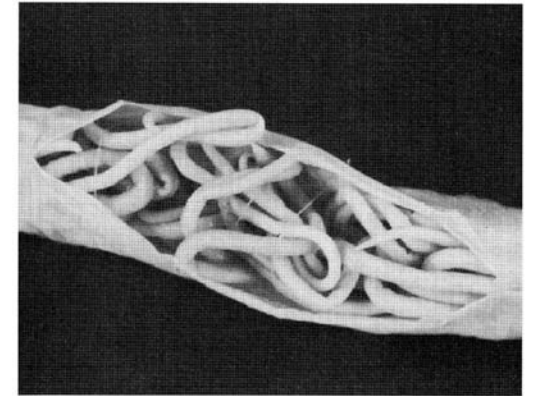


Biological Sciences 318- **Parasitology**

Professor: Carl Lowenberger (clowenbe@sfu.ca)
Office SSB 6121 tel 2-3985
Laboratory SSB 6151 tel 2-4391

Lab Instructor Tammy McMullan (tmcmulla@sfu.ca)
Office BISC 9241 tel 2-3983

TA Sharra Farivar sfa19@sfu.ca



Contact via email is best: **please put parasitology 318 in the subject line**

Texts: (Optional) Parasitology & Vector Biology (Marquardt, Demaree, and Grieve)
(Optional) Parasitic Diseases (Despommier, Gwadz, Hotez, Knirsch)
(Optional) Foundations of Parasitology (Roberts and Janovy)

Parasitology BISC 318 Spring 2015

Why did you pick this course

- Your friends (!?!) recommended it
- It fit into your schedule?
- You have a passion for parasites (?)
- You need an upper division lab course?

Course Format

Tuesday 10:30-11:20

Thursday 9:30-10:20, ten min break,

Thursday 10:30-11:20

Most lectures will be presented with PowerPoint

Presentations will be available usually the day before the lectures as ppt or pdf

Do you want powerpoint or pdfs?

Labs: if you are not scheduled- see me.



Materials:

Text books: Parasitology & Vector Biology (Marquardt, Demaree, and Grieve)
Parasitic Diseases (Despommier, Gwadz, Hotez, Knirsch)
Foundations of Parasitology (Roberts and Janovy)

These should be on reserve in the Library.

Lectures will be loosely based on these texts- each has strong and weak points.

Exam material will be largely based on lectures but will include material from the texts as well.

Lab materials will be posted on Sunday/Monday before each lab.

YOU should print it out and bring it to lab.

EXAMS

Scheduled for 3 exams (20/20/25%) 65%

Lab evaluation will be presented to you next week in the first lab: 35%

Exams will be given in class- corrected and returned to you ASAP- we will go over exams for the first 20 minutes or so.

Exam Format: T/F, multiple choice, and short answer questions

WHAT IS THE BEST WAY TO EXAMINE YOU?

Each lab will contain 24 students. We will break you up into groups of 4. Each group will choose a parasitic disease not covered in the course. The group will present a 20-30 minute presentation on the problems associated with this parasite and disease and based on this course, other courses, and readings, propose what might be done differently from current strategies to reduce/eliminate problems and suffering from with this parasite. Presentations will be made in the lab sessions in the week of March 24 (subject to change).

Expectations

I do not want to fill your heads with neat trivia but useless information. However I have to evaluate you somehow.

T/F questions and multiple Choice questions are there to help me determine if you have been doing the readings and are paying attention.

Short answer questions will be used to evaluate your understanding of interrelated aspects of parasitology: ie can you figure out the consequences on parasite X by treating for parasite Y?

I may ask: you were in country X doing A, B, and C. You come home and have these symptoms. Based on what we have discussed in class, what do you think you have, how did you get it, and what do you do now?

Once you have some ideas of what parasites are what, who lives where, how they interact with the host, the questions will require that you integrate information from all lectures, and from other courses, into the answers. I would like you to think, and show me that you are thinking.

Although memorizing is a component of the course it cannot be the end point.

We have to learn the differences between trematodes, cestodes, and nematodes so that we can understand in general terms what people are talking about.

