

# Introduction to parasitology and laboratory orientation

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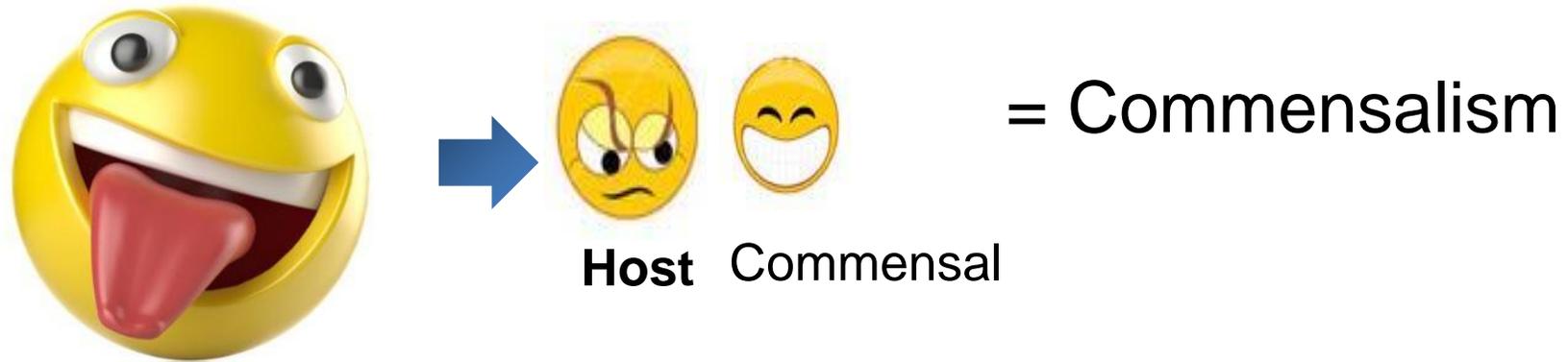
- เอกสารประกอบการบรรยายนี้ จัดทำสำหรับกระบวนวิชา 317221, 317331, 317242 ภาคเรียนที่ 2 ปีการศึกษา 2561 ของภาควิชาปรสิตวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่
- This lecture handout is prepared for a course 317221, 317331, 317242, second semester, academic year 2018 of Department of Parasitology , Faculty of Medicine, CMU

# Learning objectives

After class, students be able to

1. Define parasitological terms
2. Explain the impact of parasitic diseases
3. Apply knowledge to upcoming lessons

➤ Two animals living together



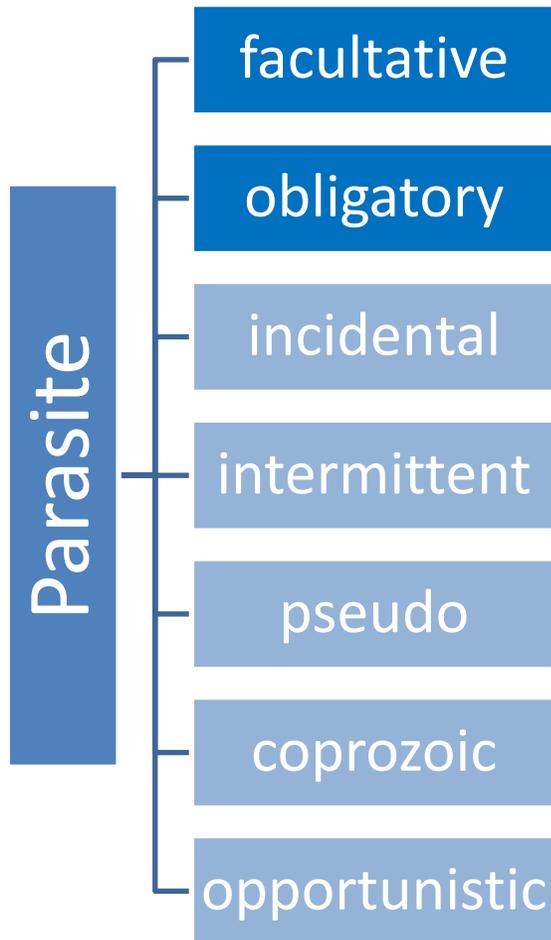
SEVENS  
HEAVEN

- “Parasitology” -a study of the relationship between parasites and hosts
- Parasites- animals that live in or on the hosts for food and shelter. Parasites are dependent on their hosts.
- Hosts- animals (usually bigger) which provide food and shelter for parasite. Sometimes, they get sick.

