PARASITOLOGY (GENERAL CONCEPTS)

Lee li Li

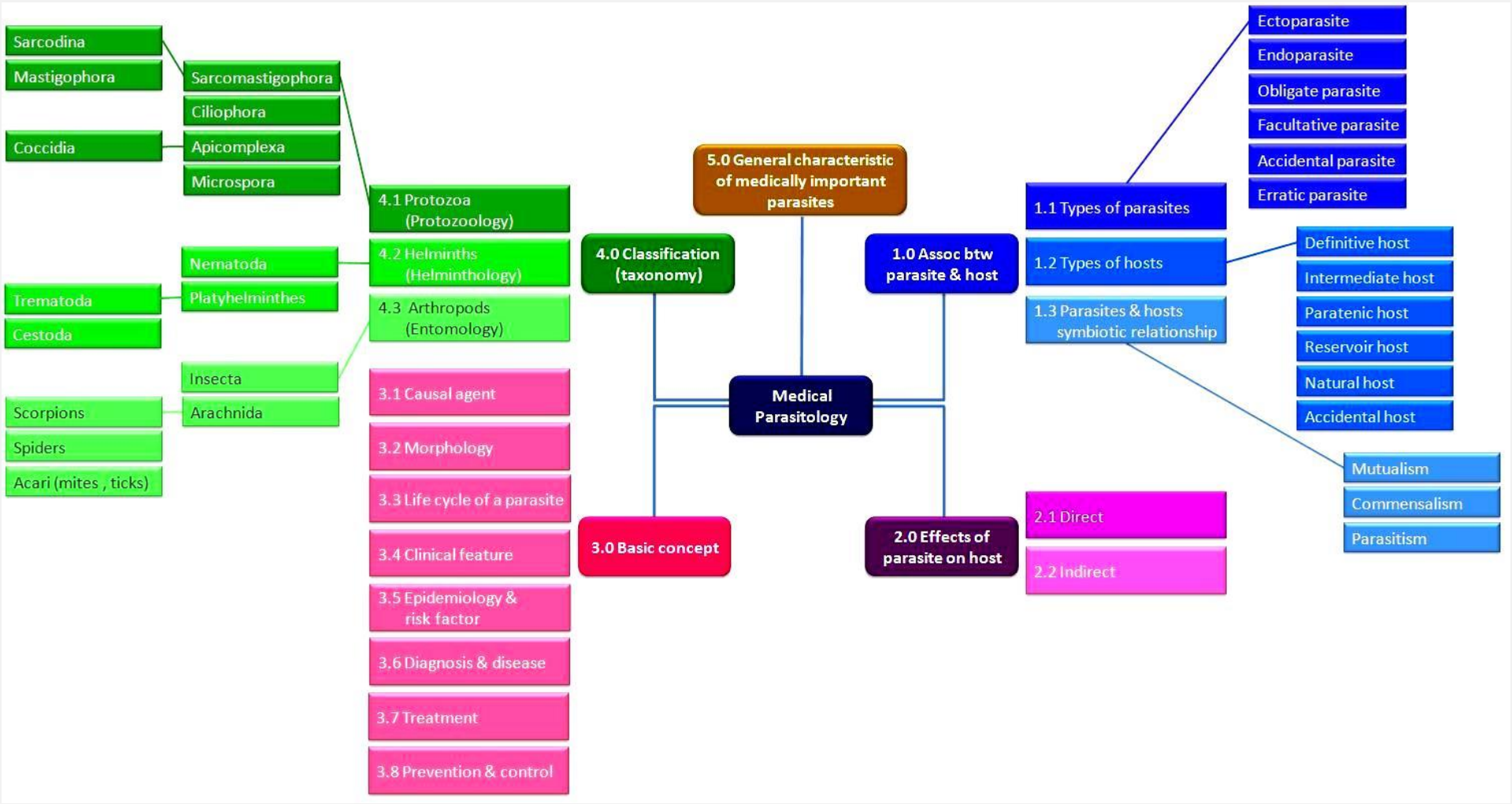
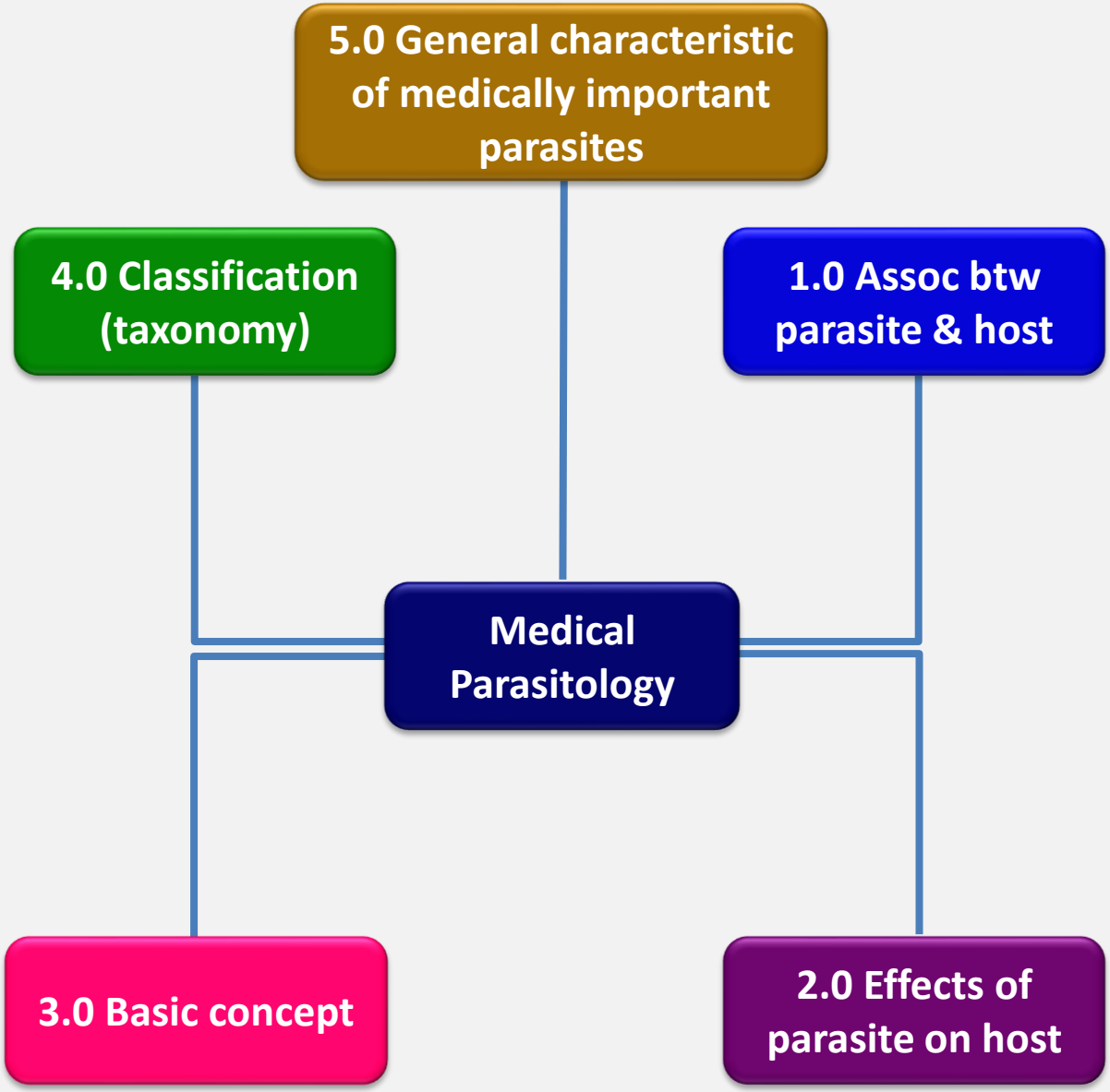
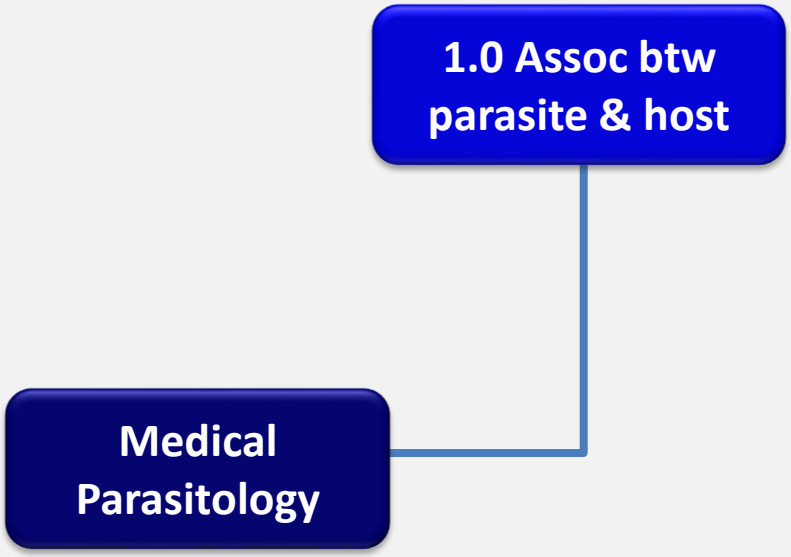