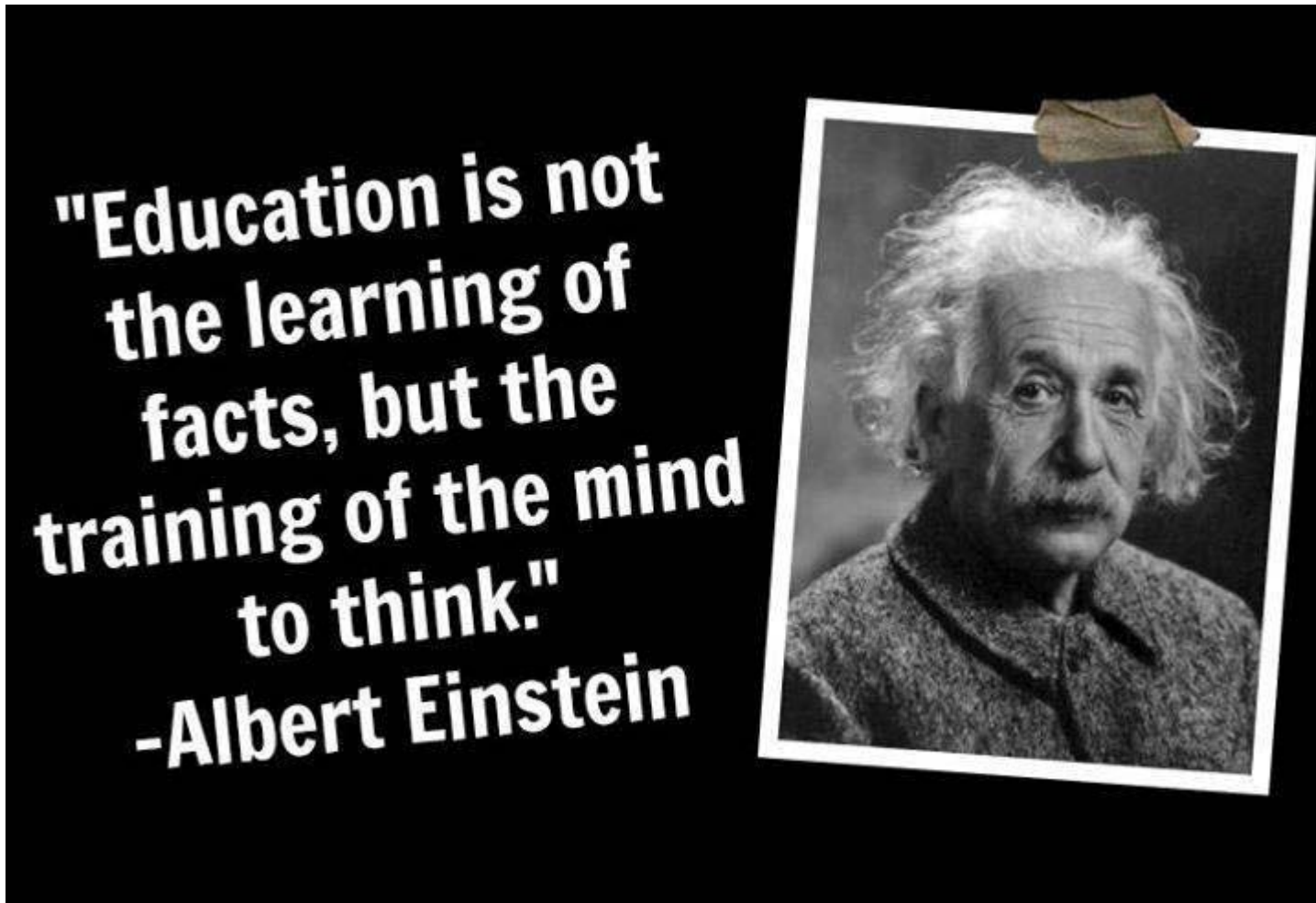
We have to learn the parasitology jargon. All fields have it and to be able to talk with parasitologists / scientists around the globe means we have to understand the words and concepts.

Different uses of terms in UK and N. America:
Incidence, prevalence, and mean intensity of infection

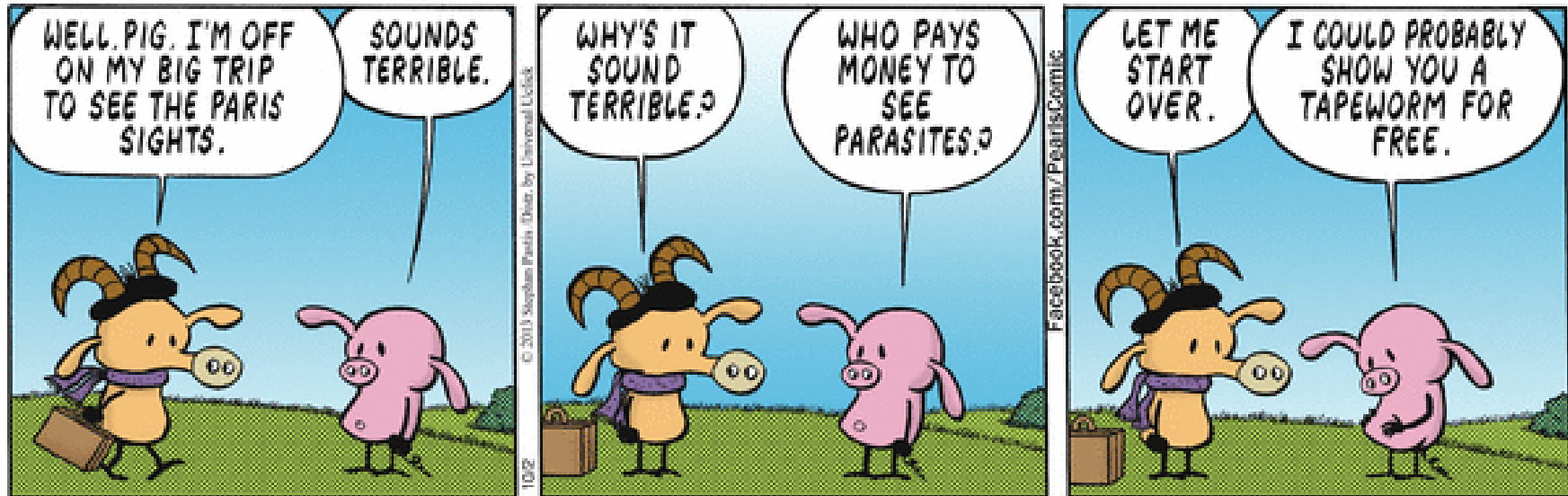
Parasitology is commonly taught in one of 2 ways;

- 1) Lectures be based on taxonomy: Starting with amoebas, giardia etc, and working up to more complex parasites.
- 2) Lectures based on tissues: all parasites infecting liver, or blood, etc

Although memorizing is a component of the course it cannot be the end point.....



