


BioMedical Parasitology

Protozoa

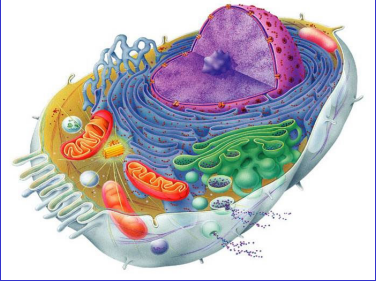


Prof Peter O'Donoghue

1

PROTOZOA


'first animals'
ancestral
not primitive
eukaryotes
unicellular
motile



4

Three modes of existence on earth!

- aquatic (many species)
- terrestrial (some species)
- parasitic (overwhelming majority)




PARASITES RULE!













2

Essential life activities

1. ingestion
2. digestion
3. excretion
4. respiration
5. reproduction
6. motility



5

<p>10m</p>  Tapeworm	<p>naked eye</p>				
<p>10⁻²</p>  Intestinal nematode	<p>worms</p>				
<p>10⁻³</p>  Adult schistosome					
<p>10⁻⁴</p>  Adult Trichinella					
<p>10⁻⁵</p>  Larval worm					
<p>light microscope</p>					
<p>10⁻⁶</p>  Amoeba	<p>protozoa</p>				
<p>10⁻⁷</p>  Trypanosome					
<p>10⁻⁸</p>  Plasmodium					
<p>10⁻⁹</p>  Staphylococcus	<p>bacteria</p>				
<p>10⁻¹⁰</p>  Pox virus	<p>viruses</p>				
<p>10⁻¹¹</p>  Influenza virus					
<p>10⁻¹²</p>  Polio virus	<p>electron microscope</p>				

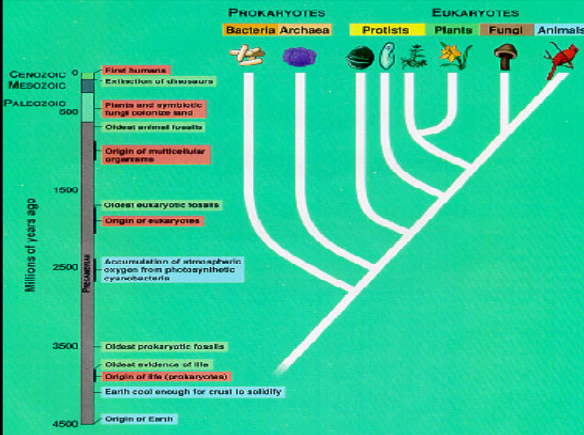
Pathogens

- Arthropods
- Helminths
- Protozoa
- Fungi
- Bacteria
- Viruses

macro-parasites (cumulative) (chronic disease)

micro-parasites (multiplicative) (acute disease)

3



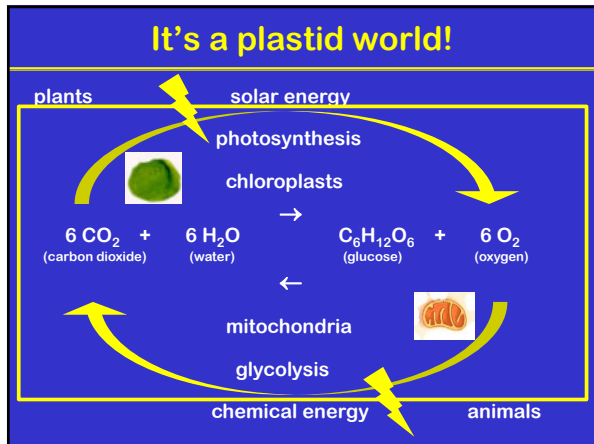
PROKARYOTES
Bacteria Archaea

EUKARYOTES
Protists Plants Fungi Animals

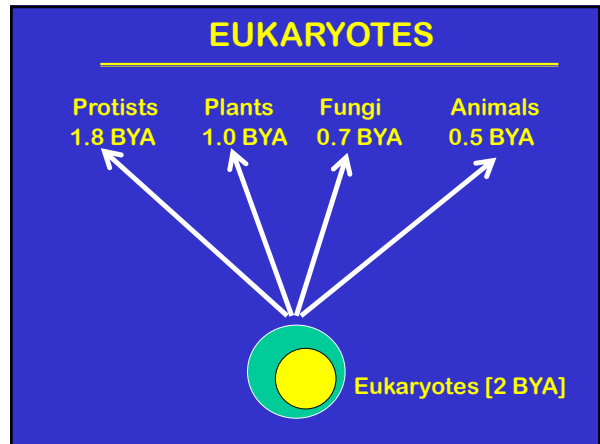
Timeline (Millions of years ago):