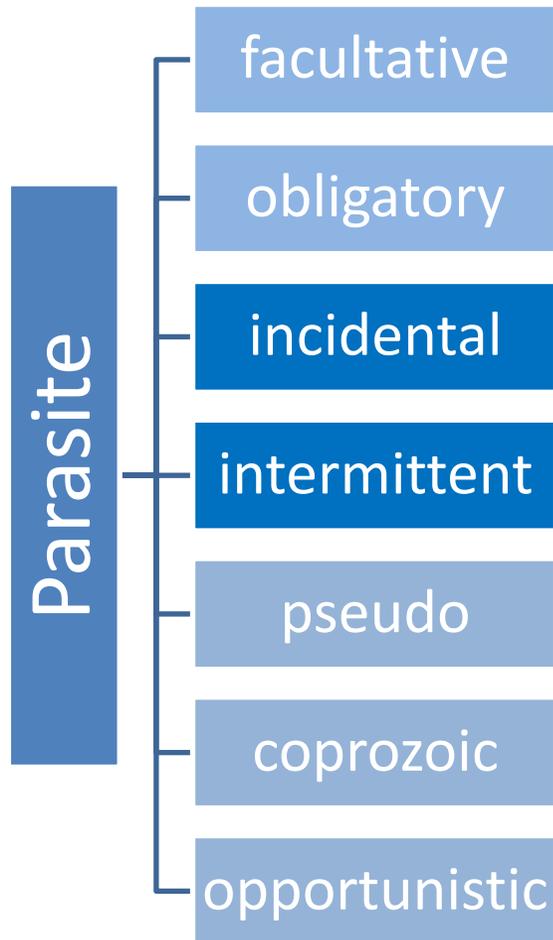
- *The principal aim* in parasitology is to acquire knowledge about parasitism in natural populations to control or eliminate parasite from unnatural populations, both of the people and of the animals on which the people depend.”

Paul C. Beaver (1981). In: *The current status and the future of parasitology*. New York: Josiah Macy Foundation, page 5.

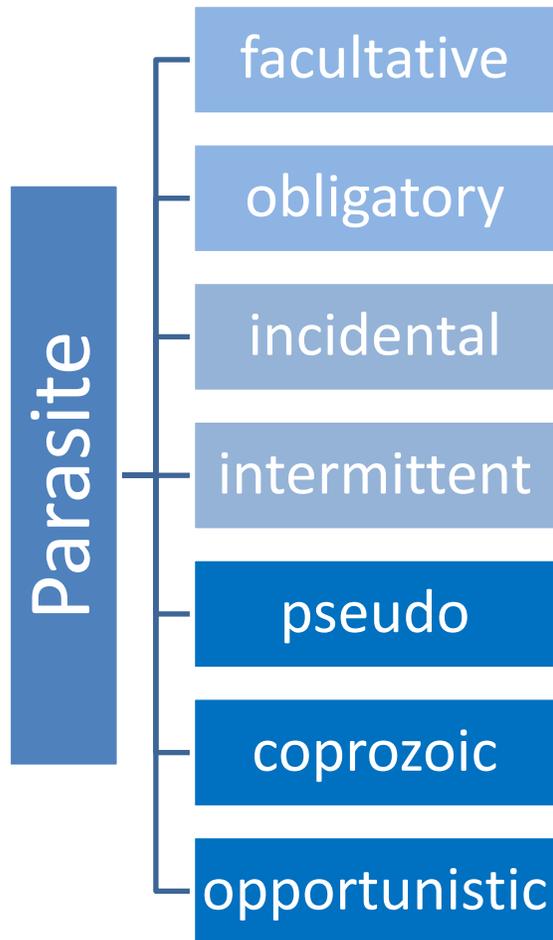
# Parasites



- Facultative parasites
  - Can live and reproduce
    - outside host (free-living) and
    - Inside host (parasitic phase)
    - Examples: *Strongyloides* and *Naegleria*
- Obligatory parasites
  - Only parasitic phase
  - Example: Beef tapeworm



- *Incidental* parasites
  - Accidentally enter unusual host
  - Example: *Toxocara*
- *Intermittent* parasites
  - Temporary (antonym = Permanent)



- Pseudoparasites (artefacts)
  - “Look alike”, e.g., pollen grains
- Coprozoic (spurious) parasites
  - Organisms eaten and found in faeces
- Opportunistic parasites
  - Immunocompetent host : no or self-limited disease
  - Immunocompromised host : severe disease
  - Examples: *Cryptosporidium*, microsporidia

