

# Protozoon II

2010 02 10

Dr. Bereik Zsuzsa

# Parasitologia

Protozoonok és Helminthek, azaz Férgék

Felosztás:

Vér és Szövetek közt élő Protozoonok

Vér és Szövetek közt élő Férgék

Bélben és testüregekben élő Protozoonok

Bélben és testüregekben élő Férgék

# Protozoonok

## Általános jellemzés

**Egysejtű, eukaryota véglények (heterotroph, anaerob, aerob)**

**Méret: 2–80  $\mu\text{m}$ , átlag 50  $\mu\text{m}$ , „pici” 10 $\downarrow$ ; „nagy” 100 $\uparrow$   $\mu\text{m}$**

**Komplex életciklus, különböző stádiumok, fejlődési szakaszok**

**Aszexualis: haránthasadás;**

**Apicomplexa szexualis és aszexualis reproductio**

**Fertőzések:**

**Asymptomatikus  $\rightarrow$  életveszélyes**

# Protozoonok

## Általános jellemzés

Regnum: Protista (215 000 ismert faj)

Alkirályság: Protozoa („állatszerű”)

Phylum: 6

100 human adaptált faj

**20 human pathogen**

**Kb. 12 ismert genom!**

### **Forma:**

Trophozoit (vegetatív – aktív, táplálkozik, szaporodik)

Cysta (túlélő – protectiv membran/vastag fal)

# Protozoonok

## Általános jellemzés

### Szakkifejezések, elnevezések

#### Trophozoit formák:

#### Haemoflagellaták

Amastigot

Promastigot

Epimastigot

Trypomastigot

??? Flagellum +/-

??? Kinetoplast helye

#### Apicomplexa

Tachyzoit; Bradyzoit (*Toxoplasma gondii*)

Merozoit (*Plasmodia*)

Gametocyta/gameta – szexuális forma

# Protozoa

## General characterisation

Szakkifejezések, elnevezések  
aszexuális reproductio:

### Apicomplexa

Endodyogenia (Toxoplasma)

Schizogonia (Plasmodia)

Szexuális reproductio:

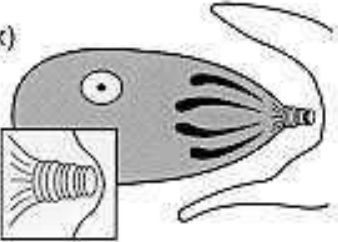

### Apicomplexa

Gameta (gamogonia)

Megtermékenyülés → Zygota → Encystatio → Oocysta

Oocystában: infectív sporozoiták (sporogonia)

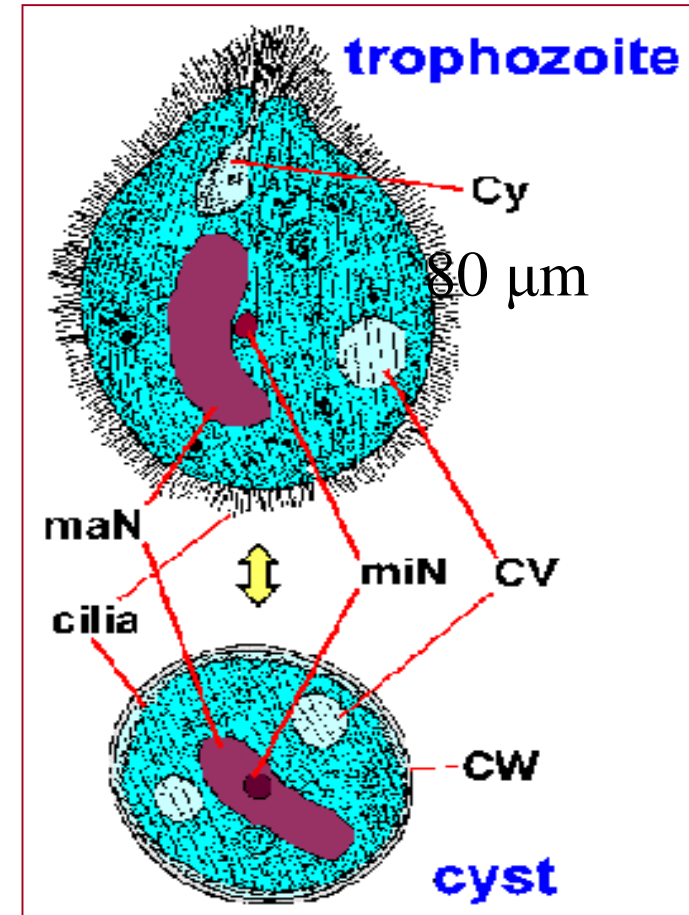
**Table 77-1. Classification of Parasitic Protozoa and Associated Diseases**

Phylum	Subphylum	Representative Genera	Major Diseases Produced in Human Beings	Chapter
Sarcomastigophora (with flagella, pseudopodia, or both)	Mastigophora (flagella)	<i>Leishmania</i>	Visceral, cutaneous and mucocutaneous infection	82
		<i>Trypanosoma</i>	Sleeping sickness Chagas' disease	
		<i>Giardia</i>	Diarrhea	80
		<i>Trichomonas</i>	Vaginitis	
	Sarcodina (pseudopodia)	<i>Entamoeba</i>	Dysentery, liver abscess	79
		<i>Dientamoeba</i>	Colitis	
		<i>Naegleria</i> and <i>Acanthamoeba</i>	Central nervous system and corneal ulcers	81
		<i>Babesia</i>	Babesiosis	
Apicomplexa (apical complex)		<i>Plasmodium</i>	Malaria	83
		<i>Isospora</i>	Diarrhea	80
		<i>Sarcocystis</i>	Diarrhea	
		<i>Cryptosporidium</i>	Diarrhea	
		<i>Toxoplasma</i>	Toxoplasmosis	84
Microspora	—	<i>Enterocytozoon</i>	Diarrhea	—
Ciliophora (with cilia)		<i>Balantidium</i>	Dysentery	80
Unclassified	—	<i>Pneumocystis</i>	Pneumonia	85

Medmicro ch77

# Egyszerűsített morfológia, taxonómiai besorolás (class, genus, species)

- **Lobosea (amoebae)**  
*Entamoeba*  
*Naegleria, Acanthamoeba*
- **Flagellata**  
*Giardia, Trichomonas*  
*Leishmania, Trypanosoma*
- **Sporozoa (apicomplexa)**  
*Cryptosporidium*  
*Toxoplasma,*  
*Plasmodium, Babesia*
- **Ciliata** →



*Balantidium coli*



# Bél/testüreg

**Ameba/rhizopoda/lobosea**

Entamoeba histolytica

**Flagellata/mastigophora**

Giardia lamblia

Trichomonas vaginalis

**Ciliata/ciliophora**

Balantidium coli

**Sporozoa (apicomplexa)**

Cryptosporidia



## Vér/szövetek

### Ameba/rhizopoda

Naegleria

Acanthameba

### Flagellata/mastigophora

#### Trypanosoma

T. brucei gambiense/rhodesiense → álmokór

T. cruzi → Chagas kór

#### Leishmania

L. donovani → visceralis, Kala-azar

L. tropica → cutan, Aleppo fekély

L. brasiliensis → muco-cutan, Espundia

### Sporozoa (apicomplexa)

#### Plasmodia sp.

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

#### MALARIA

### Toxoplasma gondii

toxoplasmosis



# Ameba/rhizopoda

**Human mucosa** adaptált:

commensalisok: *Entamoeba gingivalis*, *E. hartmanni*, *E. coli*, *E. dispar*

pathogen: *E. histolytica*

**Szöveti** pathogenek:

Szabadon élő (víz, talaj) amoebák:

*Naegleria fowleri*, *Acanthamoeba castellani*

## GI tractus

Ameba/rhizopoda/lobosea

**Entamoeba histolytica**

Flagellata/mastigophora

Giardia lamblia

Trichomonas vaginalis

Ciliata/ciliophora

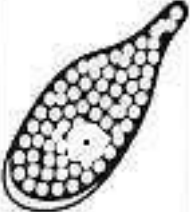

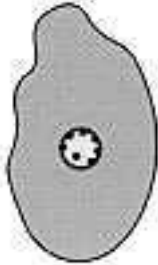

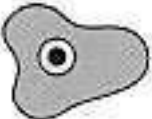
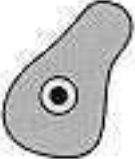






Balantidium coli

**Sporozoa (apicomplexa)**

Cryptosporidia

# GI tractus

# Ameba/rhizopoda

		Amebae					
		<i>Entamoeba histolytica</i>	<i>Entamoeba hartmanni</i>	<i>Entamoeba coli</i>	<i>Entamoeba polecki*</i>	<i>Endolimax nana</i>	<i>Iodamoeba bütschlii</i>
Trophozoite							
Cyst							

\*Rare, probably of animal origin

**FIGURE 79-3**  
**Amebas found in stool specimens of humans.**

(Modified from Brooke, MM, Melvin DM: Morphology of diagnostic stages of intestinal parasites of man. Public Health Service Publication No. 1966, 1969.)

## ***Entamoeba histolytica*** - amoebás dysenteria

Loesch 1875 (Oroszország)

A legegyszerűbb, de 2-dik legjelentősebb és legelterjedtebb

500 millió fertőzött

50 millió vérhas eset

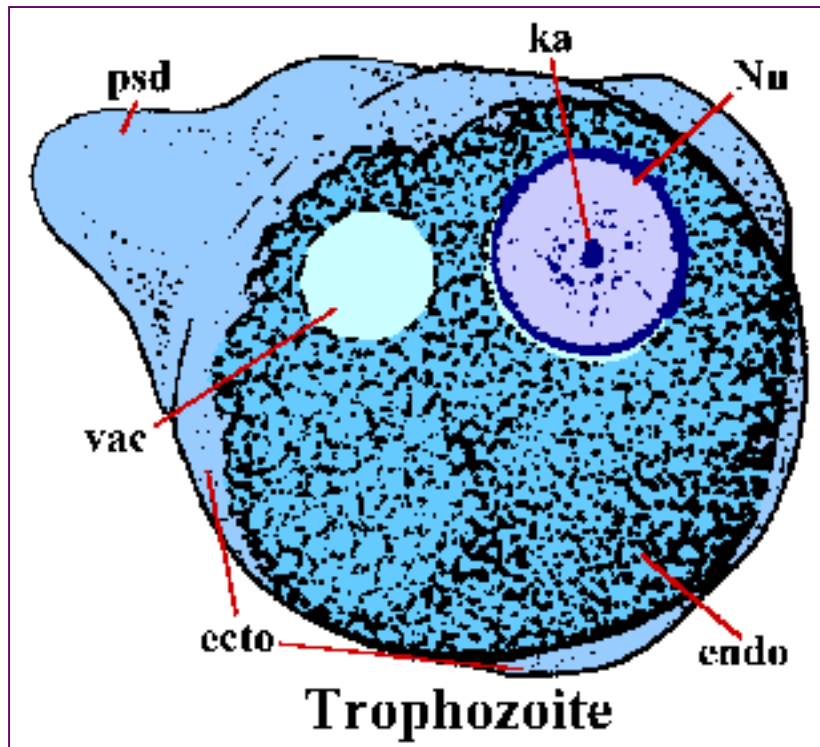
100 000 haláleset/év

A legerősebb cytolyticus hatás

cysta: nedves, párás közegben hetekig túlél!

# *Entamoeba histolytica* - amoebás dysenteria

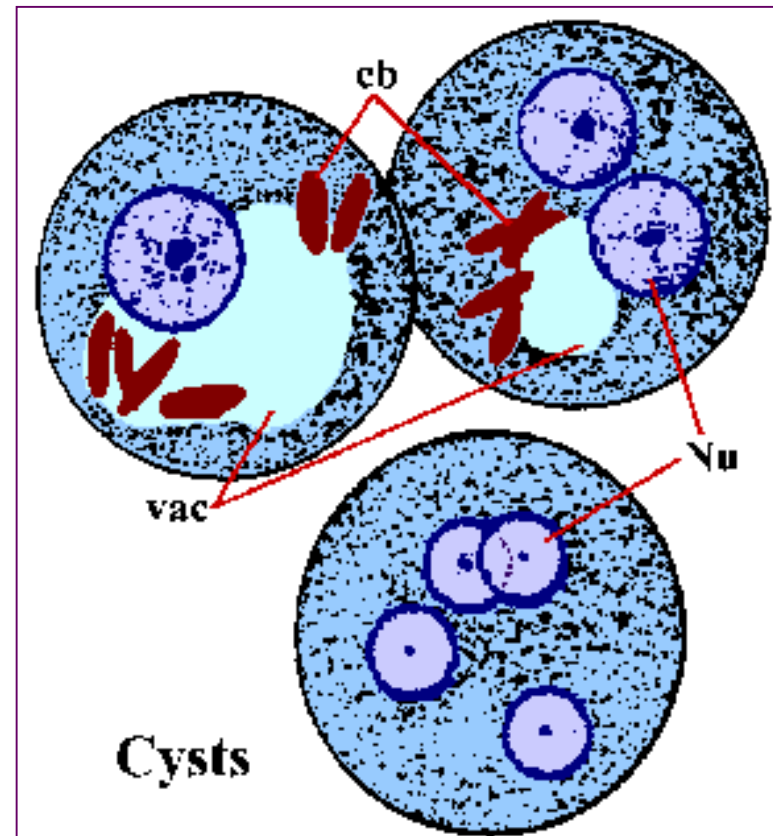
Morphologia → 10 – 50  $\mu\text{m}$



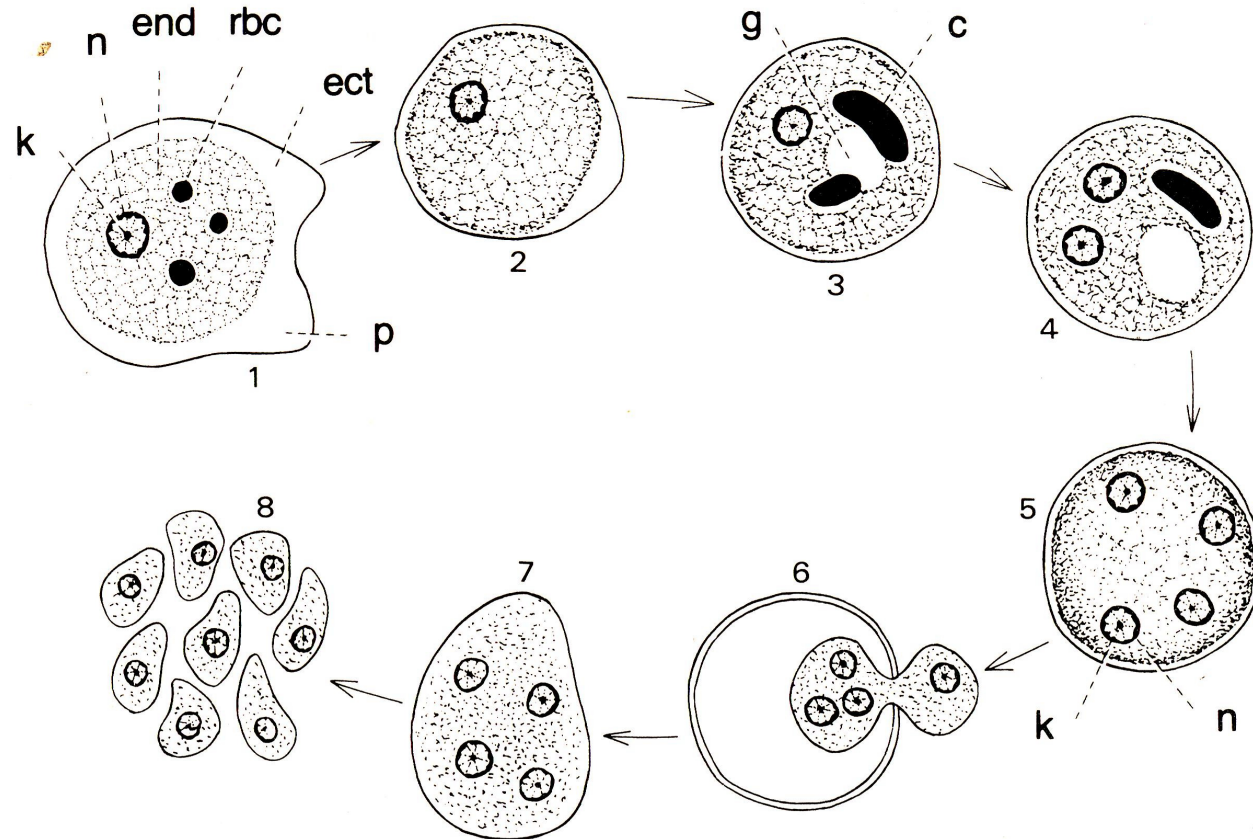
15-50  $\mu\text{m}$

[www.tulane.edu](http://www.tulane.edu)

8-15  $\mu\text{m}$



***Entamoeba histolytica*** -  
amoebás  
dysentheria



**Életciklus:**

trophozoit –  
cysta –  
trophozoit

- 1: Trophozoite
- 2: Precystic amoeba
- 3: Uninucleate cyst
- 4: Binucleate cyst
- 5: Mature quadrinucleate cyst
- 6: Excysting
- 7: Metacyst
- 8: Metacystic trophozoite

- c: chromatoid bodies
- ect: ectoplasm
- end: endoplasm
- g: glycogen vacuole
- k: karyosome
- n: nucleus
- p: pseudopodia
- rbc: red blood cell



***Entamoeba histolytica*** - amoebás dysenteria

**Fertőzés forrása:**

hordozók,  
cysta - ürítők (emberek!)

