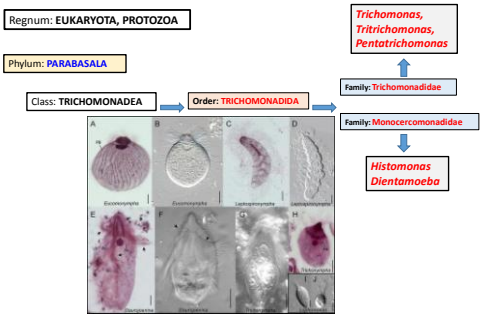
PARABASALA: TRICHOMONADEA: TRICHOMONADIDA:
Bovine, Feline and **Avian trichomonosis**;
Histomonosis of turkey, morphology, the main species, geographical distribution, prevalence, epidemiology, the life cycle, pathogenesis and clinical signs, pathology, diagnosis, treatment and control.

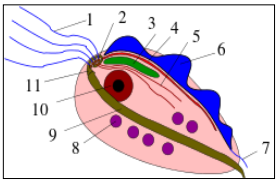
AMEBOZOA: ENTAMOEBIDEA: ENTAMOEBIDA:
Entamoebosis (amoebic dysentery); Amoebosis in humans and animals.

prof. Alica Kočišová, DVM, Ph.D.
October 18, 2023



Phylum: PARABASALA

- The greatest variability of flagellates (0-1000);
- The name according to the **parabasal apparatus** (which is a **heavily developed Golgi complex**) coupled to the nucleus by parabasal fibrils;
- Generally, a **return flagella** is developed (forms the **undulating membrane**);
- The undulated membrane is usually supported by fibrils - **„Costa„**
- **Cytostoma** - not developed; **phagocytosis** - whole surface of the cell;
- **Hydrogenosomes** (energy metabolism) / **mitochondria are missing;**
- Pear-shaped body shape; **axostyle** is routed through the axis of the cell;
- **Except for two exceptions**, **they do not create true cysts** (**some species form pseudocysts**), **the infective stage is** trophozoit;

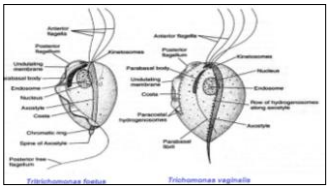


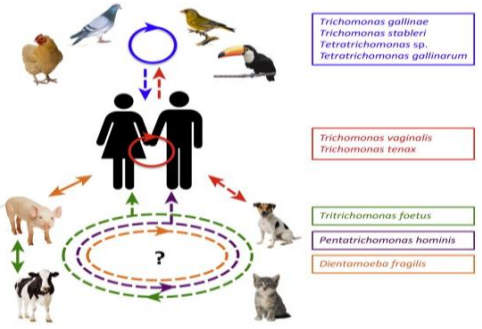
1-anterior flagella, 2-kinetosome, 3-parabasal apparatus, 4-costa, 5-parabasalfibrils, 6-undulating membrane, 7-return flagellum, 8-hydrogenosomes, 9-axostyle, 10-nucleus, 11-pelta.

Order: TRICHOMONADIDA

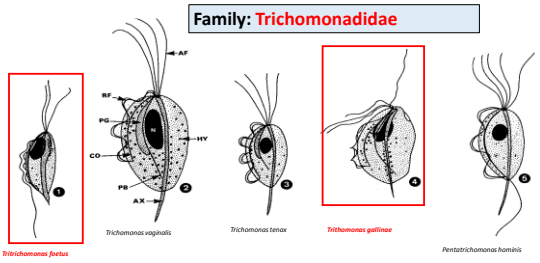
***Ditrichomonas* (Dt) - 2**
***Tritrichomonas* (Tt) - 3**
***(Tetra)trichomonas* (T) - 4**
***Pentatrichomonas* (Pt) - 5**

- **Parasites of genital or digestive tract of vertebrates;**
- **Contain** one nucleus, are oval-shape 5 – 25 µm, axostyl, parabasal body, 4 – 6 flagella;
- **Reproduction**: asexual – longitudinal fission;
- **Pseudocyst** only in some species (*T. foetus, T. muris*);
- **Hydrogenosomes** in place of **mitochondria**;
- They are microaerophilic/anaerobic organisms;

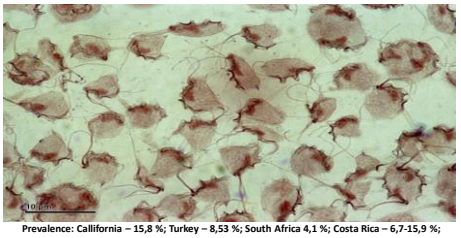




Family: Trichomonadidae

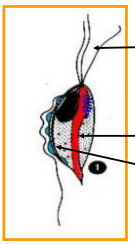


BOVINE TRITRICHOMONOSIS



Prevalence: Callifornia – 15,8 %; Turkey – 8,53 %; South Africa 4,1 %; Costa Rica – 6,7-15,9 %;
Spain – 2,9 % (1998), 32-41,5 % (2011)