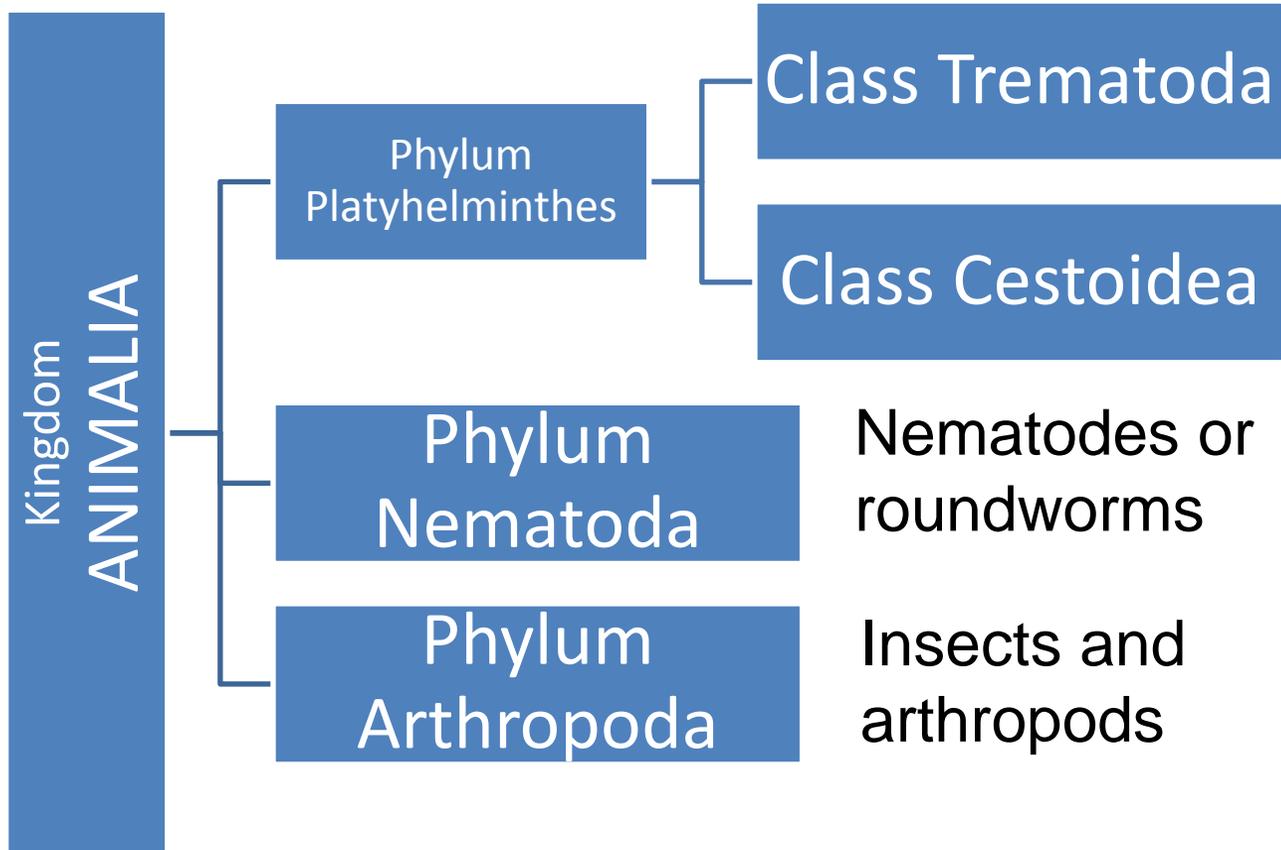
Kingdom  
PROTISTA

Subkingdom  
PROTOZOA

- Phylum Sarcomastigophora
  - Amoeba and flagellates
- Phylum Apicomplexa
  - Coccidia and malaria
- Phylum Ciliophora
  - Ciliates

Order, class, family

Scientific name ← Genus, species



Trematodes or flukes

Cestodes or tapeworms

Genus, species



Scientific name

# Simple classification

## Single cell parasites

- Protozoa
  - Amoeba
    - Pseudopodia, binary fission
  - Flagellate
    - Flagella, longitudinal binary fission
  - Ciliate
    - Cilia, transverse binary fission
  - Sporozoa
    - Sexual reproduction, oocyst formation

## Multicellular parasites

- Helminths
  - Nematodes, trematodes, cestodes
- Arthropods
  - Insects, spiders, ticks, mites, etc.
- Acanthocephalans
  - Thorny-headed worms