**Transmissio:**

faeco-oralis (víz, zöldség)

Ritkán: direkt kontaktus (anális), légy

## ***Entamoeba histolytica*** - amoebás dysenteria

### **Virulencia faktorok**

**Csíraszám:** 10 – nél kevesebb cysta elég!

### **Adhesiós molekulák**

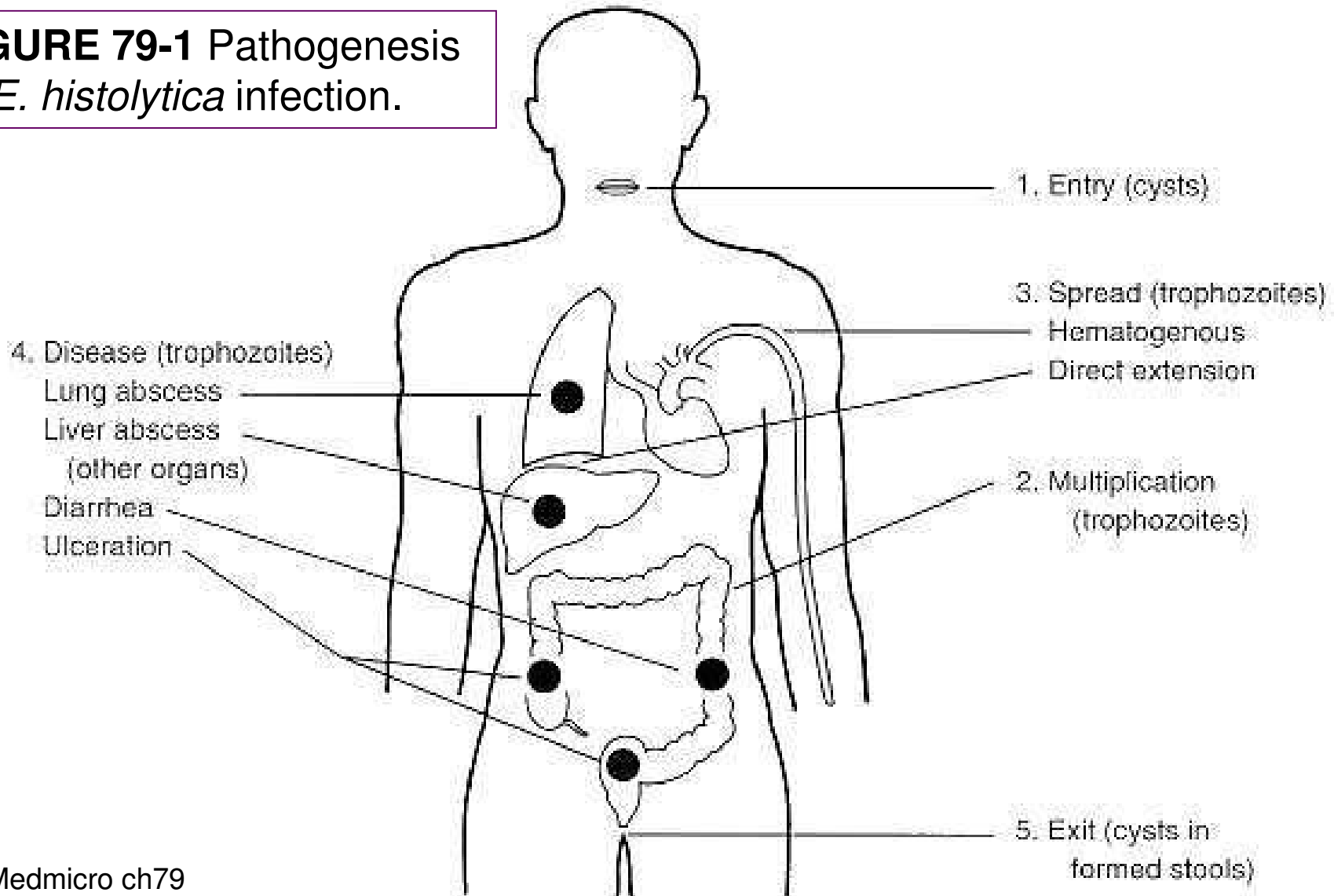
Gal/GalNac **lectin**

Amoeba ionophorin (**amoeboporin**)

**Histolyticus enzimek:** protease-ok, **cystein kinase, phospholipase A**, hialuronidase, collagenase, elastase, RNase

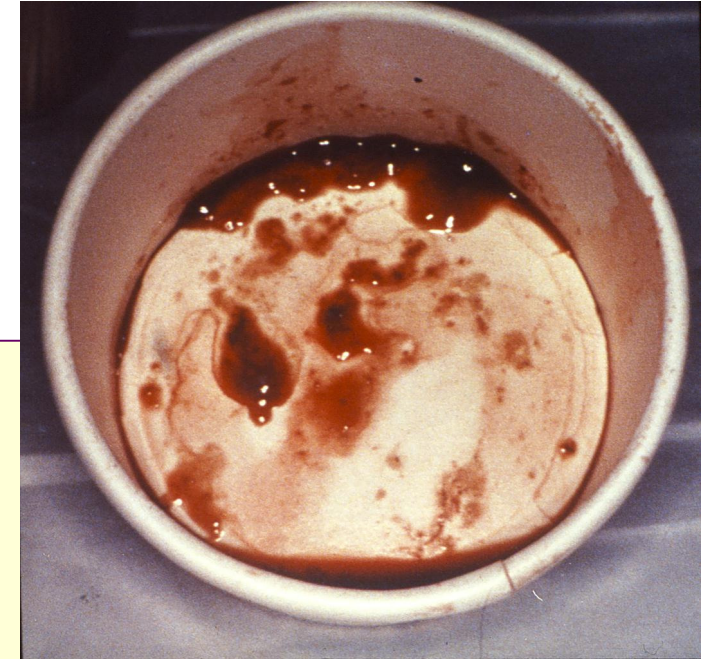
# *Entamoeba histolytica* - amoebás dysenteria

**FIGURE 79-1** Pathogenesis of *E. histolytica* infection.



# ***Entamoeba histolytica*** - amoebás dysenteria

„széklet”



**Kórképek, klinikai formák**

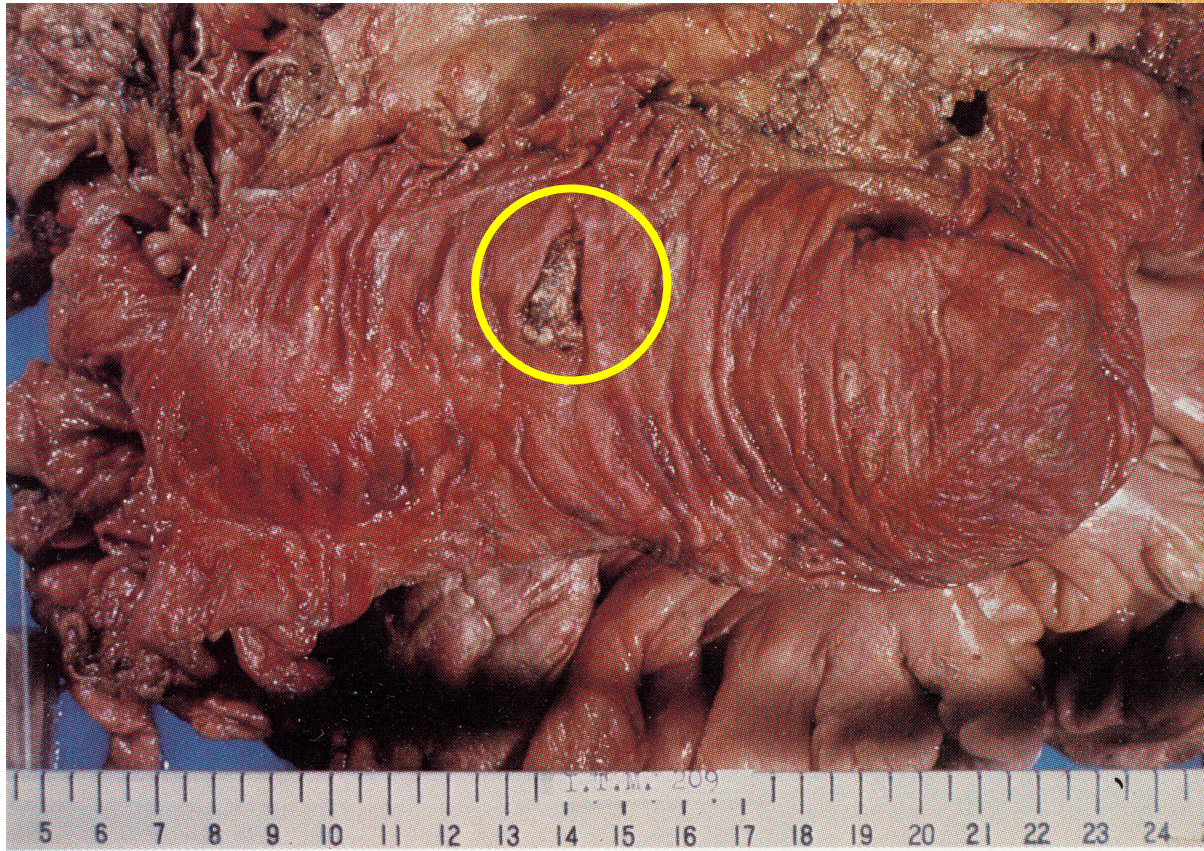
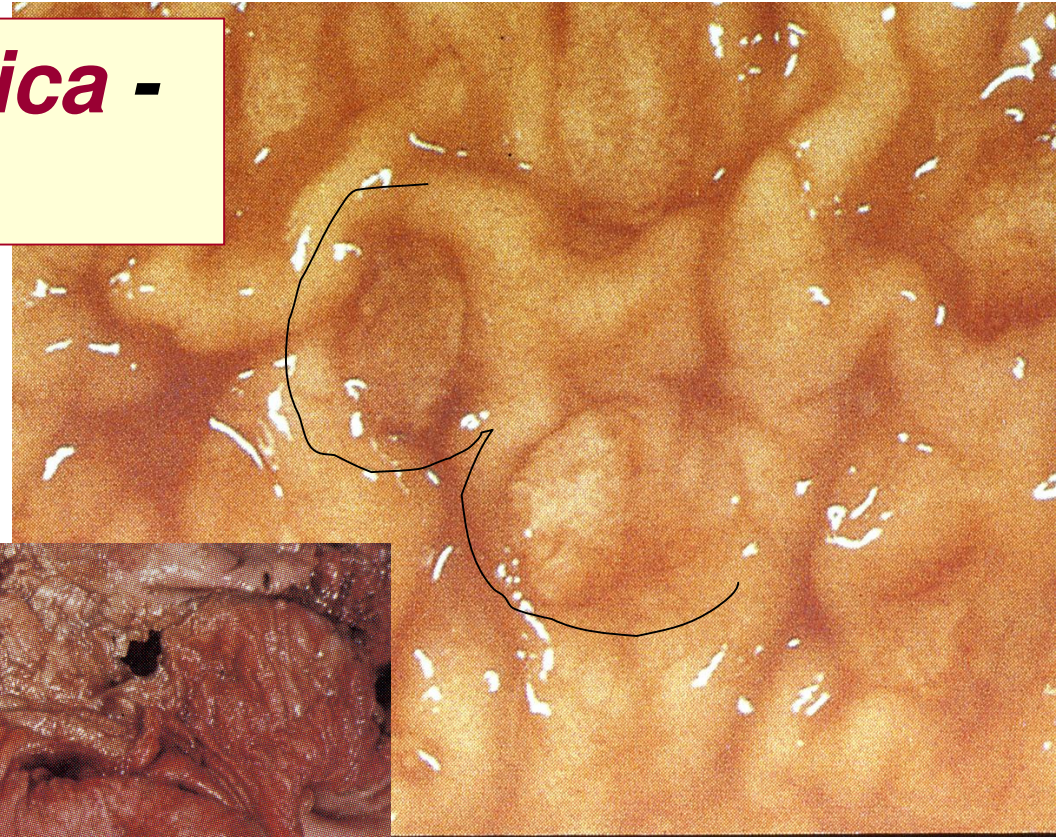
Amoebás colitis, peritonitis

extraintestinalis amoebiasis

Tályogok – máj, tüdő, agy

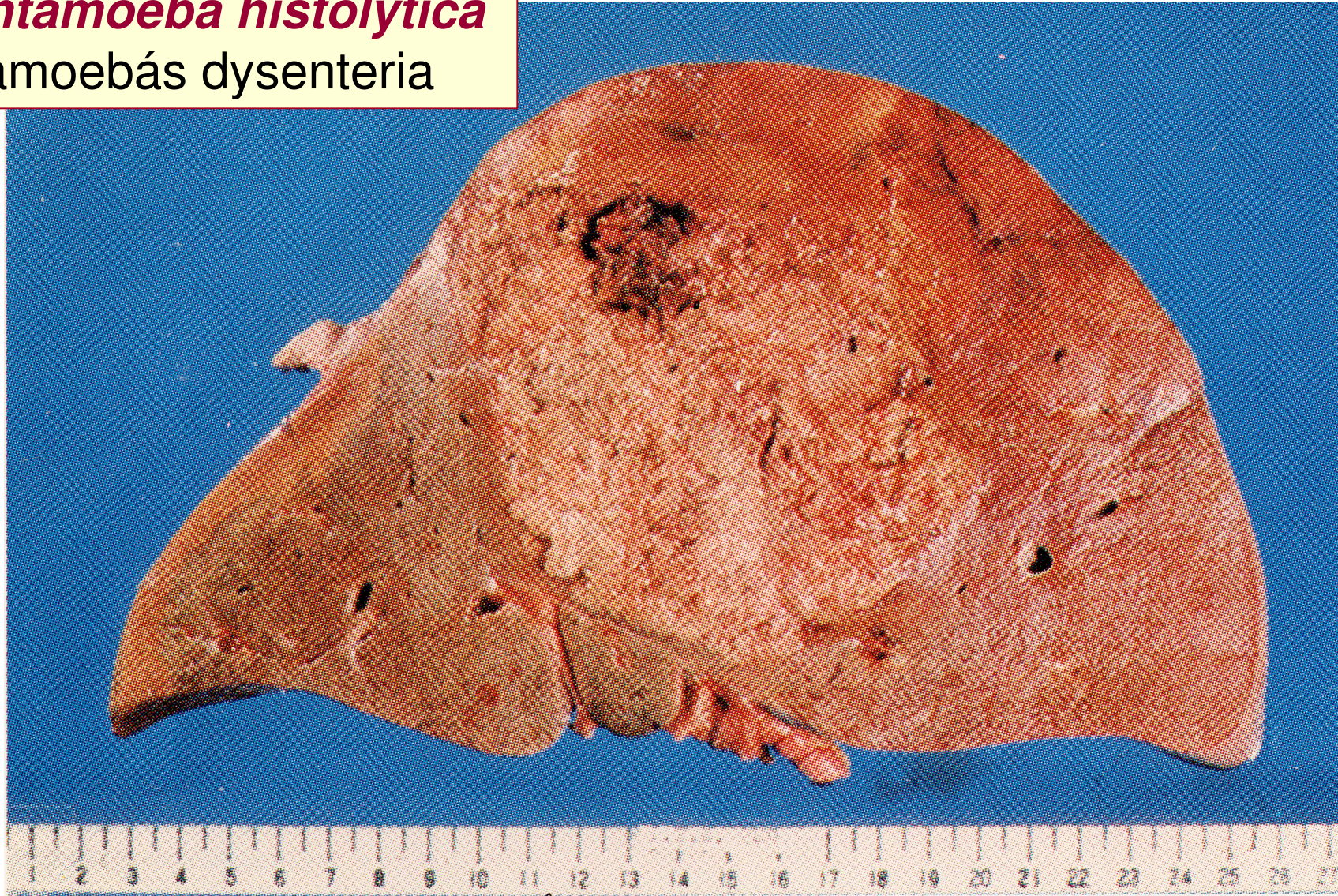
Chronicus intestinalis amoebiasis

***Entamoeba histolytica* -  
amoebás dysenteria**



**fekélyek**

***Entamoeba histolytica***  
- amoebás dysenteria



Amoebic liver abscess. 45-year-old man. Fetal head size abscess seen in the right lobe. Y173

