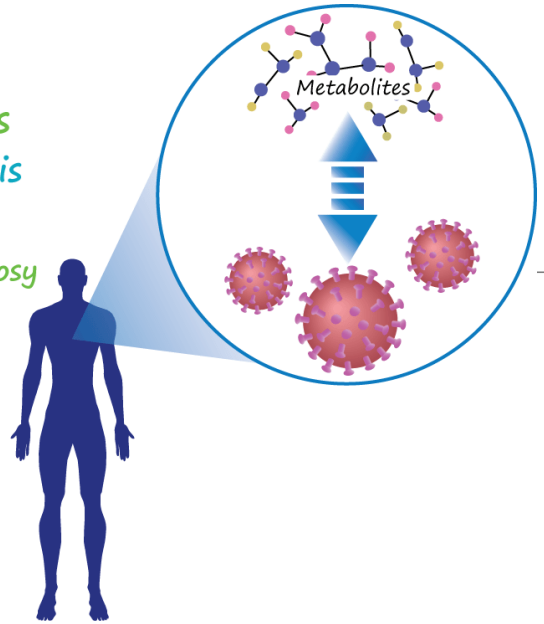
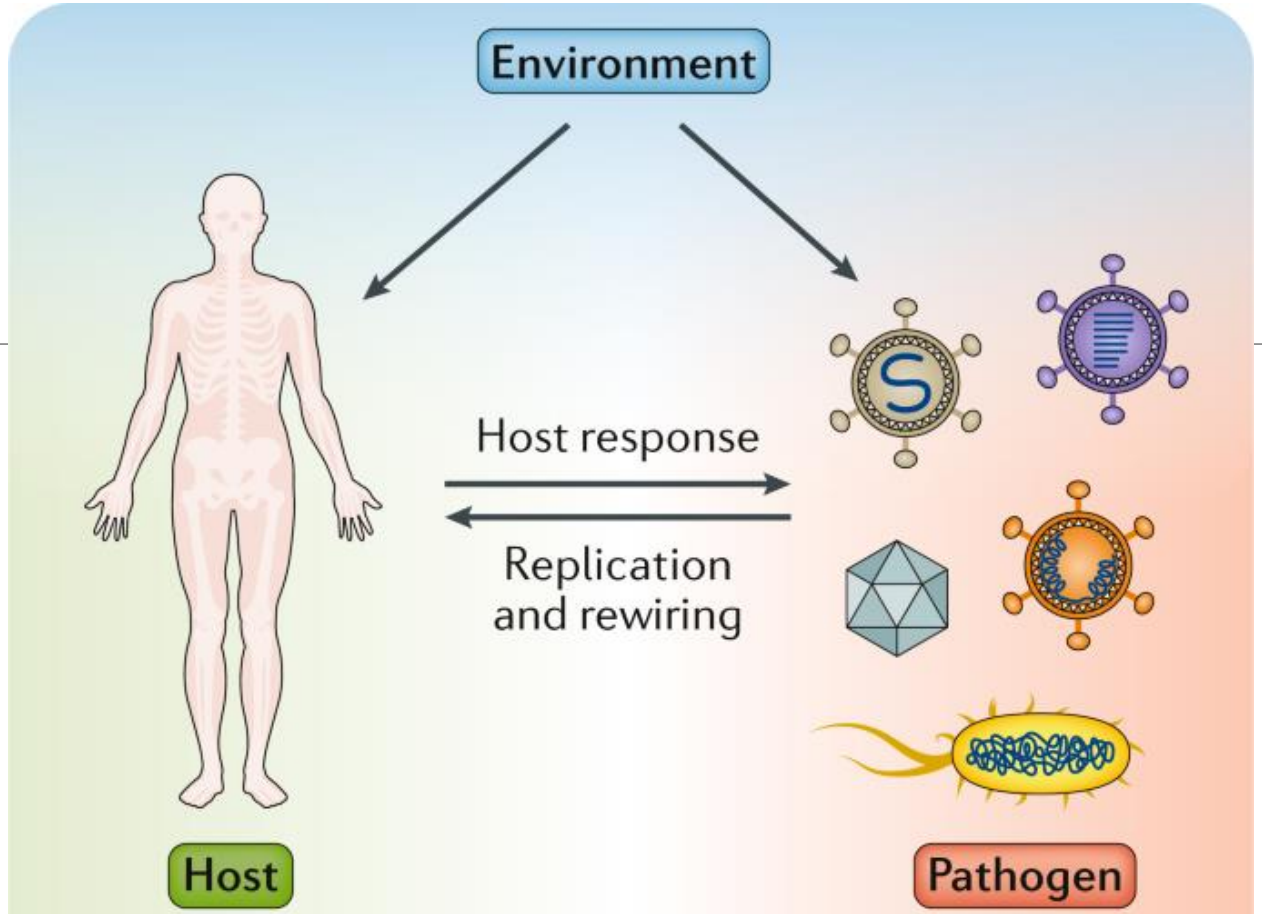
Infectious Diseases