# Previously protozoan parasite → now fungus

- *Pneumocystis jirovecii*
- Microspora

| Jan 22 | Apicomplexa: Malaria                                     |
|--------|--|
| Jan 29 | Apicomplexa: Coccidia<br><i>Pneumocystis</i> spp.        |
| Feb 5  | Flagellates I: Genito-urinary and intestinal flagellates |
| Feb 12 | Flagellates II: Hemoflagellates                          |

# Host

| Terminology        | Parasitic stage in the host                      |
|--------------------|--|
| Definitive hosts   | Adult stage (sexually mature)                    |
| Intermediate hosts | Larval stage- developing to infective stage      |
| Paratenic hosts    | Larval stage (infective)/ no further development |
| Reservoir hosts    | Adult stage- Source for human infection          |
| Accidental hosts   | Mostly larval stage- Dead end of parasite        |

# Parasite Life Cycle

- Simple (homoxenous)
  - Intermediate host not required to complete life cycle
- Complex (heteroxenous)
  - Requires one or more intermediate host

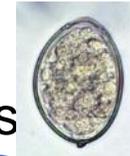
Fish-eating mammals



Human

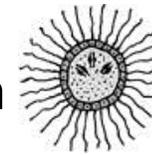
Fish tapeworm  
Adults In the small intestine