What we say, and what we mean may be interpreted differently by others!



Paris Sights \neq Paris Sites \neq Parasites

Throughout the course we want you to think from the perspective of a parasite.

Why parasitize host A and not Host B.

Why develop in tissue X and not Y.

Why behave in a particular manner.

Why does nematode 1 live in the gut but nematode 2 in the bloodstream?

Why does species 1 use sexual reproduction but species 2 is asexual?

What are the pros and cons of sexual vs asexual reproduction?

What are priorities to the parasite? How does this affect its relationship with the host?

Are these behaviours beneficial, detrimental or neutral to the parasite?

Why (and how) have the parasites developed such complicated life cycles?

Why are some parasites so difficult to control?

Think and integrate information-stop me and complain if I am wrong or my interpretation is different than you have learned in another class!

I will put in errors in later lecture notes to see if you have read the materials or if you are paying attention!

The course outline indicates what we will talk about each lecture.

This is flexible. If some parasite becomes very prominent ie an outbreak somewhere in the world- we may drop one lecture to keep current with what is happening.

Concepts to keep in mind:

Why is this parasite important (physiology/mol. biology/epidemiology/disease)

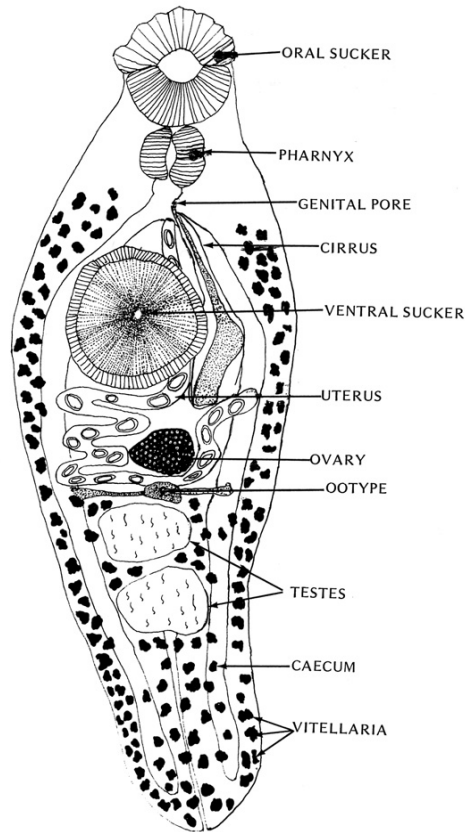
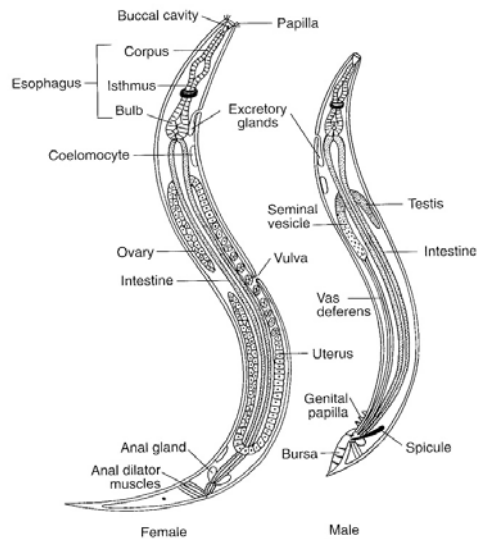
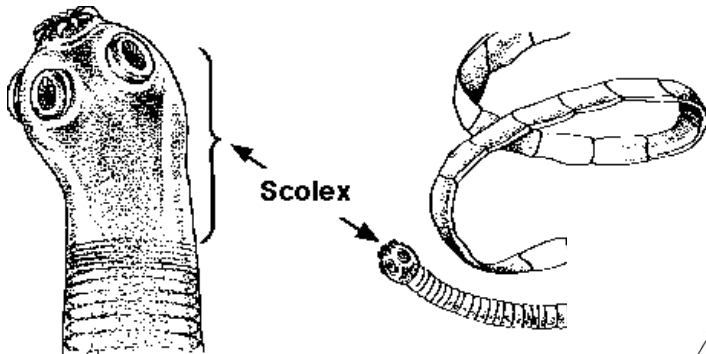
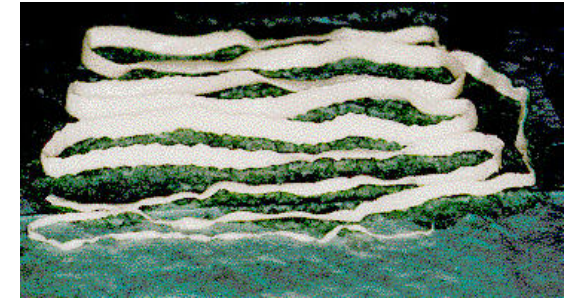
How did it get to be a problem? (physiology/mol. Biology/ecology/mol. Biology)

How can it be controlled? (physiology, vaccines, drugs, behavioural changes)

Why is malaria not important in Canada?

What is Parasitology

What is a parasite?