Yellow fever
Dengue Meningitis
Zika Influenza Sepsis
COVID-19
-AIDS/HIV Herpes Leprosy
Encephalitis SARS
MRSA Hepatitis
Tuberculosis





Health	Disease
• Resistance	• Susceptibility
• Acquired immunity	• Immunodeficiency
• Tolerance	• Pathogenicity
• Non-virulence	• Virulence

Infectious diseases

1. Bacteria

2. Viruses

3. Mycetes

4. Parasites

Bacterial infections

toxemia = toxins in blood circulation

alimentary
- botulotoxin (*Cl. botulinum*)
- enterotoxin (*Staphylococci*)

wound
- tetanotoxin (*Cl. tetani*)

other
- diphtheratoxin (*C. diphtheriae*)

regressive changes (liver, kidney, heart)

Bacterial infections

bacteremia = bacteria in blood circulation

time-limited

elimination by immune system

e.g.: digestion, tooth extraction, tonsillectomy, catheter, cystoscopy…

!!! heart valves defect → infective endocarditis → ATB cover !!!

Bacterial infections

sepsis = bacteria > immune system

fever + splenomegaly + lymphadenopathy

s*treptococci, staphylococci*

metastasizing sepsis (septicemia)

nasopharynx → menings (*N. meningitidis*)

pulmonary abscess → brain abscess

furuncle → bones + kidney (*Staphylococci*)

Bacterial infections

pyemia (septicopyemia) = thrombi + bacteria in blood circulation

sequela: septic infarction → metastatic abscess

1. central – infective endocarditis
   → brain, kidney, skin, …

2. peripheral – purulent thrombophlebitis (p.t.)
   → lungs

3. portal – p. t. of portal vein branch
   → liver

4 . umbilical – p.t. of umbilical vein (newborn)

Staphylococci

Gram+, common

normally on skin + mucosa

skin abscesses x sepsis

nosocomial infections

secondary infections (influenza)

Staph. aureus + Staph. epidermidis

Staphylococci

1. skin lesions (wounds)
   - furuncle → carbuncle (DM)
   - impetigo
   - panaritium
2. mastitis (breast feeding woman)
3. osteomyelitis + arthritis
4. enterocolitis + alimentary enterotoxicosis
5. acute infective endocarditis
6. toxic shock syndrome

Streptococci

Gram+, common

β-hemolytic (A-D, G)

- ***Str. pyogenes (A)***
- ***Str. agalactiae (B)*** – mother´s vagina → newborn´s meningitis

α-viridans (H)

- subacute infective endocarditis
- ***Str. mutans*** – caries, pulpitis

*anaerobic (**Peptostreptococci**)* – oral cavity

Streptococci

Str. pyogenes (A)

1. local inf. – phlegmone, impetigo, wound inf.
2. angina (tonsilitis) → otitis, sinusitis
3. scarlet fever (erythrogenic toxin)
   - angina + oral enanthema (raspberry tongue) + skin exanthema (face, trunk)
4. erysipelas
   - skin erythema (lower limbs, face) + toxemia
   - lymphatic + blood vein thrombosis → lymphostasis → edema → elephantiasis

Streptococci

sequelae (*Streptococcus A*)

- M protein
- cross reaction (immune)
- **acute glomerulonephritis**
- **rheumatic fever**