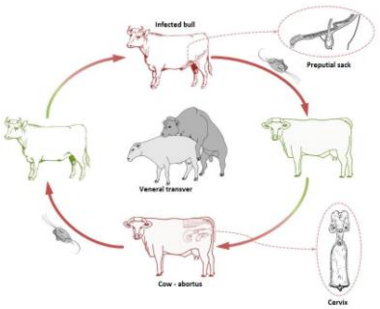
Tritrichomonas foetus B – (bovine strain)



REPRODUCTION:
longitudinal binary fission

NO – environmentally resistant stages
only – **pseudocyst**

Size: 10 - 25 x 3 -15 µm



Tritrichomonas foetus – epizootiology

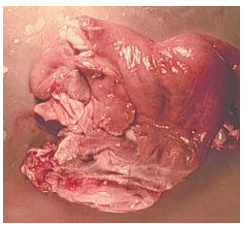
- **Veneric disease – transmission by:**
  - coitus
  - artificial insemination
  - gynecological examination of cows

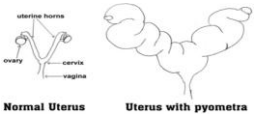
- **Infected bulls are source of infection !!!**

- **In infected cattle infection only persists: for 2-4 months, not longer than 7 months**

Tritrichomonas foetus – pathology

- **vestibulovaginitis catarhalis purulenta**
- **endometritis catarhalis purulenta**
- **idiopatic abortus**
- **pyometra**
- **disorders of reproduction and sterility**





Normal Uterus **Uterus with pyometra**

Trichomonosis of cattle – clinical symptoms

- **bulls** – inflammation of preputial sac, small nodules after infection
  chronic infections show no gross lesions
- bulls **older than 3–4 years**: **spontaneous recovery**; = **remain lifelong carriers** (asymptomatic)
  bulls **younger than 3–4 years**: transient infection
- **cows** – **early abortion in 8.–16. weeks gravidity**, uterine discharge, purulent endometritis, irregular oestrous cycles, pyometra, sterility

Trichomonosis of cattle – diagnosis
DIRECT CONFIRMATION

Number of parasites varies, the highest is:

- **14–18 days** p.i. are **detectable in vaginal mucus**
- **2–3 days** before oestrus and **3–7 days** after oestrus – parasites are **present in vagina**
- **ABORTUS** in **8. – 16. week** of gravidity (in aborted foetus)

Trichomonosis of cattle – diagnosis
DIRECT CONFIRMATION

- **CLINICAL HISTORY**
  - early abortion, irregular oestrus cycle
- **DEMONSTRATION OF ORGANISMS**
  - **in case of abortion:** placenta fluid, stomach contents of aborted fetus, uterine washing, pyometra discharge, vaginal mucus
  - **in infected herds**: preputial or vaginal washings or scrapings
  - Bulls are main reservoir = **long-term carriers**

Tritrichomonosis of cattle – diagnosis
DIRECT CONFIRMATION

- trichomonads move with a jerky, rolling motion
- native preparations
- stained smears
- culture procedure (commercial)
- PCR

Bovine tritrichomonosis – therapy, control

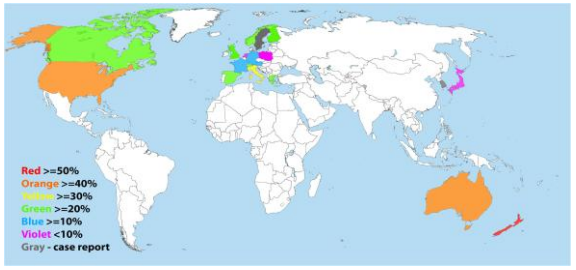
- **WOAH-listed** notifiable disease
- **ARTIFITIAL INSEMINATION** with semen from trichomonad-free bulls – the best method of preventing and eradicating infection
- Central and western **EUROPE** – eradicated

- symptomatic treatment is only indcated;
- NITROIMIDAZOLES – **ARE NOT REGISTRATED DRUGS**
  (Metronidazol; Dimetridazol per os 50 mg/kg^{-1} for 5 days)

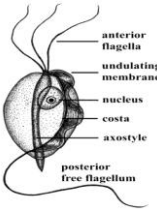
PREVENTION

- **Biosecurity of farms**; In the case of inadequate hygiene in the breed, the trichomonads, the workers can passively transfer;
- In urine and manure survive 3-14 days; 1-7 days at 10 ºC and 1-8 days at 0 ºC;
- They are **resistant** to penicillin, streptomycin and other ATBs;
- Control of bulls, semen, instrument hygiene during artificial insemination;
- Vaccination **?!?**
- Obligation to report = **OIE-listed notidiable disease**