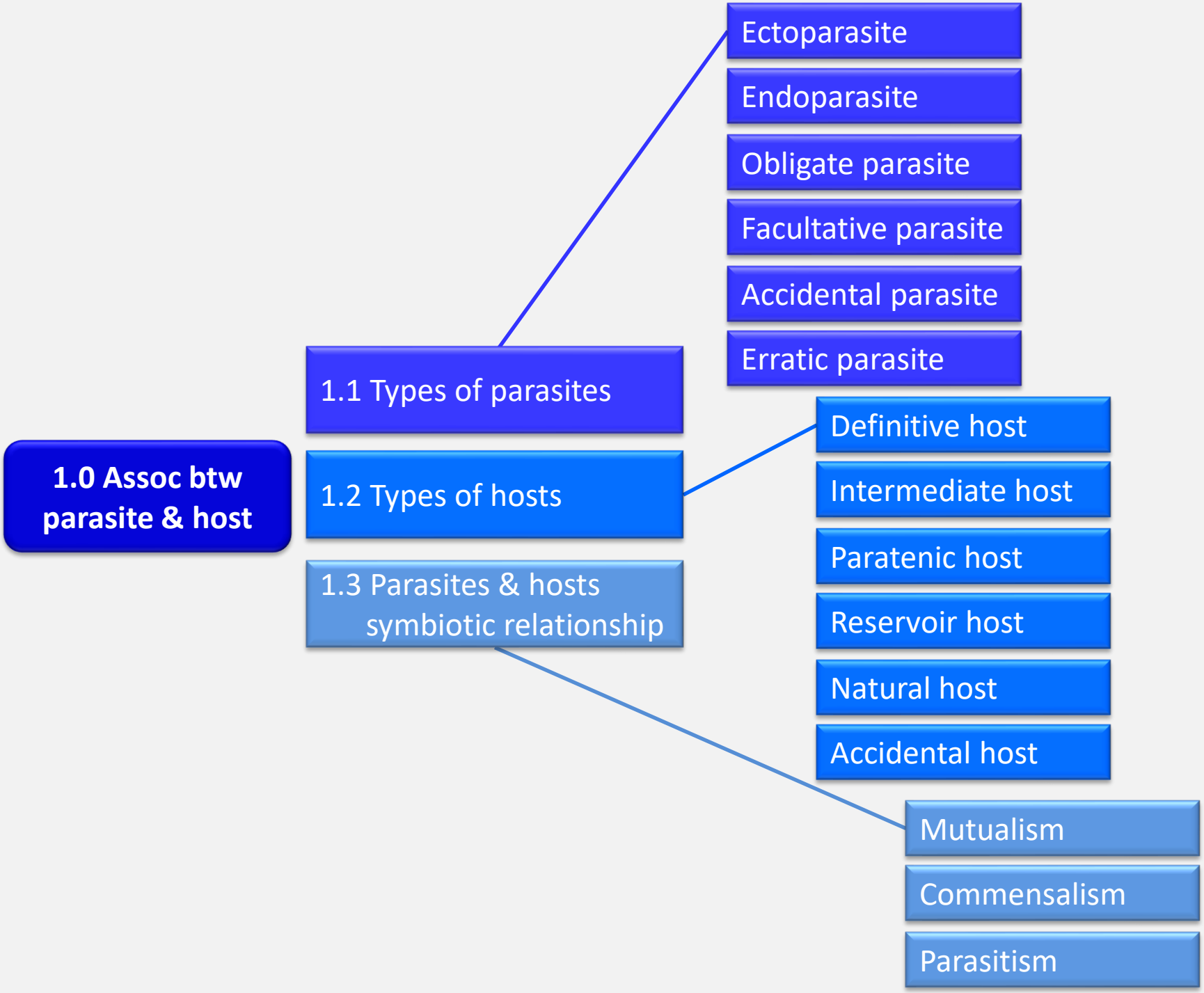
Figure 1.0 Overview of Medical Parasitology

Overview of Medical Parasitology

1.0 Assoc btw parasite & host	2.0 Effects of parasite on host	3.0 Basic concept	4.0 Classification (according to taxonomy)	5.0 General characteristic of medically important parasite
1.1 Types of parasites	**2.1 Direct**	**3.1 Causal agent**	**4.1 Protozoa**	**5.1 Protozoa**
Ectoparasite Endoparasite Obligate parasite Facultative parasite Accidental parasite Erratic parasite		**3.2 Morphology** **3.3 Life cycle of parasite** **3.4 Clinical features**	Sarcomastigophora Sarcodia Mastigophora Ciliophora Apicomplexa Coccidia Microspora	
1.2 Types of hosts	**2.2 Indirect**	**3.5 Epidemiology & risk factor**	**4.2 Helminths**	**5.2 Helminths**
Definitive host Intermediate host Paratenic host Reservoir host Natural host Accidental host		**3.6 Diagnosis & disease** **3.7 Treatment** **3.8 Prevention & control**	Nematoda Platyhelminthes Trematoda, Cestoda	
1.3 Parasite & host symbiotic relationship			**4.3 Arthropods**	**5.3 Arthropods**
Mutualism Commensalism Parasitism			Insecta Arachinid Scorpions, spiders, acari	


5.0 General characteristic of medically important parasites
4.0 Classification (taxonomy)
1.0 Assoc btw parasite & host
Medical Parasitology
3.0 Basic concept
2.0 Effects of parasite on host


1.0 Assoc btw parasite & host
Medical Parasitology


1.0 Assoc btw parasite & host
1.1 Types of parasites
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1.3 Parasites & hosts symbiotic relationship
Ectoparasite
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Obligate parasite
Facultative parasite
Accidental parasite
Erratic parasite
Definitive host
Intermediate host
Paratenic host
Reservoir host
Natural host
Accidental host
Mutualism
Commensalism
Parasitism

1.0 Association between parasite & host

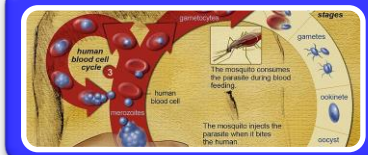
1.1 Types of parasites

Ectoparasite

- a parasitic organism that lives **ON** the outer surface of its host
- e.g. lice, fleas, mites, ticks

Endoparasite

- lives **INSIDE** the body of their host
- e.g. *Entamoeba histolytica*



Obligate parasite

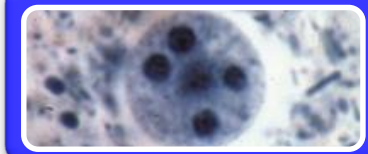
- **completely dependent** on the host during a segment or all of its life cycle
- e.g. *Plasmodium* spp.

Facultative parasite

- exhibits **parasitic & non-parasitic** modes of living
- e.g. *Naegleria fowleri*, *Acanthamoeba* spp.

Accidental parasite

- attacks an **unnatural host & survives**
- e.g. *Hymenolepis diminuta* (rat tapeworm)



Erratic parasite

- **wanders in to an organ** in which it is not usually found
- e.g. *E. histolytica* in the liver or lung of humans

1.0 Association between parasite & host

1.2 Types of hosts

Definitive host

- a host that harbors a parasite in the **adult** stage or where the parasite undergoes **sexual reproduction**

Intermediate host

- harbors **larval stages** of a parasite or an **asexual cycle** of development
- if larval dev. Is completed in 2 diff. intermediate hosts, 1st & 2nd intermediate hosts

Paratenic host

- **temporary refuge** and vehicle for reaching an **obligatory host** to survive, usually a definitive host

Reservoir host

- makes a **parasite available for the transmission to another host** and is usually **NOT affected by the infection**

Natural host

- **naturally infected** with a certain sp. of parasite
- e.g. monkeys <– >*Blastocystis* sp.