Physiology

Behavioural ecology

Ecology

Chemical ecology

Transmission dynamics

Mathematical Models

Taxonomy

Host-parasite-interactions

Vector Biology

Description

Molecular Biology

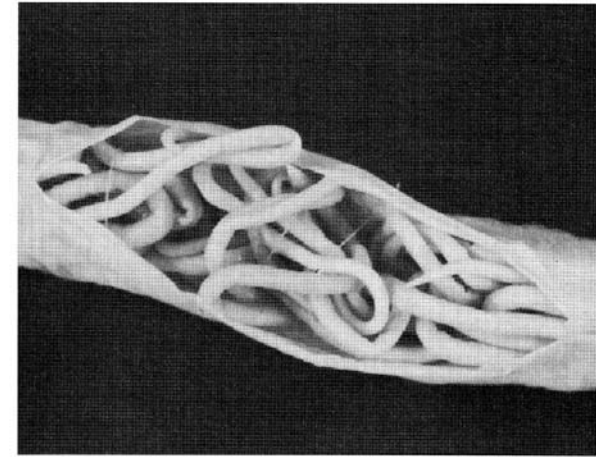
Immunohistochemistry

Are Parasites important?

Malaria kills 2-3 million / year

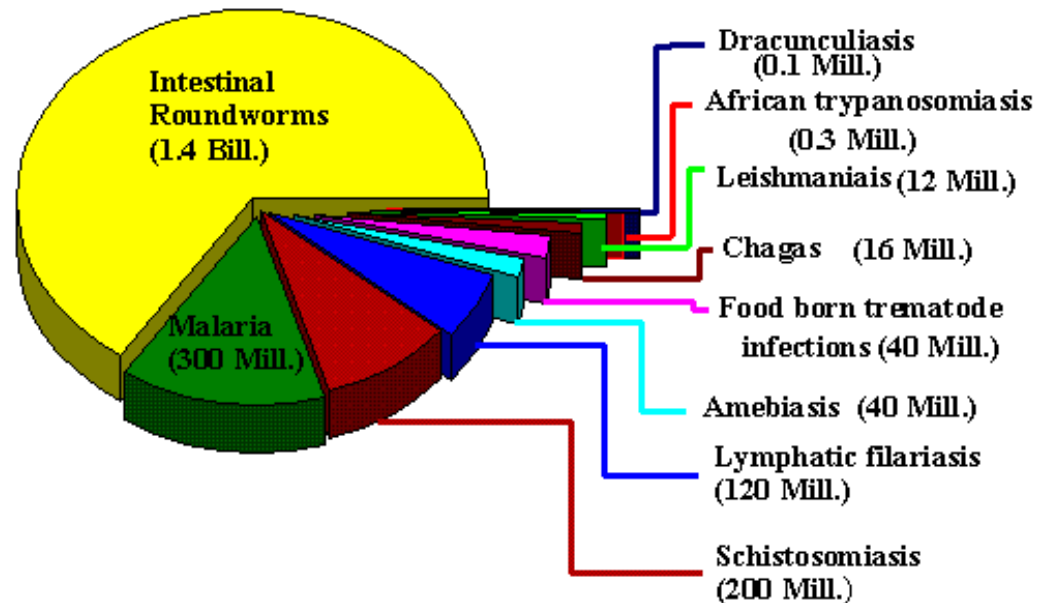
HIV/AIDS kills 2-3 million/year

TB kills 2-3 million/year



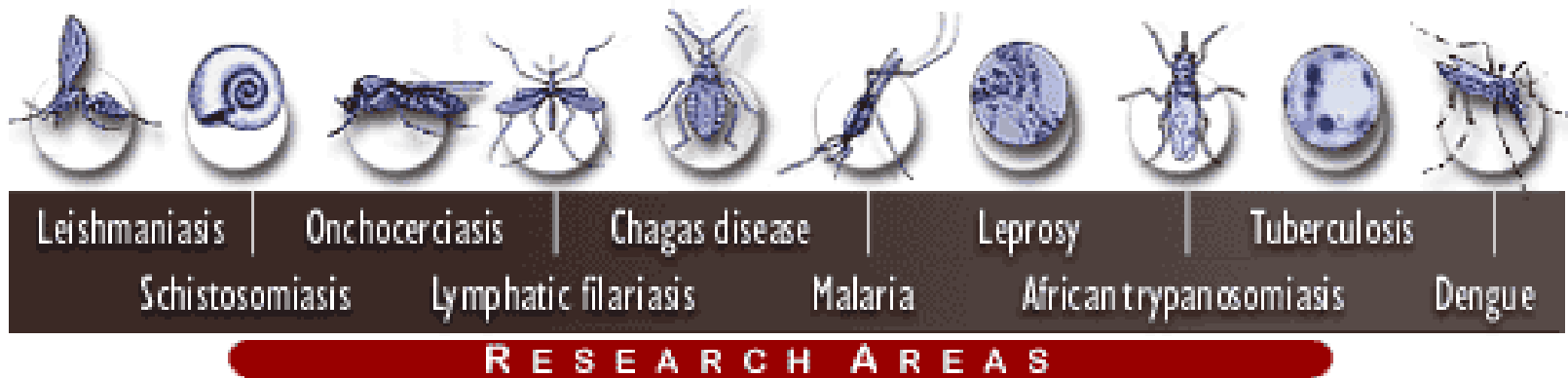
Parasitic infections

What are they and how many people have them?



How important are Biological vs Sociological Factors in determining disease?