Geographical distribution of surveys for and case report of *Tritrichomonas foetus* detected positive cats worldwide



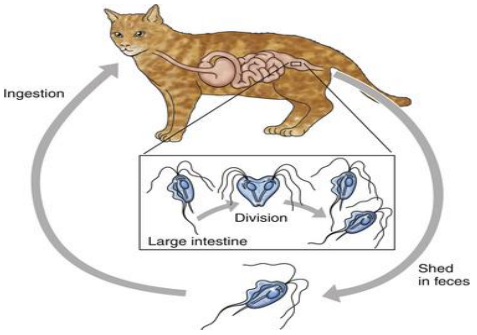
Tritrichomonas foetus C – (cat strain)

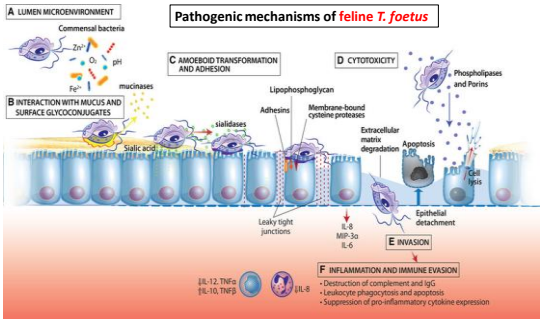


- ***T. foetus* C** - colonises the intestine
- **cause chronic diarrhoea**
- **colitis**: infection of ileum, colon, caecum
- **cats younger than 1 year**

Size: 10 - 25 x 3 -15 µm

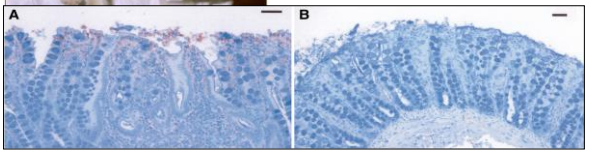
Trichomonas canistomae – mouth of dogs
Trichomonas felistomae - mouth

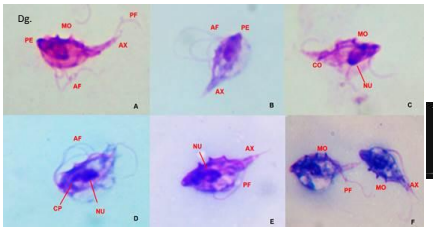


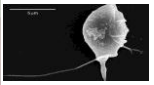


Normal appearance
Large bowel diarrhea

- Semiformed to cow-pie
- ± Fresh blood and mucus
- Malodorous
- Dribbling of feces common
- Anus red, swollen & painful







Tritrichomonas fetus isolated from a cat

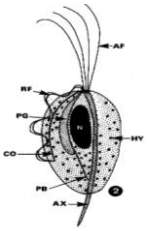
Tritrichomonas foetus C – therapy

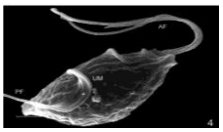
- **Ronidazole** (**off label use**) 30 mg/kg b.w. p.o. every 12 hrs for 2 weeks;
- the drug should only be applied under supervision of vet, because of occasional side effect;

AVIAN TRICHOMONOSIS

Trichomonas gallinae
Tetratrichomonas gallinarum
Tetratrichomonas anatis
Tetratrichomonas anseris

Trichomonas gallinae



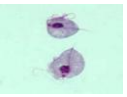


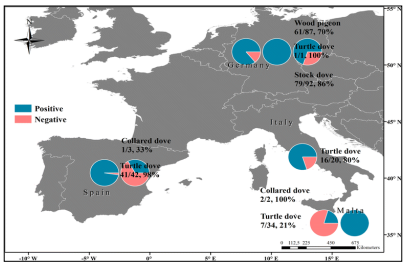
size: 6-18 x 2-9 µm

- pear shape
- 4 anterior flagella
- undulating membrane reaches 2/3 length of cell
- motile – rolling jerky movement

Trichomonas gallinae – occurrence

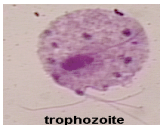
- **Worldwide** in **domestic pigeons**
- Very common – up to 80% of old birds are asymptomatically infected
- **Turkey** – frequent
- **Domestic chickens** – rare
- Found in many other birds: gallinaceous birds, birds of prey, parrots, etc.