Pneumococci

Str. pneumoniae

Gram+ diplococci

children

- rhinitis, nasopharyngitis, sinusitis, otitis

adults

- lobar pneumonia $\rightarrow$ meningitis

Neisseria

Gram- diplococci

N. meningitidis

sporadic x endemic

children, young adults, soldiers

nasopharynx → menings

!!! rapid course → death (hours) !!!

meningeal syndrom + skin purpura + DIC

Waterhouse-Fridrichsen syndrome

- meningococcal sepsis + DIC + bleeding in adrenals (insufficiency)

Neisseria

N. gonorrhoeae

gonorrhoea – STD

purulent inflammation + discharge

M: urethritis → prostate, vesicles

F: kolpitis, cervicitis → endometritis → salpingo-oophoritis → sterility

distant complication: arthritis (knee)

Escherichia coli

Gram- rod

normal in colon x other location - pathogenic

enteropatogenic – diarrhoea (newborn)

enteroinvasive – diarrhoea (adults)

enterotoxigenic – travellers´ diarrhoea

enterohemorrhagic - verotoxin

- hemorrhagic colitis
- hemolytic-uremic syndrome (children)

Salmonella

***S. typhi* – typhoid fever**

food → bowel → liver → gallbladder → bowel

ileum

1. hyperplasia of RES in ileum – typhoid cells
2. mucosal necroses upon Peyer patches
3. ulcerations
4. reparation → scar

complications

- bowel perforation/hemorrhage
- chronic carriage (gallbladder)

Salmonella

S. paratyphi – **paratyphoid fever**

S. enteritidis, S. typhimurium

gastroenteritis + enterocolitis

alimentary

vomiting + diarrhoea

Shigella

S. dysenteriae, S. sonnei., S. flexneri

bacillar dysentery

„dirty hands“ + alimentary

hemorrhagic colitis + ulcers + pseudomembranes

Campylobacter + Helicobacter

Campylobacter jejuni

infants

diarrhoea

Helicobacter pylori

asymptomatic

etiology of:

- chronic gastritis
- peptic ulcer of stomach and duodenum
- gastric carcinoma
- gastric MALT-lymphoma

Vibrio

V. cholerae – **cholera**

water, food, ill man

massive watery diarrhoea (15 l) !!!

NO inflammation x enterotoxin

dehydration → collapse

cholera nostras - enterotoxins

Klebsiella

K. pneumoniae

pneumonia

lung + liver abscesses

K. rhinoscleromatis

ulcerations of upper airways

Haemophilus

H. influenzae

superinfection of viral infections

children – **epiglottitis**, meningitis, pneumonia

adults - otitis, sinusitis, bronchitis

H. ducreyi

ulcus molle (chancroid, soft chancre) - STD

Corynebacterium

C. diphtheriae – **diphtheria**

children

pseudomembranous tonsilitis + laryngitis

airway obstruction

diphtheratoxin - myocarditis

Bordetella

B. pertussis – **whooping cough**

children

acute inflammation of upper airways

cough + vomiting + face edema

Pseudomonas

P. aeruginosa

colonization of respiratory and urinary tract

immunocompromised patients

plastic, catheters

serious nosocomial infection

pneumonia, enterocolitis, meningitis, sepsis

Listeria

L. monocytogenes

milk, cheese, meal

necrotising granulomatous inflammation

transplacental
- abortion
- **granulomatosis infantiseptica**

newborn
- meningitis

adults
- meningitis

Bacillus

B. anthracis – **anthrax**

animal products + dust

hemorrhagic necrotising lesions

skin – *pustula maligna*

lungs, GIT, …

Yersinia

Y. pestis - **plague**

rodents → rats → flea *(Xenopsylla cheopis)*→ man

bubonic plague

- skin bite → LN (groin) → hemorrhagic necrosis (black color) + fistulas

pneumonic plague

- lung abscesses

↑ mortality

WHO report

Yersinia

Y. pseudotuberculosis, Y. enterocolitica – lymphadenitis mesenterialis

children, ~ appendicitis

alimentary

bowel $\rightarrow$ mesenteric LN

operation: normal app. + enlarged LN

purulent granulomatous inflammation

Francisella

F. tularensis - **tularemia** (hare disease)

rodents → man

regional LN – hemorrhagic necrosis + granulomatous inflammation

ulceroglandular – most common, skin wound

oculoglandular - coniunctiva

typhoid – sepsis

pneumonic

Legionella

L. pneumophila

water

flu-like x pneumonia

complications

- pancarditis
- skin + liver abscesses

Clostridium

***Cl. tetani* – tetanus**

wound → toxins (blood, nerves) → spinal cord → spasms of striated muscles (necroses)