Accidental host

- **under normal circumstances NOT infected** with the parasite
- e.g. human <--> *Toxocara canis* (dog's parasite)

1.0 Association between parasite & host

1.3 Parasites & hosts symbiotic relationship

Mutualism

Commensalism

Parasitism

1.0 Association between parasite & host

1.3 Parasites & hosts symbiotic relationship

Mutualism

- an assoc. in which **both partners are metabolically dependant on each other**, **1 cannot live w/o the help of the other**, **none of the partners suffers** any **harm** fr the assoc.
- e.g. *Trichonympha* (flagellated protozoa) in the guts of termites

Commensalism

Parasitism

1.0 Association between parasite & host

1.3 Parasites & hosts symbiotic relationship

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Commensalism

- commensal **takes the benefit w/o causing injury** to the host
- e.g. most of the normal floras of humans' body

Parasitism

1.0 Association between parasite & host

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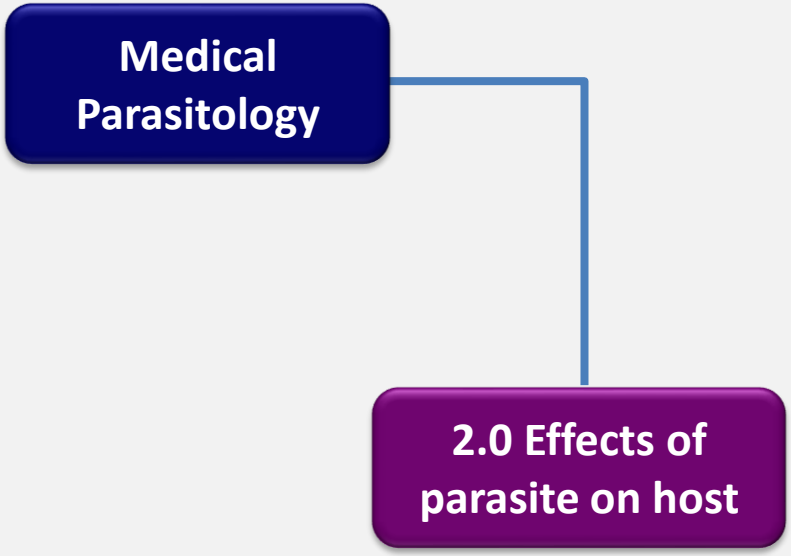
- e.g. *Trichonympha* (flagellated protozoa) in the guts of termites

Commensalism

- commensal **takes the benefit w/o causing injury** to the host
- e.g. most of the normal floras of humans' body

Parasitism

- **lives on the expense of the other**, 1 of the partners is harmed
- e.g. malaria infected female *Anopheles* spp. <-- > human blood meal, inoculate sporozoites in human host, caused malaria


Medical Parasitology
2.0 Effects of parasite on host

2.0 Effects of parasite on host

- 2.1 Direct
- 2.2 Indirect

2.0 Effects of parasite on host

2.1 Direct

2.2 Indirect

2.0 Effects of parasite on host

2.1 Direct

- causes
  (a) mechanical injury,
  Wuchereria bancirofti → lymphatic filariasis → elephantiasis
  (b) deleterious/ harmful effect of toxic substances,
  Plasmodium falciparum → toxic substances → rigors and other symptoms
  (c) deprivation of nutrients, fluids & metabolites
  Giardia lamblia → malabsorption → malnutrition

2.2 Indirect

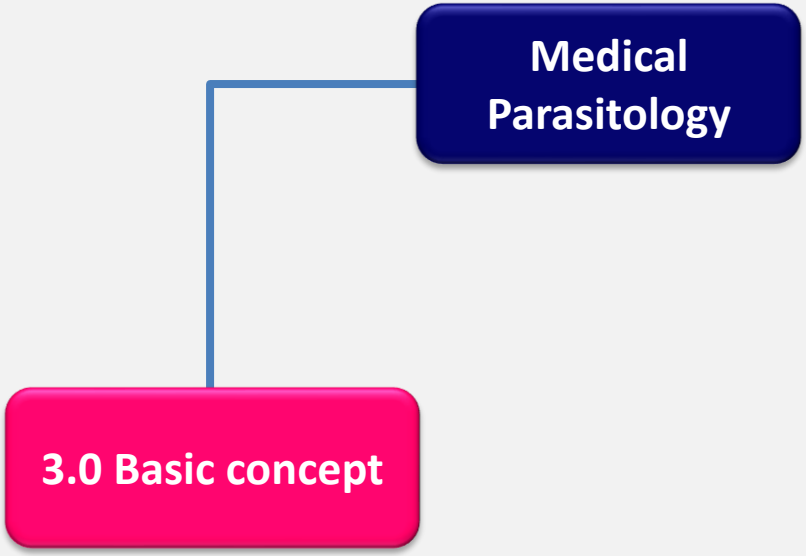
2.0 Effects of parasite on host

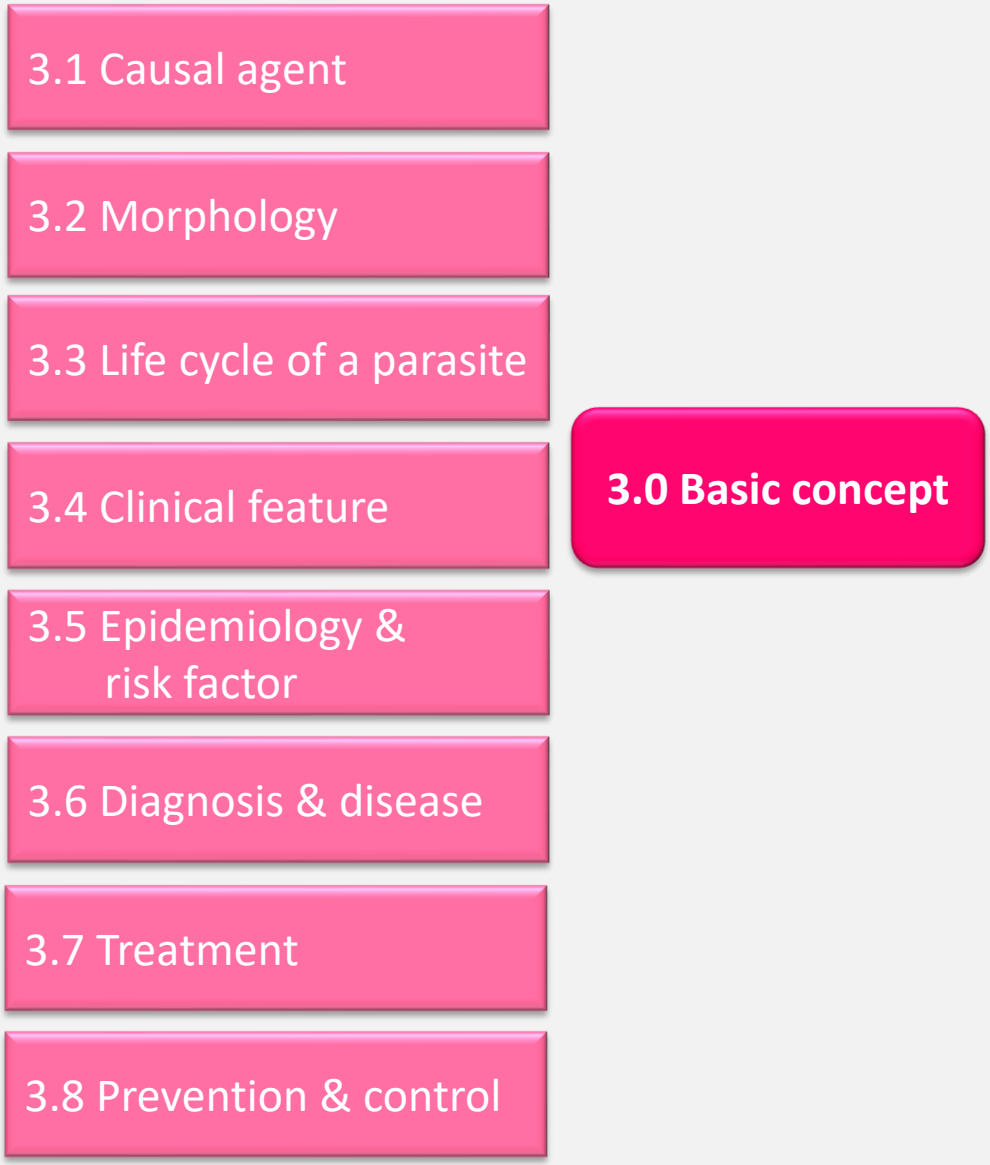
2.1 Direct

- causes
  (a) mechanical injury,
  Wuchereria bancirofti → lymphatic filariasis → elephantiasis
  (b) deleterious/ harmful effect of toxic substances,
  Plasmodium falciparum → toxic substances → rigors and other symptoms
  (c) deprivation of nutrients, fluids & metabolites
  Giardia lamblia → malabsorption → malnutrition