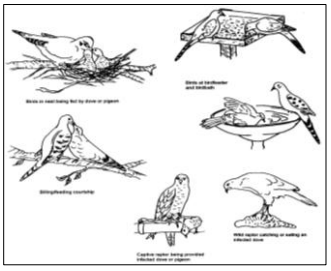
Trichomonas gallinae/ Trichomonosis

Disease characterized by mucopurular inflammation and formation of pseudomembranes and nodules in the beak cavity, sinuses, pharynx, oesophagus, throat;



- yellow, necrotic lesions in the beak, oesophagus and crop of birds
- **fatal in pigeon (2-4 weeks old)** – infection is acquired via regurgitated crop contents from adult birds – with the **„crop milk"** to the offspring

Trichomonosis of birds – epizootiology



PIGEONS
- transmission due to regurgitation of food

HAWKS
- ingestion of infected birds

OTHER BIRDS
- acquire the infection through drinking water contaminated by pigeons

Trichomonosis of birds – pathogenesis + clinical signs

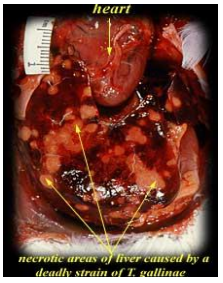
- **Avian trichomonosis is mainly a disease of young birds: 2–4 weeks old pigeon squabs** – from mild to acute up to fatal – 100% mortality
- **Adult pigeons – asymptomatic, latent duration**, show no evidence of disease (80-90%)

caseous lesions in proventriculus

Trichomonosis of birds – clinical signs

TYPICAL LESIONS – beak cavity, infraorbital sinuses, pharynx, oesophagus, crop and glandular stomach

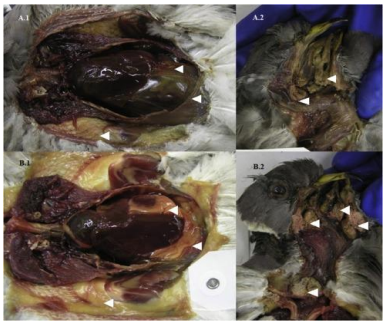
Trichomonosis of birds – clinical signs, pathogenesis



Liver, heart, navel, rarely other organs

LESIONS – **„ yellow buttons“** circumscribed, or disc-shaped, yellowish, caseous necrotic foci

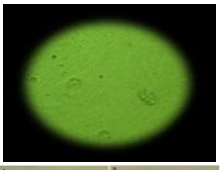
Recovered pigeons remain asymptomatic
= **PARASITE RESERVOIR**

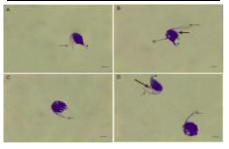


Trichomonosis – diagnosis

- **LIVING ANIMALS**
  – crop swabs
  microscopic examination of wet or stained smears, culture techniques

- **POST MORTEM**
  – smears
  - taken from the boundary layer between normal and affected tissue
  - **from esudate of body cavity**





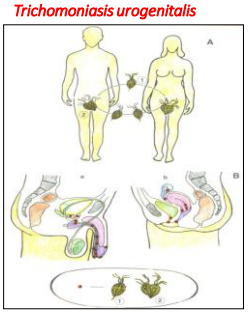
Trichomonosis of birds – therapy and control

- **Nitroimidazol** compounds – are **only** authorized for treatment of birds that are **not used for food production** (e.g. carrier pigeons)
- Metronidazol
- Dimetridazole
- Ronidazole

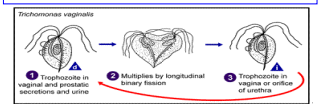
CONTROL

- sanitation, prevention of contact between pigeons and other domestic and wild birds

Trichomoniasis urogenitalis

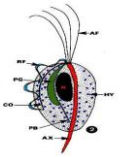


- ***Trichomonas vaginalis***
- **trophozoit** (4 free flagella, 5th – reveresed – short undulating membrane)
- **Never creates cysts !!!**
- Trophozoite stage transmitted during sexual intercourse
  - non-sexual contact possible
  - in rare instances it has been passed through wet towels, washcloths or bathing suits
- Common STD
  - co-infection w/other STDs
  - more prevalent in at risk groups
- Associated with epithelium of uro-genital tract
  - females: vagina
  - males: urethra, prostate, epididymis
- Both sexes equally susceptible
- Symptoms more common in females

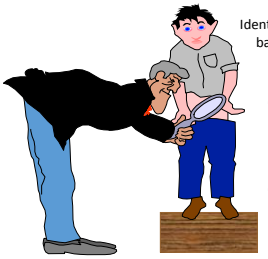


Transmission

- Sexual intercourse
- Mutual masturbation
- Sharing sex toys
- Mother to child during vaginal delivery



Clinical Diagnosis Approach



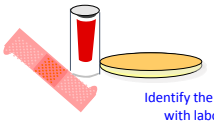
Identify the STI causing symptoms based on clinical experience

even experienced STD providers often misdiagnose STDs

miss mixed infections

difficult for surveillance

Aetiologic Diagnosis Approach



Identify the organism causing the symptoms with laboratory tests and microscopy

- Tests can be time consuming and expensive e.g. cultures take up to six days
- Even rapid tests (RPR) require equipment to obtain and separate venous blood
- Dependent on technician & lab. accuracy