Are Vector-Borne Disease Important?



Leishmaniasis

Schistosomiasis

Onchocerciasis

Lymphatic filariasis

Chagas disease

Malaria

Leprosy

African trypanosomiasis

Tuberculosis

Dengue

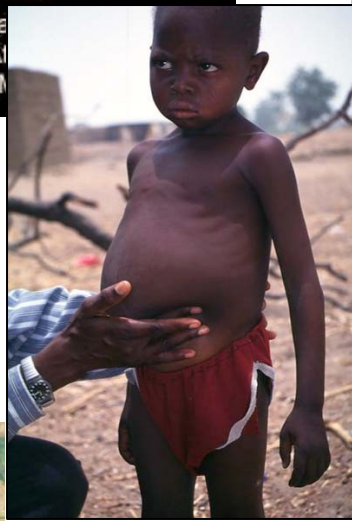
RESEARCH AREAS



Cutaneous Leishmania
W. Peters: A Colour Atlas
Arthropods in Clinical M




African Sleeping Sickness



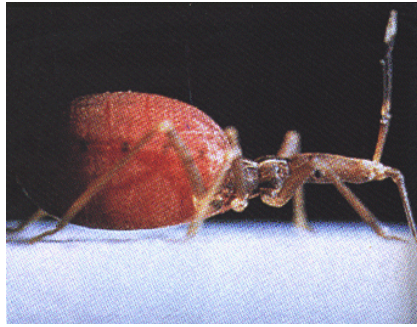
**FROM HORROR TO HOPE:
The fight against
RIVERBLINDNESS**

For 30 years, rich countries and poor worked together to defeat one of West Africa's nastiest diseases. Now they're using what they learned to one of the world's most successful cross-border health campaigns to tackle other ills



You need to see these things... the world's most successful cross-border health campaigns to tackle other ills





My background

BSc Entomology- Biological Control

Masters Entomology / Parasitology/ pest management

PhD Parasitology

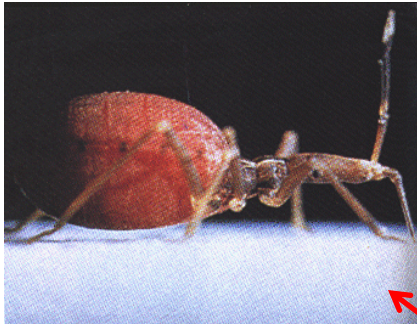
What do I study?

Vectors: Insects that transmit parasites- mosquitoes, black flies, kissing bugs

Why do these insects transmit parasites

Why do all insects not transmit all parasites- what defines the specific associations?

How can insects protect themselves and kill the parasites?