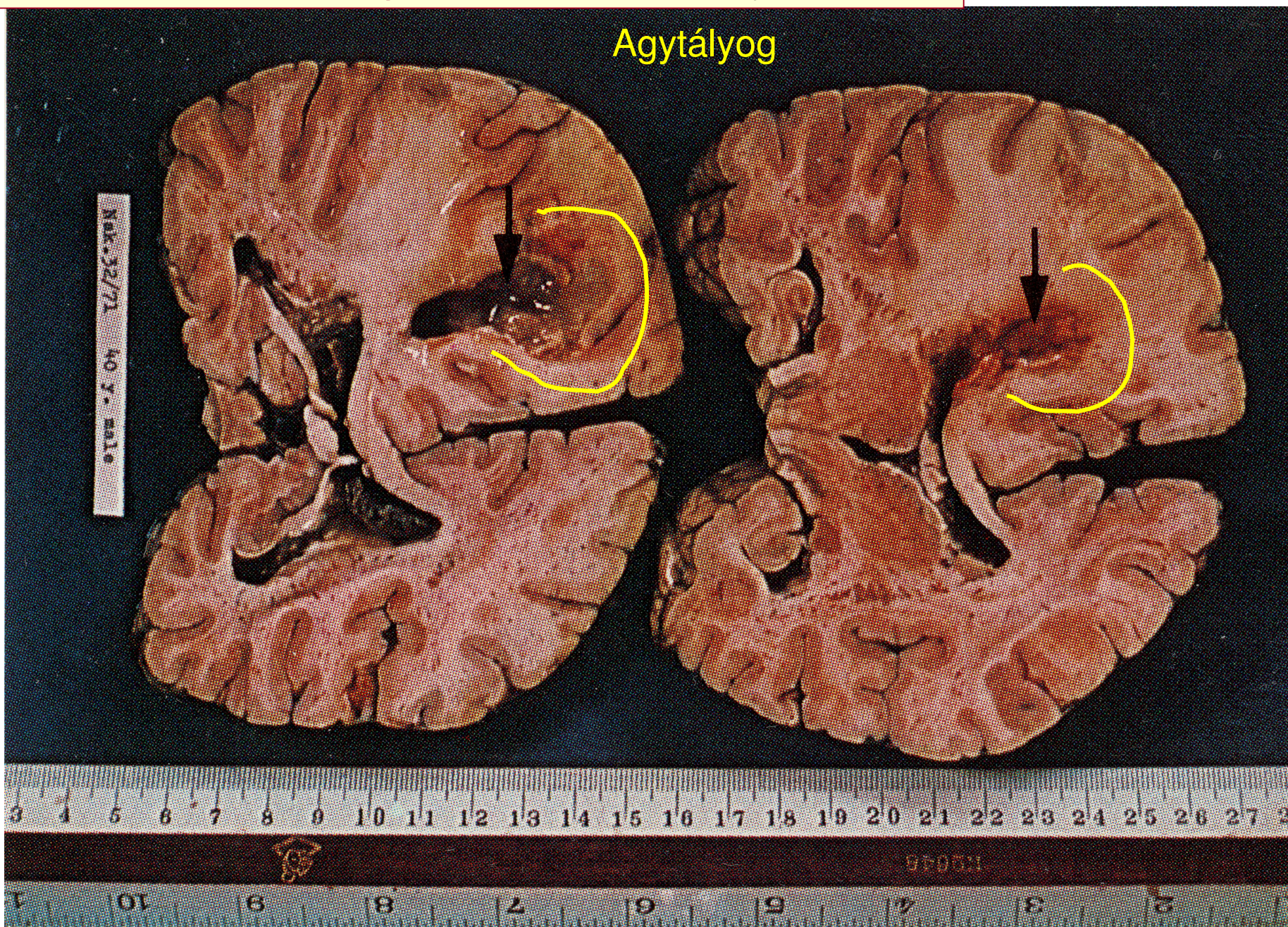
***Entamoeba histolytica***  
- amoebás dysenteria

Amoebic liver abscess. 59-year-old man.  
Enlarged liver, ruptured abscess. Y174



***Entamoeba histolytica* - amoebás dysenteria**

Agytályog





## ***Entamoeba histolytica*** - amoebás dysenteria

### **Diagnosis**

Direct kimutatás -mikroszkóp:  
trophozoitok (emésztett vvt!)

Minta: széklet (friss, meleg!), colonoscopiás  
biopszia

Cysta ürítők: Ag detektálás (ELISA)

# ***Entamoeba histolytica*** - amoebás dysenteria

## **Therapia**

Amoebás dysenteria, extraintestinalis amoebiasis:

**metronidazole** (10 nap) vagy tinidazole (5 nap)

Kontroll: Ag kimutatás vagy PCR

Cysta ürítés megszüntetése: paromomycin (nem felszívódó aminoglycoside)

## **Preventio, megelőzés**

Cysta mentes, egészséges ivóvíz (forralás, szűrés 1  $\mu\text{m}$ )

NO nyers zöldség, NO jégkocka, NO hámozhatatlan gyümölcs

- **cysta: a szokványos klórozást túléli!**

**Védőoltás – kísérleti szakasz:**

a./ recombináns adhesiós molekula

b./ élő amoeba, amoeboporin és cystein kinase mentes

## GI tractus

**Ameba/rhizopoda/lobosea**

Entamoeba histolytica

**Flagellata/mastigophora**

**Giardia lamblia**

Trichomonas vaginalis

**Ciliata/ciliophora**

Balantidium coli

**Sporozoa (apicomplexa)**

Cryptosporidia

GI tractus

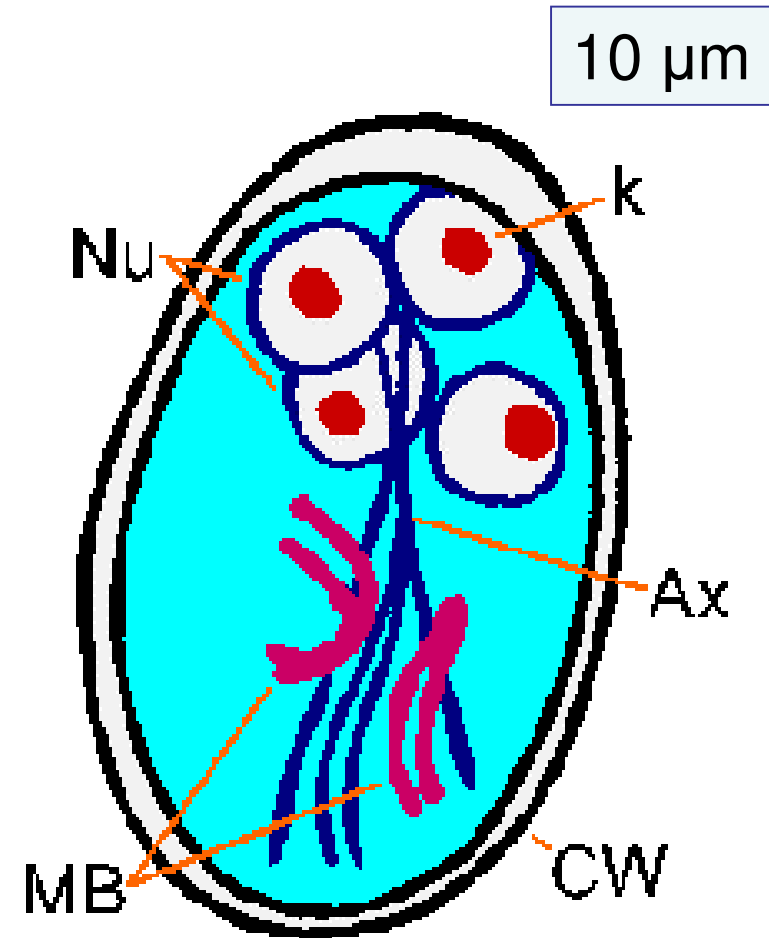
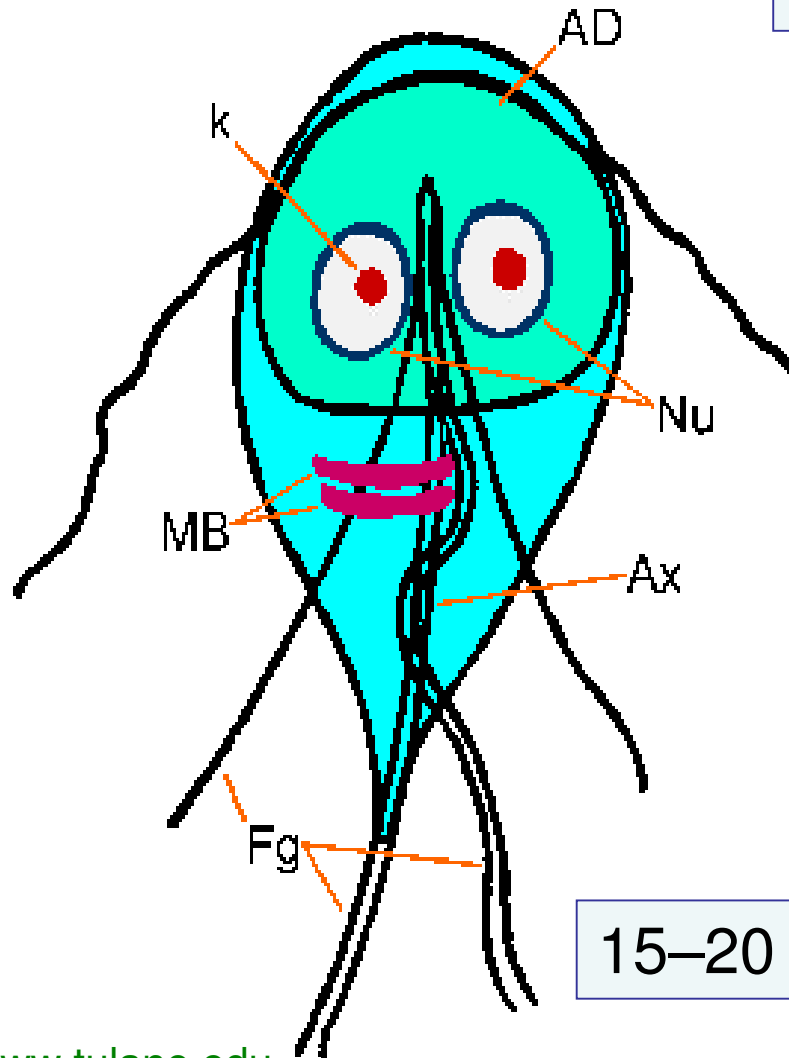
Flagellata

Giardia lamblia

# Giardia lamblia

Flagellata: GI mucosa-hoz adaptált

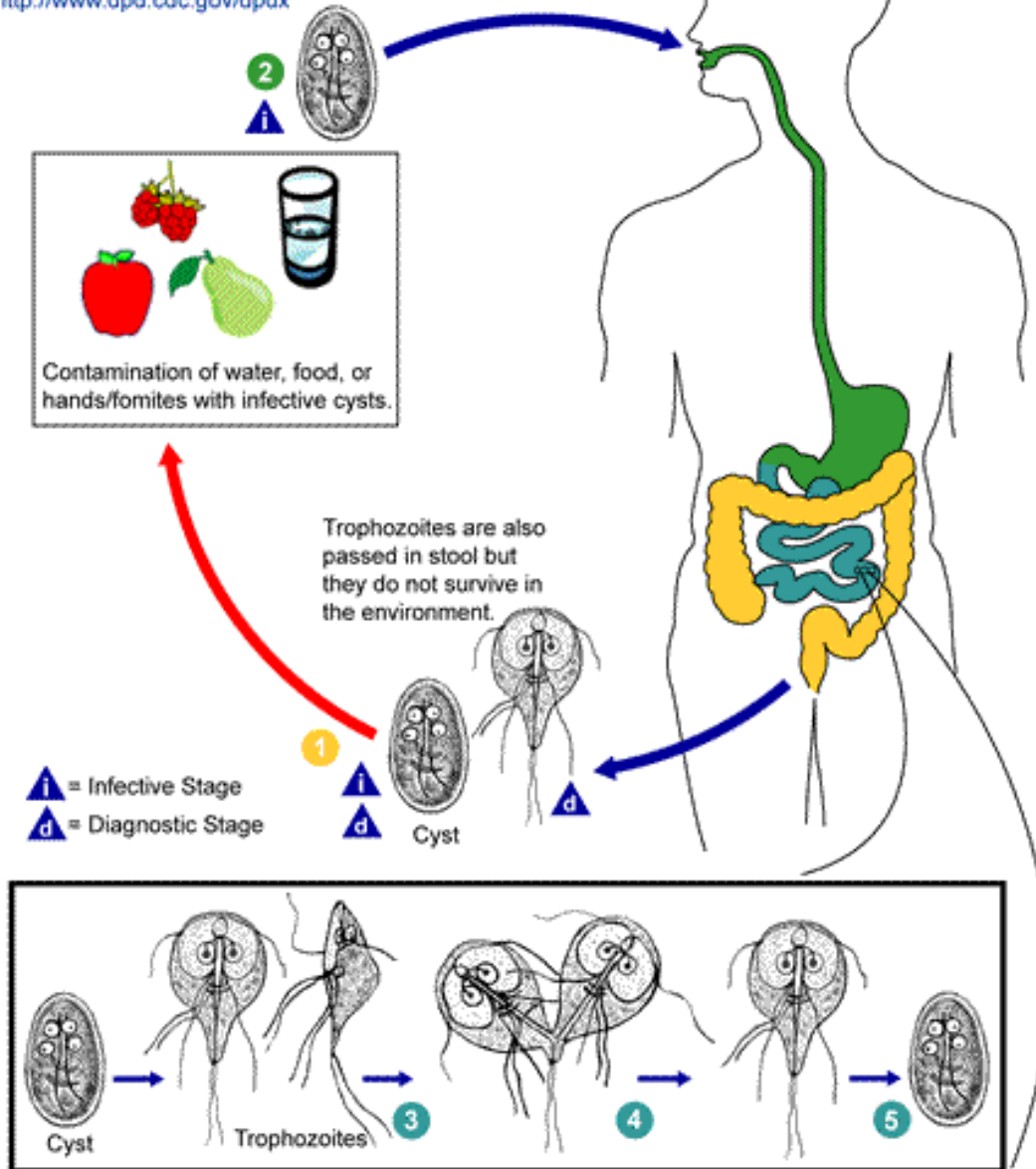
Morphologia → 10 – 20 μm





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<http://www.dpd.cdc.gov/dpdx>

## Life cycle



# Giardia lamblia

- faeco-oralis transmissio
- forrás: cysta hordozók  
szennyezett víz, élelmiszer
- duodenum, vékonybél
- nincs invasio
- 2-dik leggyakoribb  
bélprotozoon

# Giardia lamblia

mechanikai irritatio, gyulladás

## Kórkép

### **Giardiosis**

acut: enyhe hasmenés, híg, bűzös, zsíros széklet

chronicus: mucosa atrophia, malabsorptio

## Diagnosis

Direkt kimutatás - mikroszkóp

**Trophozoit duodenum váladékból festett, natív**

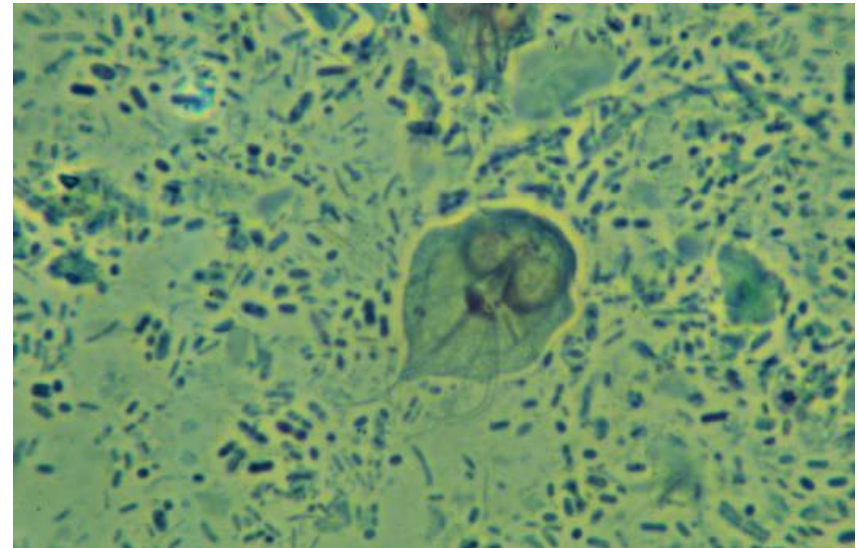
**Trophozoit, cysta – friss széklet, natív, DIF**

## Therapia

**metronidazole** vagy tinidazole,  
paromomycin



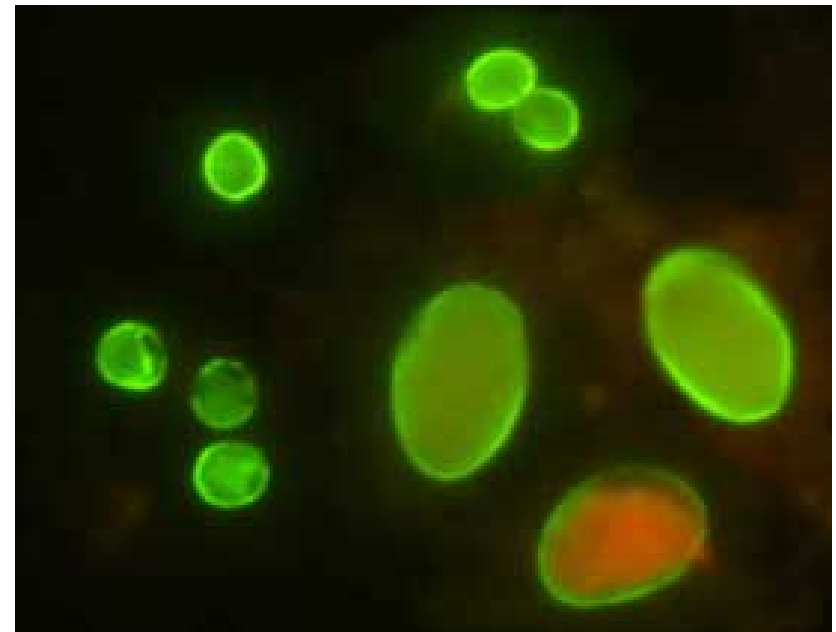
**native**



*Giardia* image  
from <http://pangloss.ucsfmedicalcenter.org/SFGH/Microbiology/images/Giardia.jpeg>