DIAGNOSIS

- **Demonstration of parasite**
- **Direct observation or in vitro culture**
  - **vaginal discharge**
  - **urine sediment**
  - **prostatic secretion**

PREVENTION

- **limit of sexual partners**
- **condoms**

TREATMENT

- **Metronidazole, nitroimidazol, ornidazol**
  - **250 mg (3/d) for 5-7 days**
  - **single 2 g dose**
- **Simultaneous treatment of partner! (85-90% cure rate)**

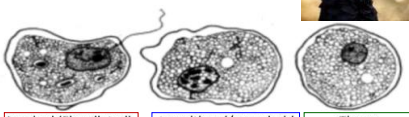
Histomonosis in poultry (Blackhead disease)

(enterohepatitis, typhlohepatitis)

TRICHOMONADIDA

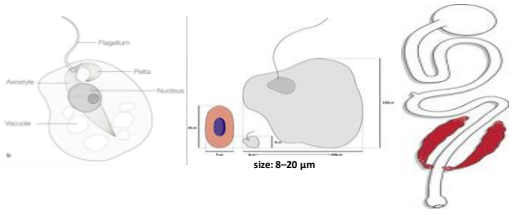
Family: Monocercomonadidae

Histomonas meleagridis



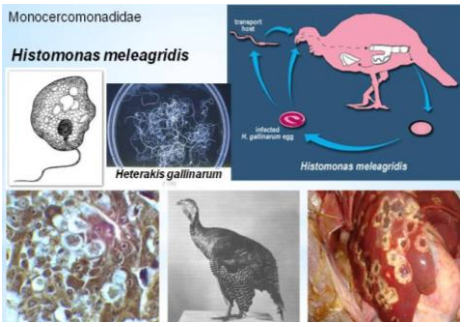
Luminal (Flagellated) | transitional/amoeboid (non-flagellated) | Tissue (non-flagellated)

Histomonas meleagridis



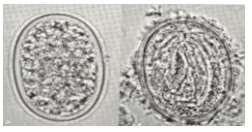
size: 8–20 µm

Inicial stages – caeca

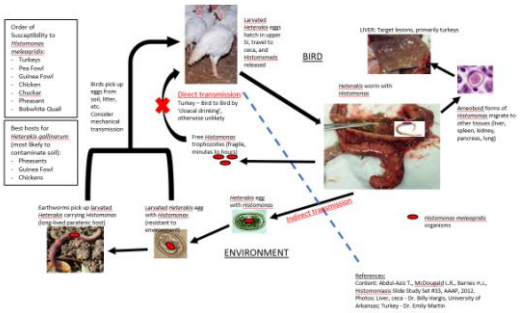


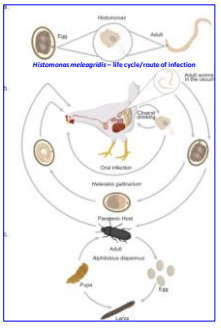
Histomonas meleagridis **– epizootiology**

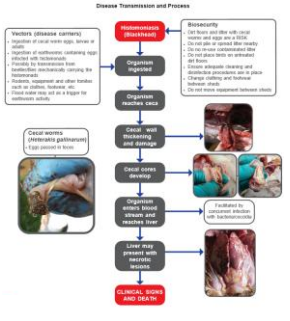
INDIRECT TRANSMISSION

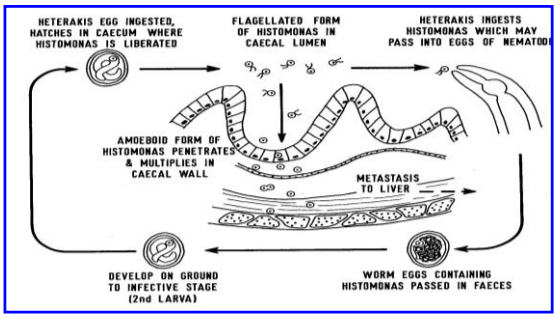


Histomonas meleagridis can survive in embryonated ***Heterakis* spp.** eggs **>2 years** in the soil and in the earthworms









Histomonas meleagridis

HISTOMONOSIS – „BLACK HEAD"

enterohepatitis infectiosa meleagridum

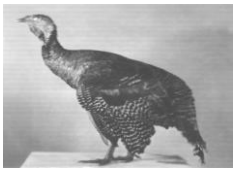
- outbreaks often associated with **high morbidity** and **mortality**

HOST: mainly turkeys, occasionally chickens, guinea fowl

PREDILECTION SITE: **caeca, liver**

- 14–weeks old turkeys – 100% mortality, acute disease
- birds, which recover, the caecum and liver may be permanently scared (irreversibile changes)