2.2 Indirect

- causes immunological reaction
  (a) Tissue damage may be caused by immunological response of the host
  Plasmodium infections →nephritic syndrome
  (b) Excessive proliferation of certain tissues due to invasion by some parasites can also cause tissue damage in man,
  Deposition of the ova of *Schistosoma* →fibrosis of liver

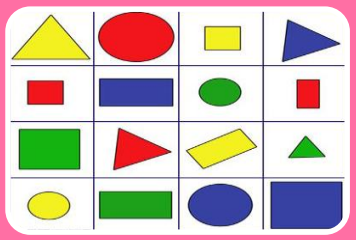

Medical Parasitology
3.0 Basic concept


3.1 Causal agent
3.2 Morphology
3.3 Life cycle of a parasite
3.4 Clinical feature
3.5 Epidemiology & risk factor
3.6 Diagnosis & disease
3.7 Treatment
3.8 Prevention & control
3.0 Basic concept

3.0 Basic concepts (std subheadings)

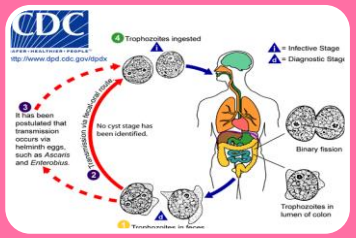
Causal agent

- Parasite that causes a certain disease
- e.g. Ascariasis --> *Ascaris lumbricoides*



Morphology

- size, shape, color & position of different organelles in diff parasites
- important in laboratory diagnosis -> to identify the diff stages of dev & differentiate btw pathogenic and commensal organisms.
- e.g. *Entamoeba histolytica* and *E. coli*



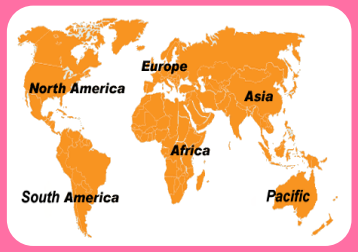
Life cycle of parasite

- the route followed by a parasite from the time of entry to the host to exit, including the extracorporeal (outside the host) life

Clinical features

- manifestation of disease caused by parasitic infection

3.0 Basic concepts (cont')



Epidemiology & risk factor (Geographical distribution)

- The presence and food habits of a suitable host
- Easy escape of the parasite from the host
- Environmental conditions
- The presence of an appropriate vector or intermediate host

Diagnosis & disease

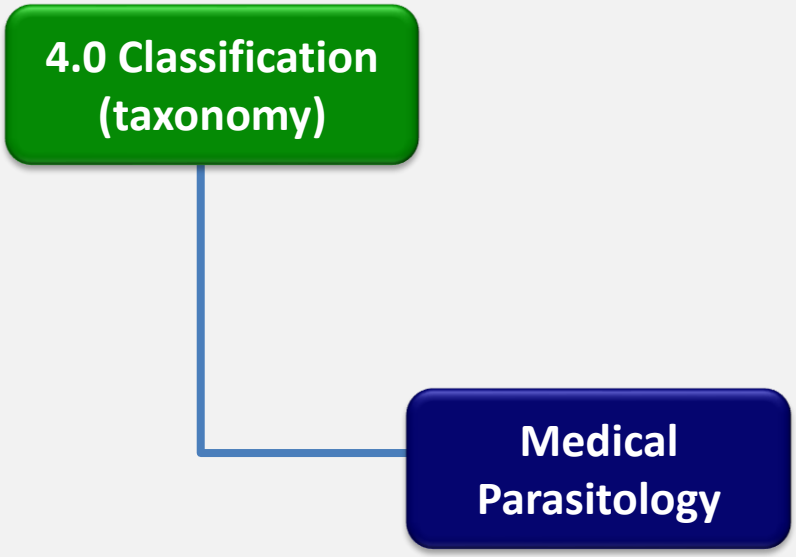
- Laboratory diagnosis:
  Direct evidence - blood, stool, urine, sputum, biopsy material, urethral/ vaginal discharge
  Indirect evidence - cytological changes in blood, serological tests

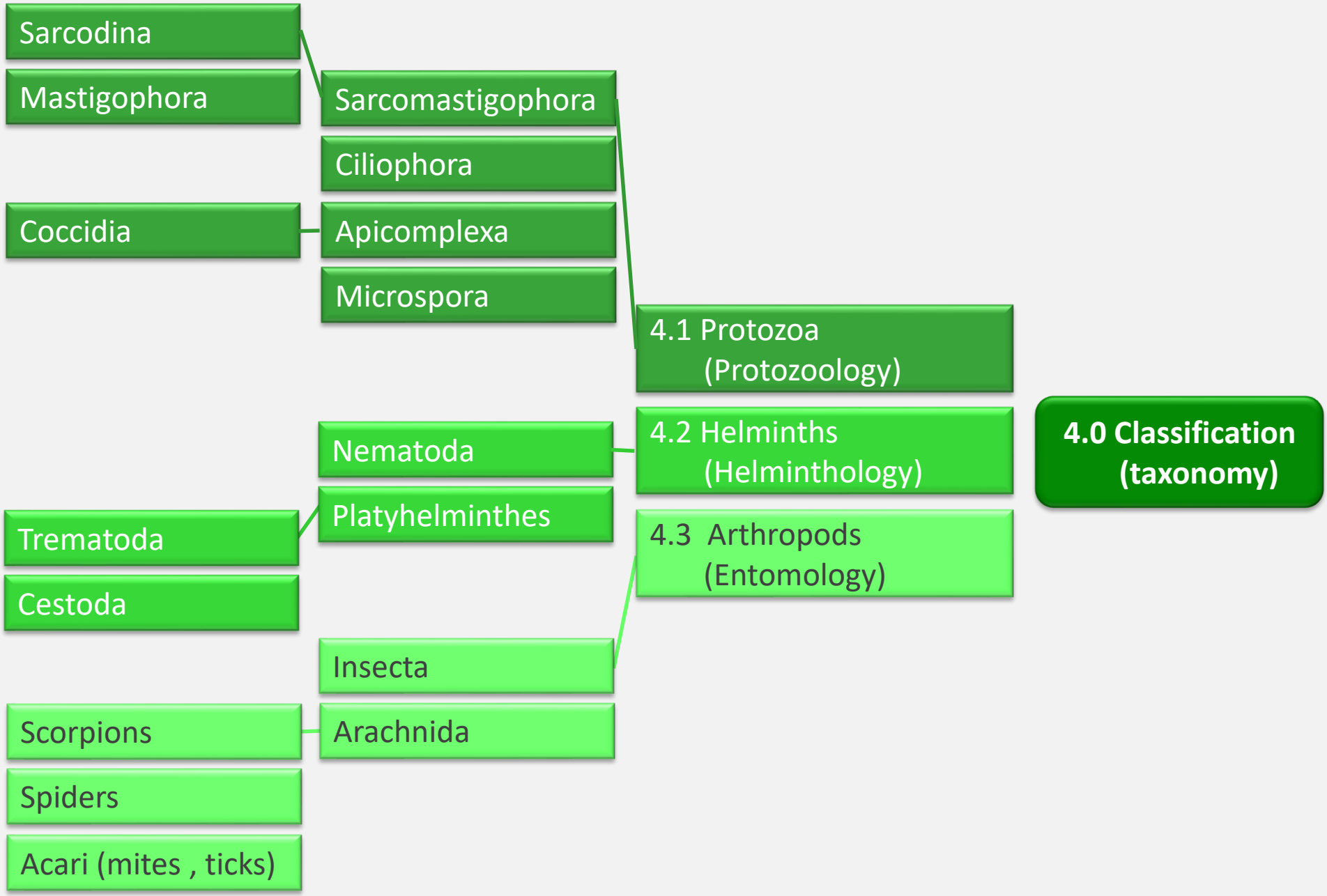
Treatment

- Many parasitic infections can be cured by specific chemotherapy
- Treatment criteria: not absorb by host's body, min toxic effect on host, direct effect on parasite