Eggs



Fish 2

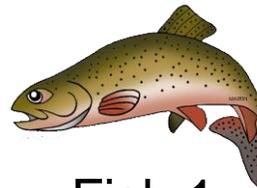
Coracidium



Plerocercoid larva

Plerocercoid larva

Procercoid larva



Fish 1



Copepod

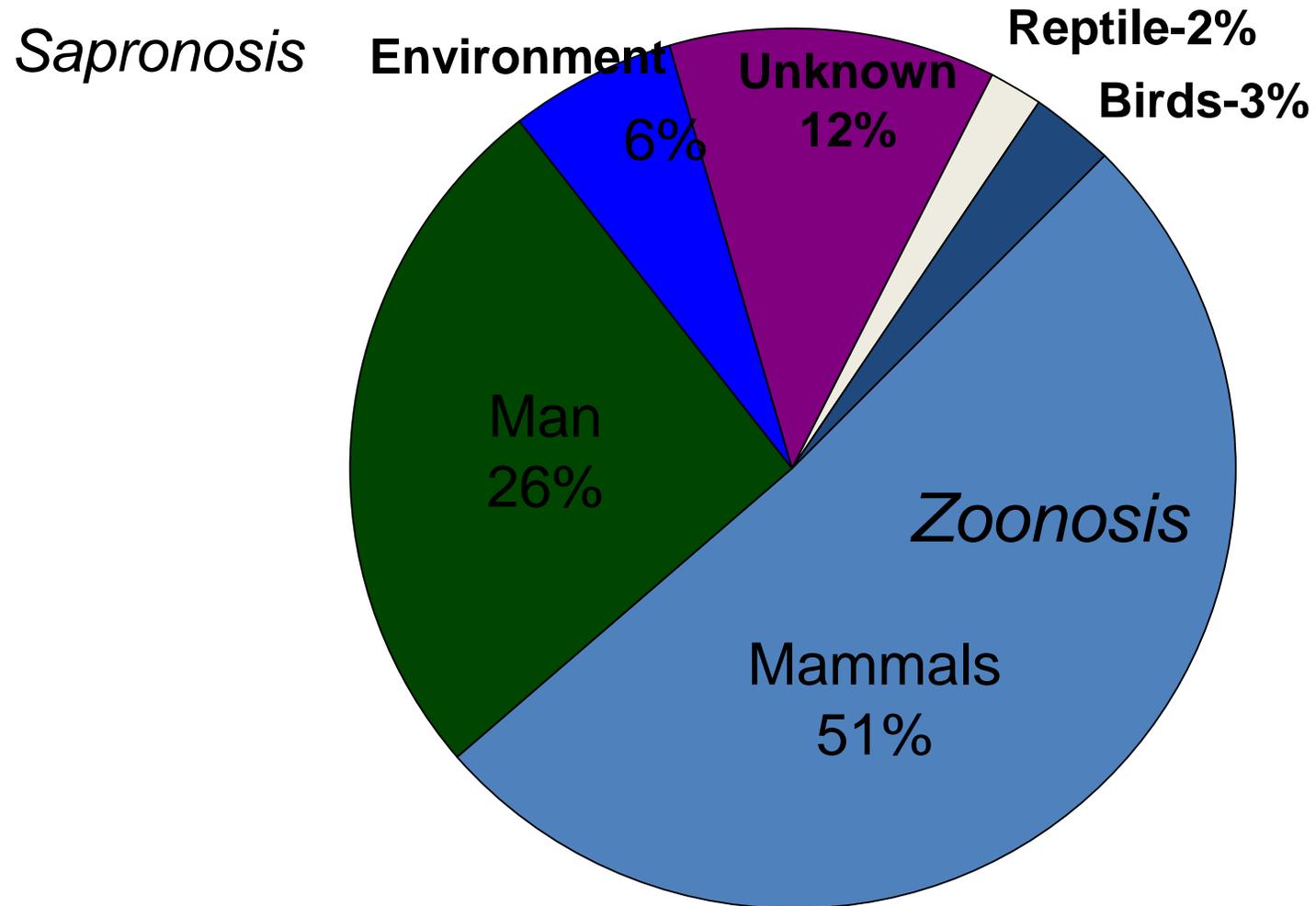
# Terminology

- Human is .....host
- Fish-eating mammals are.....host
- Copepod is.....host
- Fish 1 is.....host
- Fish 2 is.....host
- The tapeworm infective stage is.....

## Mode of infection

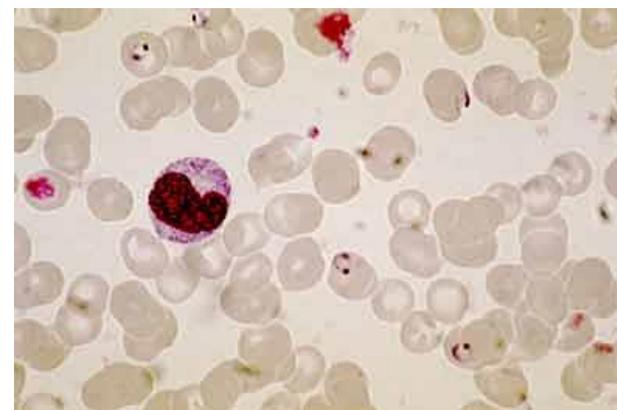
- Waterborne, e.g., amebiasis
- Foodborne, e.g., trichinellosis
- Soil-transmitted, e.g., ascariasis
- Person-to-person, transplacental or autoinfection
- Zoonosis, e.g., Zoonotic leishmaniasis
- Mosquito-borne, e.g., filariasis

# Zoonotic status of man's parasite



# Prepatent period

- Time from acquiring parasite (infective stage) until parasite (mature) or its products detected
- Mosquito bite (sporozoite) until blood smear positive

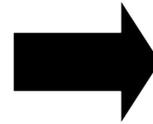


[www.niaid.nih.gov/.../bugborne01/malaria.htm](http://www.niaid.nih.gov/.../bugborne01/malaria.htm)

[www.ma.uni-heidelberg.de/inst/imh/leistungen/...](http://www.ma.uni-heidelberg.de/inst/imh/leistungen/...)

# Incubation Period

- Time from acquiring parasite (sporozoite) until appearance of signs and symptoms (fever)



[www.fiocruz.br/ccs/estetica/malaria.htm](http://www.fiocruz.br/ccs/estetica/malaria.htm)

[www.who.int/features/2003/04b/en/](http://www.who.int/features/2003/04b/en/)

# Example

- Vivax malaria
- Prepatent period 11-13 days
- Incubation period 12-17 days
- Useful for presumptive diagnosis
- Incubation period is usually longer than PP except some diseases

# Damage

- Destruction of tissues by parasite's enzymes
- Mechanical injury
  - Large worm- obstruction, e.g., ascariasis
  - Penetrating intestinal wall, e.g., *Ascaris*
- Immunological reaction to parasites or their metabolites
  - Schistosomiasis
- Others

# Importance of parasitic diseases

- Death
- Chronic illness
  - E.g., gnathostomiasis
- Deformities
  - E.g., leishmaniasis
- Symptomless
  - E.g., liver fluke infection



Health loss  
Disability  
adjusted life  
year (DALY)