Histomonas meleagridis – clinical signs



INCUBATION PERIOD: 2–3 weeks
turkeys become apatic, ruffled feathers

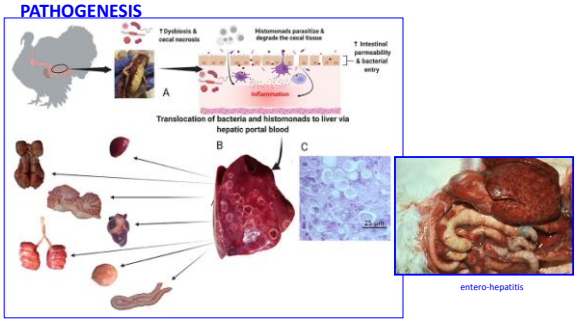
faeces: sulphur-yellow in colour

circulation disorders: **cyanosis** of the skin – comb + wattles + head

"BLACK HEAD"

Unless treated:
birds die within 1–2 weeks p.i.

PATHOGENESIS



entero-hepatitis

Histomonas meleagridis – clinical signs

TURKEY

degree of illness and mortality depends on age

- **young animals 3 – 12 weeks old** - very susceptible; acute course, leads to death (15–100 %)
- **older animals** - usually recover after chronic course of disease

Histomonas meleagridis – clinical signs

CHICKEN

- **are more resistant**; may remain asymptomatically infected with parasites confined to caeca
- they can be severely affected as a result of liver infection
- simultaneous infection of the caeca with *Eimeria tenella*


Histomonas meleagridis – pathogenesis – CAECA

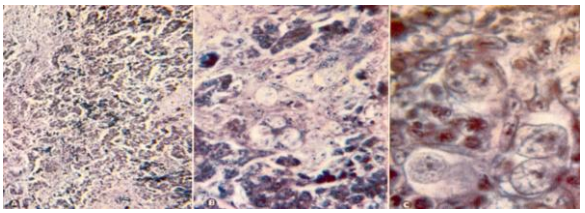

- from the **caecal lumen** histomonads penetrate into the **caecal wall**; they multiplay extracellularly – **lesions in the mucosa**

- thickened mucosa become necrotic, exudate is produced that can solidify into **hard, cheesy plugs**

Histomonas meleagridis – pathogenesis – LIVER

- histomonads reach the liver by the portal stream and colonise the **liver parenchyma**
- production of circular **necrotic foci (3-10 mm in diameter)** which increase in size as the parasite multiply in the periphery of the lesions
- histomonads **can also colonize** kidney, lung, spleen, brain, bursa of Fabricius and other organs (without anatomical changes)


Histomonas meleagridis – pathogenesis – LIVER



in the liver amoeboid forms, exhibit pseudopodial movement

Histomonas meleagridis – diagnosis

- ***Post mortem*** findings must be confirmed by **histological examination**
- **Differential diagnosis** *(Candida albicans...* etc.)
- **PCR** techniques
- Detection in **cultures**


Histomonas meleagridis – control

- Turkey should be kept **separate** from domestic chicken
- Hygienic maintenance of the animals in stables with disinfectable floors, feeders + drinkers; litter must be kept dry at all times
- Before restocking, floors should be cleaned and disinfected and litter renewed
- Systematic control of ***Heterakis gallinarum*** infection
- Systematic control of **coccidiosis** – ***Eimeria*** spp.

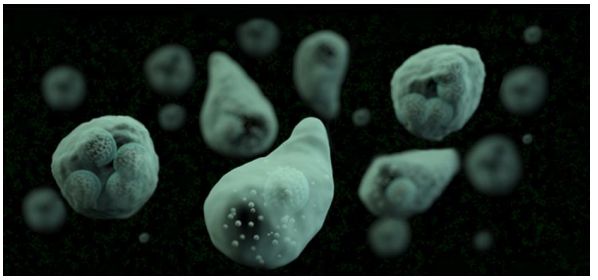
Histomonas meleagridis – treatment

- Currently, **there are no specific antihistomonal drugs** authorized for chemoprophylactic in Europe
- **Paromomycin** – alternative ATB
  - applied in feed at a concentration of 400 ppm
  - (permitted substance according to EU Regulation 37/2010)

Prevention

- **Do not range turkeys on ground previously used by chickens unless several years have elapsed.**
- **Rotate ranges periodically if possible.**
- **Cecal worm control is necessary to reduce blackhead incidence.**
- **Wire or slatted floors reduce exposure.**

AMOEBAS



Regnum: **EUKARYOTA, PROTOZOA**

Phylum: **AMOEBOZOA**

Classes: **ENTAMOEBIDAE LOBOSEA**

Order: **ENTAMOEBIDA** → Family: **Entamoebidae** → ***Entamoeba*** ***Endolimax*** ***Iodamoeba*** ....

Order: **CENTRAMOEBIDA** → Family: **Acanthamoebidae** → ***Acanthamoeba*** ***Naegleria***

Order: **EUAMOEBIDA** → Family: **Leptomyxiidae** → ***Balamuthia***

.....