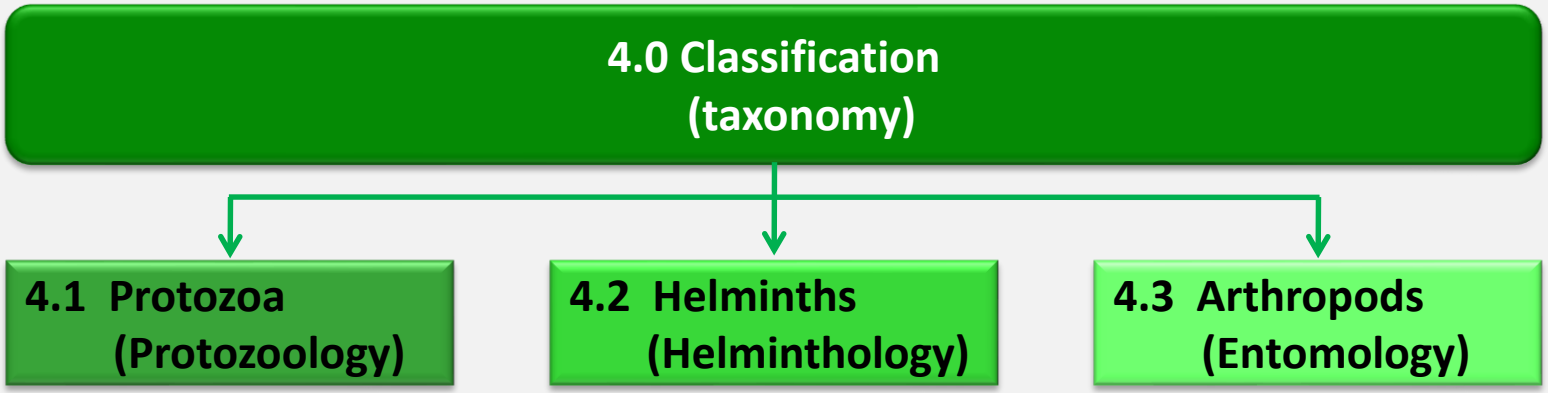
Prevention & control

- Preventive measures designed to **break the transmission cycle** are crucial to successful **parasitic eradication**
- Reduction of the source of infection: Sanitary control of drinking water and food, Proper waste disposal, insecticides, Protective clothing, Good personal hygiene., Avoidance of unprotected sexual practices.

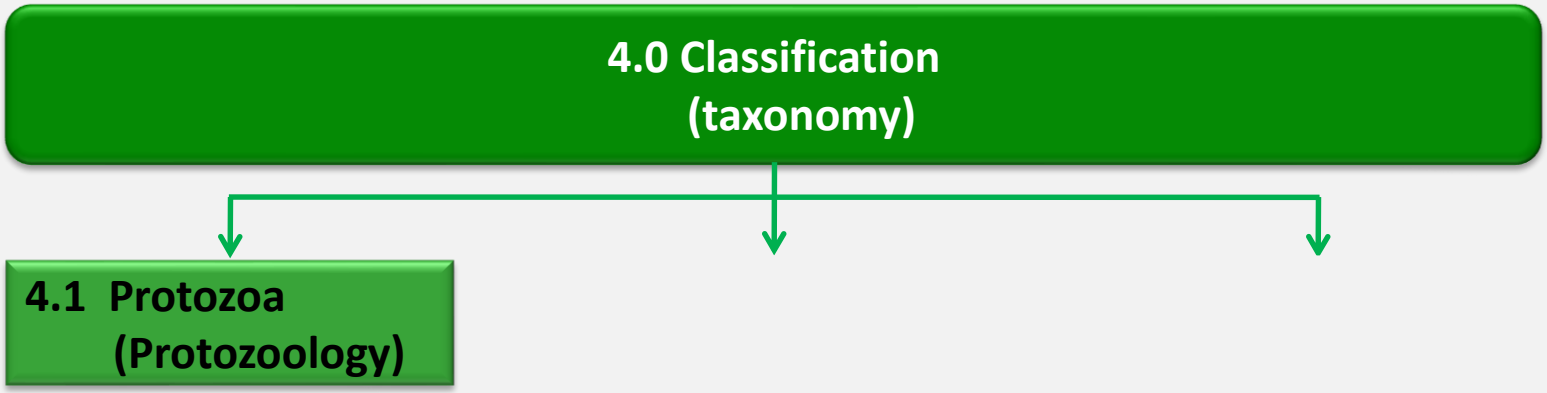

4.0 Classification (taxonomy)
Medical Parasitology


4.0 Classification (taxonomy)
4.1 Protozoa (Protozoology)
4.2 Helminths (Helminthology)
4.3 Arthropods (Entomology)
Sarcomastigophora
Apicomplexa
Microspora
Ciliophora
Sarcodina
Mastigophora
Coccidia
Nematoda
Platyhelminthes
Trematoda
Cestoda
Insecta
Arachnida
Scorpions
Spiders
Acari (mites , ticks)

4.0 Classification of pathogenic & commensal parasites



4.0 Classification of pathogenic & commensal parasites



4.1 Classification of protozoan parasites found in human

PHYLUM	PARASITE	DISEASE
Sarcomastigophora		
Subphylum Sarcodina	*Entamoeba histolytica/ dispar* *E. coli* *Endolimax nana* *Iodamoeba buetchlii* *Blastocystis hominis** *Acanthamoeba sp.* *Naegleria fowleri*	 Blastocystosis Acanthamoeba keratitis Primary amebic meningoencephalitis Granulomatous amebic encephalitis
Subphylum Mastigophora	*Giardia lamblia/ intestinalis* *Chilomastix mesnili* *Enteromonas hominis* *Dientamoeba fragilis* *Trichomonas vaginalis* *Leishmania sp.* *Trypanosoma sp.*	Giardiasis Trichomoniasis Leishmaniasis Trypanosomiasis

Taxonomy of pathogenic parasites found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Protista	
Subkingdom	Protozoa	
Phylum	Sarcomastigophora	
Subphylum	Sarcodina	
Class	Lobosea	
Order	Amoebida	
Family	Endamoebidae	
Genus	*Entamoeba*	
Species	*histolytica*	*Entamoeba histolytica*

4.0 Classification of parasites found in human (cont')

PHYLUM	PARASITE	DISEASE
Ciliophora	*Balantidium coli*	Balantidiasis

Taxonomy of pathogenic parasites found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Protista	
Superphylum	Alveolata	
Phylum	Ciliophora	
Class	Litostomatea	
Order	Vestibuliferida	
Family	Balantiididae	
Genus	*Balantidium*	
Species	*coli*	*Balantidium coli*

4.0 Classification of parasites found in human (cont')

PHYLUM	PARASITE	DISEASE
Apicomplexa		
Coccidia	*Cryptosporidium parvum* *Isospora belli/ Cystoisopora belli* *Cyclospora cayetanensis* *Toxoplasma gondii* *Plasmodium spp.* *Babesia microti*	Cryptosporidiasis Isosporiasis/ Cystoisoporiasis Cyclosporiasis Toxoplasmosis Malaria Babesiosis

Taxonomy of pathogenic parasites found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Protista	
Subkingdom	Protozoa	
Phylum	Apicomplexa	
Class	Sporozoasida	
Order	Eucoccidiorida	
Family	Plasmodiidae	
Genus	*Plasmodium*	
Species	*falciparum*	*Plasmodium falciparum*