risus sardonicus + opisthotonus

10-50% mortality

***Cl. botulinum* - botulism**

meal from tins (toxin)

visual disturbances, muscle paralysis → respiratory insufficiency + arrhythmias → **death**

Clostridium

Cl. perfringens

wound → emphysematous gangrene

Cl. difficile

pseudomembranous enterocolitis

after ATB treatment

Leptospira

L. icterohaemorrhagica – **Weil´s disease**

rodents´ urine + skin wound

fever + jaundice + anuria

liver - necroses + nephritis

muscle necroses + myocarditis

Spirochetes

***Treponema pallidum* – syphilis (lues)**

Borrelia

B. recurrentis – **febris recurrens**

ill man → louse → infection

mucosal hemorrhages + microabscesses

liver + spleen necroses

B. burgdorferi – **Lyme disease**

rodents → tick *(Ixodes)* → man

1. erythema migrans (skin)
2. multiple EM + CNS + heart + joints
3. acrodermatitis chronica atrophicans + CNS

Mycobacterium

M. tuberculosis – **TBC**

M. leprae – **leprosy**

atypical mycobacteria

M. kansasi, M. xenopi, M. intracellulare-avium

TBC ~ pneumonia

in AIDS patients

Actinomyces

A. izraelii – **actinomycosis**

normal in oral cavity

firm infl. infiltrate → fibrosis (scar) → fistulas

1. cervicofacial – most common

2. thoracic – lung abscesses

3. abdominal – IUD → salphingo-oophoritis

Mi: pus + act. colonies + Hoeppli-Splendore phenomenon

Mycoplasma

NO cellular wall

children + young adults

M. pneumoniae

- pneumonia, otitis, sinusitis

M. hominis

- non-gonococcal urethritis

Ureaplasma urealyticum

- non-gonococcal urethritis

Rickettsia

intracellular

R. prowazeki – **spotted fever** (typhus exanthematicus)

ill man → louse *(Pediculus h. corporis)* → skin wound

endothelium (+ vasculitis) → blood circulation

skin exanthema + petechiae

encephalitis + myocarditis

↑ mortality (20-70%)

recurrence (20 years) – **Brill-Zinser disease** (LN)

Rickettsia

R. rickettsii – **Rocky Mountain fever**

tick *(Dermacentor)*

Coxiella burnetii - **Q fever**

Australia

animal milk, dust inbreathing

atypical pneumonia

liver + bone granulomas

Bartonella

B. quintana – **trench fever**

eastern Europe

B. henselae

bacillary angiomatosis + peliosis hepatis

cat scratch disease

- regional LN – purulent granulomatous infl.

Chlamydia

intracellular

Chl. psittaci – **ornithosis** (psittacosis, parrot disease)

poultry

dust inhealing - interstitial pneumonia

Chl. trachomatis (L1-3) – **veneric lymphogranuloma**

STD (Africa, Asia)

skin + mucosal painless ulcers (M: penis x F: cervix)

LN: abscesses + necrosis + epithelioid cells

Chlamydia

Chl. trachomatis (A, B, C) - **trachoma**

contagious keratoconiunctivitis

hypertrophic coniunctivitis → pannus over cornea → blindness

Chl. trachomatis (D-K) - **urethritis**

Reiter syndrome: urethritis + arthritis + coniunctivitis

Chl. pneumoniae (TWAR) – **atypical pneumonia**

Infectious diseases

1. Bacteria

2. Viruses

3. Mycetes

4. Parasites

Viruses

intracellular

DNA or RNA

cytopatogenic effect

inclusions

- intranuclear (IN)
- intracytoplasmic (IC)

DNA viruses

1. *Poxvirus*
2. *Herpesvirus*
3. *Adenovirus* – pneumonia, ep. keratoconiuctivitis
4. *Papovavirus*
5. *Parvovirus* – erythema infectiosum
6. *Hepadnavirus* – HBV (Dane´s part.) - hepatitis B

Poxviridae

1. Variola (smallpox)

E. Jenner - vaccination

world-wide eradication

ill man → air droplets

skin: macula → papula → pustula → scar (face)

IC - Guarnieri bodies

generalization → necroses (liver, spleen, kidney..)