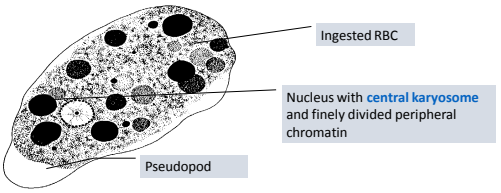
ENTAMOEBIDA

- ***Entamoeba histolytica*** (colon, liver) – **humans,** primates, dogs, cat, pigs, rats
- ***Entamoeba polecki*** – pig & goat, and **humans**
- ***Dientamoeba fragilis*** (caecum & colon)

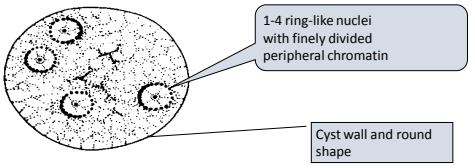
- ***Naegleria* spp.** nasal cavity, olfactory nerves, meninges
- ***Acanthamoeba* spp. skin, respir. tract, urogenital, meninges**
- ***Balamuthia* spp.** subacute, chronic form (*Acanthamoeba* like)

- ***Endolimax nana***
- ***Iodamoeba butschlii***

Entamoeba histolytica Morphology of trophozoite

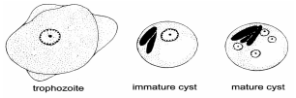


Entamoeba histolytica – Morphology of cyst

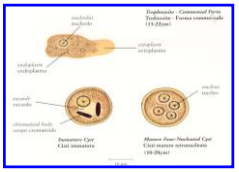


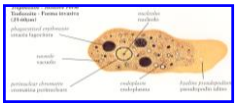
Two type of trophozoites:

- **Forma minuta** - 5 – 20 µm (chronic, latent), it forms cysts with 4 nuclei



- **Forma magna** - 10 – 60 µm (dysenteric) no cysts formation !





Entamoeba histolytica

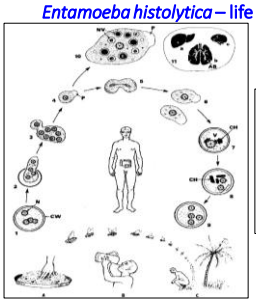
PRIMARY LOCALIZATION - COLON
dysentery, ulceration

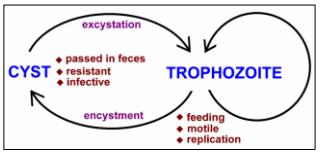
forma minuta

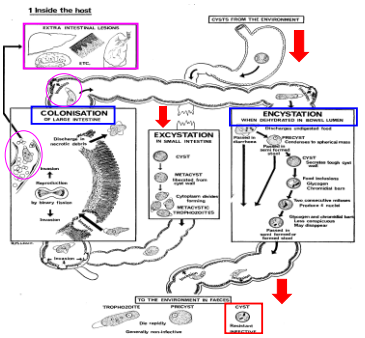
EXTRAINTESTINAL LOCALIZATION
hepatitis with abscesses
amoeboid icterus

forma magna

Entamoeba histolytica – life cycle







Entamoeba histolytica – clinical symptoms

1. most infections are **asymptomatic**

2. infections could develop to **progressive invasive disease** (young adults)
   - **intestinal disease** – small ulcers - colitis
     - perforation of intestine
     - acute, fatal amoebic dysentery
     - **hepatic abscess**
     - other extraintestinal localisation **lungs** or **brain**

aspiration from abscess in liver

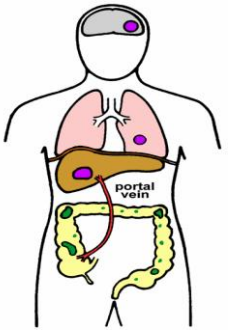
Pathogenesis, clinical symptoms

- Wide spectrum from **asymptomatic to intestinal**: dysentery, colitis, appendicitis, toxic megacolon, amebomas
- **Extra-intestinal form**: liver abscesses, peritonitis, pleuropulmonary abscesses, skin and genital ama lesions

Extra-intestinal entamoebosis

Disease Manifestations

ameboma = inflammatory thickening of intestinal wall around the abscess (can be confused with tumor)



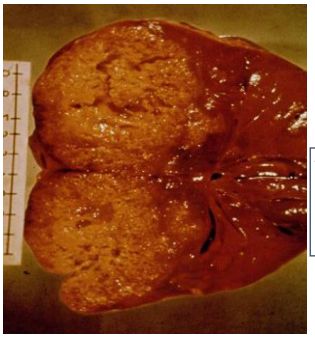
Symptomatic Infection:

Intestinal Amebosis: (colon and rectum)

- **Acute Dysenteric** (dysentery)
- **Chronic Non-Dysenteric** ("self-cured")

Extra-Intestinal Amebosis:

- **Amebic Liver Abscess (ALA)**
- **Amebic Pulmonary Abscess**
- **Other sites (brain, skin, ...)**

