bacterial Infections	
Trachoma	*Chlamydia trachomitis*
Leprosy	*Mycobacterium leprae*
Buruli ulcer	*Mycobacterium ulcerans*

(Modified from [3])

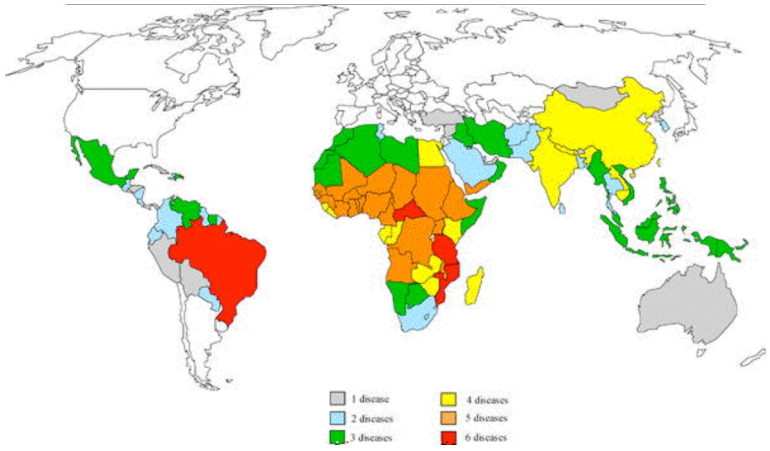
PLoS Med 2(11): e336 doi:10.1371/journal.pmed.0020336

Common features of the NTDS

- **diseases that have burdened humanity for centuries**
- **cause immense suffering**
- **cause life-long disabilities**
- **impair childhood growth & development**
- **poverty-promoting conditions**
- **disproptionate effect on the poor**
- **shortage of safe and effective treatments**
- **gap in attention for global R & D**
- **no commericial markets for products that target these diseases**

Africa's Burden

Sub-Saharan Africa Has the Highest Prevalence of Nine Neglected Tropical Diseases



Up to 90% of the world's disease burden of the listed diseases

The study of parasites

- **What is a parasite?**
- **Do you know anyone who had/has a parasitic infection?**
- **Why do you want to study parasites?**
- **What do you expect to learn?**
- **What parasites might you find in Massachusetts?**

Assignment #1: PubMed/Google search for at least 2 parasites found in Massachusetts - Printout 1st page

Parasitology

- Class website can be viewed at
  http:courses.umass.edu/mic590s/2010/index.html
- The site contains the syllabus, schedule, required readings and resources, and lectures notes, links, and news items.
- Refer to the schedule often

Some book suggestions

- Foundations of Parasitology

  Roberts & Janovy, Macgraw Hill, 7th ed. 2005

  Earlier editions are useful as well (Amazon.com)

- Parasitology & Vector Biology 2nd ed. 2000

  Marquardt, Demaree & Grieve
- Color Atlas of Tropical Medicine and Parasitology, 4th ed. 1995

  Peters & Gilles
- Modern Parasitology, 2nd ed. 1993

  Cox

Websites

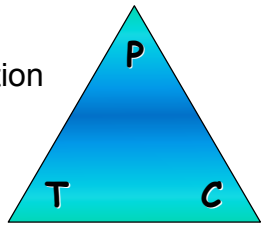
- There are thousands of web sites providing information and images on parasites, not all of them are as trustworthy as one could wish.
- Two excellent sites to look for general information and material for visual illustration are: CDC Division of Parasitic Diseases, and WHO Tropical Disease Research Program (course web site provides links to these sites)

Lecture Format - Survey Plus

- Lectures will be mainly powerpoint presentations with **class discussion**.
- I will assume that you have read the assignments prior to each class meeting….this will greatly assist in your **class participation**.
- You will also read primary literature for Journal club discussions. Why??
- Any information from the additional reading material presented/discussed in a lecture may appear on an exam.
- Lectures will combine biology of the parasites and vectors, pathogenesis of the disease, treatment and prevention of diseases, and control efforts….some more survey than others.
- Where possible we will try to include new cutting edge science with a focus on new molecular concepts.