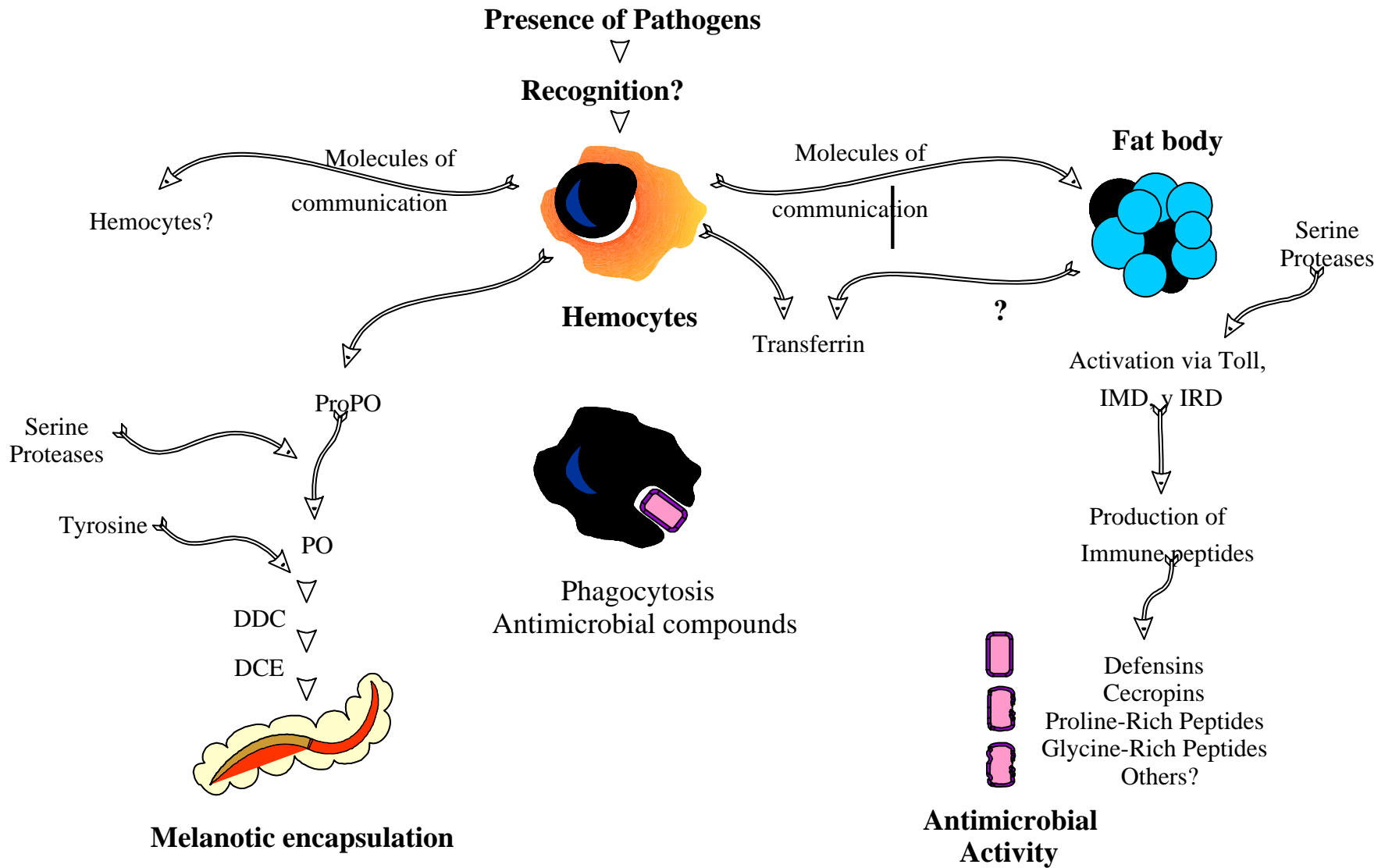


Trypanosoma cruzi
Chagas Disease

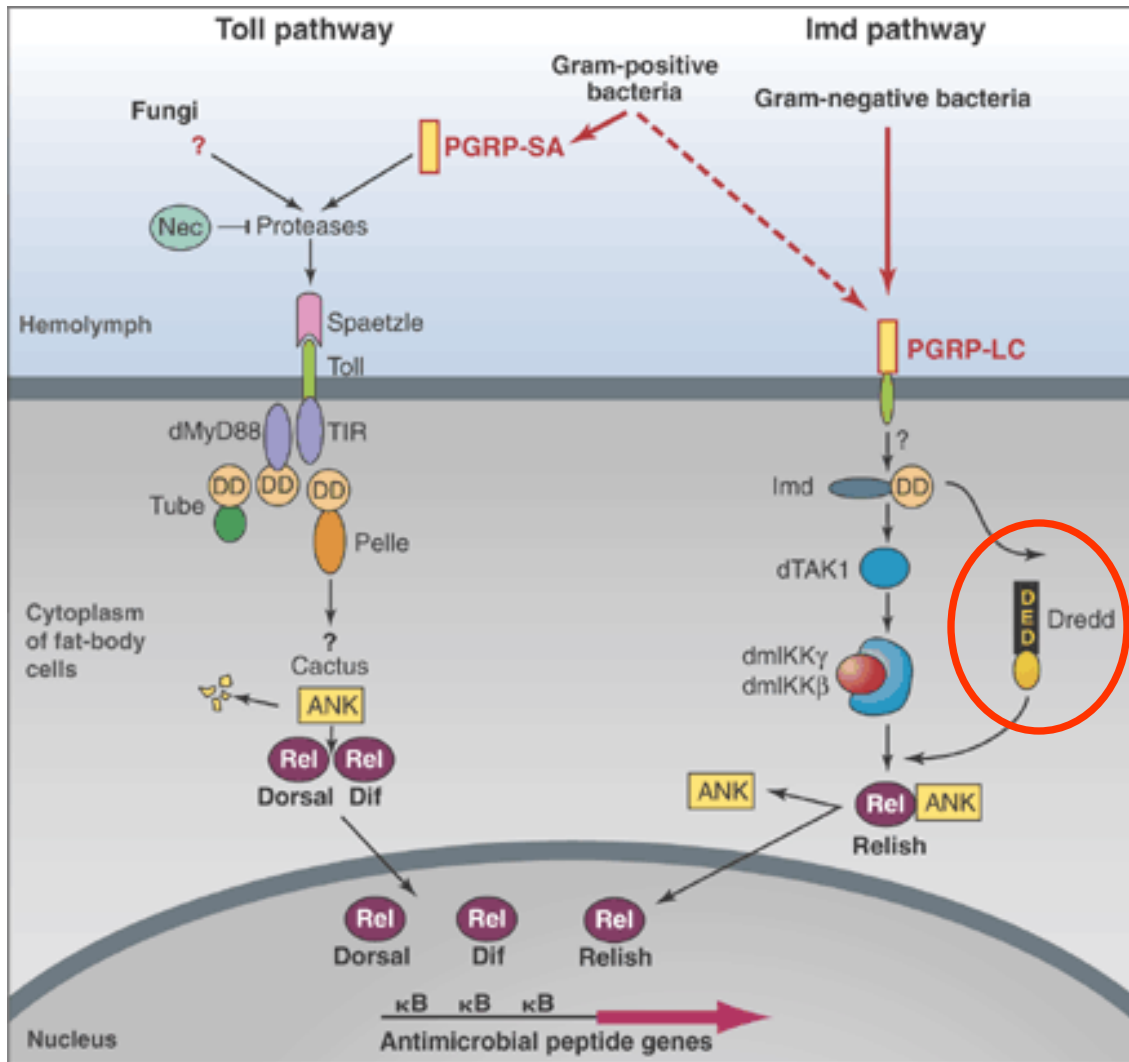
Dengue virus
Dengue

Oncocerca volvulus
River Blindness

Immune Response of Insects



Stages of the Insect Immune Response



Recognition

PAMP-PRR

Molecular patterns

Regulation

Effector Proteins

<u>Interactions between organisms</u>	<u>result</u>
Predator / prey: short term relationship	death
Parasite / host: short/long term	??
Parasitoid / host: short/long term	death