**Economic  
loss**

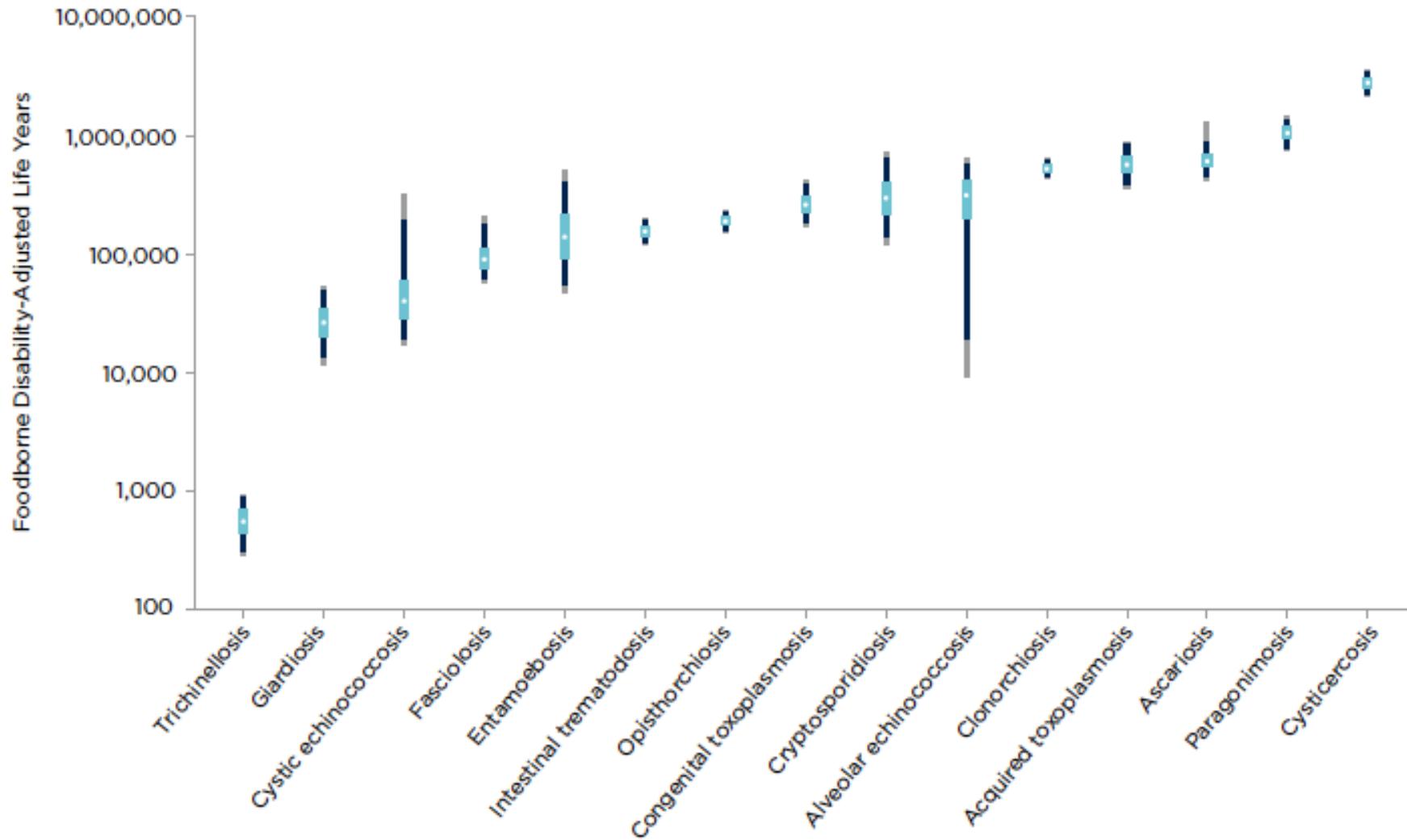
Drug cost, income loss

# WHO TDR

- Important parasitic diseases needed research
- High DALY
  - Leishmaniasis
  - Malaria
  - Trypanosomiasis
  - Lymphatic filariasis
  - Onchocerciasis
  - Schistosomiasis

# Schistosomiasis

- *“According to WHO, 200 million people are infected worldwide, leading to the loss of 1.53 million disability-adjusted life years, although these figures need revision.”*
- *“The estimated minimum global human burden of cystic echinococcosis averages 285,000 disability-adjusted life years (DALYs) or an annual loss of US \$194,000,000.”*



Foodborne Disability Adjusted Life Years 2010 (WHO ESTIMATES OF THE GLOBAL BURDEN OF FOODBORNE DISEASES, 2007- 2015)