Parasitology: a multi-disciplinary study

- **Prevention** - Vaccination
  - Effective vaccination? - target identification
- **Control** - Block transmission
  - Mechanical control measures
  - Biological control measures
- **Treatment** - Chemotherapeutic
  - Drug resistance
  - Rationale drug design
- **Diagnoses**
- **Epidemiology**



Look at the ASP website for potential careers related to parasitology.

Symbiosis - "living together"

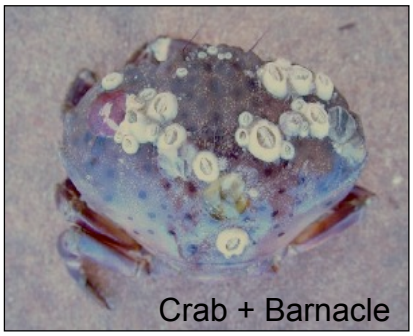
- Intimate association between two different species
  - Usually a larger organism is the host, the smaller is the symbiont
- Give some examples of symbioses

Specific types of association

Phoresis - traveling together

- No dependence from either participant
- One participant is usually machanically carried by the other
- Hitch-hiking

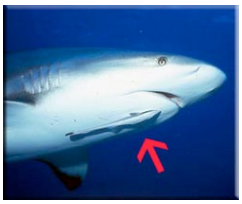
Another example?

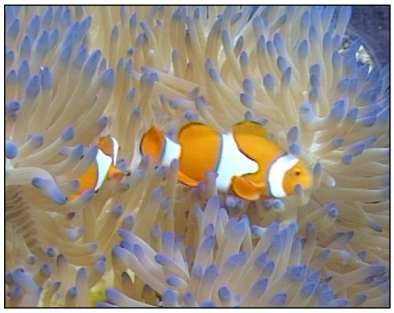


Crab + Barnacle

Commensalism

- “Sharing the table”
- One partner benefits, but the other is neither helped nor harmed.



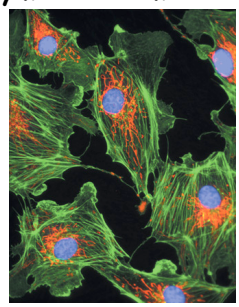


Clownfish + Sea anemone

Mutualism

- Interspecific interaction that benefits both members
- Frequently, the relationship is essential for survival of at least one of the members
  - Obligate interaction

Endosymbiosis - mitochondria

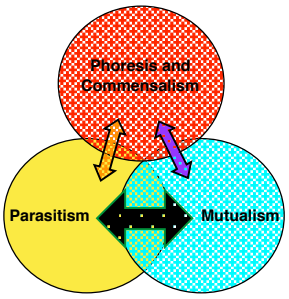


Lichen on tree bark

Moray + cleaner wrasse

Parasitism

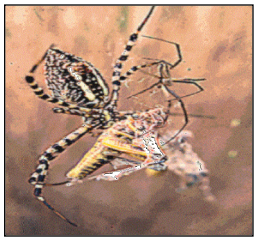
- Parasite and parasitism are terms that define a way of life rather than a coherent evolutionary related group of organisms.



- Numerous definitions
  - **the intimate association of two species where one species (the parasite) benefits at the expense of the other (the host).**
  - **the parasite relies on the host for nutrients and as a place to live.**

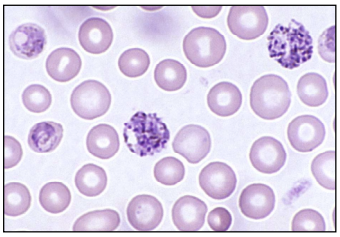
Is this parasitism?

- The benefit in these relationships are clearly skewed toward the lion and the spider.
- Predator vs. prey
- Predators tend to be larger than their prey, and consume many prey in a lifetime.



What is a parasite?

- Parasites are usually much smaller than their host, and do not kill the host before taking a meal.



Is this parasitism?

- Micropredation - the mosquito is certainly gaining a nice blood meal.
- Blurry lines between these definitions.
- The host is the food source, and a specific niche for the parasite.
- Many parasites show strict specificity for a single host species.

Summary

- Symbiosis
  - Phoresis
  - Commensalism
  - Mutualism
  - Predation
  - Parasitism
    - Know these definitions
    - Be able to compare/contrast using specific examples

Parasitism - relationship between 2 different species in which the smaller (parasite) has the potential of harming the larger (host). Parasite uses the host for nutrients and a home, and has a greater reproductive potential than the host.