- 0: First humans
- ~200: Extinction of dinosaurs
- ~250: Plants and eukaryotic fungi colonize land
- ~350: Oldest animal fossils
- ~1900: Oldest eukaryotic fossils
- ~2500: Accumulation of atmospheric oxygen from photosynthetic cyanobacteria
- ~3500: Oldest prokaryotic fossils
- ~4500: Oldest evidence of life
- ~4500: Origin of life (prokaryotes)
- ~4500: Earth cool enough for crust to solidify
- 4500: Origin of Earth

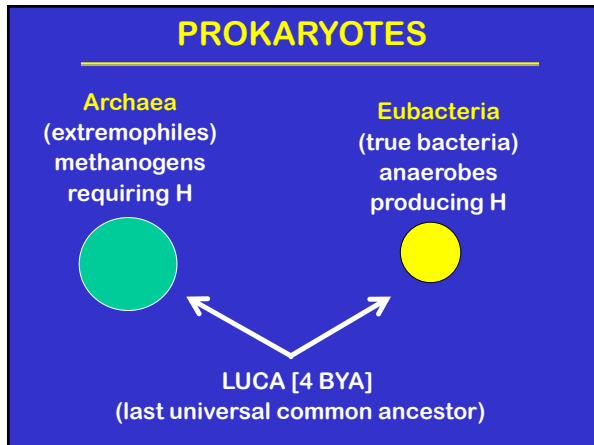
6



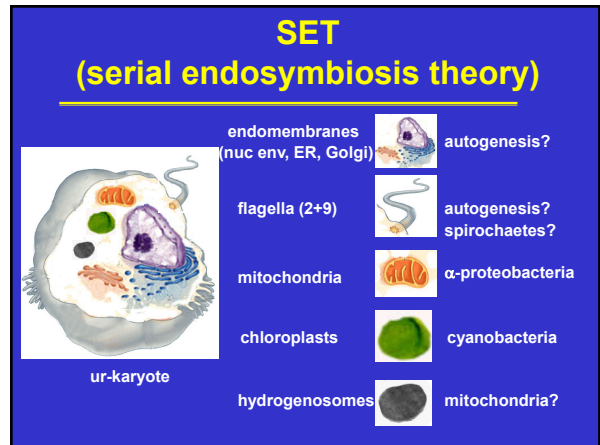
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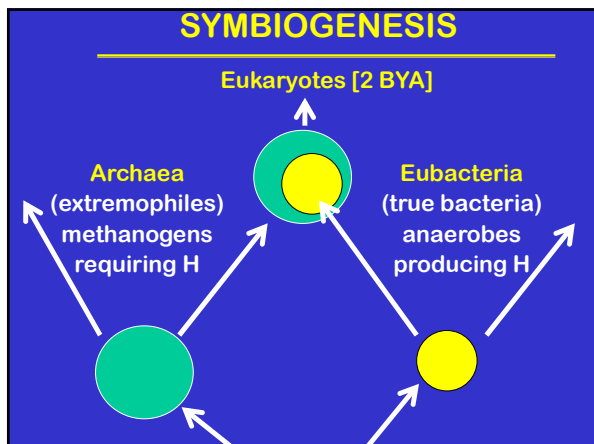
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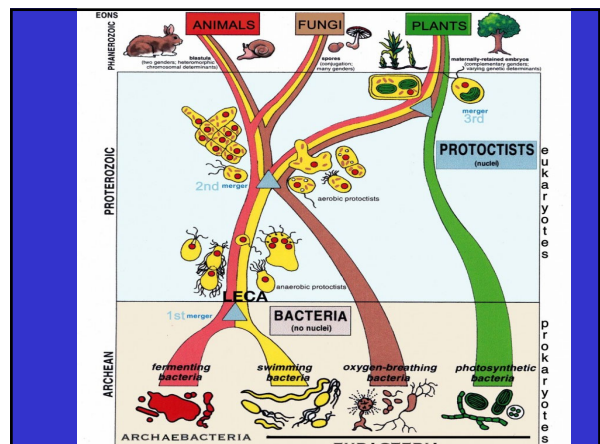
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11







9



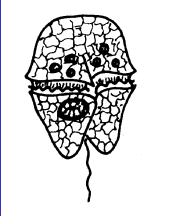
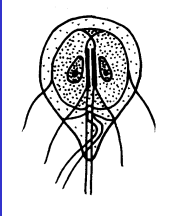
12