## Neglected tropical diseases of the ASEAN countries requiring Rx

| Country   | Intestinal helminth in children | Lymphatic filariasis | Schistosomiasis |
|-----------|---------------------------------|----------------------|-----------------|
| Brunei    | 15,000                          |                      |                 |
| Cambodia  | 2.9 m                           | ?                    | 6,008           |
| Indonesia | 43.5 m                          | 3,035                | 18,994          |
| Lao PDR   | 1.4 m                           | 132,644              | 9,164           |
| Malaysia  | <0.1 m                          |                      |                 |

## Neglected tropical diseases of the ASEAN countries requiring Rx

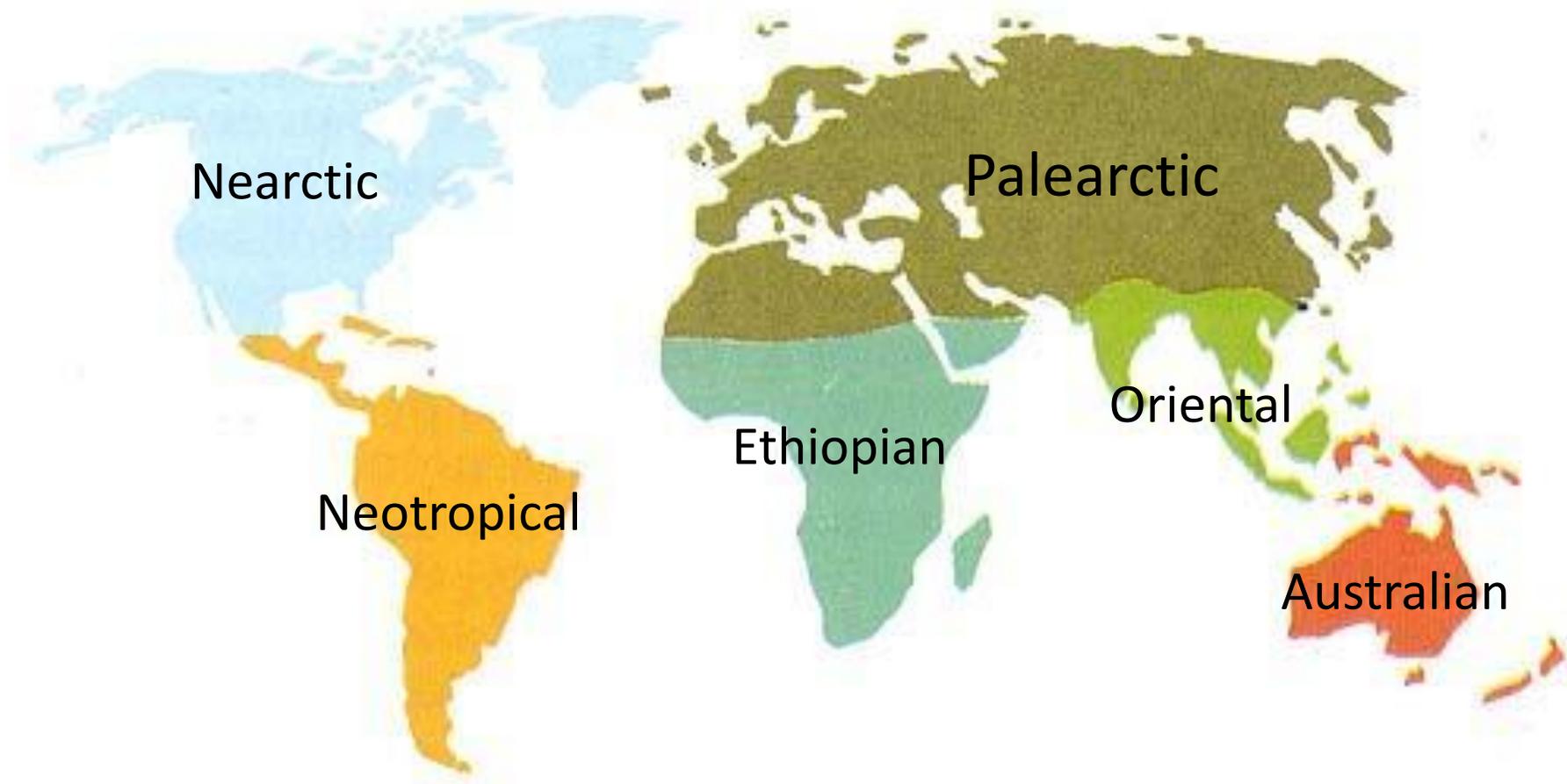
| Country             | Intestinal helminth in children | Lymphatic filariasis | Schistosomiasis |
|---------------------|---------------------------------|----------------------|-----------------|
| Philippines         | 22.2 m                          | 29.4 m               | 2,150           |
| Singapore           | None                            |                      |                 |
| Thailand            | <0.1 m                          | 73,495               |                 |
| Vietnam             | 5.2 m                           | ?                    |                 |
| % global population | 13.4%                           | 13.1%                | 0.2%            |