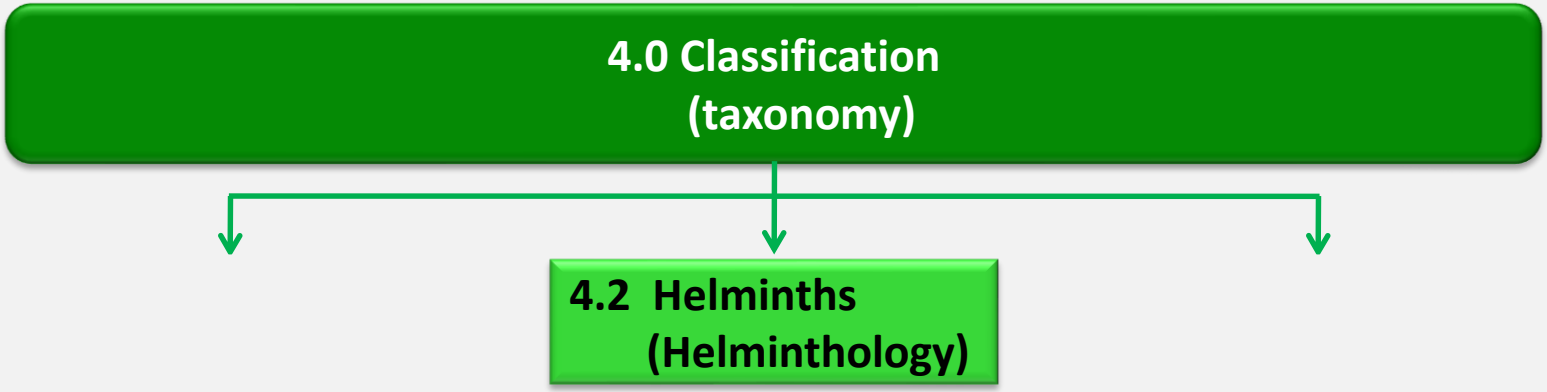
4.0 Classification of parasites found in human (cont')

PHYLUM	PARASITE	DISEASE
Microspora	*Microsporidia* (e.g *Enterocytozoon bieneusi)*	Microsporidiosis

Taxonomy of pathogenic parasites found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Fungi	
Subkingdom	--	
Phylum	Microspora	
Class	Microsporea	
Order	Microsporida	
Family	Enterocytonoonidae	
Genus	*Enterocytozoon*	
Species	*bieneusi*	*Enterocytozoon bieneusi*

4.0 Classification of pathogenic & commensal parasites



4.2 Classification of helminths found in human

PHYLUM	PARASITE	DISEASE
Nematoda		
Intestine	*Enterobius vermicularis* *Ascaris lumbricoides* *Trichuris trichiura* *Strongyloides stercolis* Hookworm: *Necator americanus/* *Ancylostoma duodenale*	Enterobiasis Ascariasis Trichuriasis Strongyloidiasis Hookworm infection
Blood/ Tissue*/ Subcutaneous+	*Wuchereria bancrofti* *Brugia malayi* *Loa loa+* *Onchocerca volvulus +* *Mansonella ozzardi* *M. pertans* *M. streptocerca* *Dirofilaria immitis* *Trichenella spiralis ** *Dracunculus medinensis**	Lymphatic filariasis Lymphatic filariasis *Loa loa* filariasis/ s.f. River blindness/ s.f. Serous cavity filariasis Serous cavity filariasis Subcutaneous filariasis (s.f.) Trichinosis

Taxonomy of pathogenic helminth found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Animalia	
Phylum	Nematoda	
Class	Rhabditea	
Order	Ascaridida	
Family	Ascarididae	
Genus	*Ascaris*	
Species	*lumbricoides*	*Ascaris lumbricoides*

4.2 Classification of helminths found in human (cont')

PHYLUM	PARASITE	DISEASE
Platyhelminthes (flat worms) **Class Trematoda (flatworms)**		
Intestine	*Faciolopsis buski*	Faciolopsiasis
Blood	*Schistosoma mansoni* *S. japonicum* *S. haematobium*	Schistosomiasis
Liver/ Lung*	*Faciola hepatica* *Paragonimus westermani**	Facioliasis Paragonimiasis
Class Cestoda (tapeworms)		
Intestine	*Taenia saginata, T. solium*	Taeniasis
Tissue	*Echinococcus granulosus*	Echinococcosis

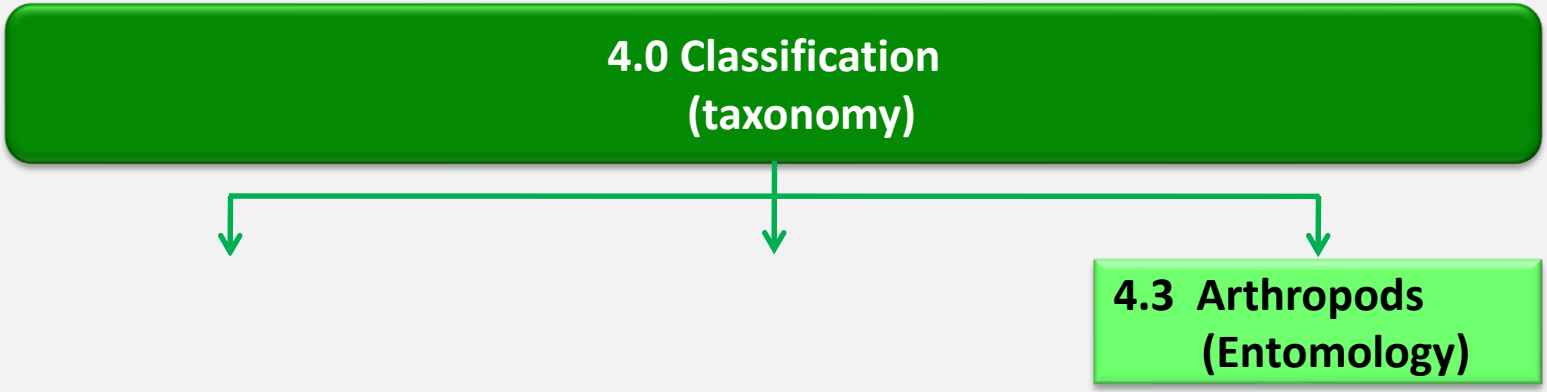
Taxonomy of pathogenic helminth found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Animalia	
Phylum	Platyhelminthes	
Class	Trematoda	
Order	Strigeiformes	
Family	Schistosomatidae	
Genus	*Schistosoma*	
Species	*mansoni*	*Schistosoma mansoni*

Taxonomy of pathogenic helminth found in human

CLASSIFICATION	NAME	EXAMPLE (*Genus* sp.)
Kingdom	Animalia	
Phylum	Platyhelminthes	
Class	Cestoda	
Order	Cyclophyllidea	
Family	Taeniidae	
Genus	*Taenia*	
Species	*saginata*	*Taenia saginata*

4.0 Classification of pathogenic & commensal parasites



4.3 Classification of arthropods affecting human

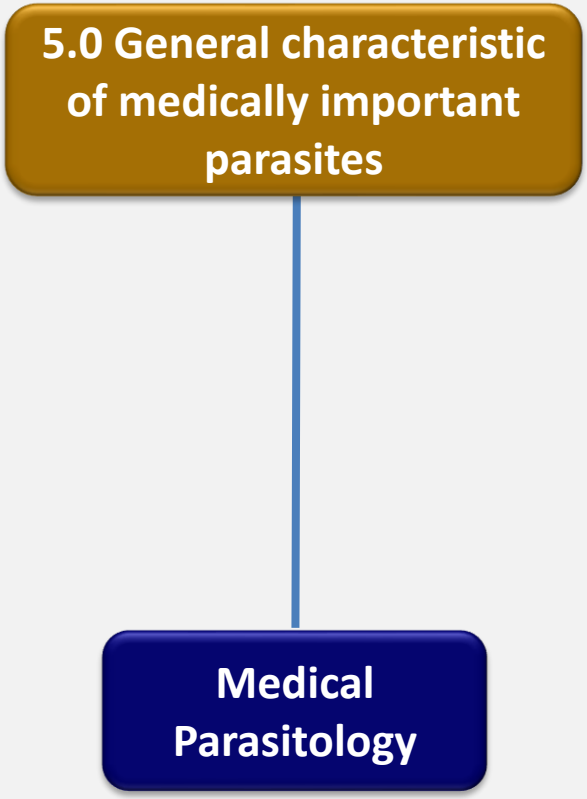
PHYLUM (ARTHROPODS)		DISEASE/ CLINICAL FEATURES
Class Insecta		
Head louse *Pediculus humanus capitis*		Itchiness, reduce host life expectancy
Body/ Clothes louse *Pediculus humanus corporis*		Itchiness, reduce host life expectancy
Pubic/ Crab louse *Pthirus pubis*		Itchiness, reduce host life expectancy
Flea *Ctenocephalides canis*, *C. felis*		Rashes due to allergic reactions to components in flea's saliva