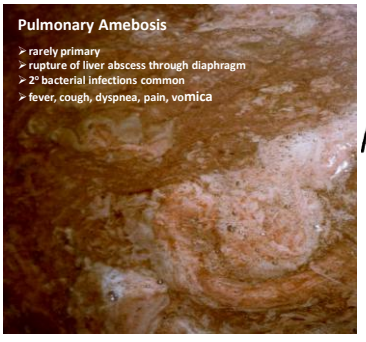


Extraintestinal Amebosis

- **metastasis via blood stream**
- **primarily liver (portal vein) frequent**
- **ameba-free stools common**
- **high antibody titers**

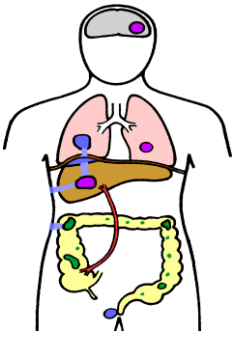
Amebic Liver Abscess

- **chocolate-colored 'pus'**
  - **necrotic material**
  - **usually bacteria free**
- **lesions expand and coalesce**
- **further metastasis, direct extension or fistula**



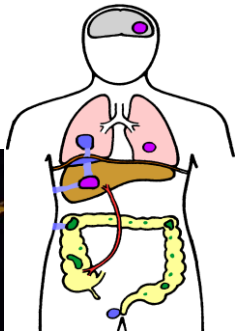
Pulmonary Amebosis

- **rarely primary**
- **rupture of liver abscess through diaphragm**
- **2° bacterial infections common**
- **fever, cough, dyspnea, pain, vomica**



Cutaneous Amebosis

- **intestinal or hepatic fistula**
- **mucosa bathed in fluids containing trophozoites**
  - **perianal ulcers**
  - **urogenital (eg, labia, vagina, penis)**



Laboratory Diagnosis

- **Examine stools** for trophs/cysts (suggestive)
- **Blood cell counts** - leukocytosis?
- **Radiologic Studies** (flat, CT, NMR?)
- **Serologic tests** (IHA or ELISA), Liver enzyme profile is usually normal
- **Catheterize** abscess and **aspirate**: Examine "anchovy paste" aspirate for trophozoites and do serologic testing for amebic antigens
- **Culture** for other pathogens (sterile on first stick, then contaminants)
- **Chemotherapeutic Trial**

Entamoeba histolytica – prevention

- Avoid of fecal contamination of water
- proper hygiene

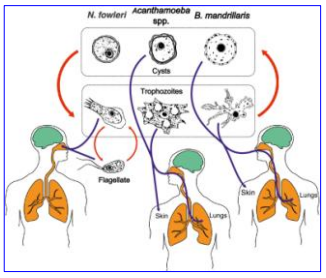
IN ENDEMIC AREAS

- consumption **only boiled (cooked) food, water**
- drinking water treat with 9 drops of 2% tincture of iodine per 1 liter for 30 min.
- Cleaning of uncooked fruits and vegetables
- Prevention of contamination of foods

Entamoeba histolytica – therapy

- NITHROIMIDAZOLES:
  metronidazol, ornidazol, tinidazol ...
- CHLOROXIN
- PAROMOMYCIN

Free-living amoebae infections

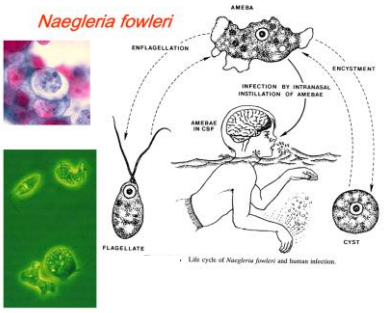


Free-living amoebae infections

Naegleria fowleri

- Mainly affects young, immunocompetent, healthy individuals
- Penetration of the host: nasal cavity, olfactory nerves, meninges
- **INCUBATION PERIOD:** 3 – 7 days
- **Primary amoebic meningoencephalitis**
- **CLINICAL SYMPTOMS:** sore throat, blocked nasal passages, intense cephalalgia, fever, vomiting, coma (in 3 – 4 days)
- **Disease is fatal**

Naegleria fowleri



Life cycle of *Naegleria fowleri* and human infection.

Free-living amoebae infections

***Acanthamoeba* spp.**

- Immunodeficient, weakened individuals
- Invasion of host through the skin, respiratory tract, urogenital tract, spreading through the bloodstream to the brain and meninges
- **INCUBATION PERIOD:** unknown (weeks, or months)
- **Granulomatous amoebic meningoencephalitis**
- **CLINICAL SYMPTOMS:** cutaneous papules, nodules, ulcers, sinusitis, cephalalgia, meningeal signs, OFTEN infect ocular cornea, keratitis, uveitis, blindness...

Acanthamoeba culbertsoni