**DIF**





## GI tractus

**Ameba/rhizopoda/lobosea**

Entamoeba histolytica

**Flagellata/mastigophora**

Giardia lamblia

**Trichomonas vaginalis**

**Ciliata/ciliophora**

Balantidium coli

**Sporozoa (apicomplexa)**

Cryptosporidia

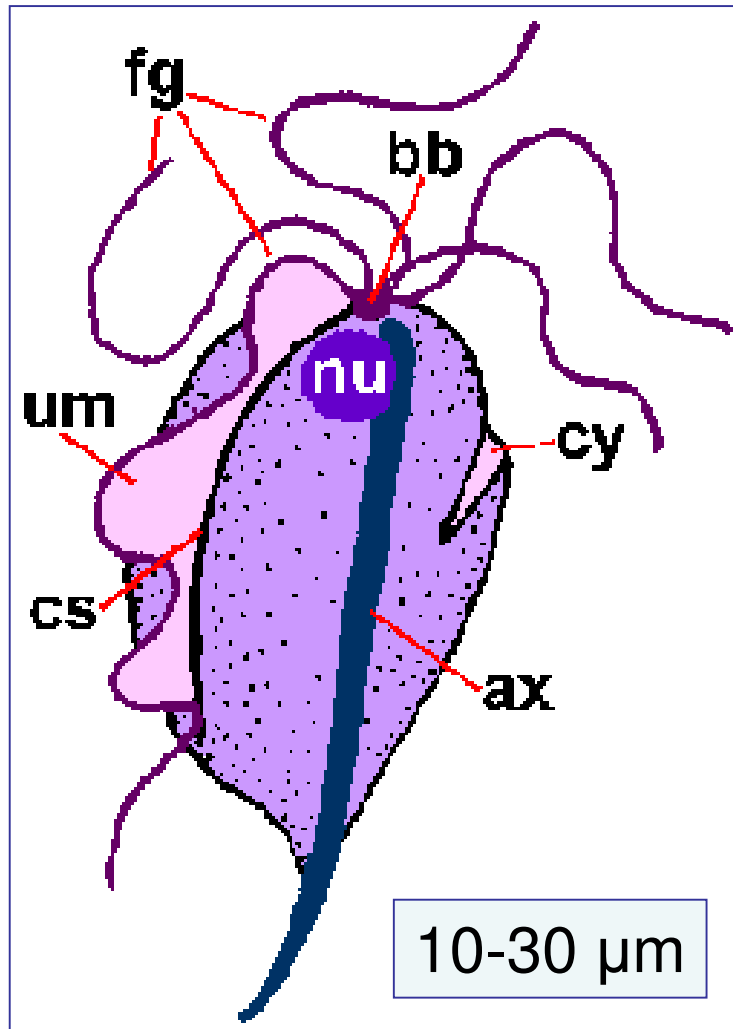
# Flagellata

## Luminalis / testüregi

# Trichomonas vaginalis

# Trichomonas vaginalis

**Flagellata** urogenitalis  
epithelhez adaptált

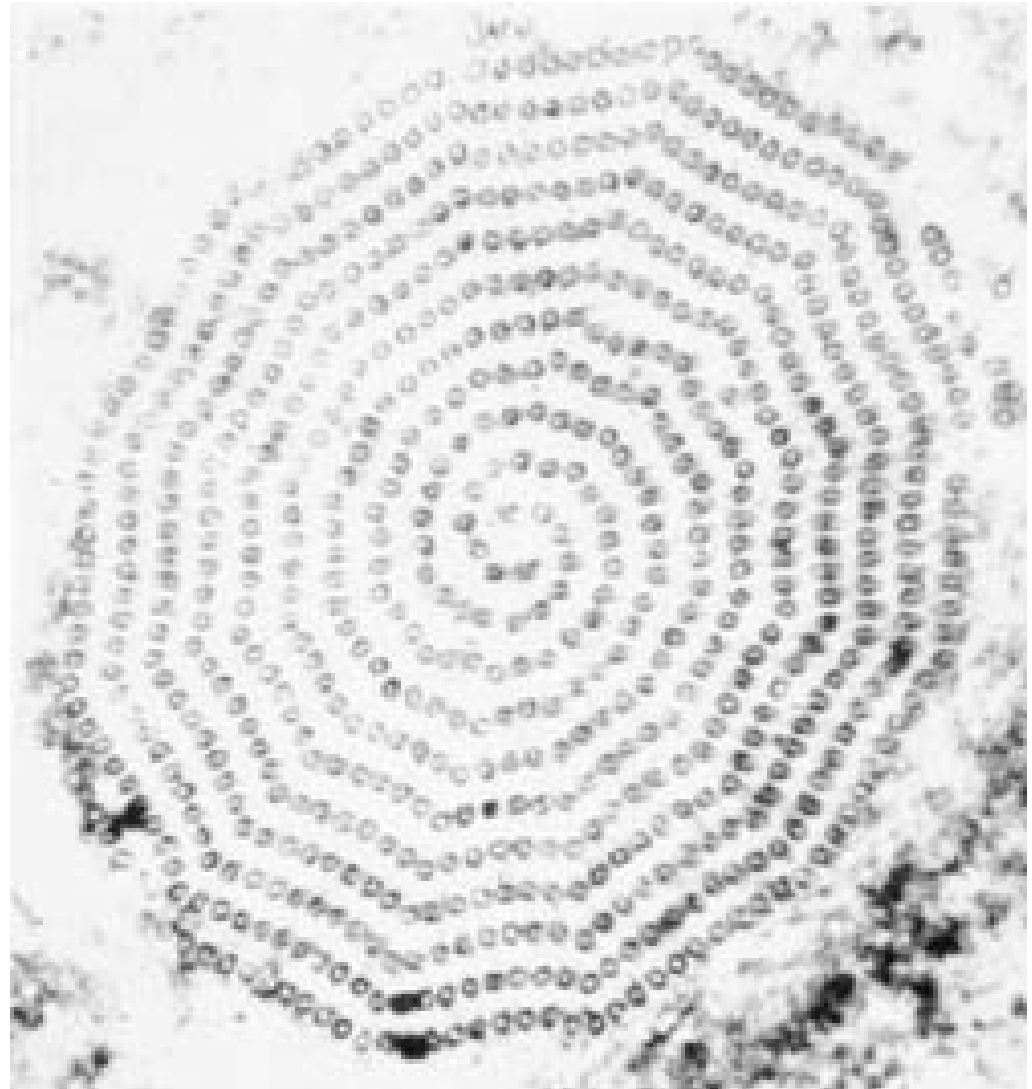


## Morphologia

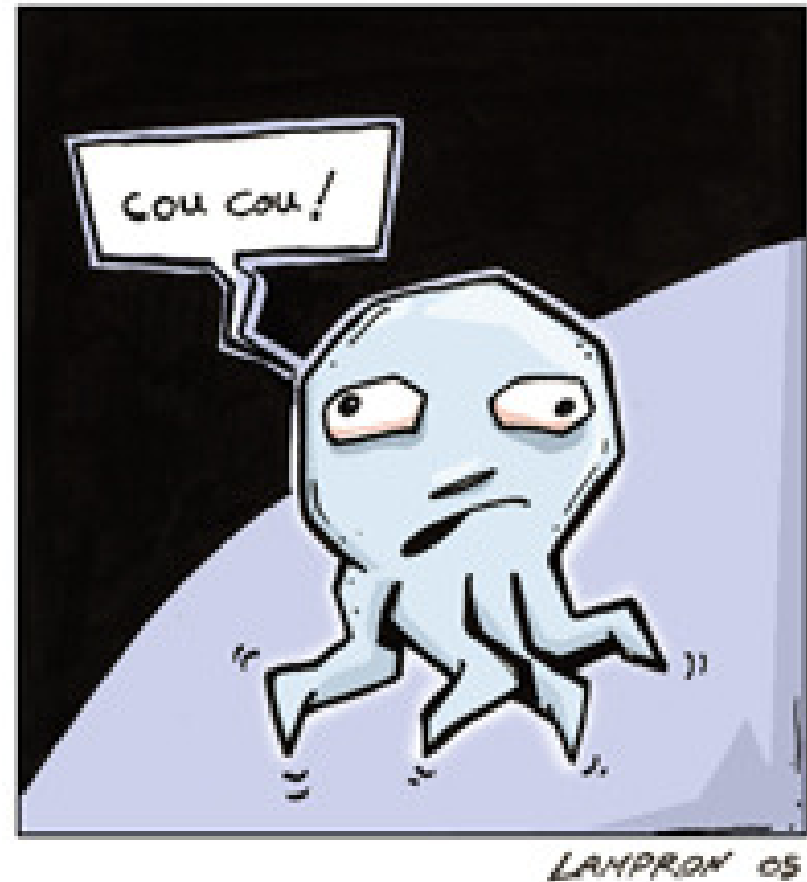
# NINCS CYSTA!

haránthasadás

Giemsa-stained trophozoite of *T. vaginalis* from in vitro culture.  
Electron micrograph of axostyle cross-section showing  
concentric rows of microtubules (right).



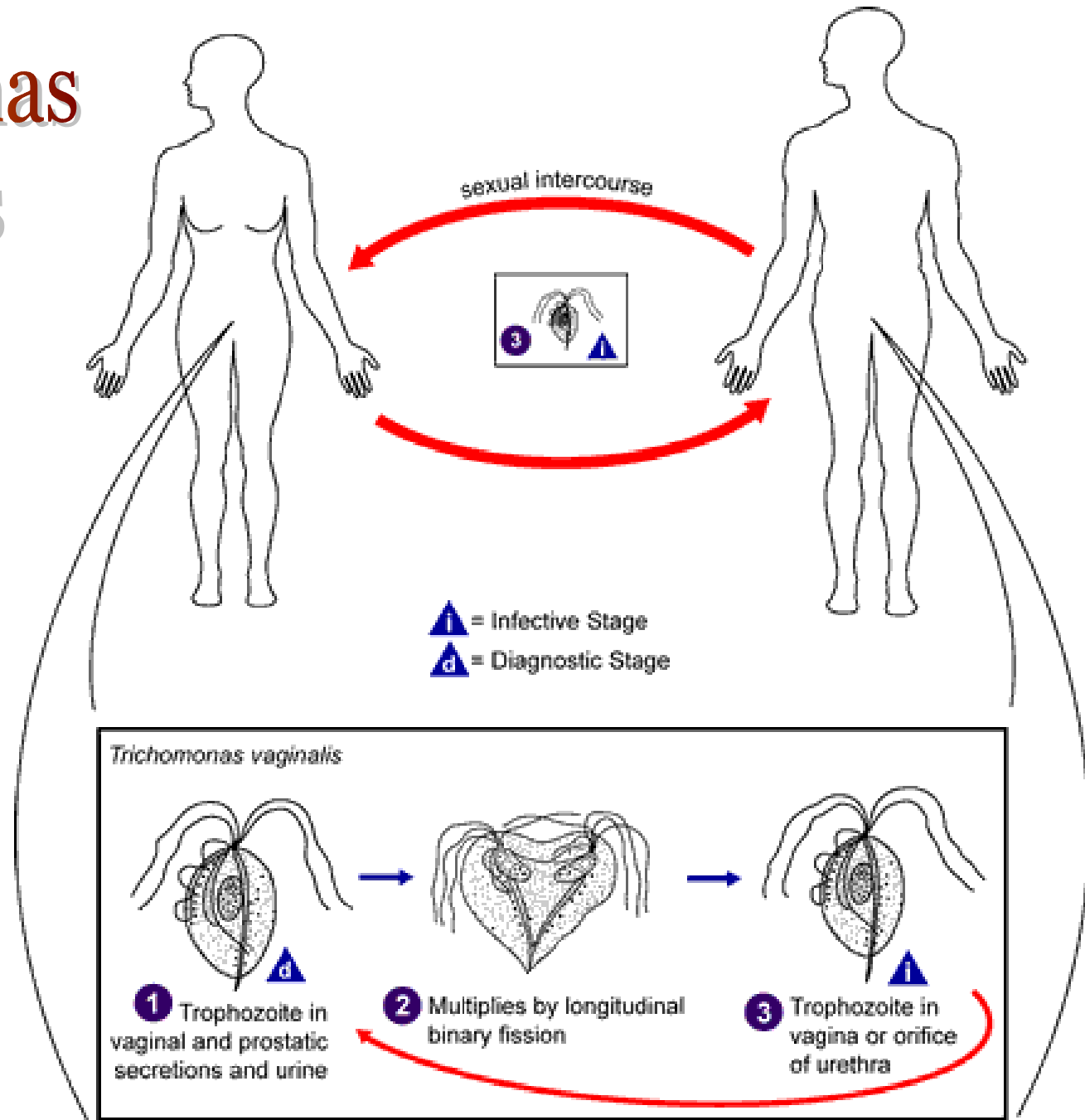
# Trichomonas vaginalis



[www.youngandhealthy.ca](http://www.youngandhealthy.ca)

# Trichomonas vaginalis

**STD!**



# Trichomonas vaginalis

## Forrás:

Human

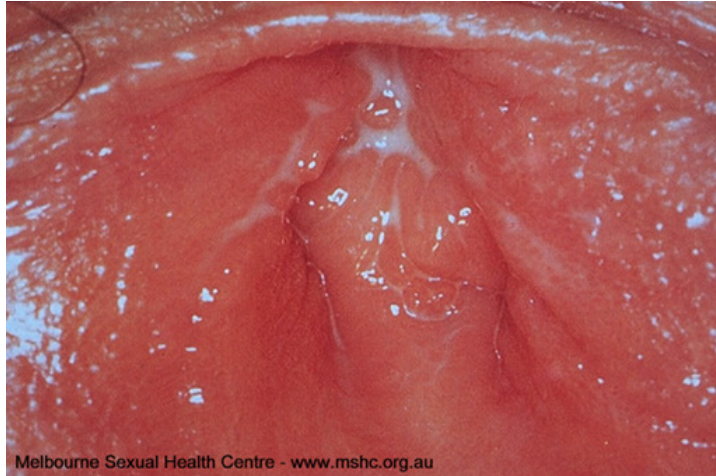
## Transmissio:

