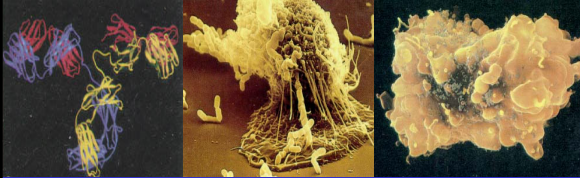


NURSING

Science lectures



Prof Peter O'Donoghue

1

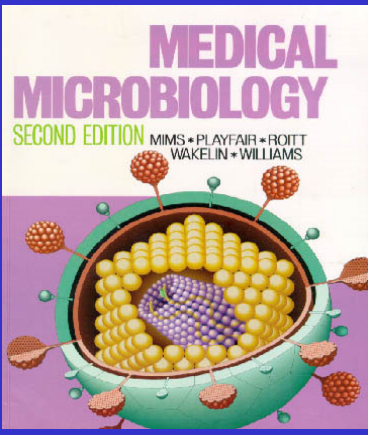
LEARNING OBJECTIVES

Lecture 7: Overview of Infection (Microbiology)

- differentiate microbial pathogens (viruses, bacteria, parasites)
- deduce major consequences of infection → disease
- review modes of transmission for specific exemplars

infectious diseases / precautions

2



First edition
1993

Second edition
1998

Third edition
2004
etc.

Today's content:
Chapters 1-3

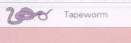
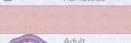
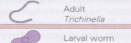
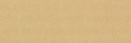
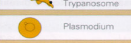
3

the GERM theory



4

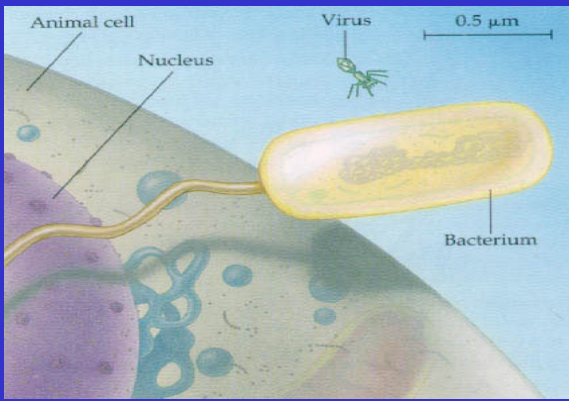
ORGANISMS

	 Tapeworm	 Intestinal nematode	 Adult schistosome	 Adult Trichinella	 Larval worm	
						naked eye worms
						light microscope protozoa
						bacteria
						viruses
						electron microscope viruses

<u>pathogens</u>	<u>hosts</u>
arthropods	humans
helminths	animals
protozoa	}
fungi	
bacteria	
viruses	
microbiology	

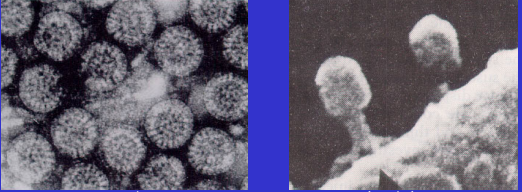
5

Eukaryote - Prokaryote Domains



6

VIRUSES (acellular)

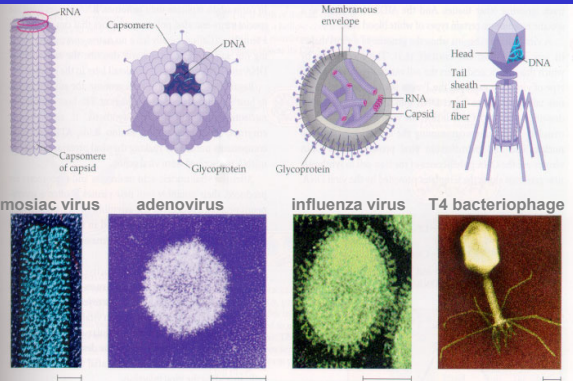


rotavirus bacteriophage

- extremely small genomic fragments
- infect prokaryotic/eukaryotic cells and reproduce
- disease caused by cell dysfunction or lysis

7

DNA/RNA ± envelope

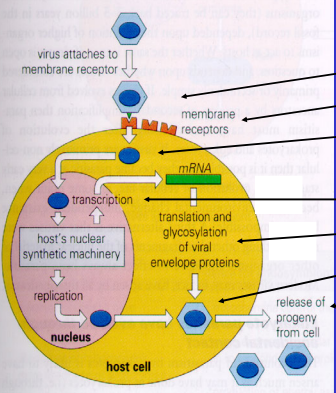


mosaic virus adenovirus influenza virus T4 bacteriophage

8

Virus reproduction

6 defined stages



- attachment
- penetration
- uncoating
- replication
 - transcription
 - translation
- assembly
- release