PROTOZOA (unicellular eukaryotes)

flagellates	amoebae	sporozoa	ciliates
			
whip-like flagella	temporary pseudopodia	non-motile 'spores'	hair-like cilia


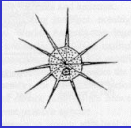
13

FLAGELLATES (2+9)

Phytoflagellates (with chloroplasts)	Zooflagellates (without chloroplasts)
	
(free-living)	(commensals/parasites)



16

AMOEBAE

Rhizopods (lobopodia, filopodia)	Actinopods (axopodia)
	
free-living bacterivores commensals/parasites	plankton


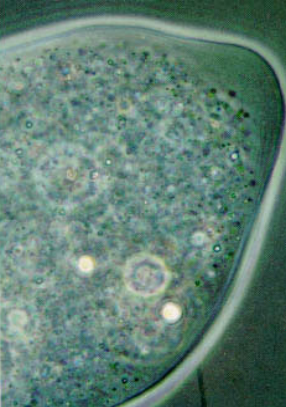
14

FLAGELLATES

	
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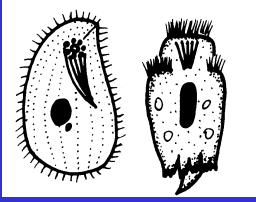
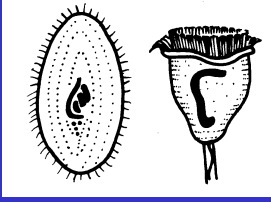
17

AMOEBAE

	
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15

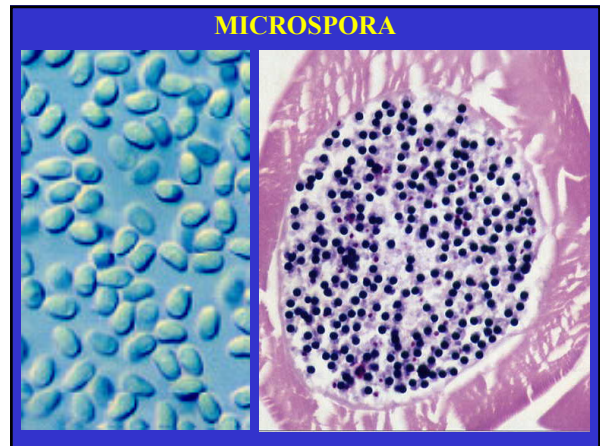
CILIATES (2+9)(Ma/Mi)

lower holotrichs (simple mouths)	higher holotrichs (oral membranelles)
	
lumen-dwellers	fouling organisms opportunists

18






19

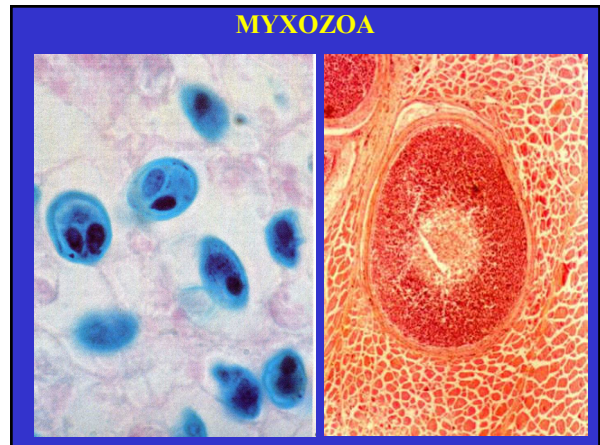


22

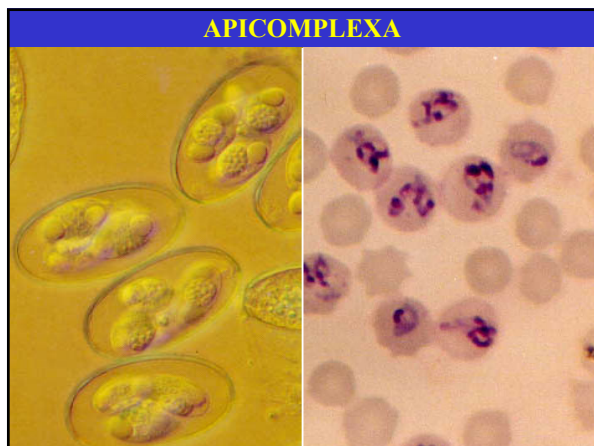
SPOROZOA

<p>Apicomplexa (apical complex) (oocysts)</p> 	<p>Microspora (unicellular) (spores)</p> 	<p>Myxozoa (multicellular) (spores)</p> 
All parasitic		