direkt kontaktus, leggyakoribb STD pathogen

## Virulencia:

Gyulladás – lipophosphoglycan, cystein proteinase

# Trichomonas vaginalis

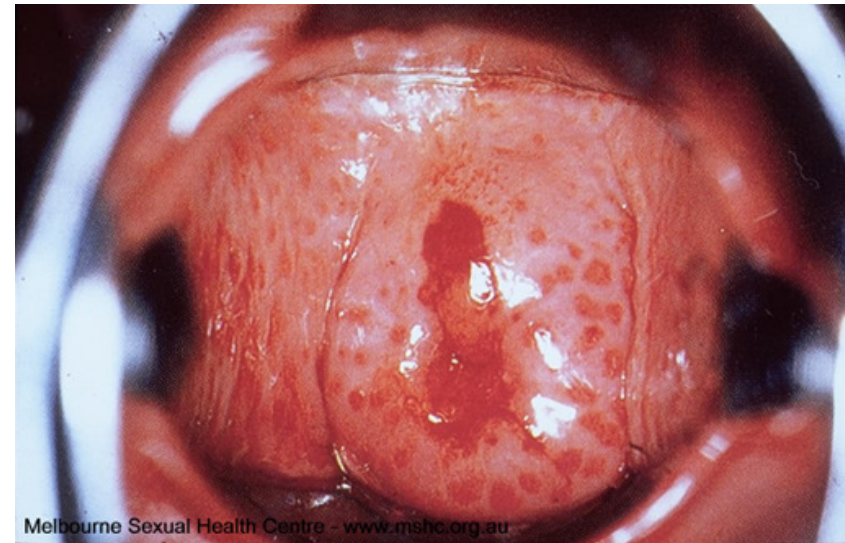


## Vaginitis

- gyulladás
- erosio
- viszkető, égő érzés
- habos váladék

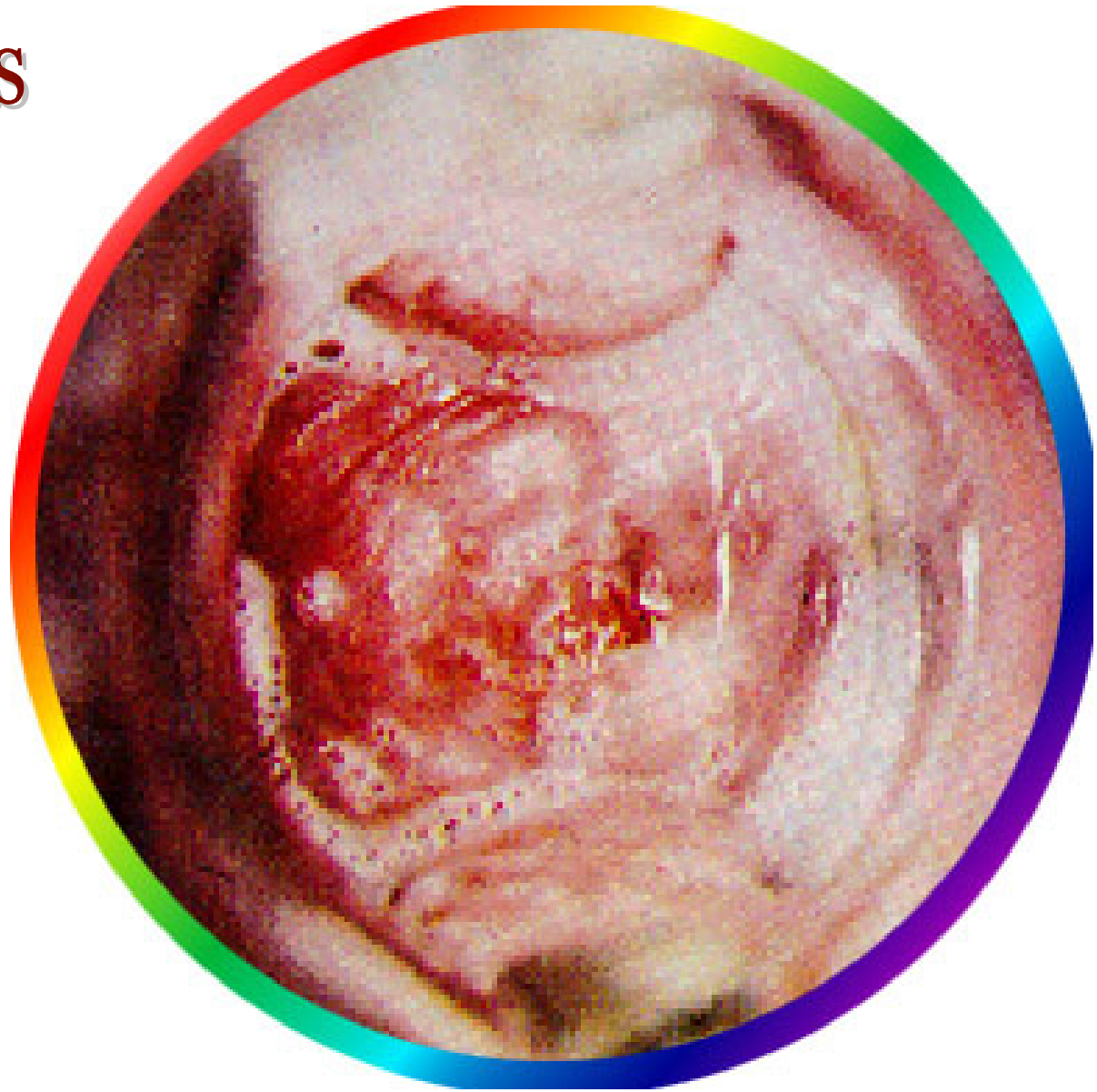
## Egyéb

- urethritis, dysuria
- dermatitis

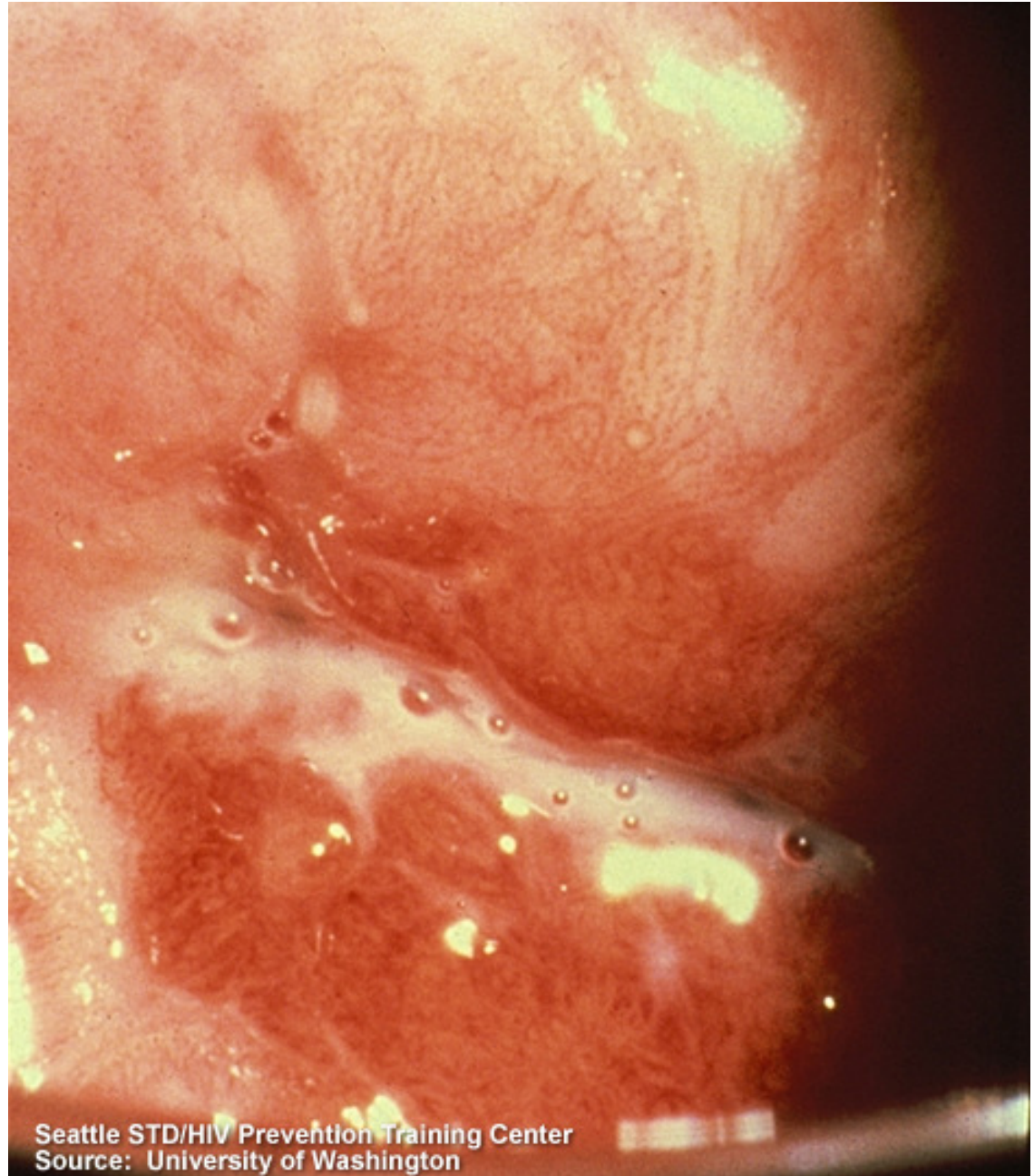




# Trichomonas vaginalis



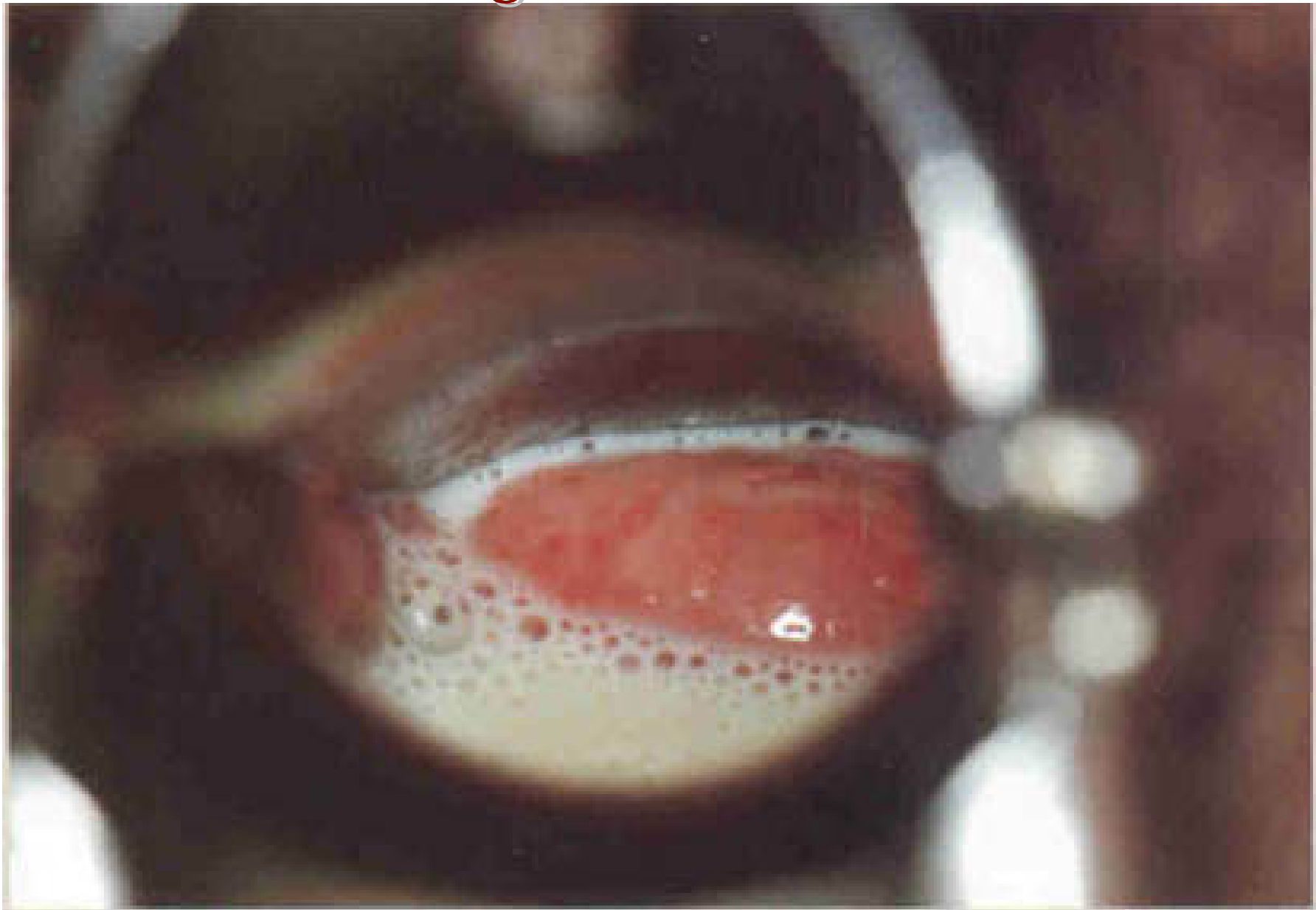
# Trichomonas vaginalis



[depts.washington.edu](http://depts.washington.edu)

Seattle STD/HIV Prevention Training Center  
Source: University of Washington

# Trichomonas vaginalis

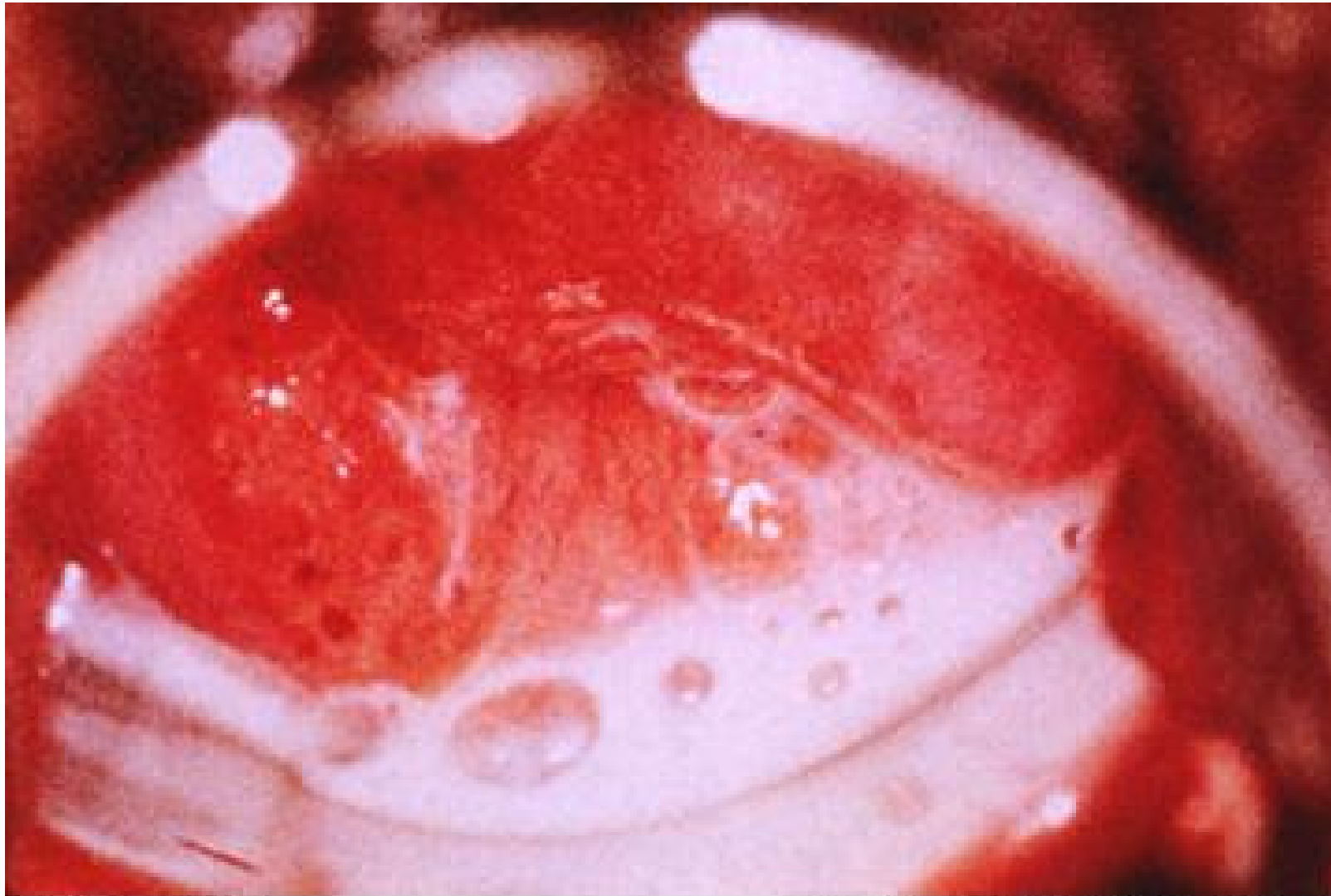


Vaginal trichomoniasis [www.ramacme.org](http://www.ramacme.org)

# Trichomonas vaginalis



**Trichomoniasis of the cervix.** The typical "strawberry" appearance can be seen. There is also malodorous itchy discharge.



www.medscape.com

Medscape ©

<http://www.medscape.com>

**Bubbly discharge of vaginal fluid growing the parasite *Trichomonas vaginalis*. Figure courtesy of James A. McGregor, MD, University of Colorado Health Sciences Center.**

# Trichomonas vaginalis

## Diagnosis

Lapos csepp

Festett kenet: Giemsa!