9

VIRUS CLASSIFICATION BY STRUCTURE


NA	strands	envelope	family	diseases
DNA	double	present	Herpes-viridae	herpes, chickenpox
		absent	Pox/Adeno/Papo	smallpox, tumors, warts
RNA	single	absent	Parvo-	animal viruses
		absent	Reo-	Colorado tick fever
		present	Toga/Retro	rubella, dengue, AIDS
		absent	Picorna-	polio, hepatitis

VIRUS CLASSIFICATION BY TISSUE TROPHISM

group	tissues affected	diseases
pneumotrophic	respiratory system	influenza, RSD, colds
dermotrophic	skin/subcutaneous	smallpox, herpes, mumps, measles/rubella
viscerotrophic	blood/viscera	yellow fever, dengue, hepatitis, AIDS
neurotrophic	nervous system	rabies, polio

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DERMOTROPIC LESIONS

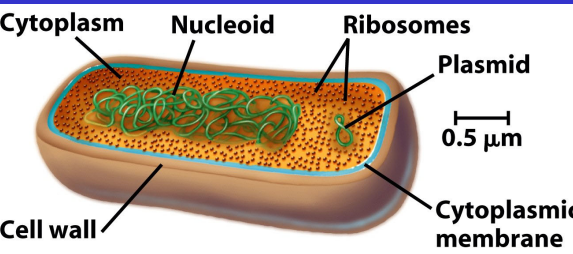


chickenpox (varicella) smallpox (variola)

herpes simplex lip lesion congenital herpes

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BACTERIA (pro-karyotes)



0.5 μm


- reinforced cell wall
- no endomembrane system
- nuclei in cytoplasm (high mutability)

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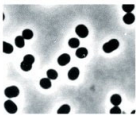
Characteristics


3 basic shapes

- spherical
- bacillus
- spiral





Coccus






Rod






Spirillum



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The Gram Stain

Step 1




Result:
All cells purple

Step 2




Result:
All cells remain purple

Step 3



Result:
Gram-positive cells are purple;
gram-negative cells are colorless

Step 4



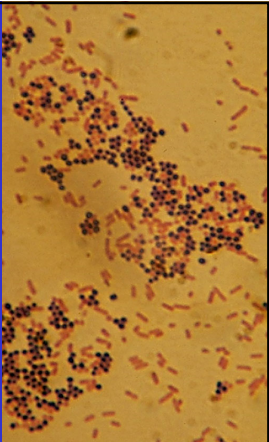
Result:
Gram-positive (G⁺) cells are purple;
gram-negative (G⁻) cells are pink to red

Flood the heat-fixed smear with crystal violet for 1 min

Add iodine solution for 1 min

Decolorize with alcohol briefly — about 20 sec

Counterstain with safranin for 1–2 min

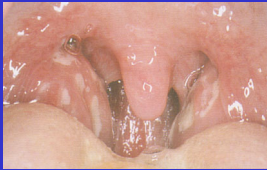


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Bacteria grouped according to major mode of transmission				
transmission	disease	agent	organs	signs
airborne	diphtheria	Gram+ rod	resp. tract	pseudomembrane
	legionellosis	Gram- rod	lungs	pneumonia
	tuberculosis	acid-fast rod	lungs	tubercle
food/water	botulism	Gram+ rod	nerve ends	paralysis
	typhoid	Gram- rod	gi tract	ulcers, fever
	cholera	Gram- rod	intestine	diarrhoea
soilborne	anthrax	Gram+ rod	blood	haemorrhages
	tetanus	Gram+ rod	nerve ends	spasms
arthropodborne	bubonic plague	Gram- rod	lymph nodes	buboes
	Lyme disease	spirochaete	skin	lesions
sexually	syphilis	spirochaete	skin	chancere
	gonorrhoea	Gram- coccus	urethra	discharge
contact	leprosy	acid-fast rod	skin	tumours
	yaws	spirochaete	skin	lesions
	'staph'	Gram+ coccus	skin, blood	abscesses, fever

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clinical bacteriology




strep throat



impetigo



gas gangrene




anthrax

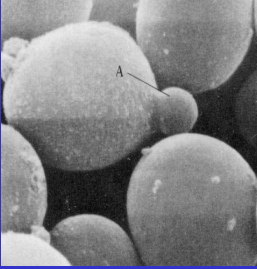
16

FUNGI are not plants or animals!