↑ mortality

Poxviridae

2. Vaccinia (cows)

3. Molluscum contagiosum

common

children

skin firm papules + central pit

IC mollusca bodies

Herpesviridae

1. *Herpes simplex virus - HSV1, HSV2*
2. *Varicella-zoster virus - VZV*
3. *Epstein-Barr virus - EBV*
4. *Cytomegalovirus - CMV*

5. *HHV8 (KSV)* – Kaposi sarcoma

Herpes simplex virus

epidermotropism + neurotropism

intraepithelial blister + IN eos. inclusions (Lipschutz)

HSV1 – oral (kissing)
- primary – h. gingivostomatitis (lips, vestibulum)
- reactivation – h. labialis

HSV2 – genital, perianal (STD)
- M: balanoposthitis, proctitis
- F: vulvitis, cervicitis, proctitis
  - newborn infection (delivery)

complications: esophagitis, hepatitis, encephalitis

Varicella-zoster virus

1. Varicella (chickenpox)

contagious febrile disease

children

skin + mucosa: small blisters → ulcers

complication

- interstitial pneumonia
- encephalitis

Varicella-zoster virus

2. Herpes zoster (shingles)

adults

reactivation from sensitive nerve ganglia

unilateral !!!

painfull blisters in dermatoma of one nerve

- trunk - intercostal nn.
- face – n. V – h.z. ophthalmicus – keratitis

complication: paresthesias

Epstein-Barr virus

1. Infectious mononucleosis

- kissing disease, children
- acute fever + RES
- tonsils (pseudomembranous a.) + LN + splenomegaly (rupture!) + liver (hepatitis)
- blood: lymphocytosis + atypical lymphocytes

2. Burkitt lymphoma (Africa – jaws)

3. Extranodal NK/T-cell lymphoma, nasal type

4. Hodgkin´s lymphoma (probably)

5. Lymphoepithelial carcinoma (nasopharynx)

Cytomegalovirus

infectious saliva, blood, urine, milk, STD

IN bas. inclusions („owl eye“)

asymptomatic

fetus

- brain (microcephaly, hydrocephalus, calcifications)
- ear, eye, liver, blood marrow, kidney, salivary glands

adults – AIDS, immunosupresion

Papovaviridae – Human Papilloma Viruses (HPV)

affinity to squamous epithelium

oncogennic effect

koilocytes (perinuclear halo)

low risk – 6, 11

- warts, condyloma acuminatum (STD)
- oral + laryngeal papillomas

high risk – 16, 18, 31

- **cervical**, vaginal, vulvar, perianal carcinomas !!! – STD
- squamous cell carcinoma of oropharynx

RNA viruses

1. *Orthomyxovirus*
2. *Paramyxovirus*
3. *Rhabdovirus*
4. *Retrovirus* – HIV - AIDS
5. *Arenavirus*
6. *Coronavirus*
7. *Bunyavirus*
8. *Reovirus*
9. *Togavirus*
10. *Picornavirus*

Orthomyxoviridae

influenza (flu)

↑ infectious febrile d.

epidemic

acute onset, fever, general symptoms

pharyngitis + hemorrhagic tracheitis

complications

- atypical pneumonia
- bacterial superinfections *(H. influenzae)*

Paramyxoviridae

respiratory syncytial virus

infants

- atypical pneumonia (Adams p.)
- bronchiolitis obliterans

adults

- upper airways infection

Paramyxoviridae

morbilli (measles)

↑ infectious exanthematous d., children

1st stage – flu-like, Koplik´s spots (cheek)

2nd stage – skin exanthema

+ RES (LN, tonsils, spleen, appendix)