Ag kimutatás: DIF

PCR vagy tenyésztés –  
tünetmentes hordozók

## Therapia

metronidazole,  
tinidazole



## GI tractus

**Ameba/rhizopoda/lobosea**

Entamoeba histolytica

**Flagellata/mastigophora**

Giardia lamblia

Trichomonas vaginalis

**Ciliata/ciliophora**

**Balantidium coli**

**Sporozoa (apicomplexa)**

Cryptosporidia

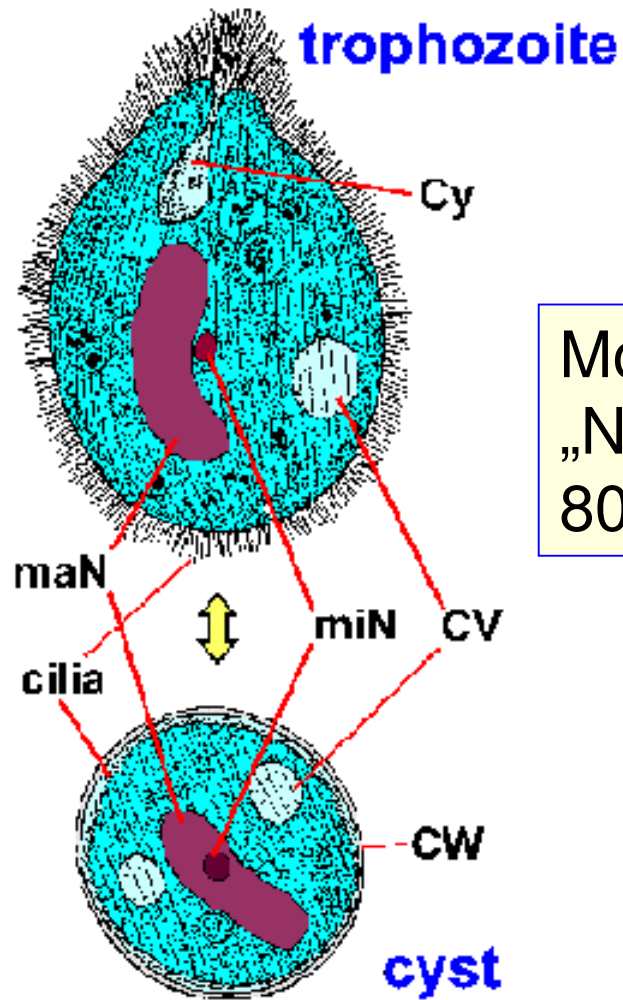
**GI tractus**

***Ciliata***

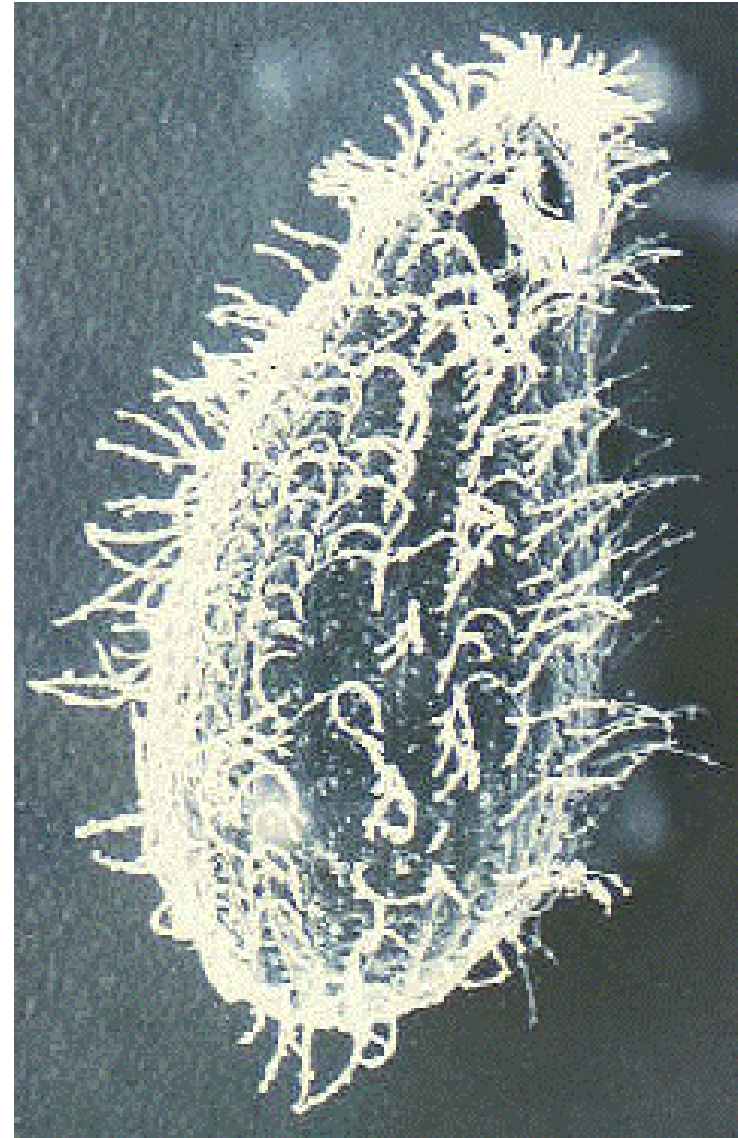
**Balantidium coli**

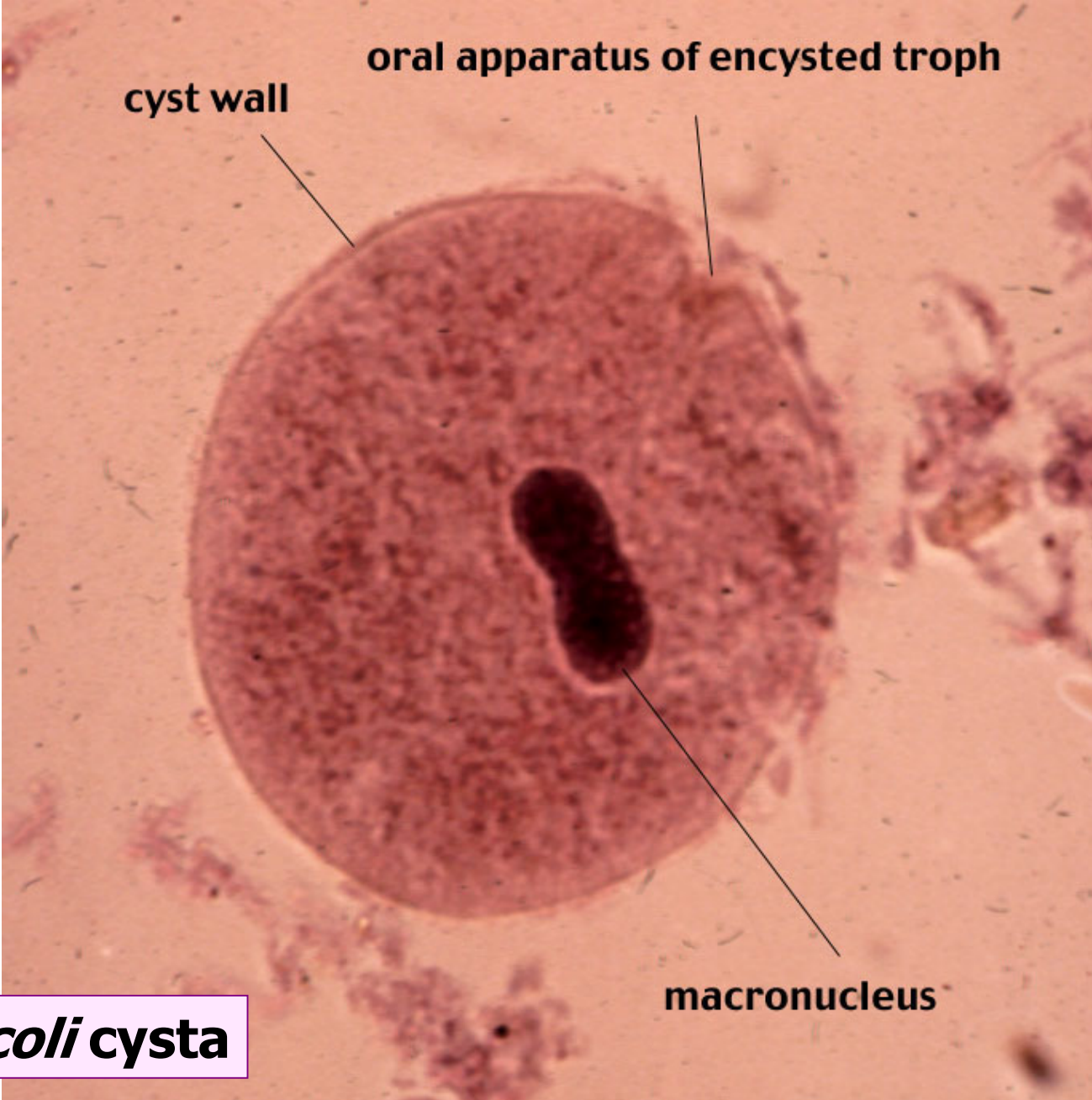


# Balantidium coli



Morphologia  
„Nagy”  
80 µm



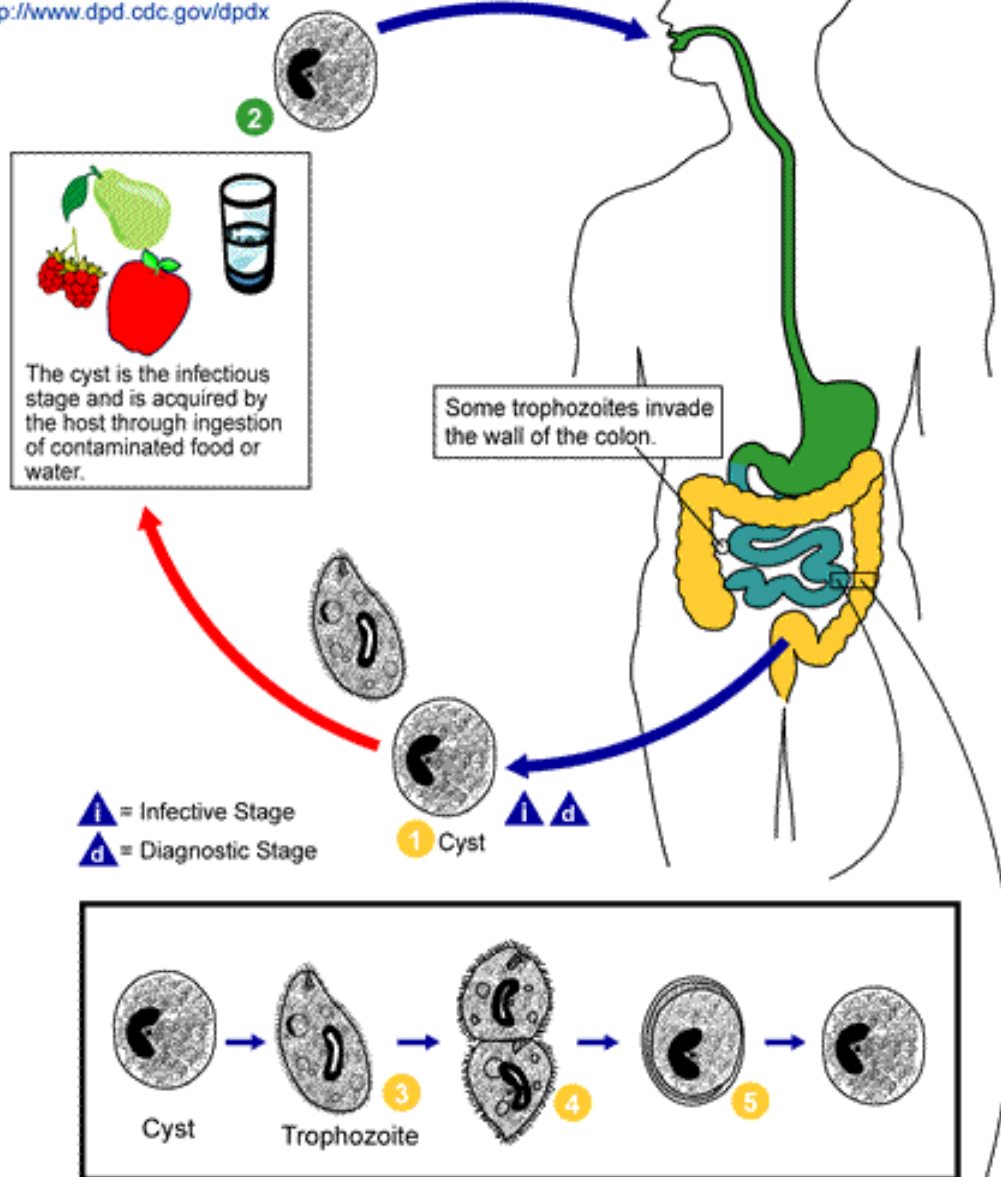


***Balantidium coli* cysta**



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# Balantidium coli



## Forrás

szennyezett víz, élelmiszer (cysták)

Excystálódás: vékonybél

Trophozoitok: vastagbél

Invasio: colon fala

Ki: cysta ürülés széklettel

## Therapia

Metronidazole

kereszthasadás

Cysts are the parasite stage responsible for transmission of balantidiasis. The host most often acquires the cyst through ingestion of contaminated food or water. Following ingestion, excystation occurs in the small intestine, and the trophozoites colonize the large intestine. The trophozoites reside in the lumen of the large intestine of humans and animals, where they replicate by binary fission, during which conjugation may occur. Trophozoites undergo encystation to produce infective cysts. Some trophozoites invade the wall of the colon and multiply. Some return to lumen and disintegrate. Mature cysts are passed with feces.

## GI tractus

**Ameba/rhizopoda/lobosea**

Entamoeba histolytica

**Flagellata/mastigophora**

Giardia lamblia

Trichomonas vaginalis

**Ciliata/ciliophora**

Balantidium coli

**Sporozoa (apicomplexa)**

**Cryptosporidia**

Sporozoa/apicomplexa

GI tractus

Cryptosporidium parvum

# Cryptosporidium parvum

**FIGURE 80-4 Cryptosporidium oocysts recovered from stool material and stained by the modified acid-fast techniques (X2,700).** (From Garcia LS, Bruckner DA, Brewer TC, Shimizu RY: Cryptosporidium oocysts from stool specimens. J Clin Microbiol 18:185, 1983, with permission.)



## Morphologia

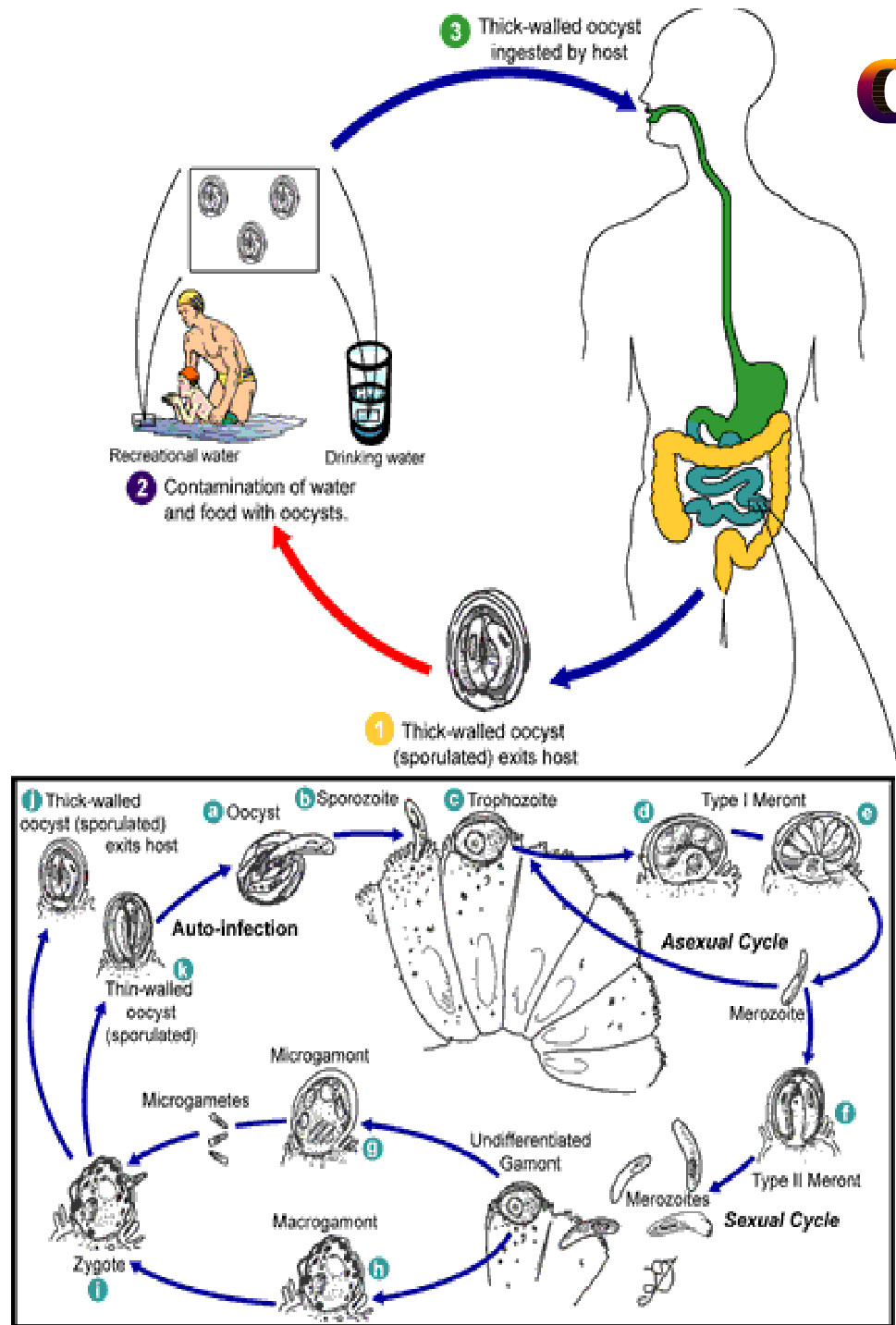
fertőző oocysta (5–8  $\mu\text{m}$ )  
benn: sporozoitok

## Szaporodás

Szexualis – gametogonia  
Aszexualis – schizogonia  
Ugyanabban a gazdában!