- no chlorophyll, chitinous walls, heterotrophic
- complex life-cycles involving spore formation



filamentous fungi

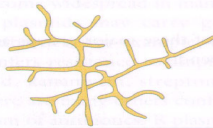


ovoid yeasts

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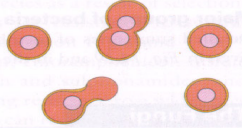
filamentous

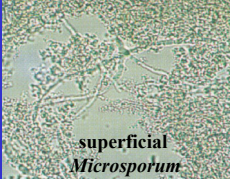
growing as multinucleate, branching hyphae, forming a mycelium




yeasts

growing as ovoid or spherical single cells multiply by budding and division





superficial
Microsporium



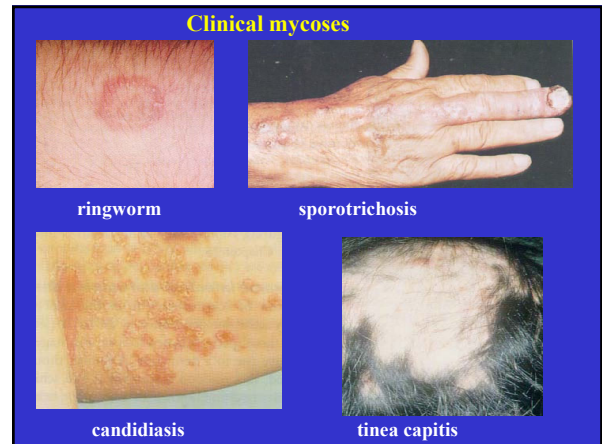
deep
Histoplasma

18

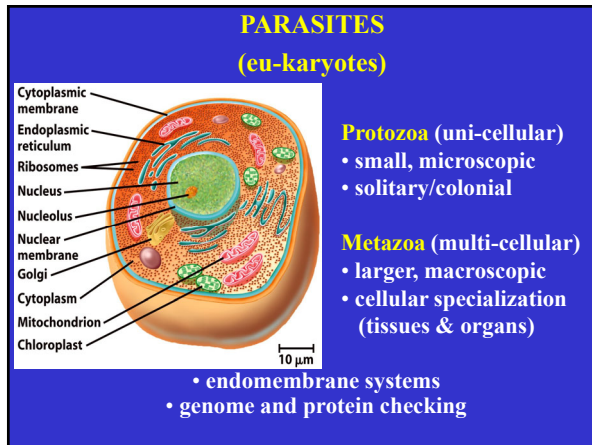
Important fungal diseases

type	location	disease	genera
superficial	cutaneous	tinea	<i>Malassezia</i>
		ringworm	<i>Microsporium</i> <i>Trichophyton</i>
	subcutaneous	sporotrichosis	<i>Sporothrix</i>
		mycetoma	various
deep	systemic	histoplasmosis	<i>Histoplasma</i>
		blastomycosis	<i>Blastomyces</i>
	opportunistic	cryptococcosis	<i>Cryptococcus</i>
		candidiasis	<i>Candida</i>
		aspergillosis	<i>Aspergillus</i>