20







23

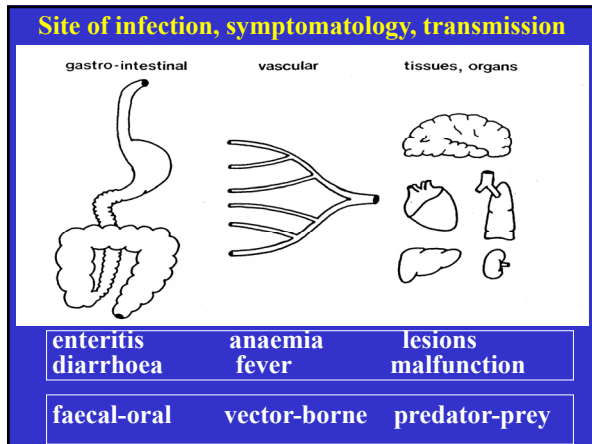


21

PROTOZOA
65,000 species
(31,250 extant + 33,750 extinct)

<p>flagellates</p>  <p>6,900 species 5,100 free-living 1,800 parasitic</p>	<p>amoebae</p>  <p>11,550 species 11,300 free-living 250 parasitic</p>	<p>sporozoa</p>  <p>5,600 species all parasitic</p>	<p>ciliates</p>  <p>7,200 species 4,700 free-living 2,500 parasitic</p>
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24



25

DISEASES

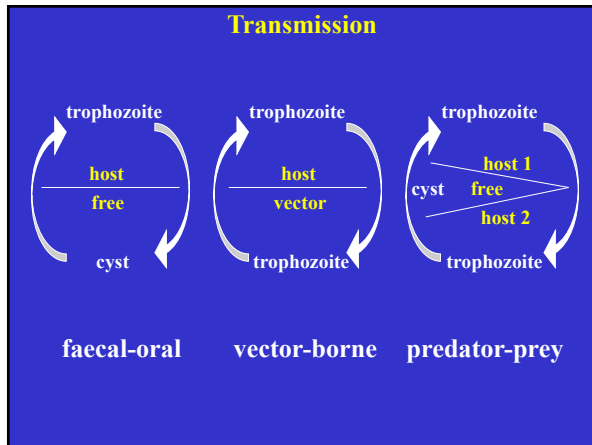
Impact of diseases

- mortality (death)
- morbidity (sickness)
- production losses (body weight)
- lesions (quality)

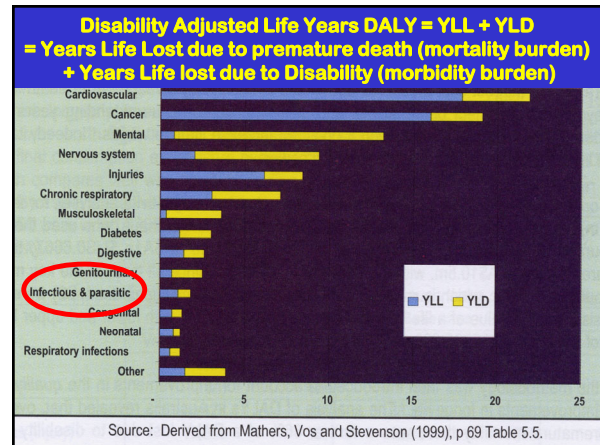
Parasitoses

- endo-parasites
- ecto-parasites
- epibiotic fouling organisms

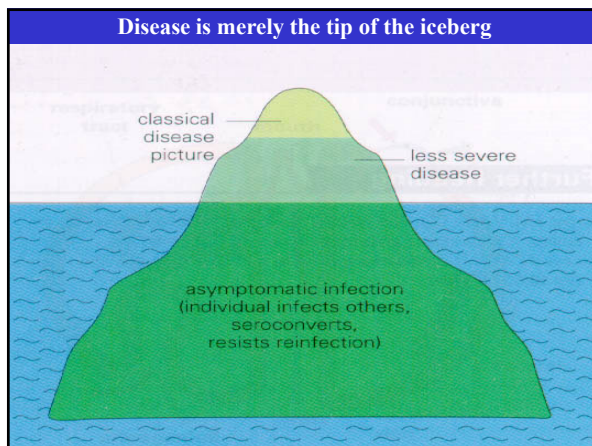
28



26



29



27

WHO top 10 parasites

Disease	Infections/vr	Deaths/vr
1. Ascariasis	900 million	20,000
2. Hookworm disease	800 million	55,000
3. Malaria	800 million	1,500,000
4. Trichuriasis	500 million	-
5. Amoebiasis	480 million	75,000
6. Filariasis	280 million	-
7. Schistosomiasis	200 million	750,000
8. Giardiasis	200 million	-
9. Trypanosomiasis	25 million	65,000
10. Leishmaniasis	1 million	1,000

30