Medmicro ch80

# Cryptosporidium parvum



## Forrás

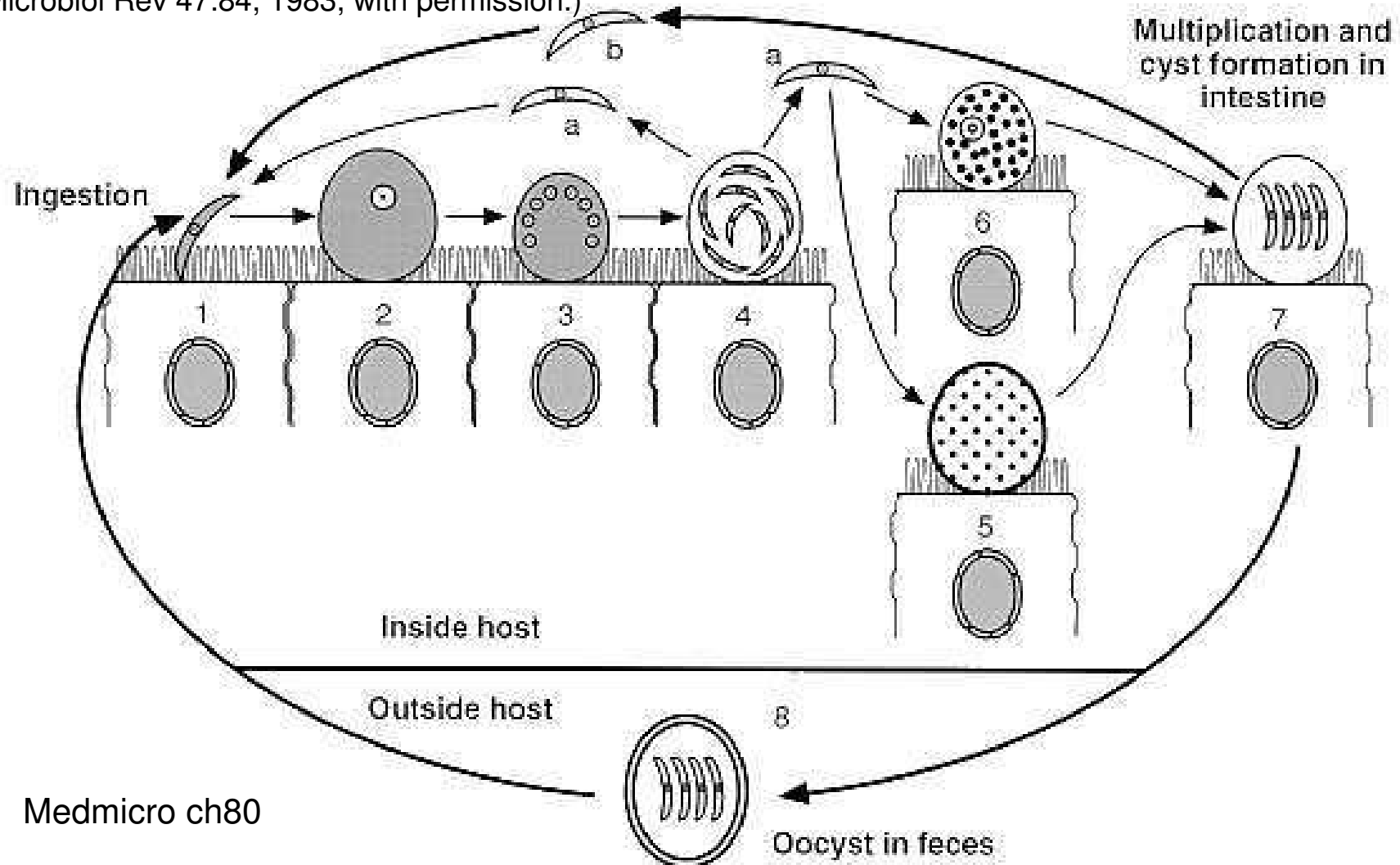
Ivóvíz - járványok!  
vékonybél

## Kórkép

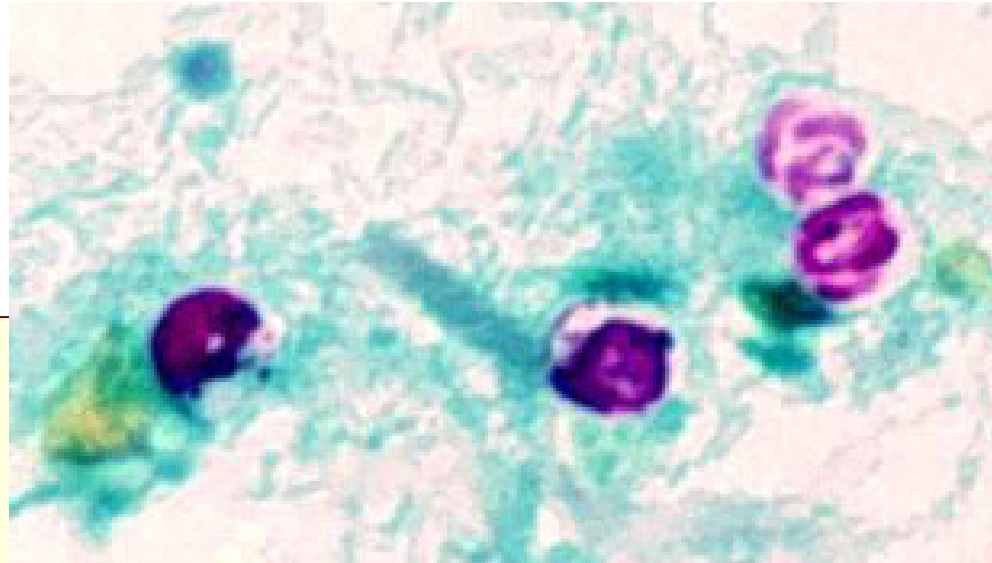
Vizes hasmenés  
kiszáradás,  
1–2 hét  
HIV/AIDS: hónapok



**FIGURE 80-3 The life cycle of *Cryptosporidium*.** (1-4) Asexual cycle of the endogenous stage: (1) sporozoite or merozoite invading a microvillus of a small intestinal epithelial cell; (2) a fully grown trophozoite; (3) a developing schizont with eight nuclei; (4) a mature schizont with eight merozoites. (5,6) Sexual cycle; (5) microgametocyte with many nuclei; (6) macrogametocyte. (7) A mature oocyst containing four sporozoites without sporocyst. (8) Oocyst discharged in the feces. (a) Merozoite released from mature schizont; (b) sporozoites released from mature oocyst. (Modified from Tzipori S: Cryptosporidiosis in animals and humans. Microbiol Rev 47:84, 1983, with permission.)



# Cryptosporidium parvum



## Therapia:

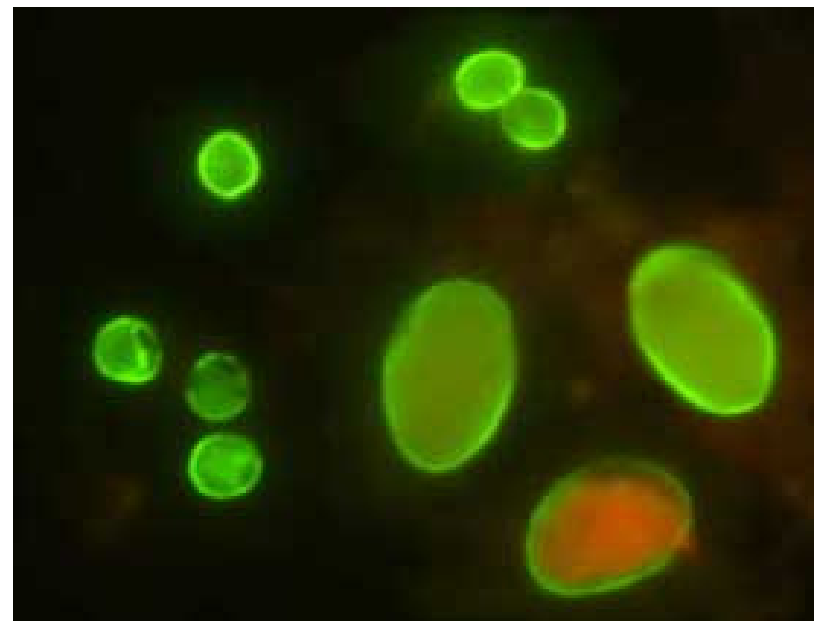
folyadékpótlás

## Diagnosis

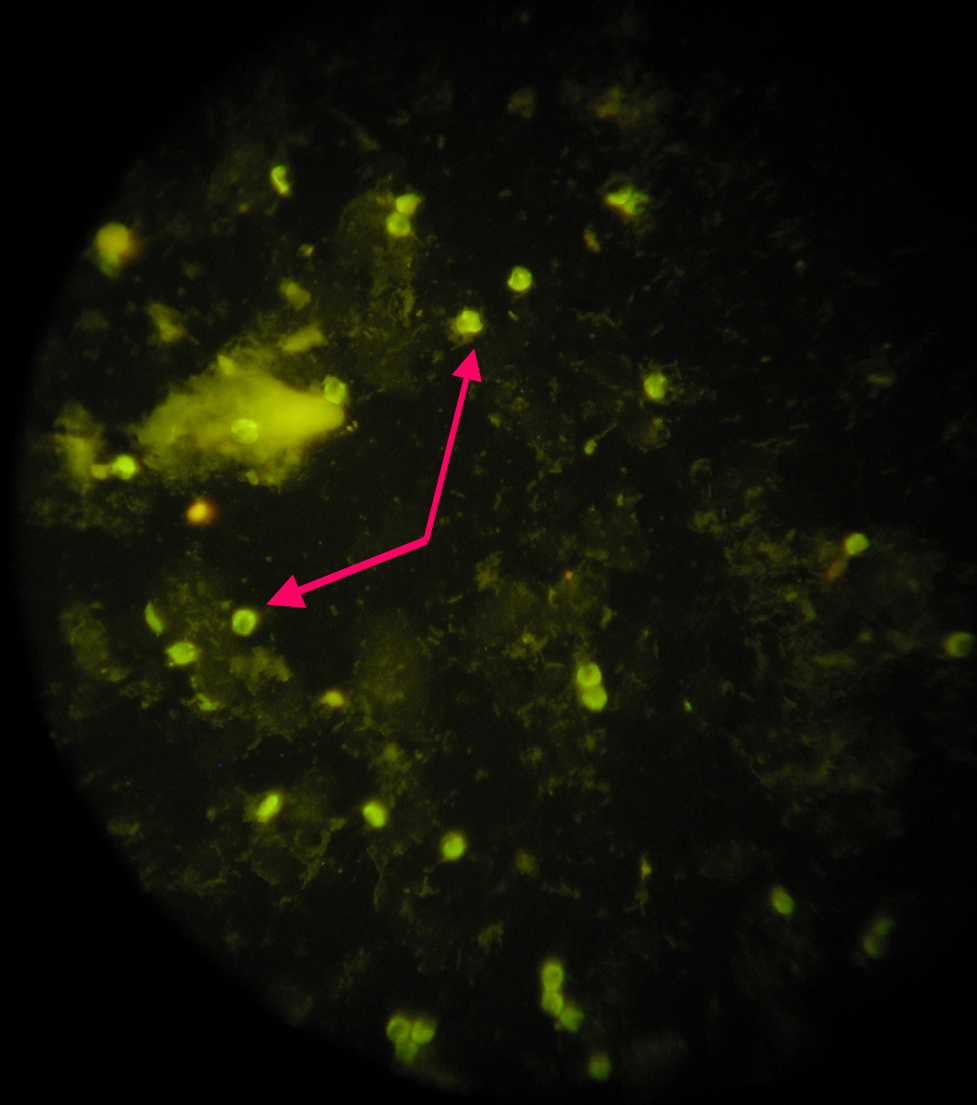
ZN (hideg) festés,  
DIF: oocysta kimutatása székletből

## Preventio

- ivóvíz szűrése, forralása
- hegyi patakok, tavak vizét kerülni



Cryptosporidia – AIDS, széklet/stool/Stuhl; fenol-auramin festés; UV



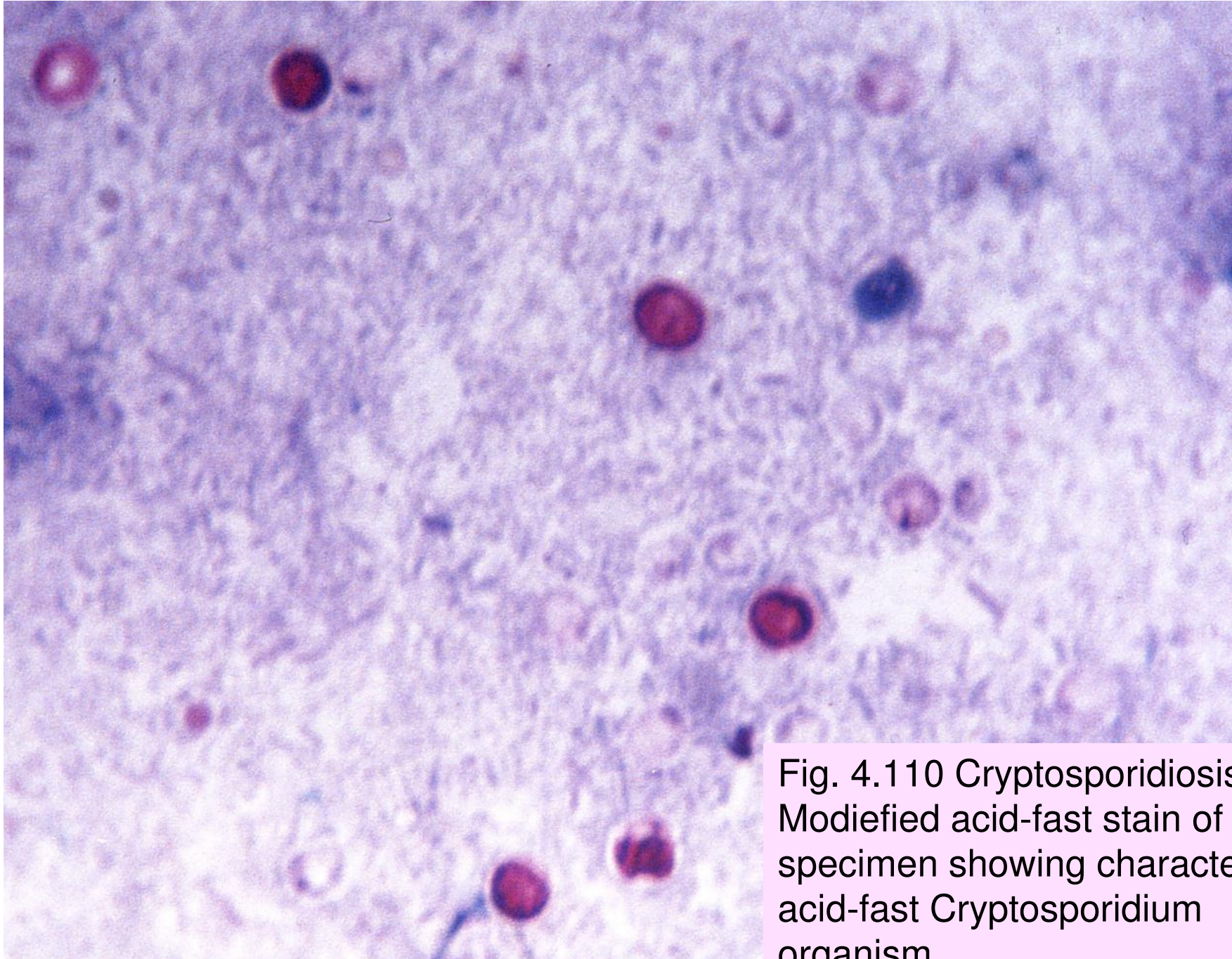


Fig. 4.110 Cryptosporidiosis. Modified acid-fast stain of stool specimen showing characteristic acid-fast *Cryptosporidium* organism.

# Summary – Összegzés

Organism	Transmission	Symptoms	Diagnosis	Treatment
<b>Entameba histolytica</b>	Oro-fecal	Dysentery with blood and necrotic tissue. Chronic: abscesses	Stool: cysts with 1-4 nuclei and/or trophs. Trophs in aspirate.	GI: Iodoquinol or <b>Metronidazole</b> Abscess: Metronidazole
<b>Giardia lamblia</b>	Oro-fecal	Fowl-smelling, bulky diarrhea; blood or necrotic tissue rare.	Stool: typical old man giardia troph and/or cyst.	Iodoquinol or <b>Metronidazole</b> .
<b>Balantidium coli</b>	Oro-fecal; zoonotic	Dysentery with blood and necrotic tissue but no abscesses.	Stool: ciliated trophs and/or cysts.	Iodoquinol or <b>Metronidazole</b> .
<b>Cryptosporidium parvum</b>	Oro-fecal	Diarrhea	Oocysts in stool	Paromycin (investigational)
Isospora belli	Oro-fecal	Giardiasis-like	Oocysts in stool	Sulpha drugs
<b>Trichomonas vaginalis</b>	Sexual	Vaginitis; occasional urethritis/prostatitis.	Flagellate in vaginal (or urethral) smear.	Mebendazole; vingar douche; steroids <b>Metronidazole</b>

## Vér / szöveti

Ameba/rhizopoda

Naeqleria

Acanthameba

Flagellata/mastigophora

Trypanosoma

T. brucei gambiense/rhodesiense → álomkór

T. cruzi → Chagas kór

Leishmania

L. donovani → visceralis, Kala-azar

L. tropica → cutan, Aleppo fekély

L. brasiliensis → muco-cutan, Espundia

Sporozoa (apicomplexa)

Plasmodia sp.