4.3 Classification of arthropods affecting human (cont')

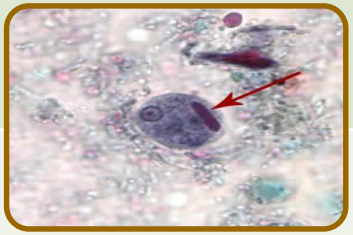
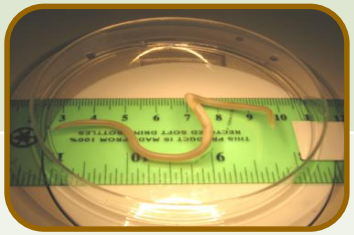
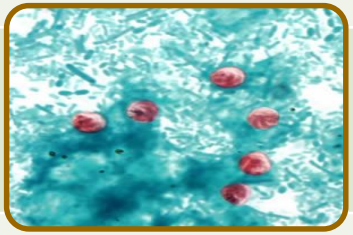
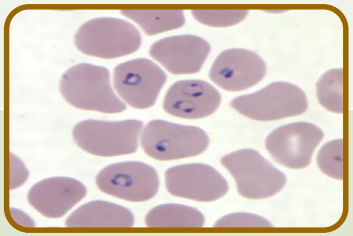
PHYLUM (ARTHROPODS)		DISEASE/ CLINICAL FEATURES
Class Insecta	 ***Anopheles freeborni***  ***Anopheles dirus***	
Mosquitoes *Anopheles* spp. (female)		Malaria
Culex, Aedes *(Wutchereria bancrofti)*		Filariasis
Mansonia *(Brugia Malayi)*		Filariasis
		Sandfly Leishmaniasis
		Tset tse fly Trypanosomiasis
		onchocerciasis

4.3 Classification of arthropods affecting human (cont')

PHYLUM (ARTHROPODS)		DISEASE/ CLINICAL FEATURES
Class Arachnida		
Scorpions		Sharp, unpleasant stings, most of which usually leave redness around the stung area
Spiders		Pain from non-venomous spider bites lasts for 5-60 mins; ≥24 hrs for venomous spider bites
Mites *Cimex lectularius* *C. hemipterus* } (Bed bugs)		Inflammation due to allergic reactions to components in mites' saliva
Ticks *Ixodes scapularis*		A host for *Babesia microti* parasite Causes babesiosis


5.0 General characteristic of medically important parasites
Medical Parasitology

5.0 General characteristic of medically important parasites

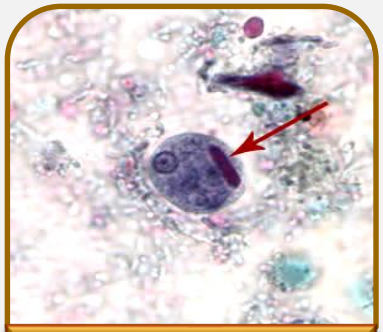
Protozoa	Helminths	Arthropods
		
		
		

5.1 General characteristic of medically important protozoa

Biology	Reproduction	Locomotive classification		
single "cell-like unit"	1. Asexual multiplication: a. Simple binary fission	Phylum	Organ of locomotion	Pathogenic protozoa
mass of protoplasm differentiated into a. **cytoplasm** (hyaline ectoplasm and an inner voluminous granular Endoplasm) b. **nucleoplasm**	b. Multiple fission or schizogony	**Sarcomastigophora** *(Subphylum Sarcodina)/* Rhizopoda (Amoeba)	Pseudopodia	*E. histolytica*
Ectoplasm: protection, locomotion, and ingestion of food, excretion, and respiration **Vacuoles**: storage of food, digestion and excretion of waste products **Nucleus**: reproduction, maintain life	2. Sexual reproduction: a. Conjugation	**Sarcomastigophora** *(Subphylum Mastigophora) /* (Flagellates)	Flagella	*Giardia lamblia*
Ability to **change morphology**: **Trophozoite** (active) →**cyst** (inactive stage), losing motility power and enclosing within a tough wall	b. Syngamy	Apicomplexa (Sporozoa)	*None, slight amoeboid movement*	*Plasmodium spp.*
Cyst, loses its power to grow and multiply, resistant stage of the parasite, **infective to human host**		Ciliophora (Cilliates)	Cilia	*Balantidium coli*

Characteristic of Protozoa

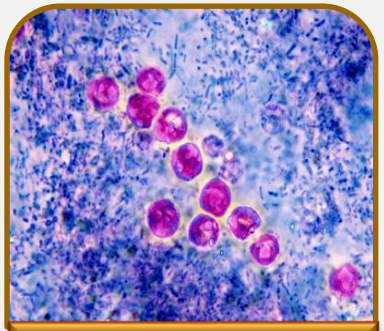
1. Unicellular organism
2. Sexual & asexual reproductions
3. Locomotive systems



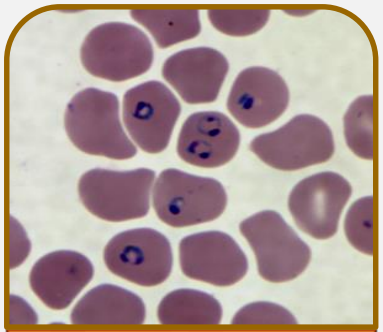
Entamoeba histolytica

Giardia lamblia

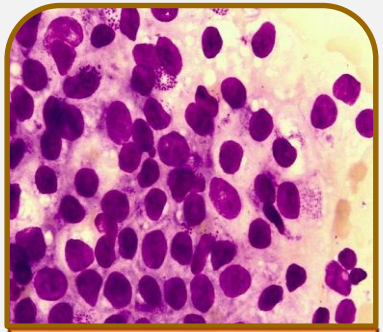
Balantidium coli



Cryptsporidium parvum



Plasmodium falciparum



Enterocytozoon bieneusi

5.2 General characteristic of medically important helminths

Characteristic	Nematode	Plathyhelminthes	
		Trematode	Cestode
Shape	Elongated, cylindrical	Leaf-like, unsegmented	Tape-like, segmented
Sexes	Separate (diecious)	Not separated (monoecious) *Except:* blood flukes (diecious)	Not separated (monoecious)
"Head end"	Without suckers, without hooks	Suckers, without hooks	Suckers, with hooks
Alimentary canal	Present , complete	Present, incomplete	Absent
Body cavity	Present	Absent	Absent

Note:

1. Multicellular
2. Bilaterally symmetrical animals
3. Have 3 germ layers

Characteristic of Nematoda

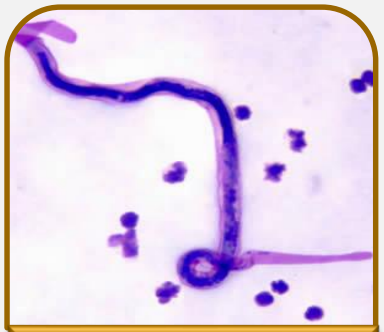
1. .**round**worms
2. having elongated cylindrical unsegmented bodies
3. Internally the cuticle is formed from an underlying hypodermis
4. has four longitudinal thickenings

Ascaris lumbricoides

Trichuris trichiura

Strongyloides stercolis

Wuchereria bancrofti



Brugia malayi

Loa loa

microfilaria

Characteristic of Platyhelminthes

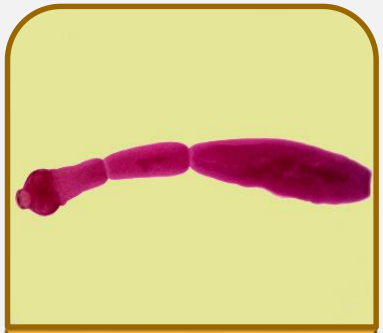
1. dorso-ventraly **flat**tened worms
2. with solid acoelomate bodies, (i.e. no body cavities),
3. the organs and muscle fibres being embedded in parenchymal tissue
4. no respiratory or circulatory systems present

Faciolopsis buski

Schistosoma mansoni

Faciola hepatica

Taenia saginata



Echinococcus granulosus

5.3 General characteristic of medically important arthropods

Characteristic of medically important arthropods (Insecta & Arachnida)
1. Bilaterally symmetrical and segmented body with jointed appendages
2. Hard exoskeleton: helps enclose and protect the muscles and other organs
3. Open circulatory system
4. With or without a dorsally situated heart pumps the blood (hemolymph) via arteries to the various organs and body tissues
5. Blood is returned to the heart through body spaces known as hemocoeles
6. Respiratory, excretory & nervous systems are present