Interactions between organisms

Symbiosis: “living together”- 2 organisms living in/on each other

Phoresis: travelling together: the phorant carried by other (spores on legs)

Mutualism: both symbionts benefit: usually an obligate relationship

termite + intestinal protozoan, lichens (alga + fungus), bacteria in guts of leeches

Commensalism: one symbiont benefits, other: no impact

facultative: ciliates on crustaceans

obligate- epiphytic plants (bromeliads)

Parasitism: one symbiont benefits at the expense of the other

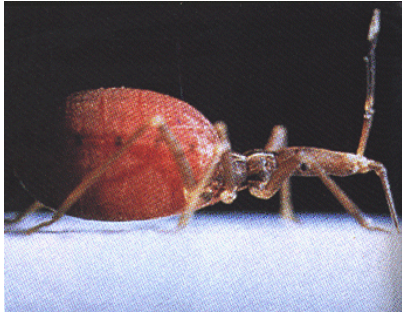
-mechanical injury, inflammation reaction, competition for resources

facultative: mosquito (micro-predator)

obligate: tapeworm

Definitions are general and arbitrary. Some cannot be easily assigned to these categories. What we call commensalism may be parasitism that we cannot recognize, and vice versa.

Are all parasites bad?



Requirements for Parasitic relationships

Live in close proximity

Smaller size than host

Ability to enter / associate with host

Attachment / interactive membranes

Physiological ability to survive in / on host and derive nutrients

Physiological ability to reproduce in / on host

Offspring must be able to contact a potential host (eggs released that pass out of or off of host, ability to infect another host or be ingested by next host)

No strong immune response by host to symbiont

Reproductive strategies: R strategists

-large numbers of offspring with no density-dependent restraints, little/no competition (liver flukes: 20 k eggs/day)

-some act more like k strategists

Tsetse fly produces one egg at a time, lice produce 1-few eggs and invest much energy into offspring

Reproduction continued:

Common for parasites to have sexual and asexual reproductive cycles

Plasmodium (causes malaria) alternates asexual and sexual cycles

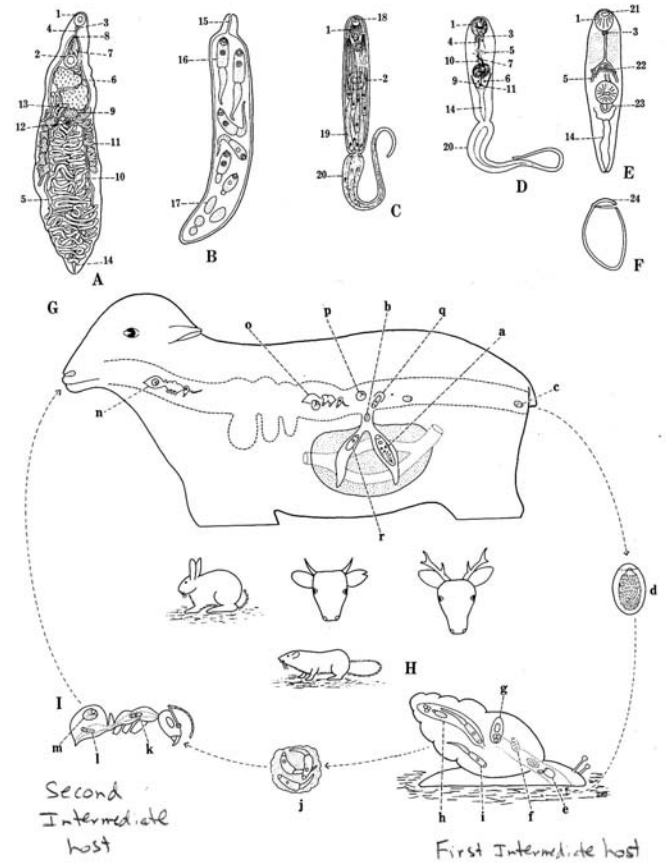
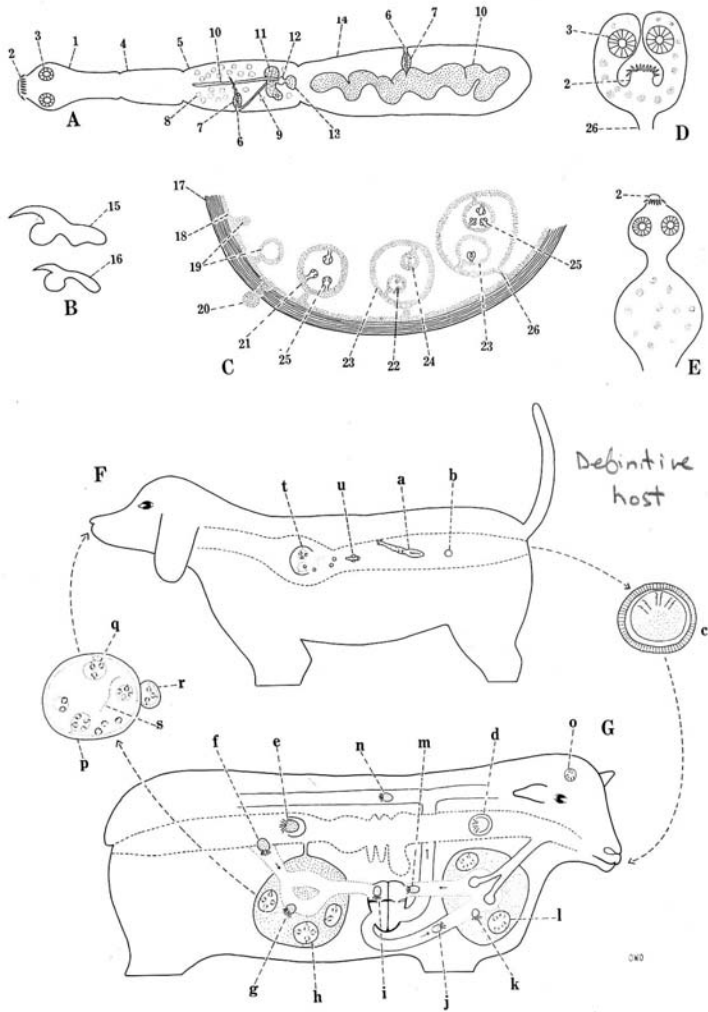
Trematodes have asexual cycles in snail hosts, sexual cycles in vertebrates