Hotez P, et al. Neglected Tropical Diseases among the Association of Southeast Asian Nations (ASEAN): Overview and Update. PLoS Negl Trop Dis 9(4): e0003575. April 16, 2015

# Factors influencing parasite fauna

- Climate (Temp/ Humidity)
  - Tropics, subtropics, temperate, polar
  - Very wet to arid
- Fauna- Animal
  - Palearctic, Nearctic, Neotropical, Oriental, Australian, Ethiopian
- Flora
  - Rain forest, evergreen forest, savanna

# Faunistic areas



The Macdonald encyclopedia of mammals, 1983.

# Disease outbreak

- Change of human behavior, travelling, globalization
- Emerging diseases- never seen before
- Re-emerging diseases- used to be, then come back
- Imported disease- acquire from abroad
- Autochthonous infection- acquire in country
- Zoonosis- acquire from animal
- Endemic area- continuing transmission of disease

# Immunity

- Human poses immune response against parasitic infection
- Immunity contribute to little protection
- People live in endemic area can be asymptomatic or tolerate to re-infection
- Vaccine is underdevelopment, yet successfully developed

The screenshot shows a webpage from Schools Week. At the top, there is a navigation bar with a 'SUBSCRIBE' button, a date 'Thursday November 29th 2018', and the 'SCHOOLS WEEK' logo. Below the navigation bar, there are links for 'News', 'Opinion', 'Features', 'Reviews', 'Bulletin', 'Supplements', 'Archive', and 'Jobs'. A search bar labeled 'Search schools' is also present. The main content area features a 'Bulletin' section with the headline 'School pupils help scientists find vaccine for human whipworm parasite' by Samantha Lauren King. Below the headline is a date and time stamp 'Sun 8th Oct 2017, 10:00' and social media sharing icons. The article image shows a microscopic view of whipworms. To the right of the image is a 'Jobs' section with the 'ED Week' logo and the text 'Trust Headteacher'. The website URL 'Schoolsweek.co.uk' is visible at the bottom right.

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Thursday November 29th 2018

**SCHOOLS WEEK**

News Opinion Features Reviews Bulletin Supplements Archive Jobs

Search schools

**Bulletin**

**School pupils help scientists find vaccine for human whipworm parasite**

Samantha Lauren King

Sun 8th Oct 2017, 10:00

ED Week Jobs

Trust Headteacher

Schoolsweek.co.uk

# Writing name

- Common name
  - พยาธิเส้นม้่า Whipworm
- Scientific name
  - *Trichuris trichiura*
  - *Trichuris* = generic name
  - *Trichiura* = species name
- Disease- genus + asis/ osis
  - Trichuriasis/ trichuriasis



# Scope of lecture

- Parasite name
- Morphology
- Life cycle
- Disease, signs and symptoms
- Epidemiology
- Diagnosis
- Prevention and control
- Treatment

# Lab session (for 317221, 317331)

- Parasite demonstration
  - Preserved specimen
  - Gross & microscopic
- Examination
  - Indicate Genus and Species of parasites



# Parasite homepage



## Department of Parasitology

Welcome to Chiang Mai Parasite Homepage!   
This site has been selected by ISI for inclusion in Current Web Contents



- **Founded in 1970, now the department consists of 16 teaching staffs, 4 academic assistants, 1 permanent employees and 4 temporary employees in the department. The primary responsibility is teaching medical parasitology to medical and health science students.**
- **Major fields of research include immunology and molecular biology of parasites, epidemiology of parasitic infections, mosquito ecology, mosquito genetics and mosquito taxonomy. Many publications have been made.**

**The department also offers a short-course training program in Medical Parasitology for foreign scientists upon request.**

Department of Parasitology, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, THAILAND  
Tel 66 53 221122 ext 5342-4 Fax 66 53 217144

[Medical Curriculum](#) **NEW!**  
[Parasite web link](#)

[Lecture notes \(Intranet\)](#)  
[Parasite e-learning system](#)

[Webmaster](#)

[Faculty Home Page](#)

<http://www.med.cmu.ac.th/dept/parasite/default.htm>

# The End