Warthin-Finkelday giant multinucleated **cells**

complications

- atypical pneumonia
- encephalitis
  - acute postinfective
  - subacute sclerosing panencephalitis (late)

Paramyxoviridae

parotitis epidemica (mumps)

acute flu-like d. + SG swelling, children

unilateral x bilateral, painful

↑ parotis + ..

complications

- orchitis + oophoritis (sterility)
- pancreatitis
- meningoencephalitis

Togaviridae

rubeola (German measles, rubella)

~ measles

skin exanthema + nuchal LN

transplacental → fetus malformations

- Gregg´s syndrome (eye, ear, brain, heart)

Rhabdoviridae

lyssa (rabies)

animal (dog, fox) saliva → bite → along nerves → CNS

neurons (cornu Amonis) – IC Negri bodies

hydrophobia, muscle spasms, furiousity, psychic alterations

!!! always lethal !!!

Arboviridae

= **AR**thropode **BO**rn

1. encephalitis

transmission by insects (mosquito, tick (Ixodes ricinus))

geographic distribution

blood → CNS (basal ganglia, cerebellum)

perivascular lymphocytic infl.

flu-like → CNS disorders

2. febris flava (yellow fever) – America, Africa

liver necroses

Picornaviridae

1. Enteroviruses

- *Polioviruses*
- *Coxsackie-viruses*
- *Echoviruses* – flu-like d.

2. Rhinoviruses

coryza (common cold) – purulent rhinitis

stomatitis epizootica (foot and mouth disease)

- stomatitis + small blisters and ulcers

Polioviruses

poliomyelitis anterior acuta

acute febrile d., children

direct contact, water

CNS - necrosis of motoneurons of anterior horns of spinal cord

muscle paresis, paralyses (lower limbs)

neurogenic atrophy

Coxsackie - viruses

epidemic d., children

herpangina – pharyngitis

myocarditis

meningitis

polymyositis

Viral hepatitis

Hepatitis	Virus	Transmission	Chronicity	Carriage	Fulminant
A	RNA	fecal-oral	NO	NO	0.4%
B	DNA	parenteral	5-10%	1%	1%
C	RNA	parenteral	80%	1%	rare
D	RNA	parenteral	5% co 80% super	10%	4% co-i.
E	RNA	fecal-oral	NO	NO	20% pregnant

Infectious diseases

1. Bacteria

2. Viruses

3. Mycetes

4. Parasites

Mycetes

1. Mycoses

- true infectious diseases

2. Mycotoxicoses

- poisoning by fungal toxins – liver necroses

3. Mycoallergoses

- allergic reaction to fungal products

4. Mycetism

- local inflammation by fungi

Mycoses

normal saprophytes in man

immunosupression – opportunistic infection

endogenous

purulent, granulomatous infl.

superficial m.

- skin + mucosa

deep m.

- organ involvement + systemic infection

Superficial mycoses

= dermatophytoses

Trichophyton, Microsporum, Epidermophyton

limited to epidermis (scales) + skin adnexa

Tinea capitis, T. barbae, T. corporis, T. pedis et manus, T. unguium (nails)

Pityriasis versicolor *(Malassezia furfur)*

Deep mycoses

candidosis

aspergillosis

cryptococcosis

pneumocystosis

mucormycosis – pneumonias, rhinocerebral inf.

histoplasmosis – H. capsulatum - ~ TBC

blastomycosis, coccidioidomycosis

Candidosis

C. albicans – normal in oral cavity

hyphae (non-branching) + blastospores

soor (moniliasis, trush)

pseudomembranous inflammation

stomatitis, esophagitis, vulvitis, colpitis

hematogenous dissemination

Aspergillosis

A. niger, A. flavus, A. fumigatus

branching hyphae (“Y“)

aflatoxins (hepatotoxic, carcinogenic)