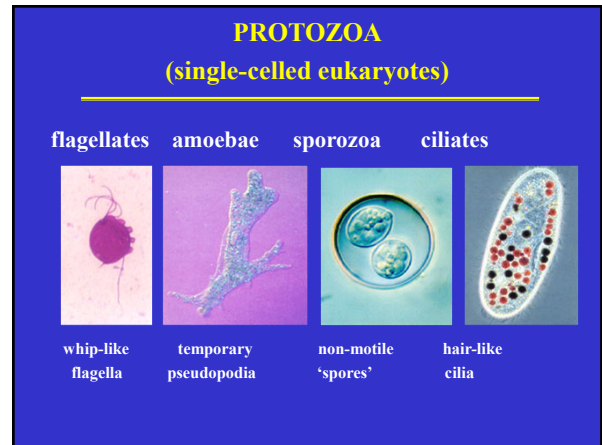
19



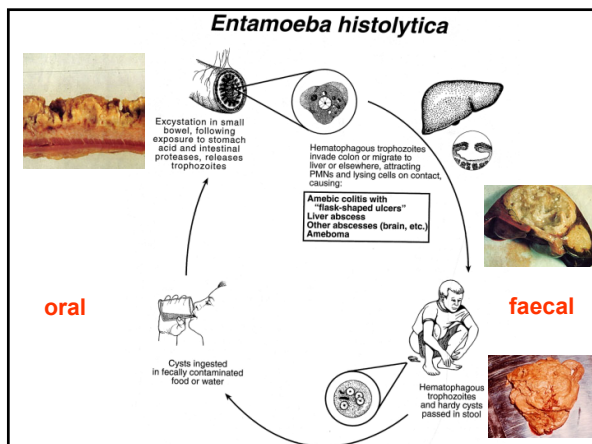
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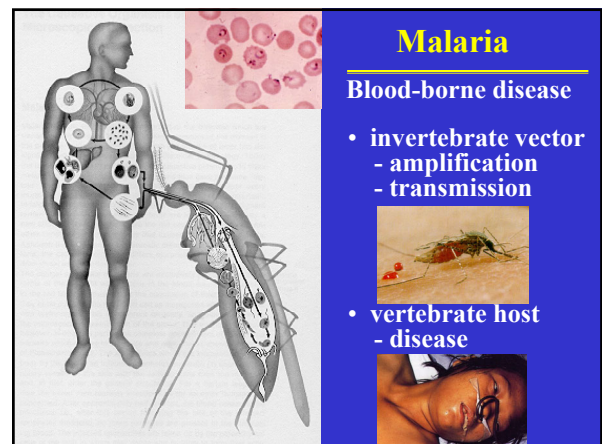
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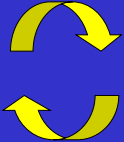


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HELMINTHS
(multicellular worms)

nematodes	cestodes	trematodes
		
roundworms	tapeworms	flukes


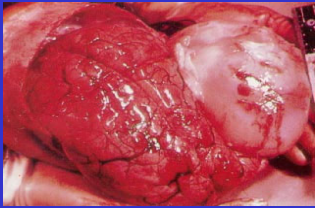
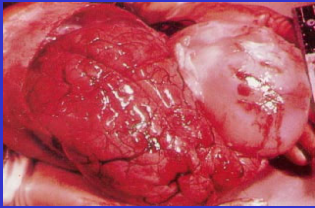
25

Ascaris (roundworm)

		
adult worms		worm eggs
gut obstruction		





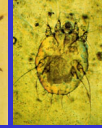
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Cestodes (tapeworms)

	
human tapeworm	dog tapeworm
	
	hydatid cyst

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PARASITIC ARTHROPODS

INSECTS (6-legged biters)			ARACHNIDS (8-legged biters)	
fleas	flies	lice	ticks	mites
				
fleas chiggers	flies mosquitoes	sucking lice chewing lice	hard ticks soft ticks	mites





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All blood-feeders
(need protein for egg casings)

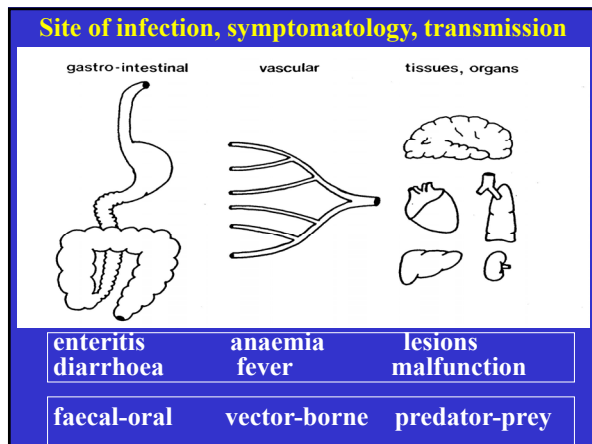
		
		

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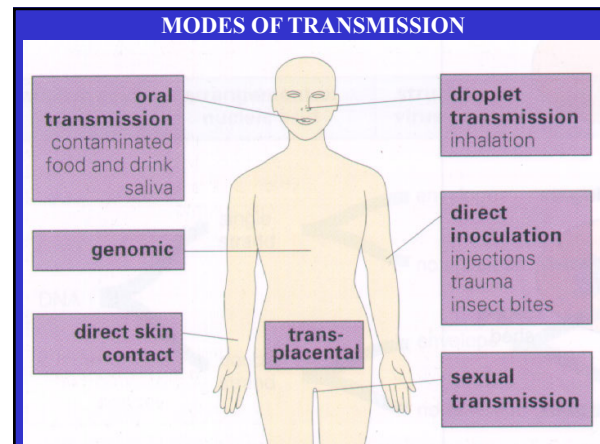
last group - XENOMORPHS

	
adults - predatory	unique oviposition
	
larva - tissue-feeder	clinical consequences

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PRECAUTIONS

Standard/Universal

⇒ treat all fluids as potentially infectious!

- handwashing
- barriers (gloves, gowns, masks, etc)
- prevent cross-infection
- sterilization/disinfection
 [heat, irradiation, filtration, chemical]

Additional precautions

- protective isolation (quarantine)
- source isolation (sanatorium)

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TAKE HOME MESSAGE

A staggering variety of micro-organisms
 cause infectious diseases in humans

Many micro-organisms are ubiquitous and have
 tremendous proliferative potential

How do hosts defend themselves against this
 microbiological onslaught?

⇒ Thank heavens for immune systems!

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