To insert some pics reflecting the characteristics

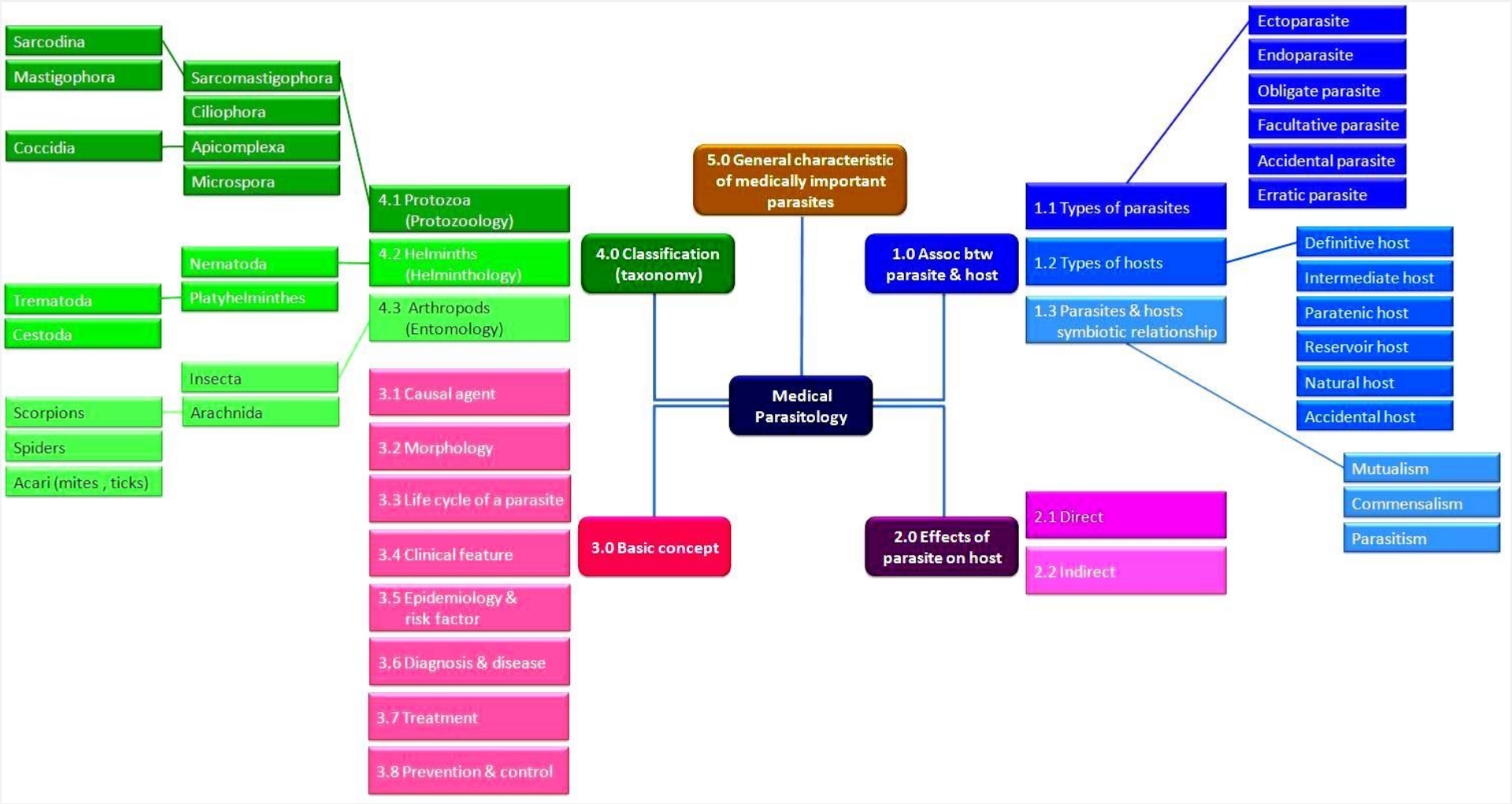
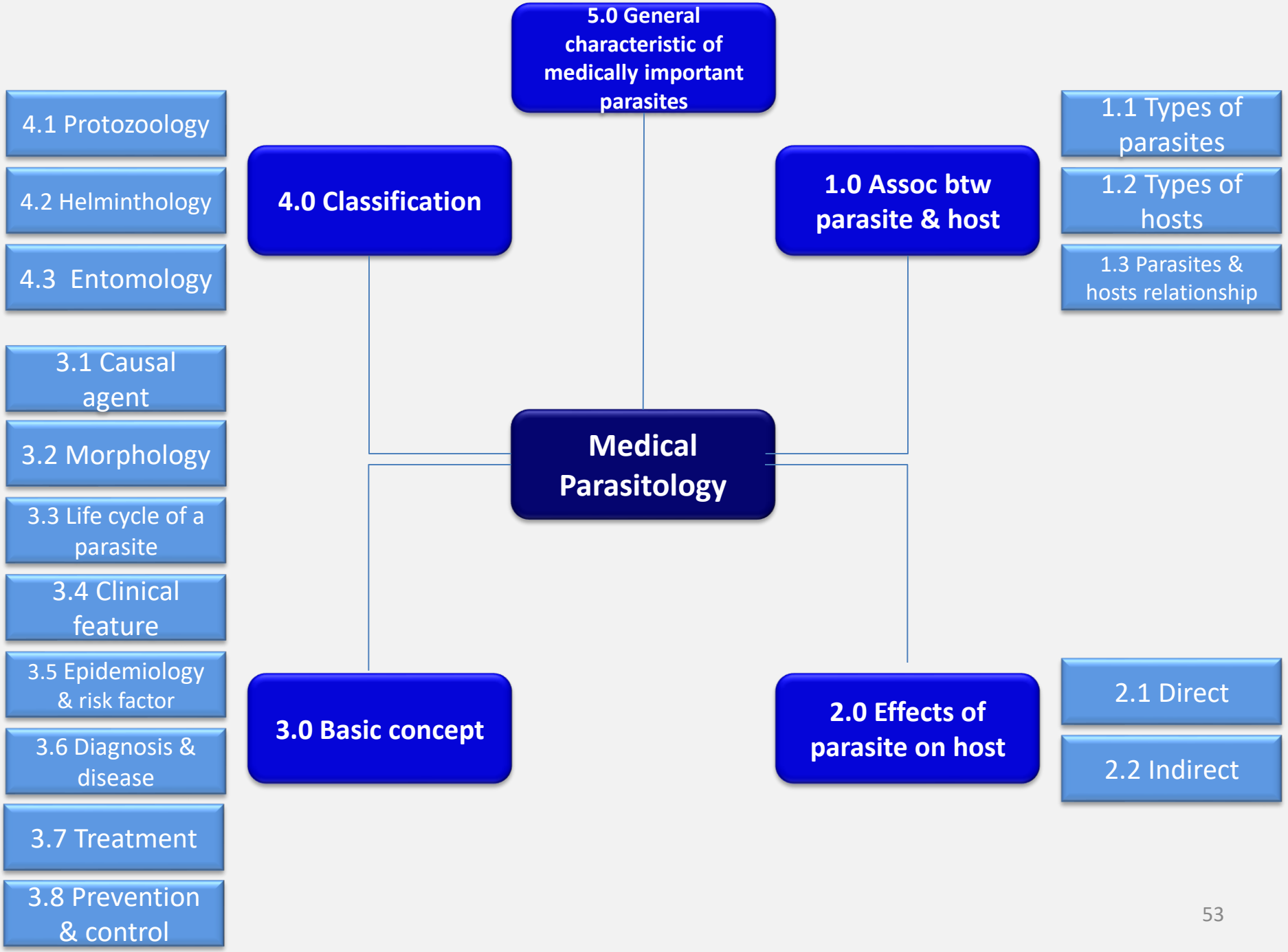


Figure 1.0 Overview of Medical Parasitology


5.0 General characteristic of medically important parasites
4.0 Classification
1.0 Assoc btw parasite & host
Medical Parasitology
3.0 Basic concept
2.0 Effects of parasite on host
4.1 Protozoology
4.2 Helminthology
4.3 Entomology
1.1 Types of parasites
1.2 Types of hosts
1.3 Parasites & hosts relationship
3.1 Causal agent
3.2 Morphology
3.3 Life cycle of a parasite
3.4 Clinical feature
3.5 Epidemiology & risk factor
3.6 Diagnosis & disease
3.7 Treatment
3.8 Prevention & control
2.1 Direct
2.2 Indirect

Terminology

	Recurrence	the return of symptoms after a remission; relapse
	Reoccurrence	
	Relapse	the return of a disease after its apparent cessation
	Reminiscence	
	Remission	the partial or complete disappearance of the clinical and subjective characteristics of a chronic or malignant disease. Remission may be spontaneous or the result of therapy. In some cases remission is permanent, and the disease is cured.