angiotropism

necrotising pneumonia

aspergilloma - in bronchiectasias, TBC cavernae

paranasal sinuses $\rightarrow$ brain

Cryptococcosis

C. neoformans

gelatinous capsule

birds (pigeons) $\rightarrow$ dust $\rightarrow$ inhale

granulomatous pneumonia

granulomatous meningoencephalitis

Pneumocystosis

P. carinii/jiroveci

infants + AIDS patients

interstitial pneumonia + alveoli fulfilled by grayish foamy mass

Infectious diseases

1. Bacteria

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Parasites

1. Protozoa

2. Helminths

3. Arthropodes

Trichomoniasis

T. vaginalis

STD

urogenital tract

F: colpitis - purulent discharge

M: asymptomatic

Toxoplasmosis

T. gondii

contact with infected animal (cat) + a. products

transplacentally

1. congenital form
   - abortus
   - hydrocephalus, microophthalmia, chorioretinits, brain cysts, calcifications (Sabin triad)
2. acquired form
   - lymphadenitis (Piringer-Kuchynka)
     - B- and T- zone hyperplasia + tiny epithelioid granulomas

Trypanosomiasis

***T. brucei gambiensae, T. b. rhodesiense* – sleeping sickness**

Africa

transmission - fly *Tse-tse (Glossina)*

chronic meningoencephalitis – coma – death

***T. cruzi* – Chagas disease**

America

transmission – flatworm *(Triatoma)*

myocarditis

Leishmaniasis

transmission by sandfly

L. tropica - skin f.

„tropical sore“ – spontaneous regress

L. donovani - visceral f.

„kala-azar“ (black fever)

RES – LN + hepatosplenomegaly

Amoebiasis

Entamoeba histolytica

food + water

amoebic dysentery

blood stools + diarrhoea + fever

ulcers (~ bottle) in colon (caecum)

complication

- portal v. → liver - abscesses

Lambliasis

L. (Giardia) intestinalis

food + water

chronic enteritis (small bowel) – diarrhoea

anemia

Malaria

!!! most important and serious tropics d.!!!

Plasmodium

M. tertiana *(P. vivax, P. ovale)*

M. quartana *(P. malariae)*

M. tropica (jungle fever) ***(P. falciparum)***

1 mil death annually

transmission – *Anopheles*

Malaria

hepatocytes → erythrocytes → breakdown

fever attack + shivering

hemolytic anemia

RES: hepatosplenomegaly + brownblack malaric pigmentum

Parasites

1. Protozoa

2. Helminths

3. Arthropodes

Enterobiasis

E. vermicularis (pinworm, seatworm)

most common, children

small bowel → large bowel → anus (eggs)

pruritus

appendicopathia oxyurica

complication

- infection of genitals in girls (scribbling)

Trichinosis (Trichinelliasis)

T. spiralis

pork → bowel wall → blood → striated muscles → bot encapsulation

eye-moving, masticatory, tongue, diaphragm, heart, …

surrounding inflammation

Ascariasis

A. lumbricoides

common, children

food → bowel wall → blood → lungs → cough → pharynx → bowel

complication

- ileus, pneumonia

Taeniasis + Echinococcosis

tapeworms

T. saginata, T. solium (cysticercosis)

food → bowel → muscles, CNS (rare)

E. granulosus

dogs

bowel wall → liver → cysts – calcification + rupture

Schistosomiasis (Bilharsiasis)

flukes (trematodes)

Sch. mansoni

water (bathing)

liver granulomas, liver fibrosis → cirrhosis

Sch. haematobium

urinary bladder → chronic cystitis → carcinoma ?

haematuria

Parasites

1. Protozoa

2. Helminths

3. Arthropodes

Scabies

Sarcoptes scabiei (mite)

wars

clothes, STD

skin corridors → eggs

interdigital spaces, genitals

pruritus → scribbling → secondary infection

Sexually transmitted diseases (STD)

1. Bacteria

- *Neisseria gonorrhoeae* - gonorrhoea
- *Treponema pallidum* - syphilis
- *Haemophilus ducreyi* – chancroid
- *Chlamydia trachomatis* – lymphogranuloma venereum
- *Calymnatobacterium granulomatis* – granuloma inguinale

2. Viruses

- *HSV* - herpes
- *HBV* – hepatitis B
- *HPV* – condyloma acuminatum + cervical cancer
- *HIV* - AIDS

3. Parasites

- *Trichomonas vaginalis* – kolpitis (vaginitis)
- *Sarcoptes scabiei* - scabies