Some Tapeworms have asexual and sexual cycles and have replication of sex organs in each segment

Some parasites live in/on 1 host

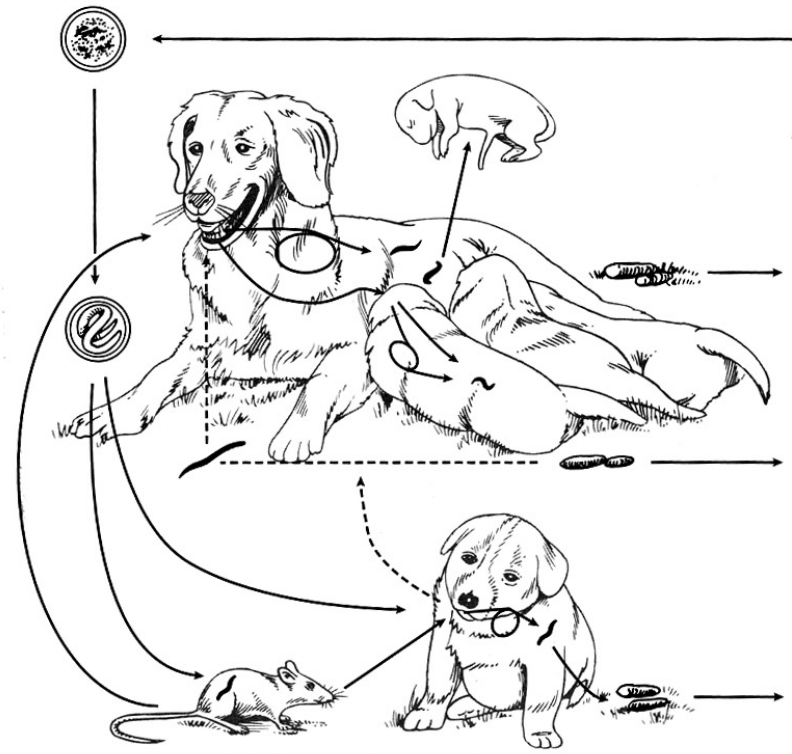
Some trematodes have 5 hosts/life cycle, and up to 5 developmental stages-

Need asexual and sexual reproduction to keep up numbers to maintain transmission



What are the factors involved in the evolution of specific traits, or the co-evolution between parasites and hosts?

Throughout this course think not only about what factors and structures exist, but also how their development may have come about



The life cycle and modes of transmission of *Toxocara canis*. There are three modes of transmission: by mouth, prenatally, and through the milk.

PARASITOLOGY TERMS AND DEFINITIONS

1. **Obligatory parasite** - one that is physiologically and metabolically dependent on the host.
2. **Facultative parasite** - establishes a relationship with a host if the opportunity presents itself.
3. **Ectoparasite** - lives on the outer surface of its host.
4. **Endoparasite** - lives inside its host.
5. **Accidental parasite** - one that is found in other than its normal host (=incidental parasite).
6. **Permanent parasite** - lives its entire adult life within or on a host.
7. **Temporary parasite** - contacts its host only to feed and then leaves (=intermittent parasite).
8. **Aberrant parasite** - characteristic of the host, but found in an unusual location within the host.

HOSTS:

1. **Definitive host** - one in which the parasite reaches sexual maturity, or the most important host if no sexual reproduction occurs.
2. **Intermediate host** - one in which some development or asexual reproduction occurs, but sexual maturity does not occur.
3. **Vector** - intermediate/definitive host that actively transmits a disease organism.
4. **Paratenic host** - host which the parasite enters, does not undergo any development or reproduction, but remains infective to the definitive host.
5. **Reservoir host** - a "living source" of the parasite; not host of primary concern.

LOCATION OF PARASITES WITHIN THE HOST:

- 1. Coelozoic** - lives in cavities of the host; i.e., peritoneal cavity, lumen of the gut, blood vessels, etc.
- 2. Histozoic** - lives in the tissues of the host, but not within cells.
- 3. Cytozoic** - intracellular parasites; live within host cells.

LIFE CYCLES:

- 1. Direct life cycle** - one host cycle (= **monoxenous parasite**), commonly called "hand-to-mouth" cycles.
- 2. Indirect life cycle** - one requiring two or more hosts (= **heteroxenous parasite**).