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

MALARIA

**Toxoplasma gondii**

toxoplasmosis



**Szöveti**

**Ameba/rhizopoda**

**Naegleria fowleri**

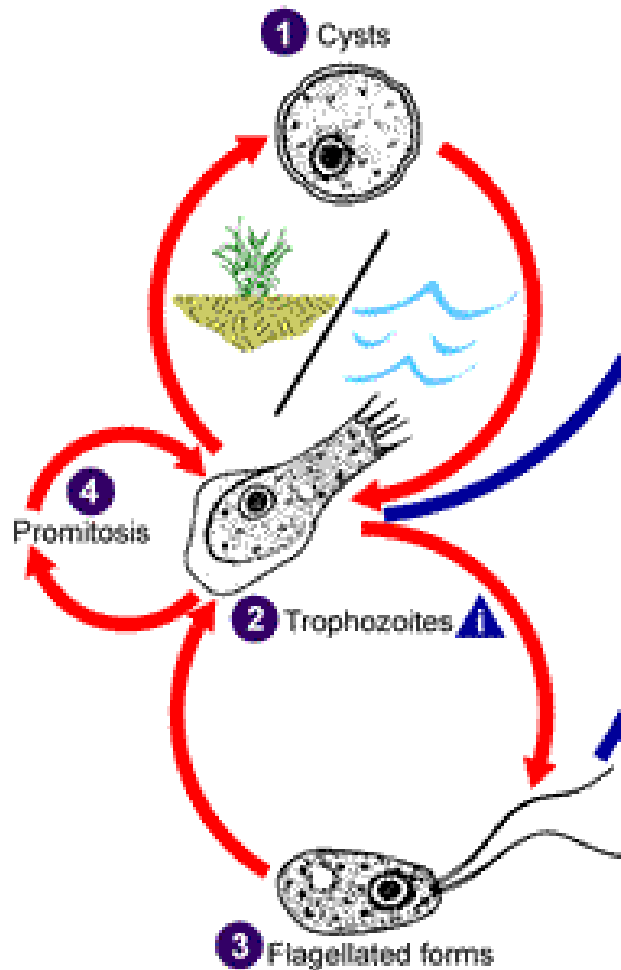
**Acanthamoeba castellani**

**Balamuthia mandrillaris**

### *Naegleria fowleri*

Enter through the olfactory neuroepithelium causing primary amebic meningoencephalitis (PAM) in healthy individuals

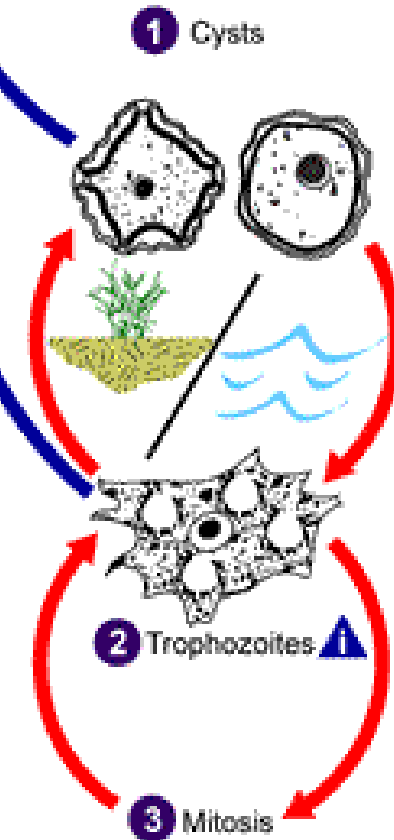
**d** Trophozoites in CSF and tissue  
Flagellated forms in CSF



### *Acanthamoeba* spp. and *Balamuthia mandrillaris*

Enter through lower respiratory tract or through ulcerated or broken skin causing granulomatous amebic encephalitis (GAE) in individuals with compromised immune system

**d** Cysts and trophozoites in tissue



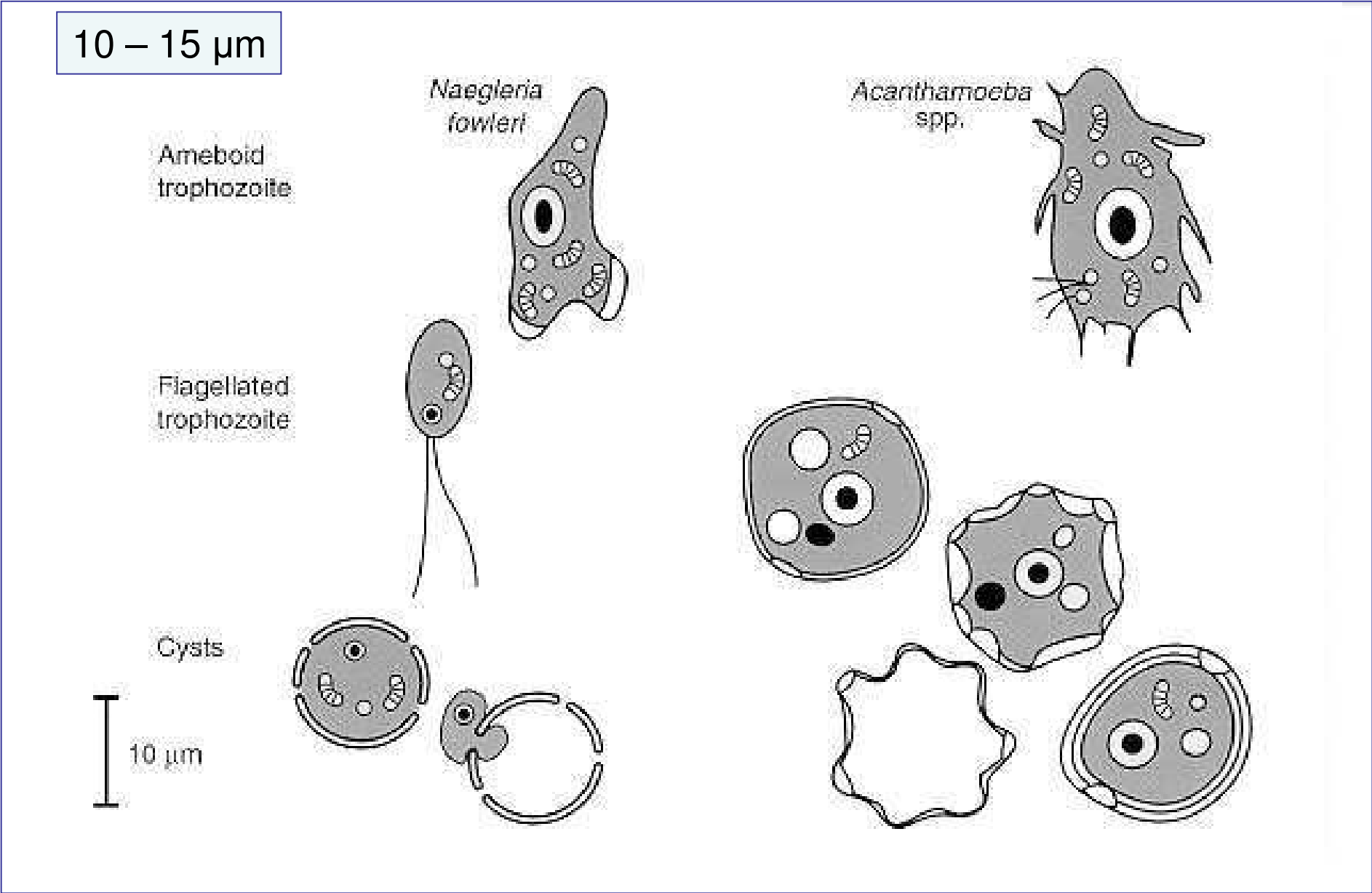
**i** = Infective Stage  
**d** = Diagnostic Stage



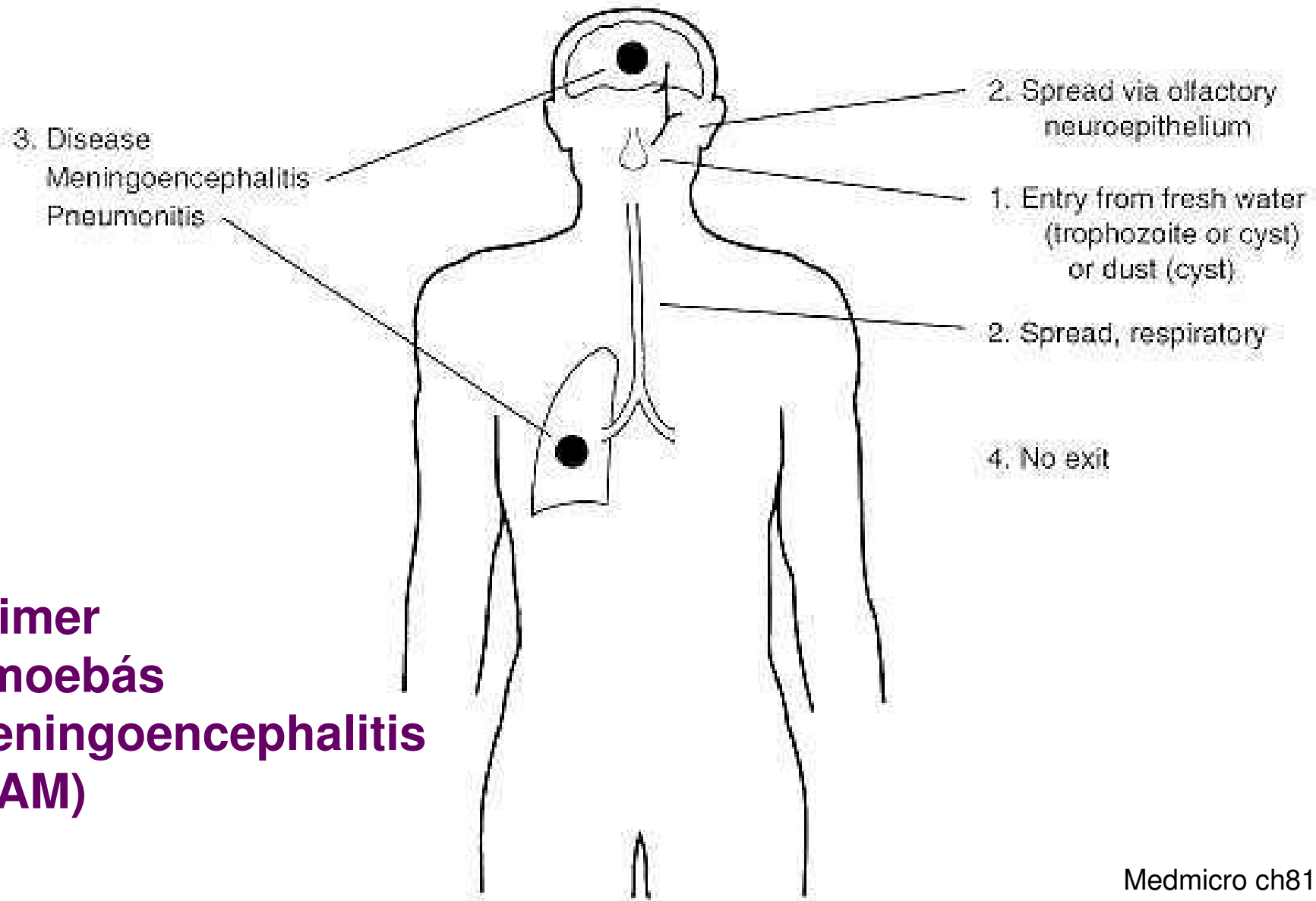
SAFER • HEALTHIER • PEOPLE™  
<http://www.dpd.cdc.gov/dpdx>



Figure 81- 1 Comparative **morphologia** of free-living amebas.



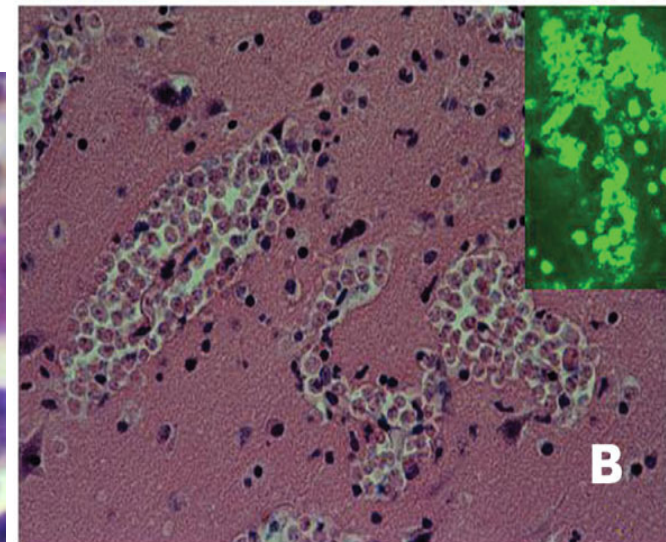
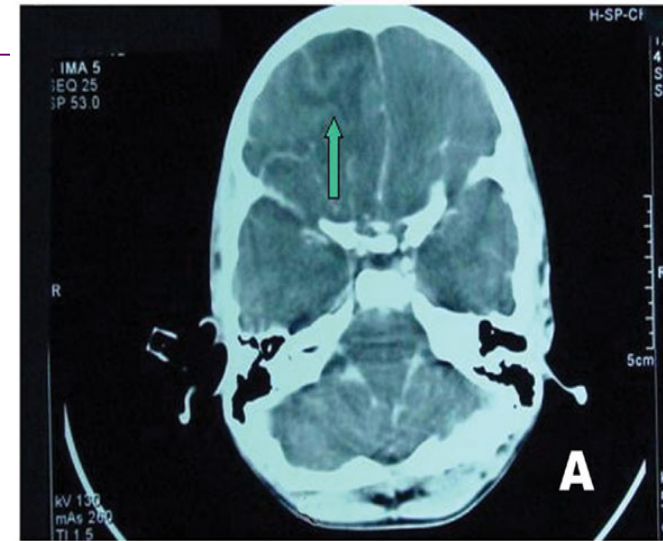
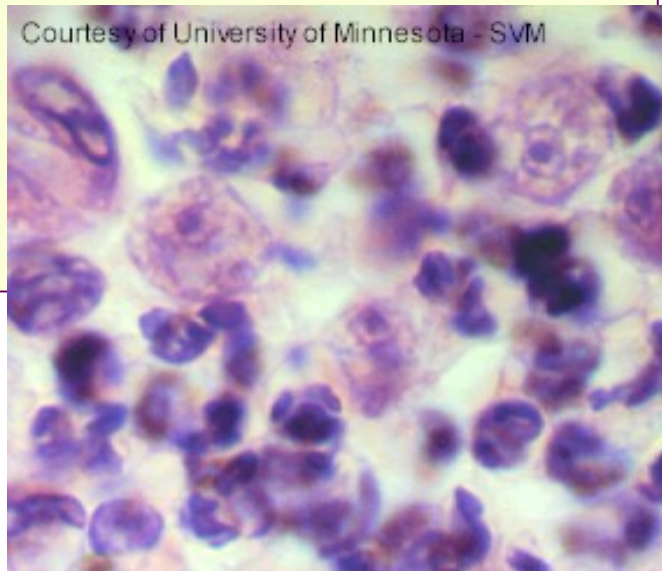
**Figure 81- 2 Pathogenesis of *Naegleria* infection.**



**Primer  
Amoebás  
Meningoencephalitis  
(PAM)**

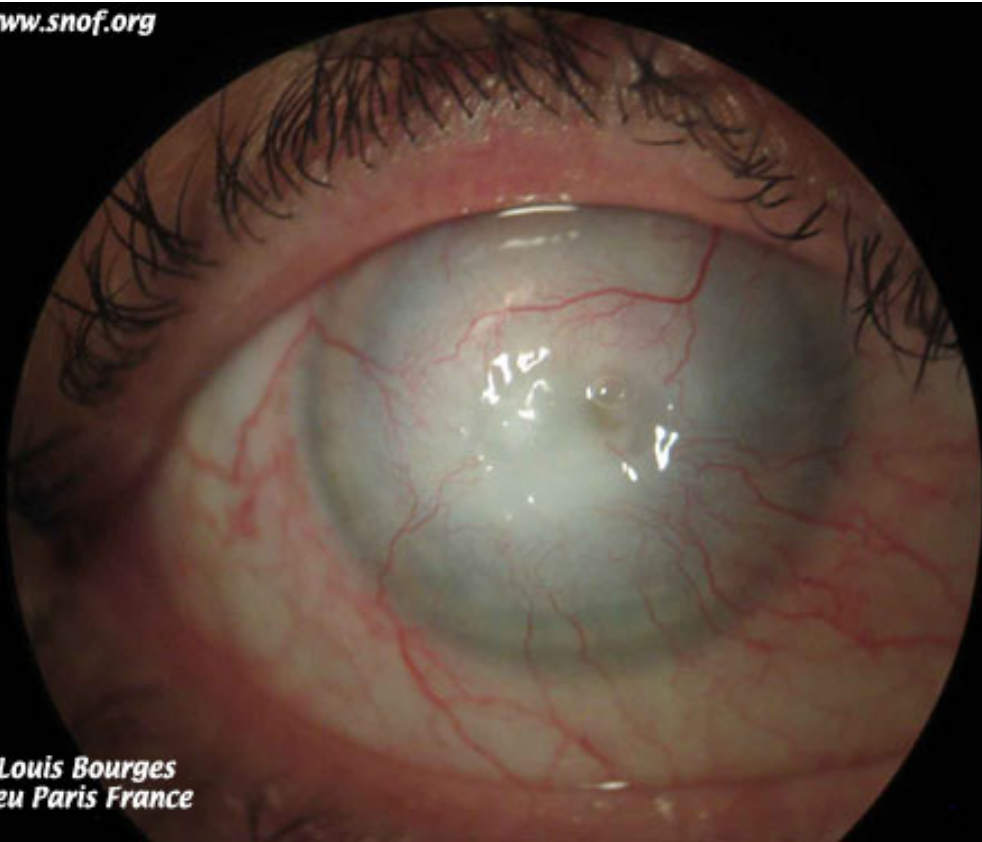
# *Naegleria fowleri* – PAM eset 9 éves fiú, 2003 július

- láz, fejfájás, kötött tarkó CT: neg,
- liquor: zavaros, FVS $\uparrow$ , glucose $\downarrow$ ,  
Th: ceftriaxon
- Bacteriologia, gomba, Ag, tenyésztés: neg
- 3-dik nap: coma,  
CT: kiterjedt léziók
- 6-dik nap: exitus letalis,
- **Megfelelő Th:**  
**amphotericin B,**  
**rifampin**



***Acanthamoeba castellani* -keratitis, fekély,  
granulomás encephalitis – immunszuppresszáltak**

<http://www.snof.org>

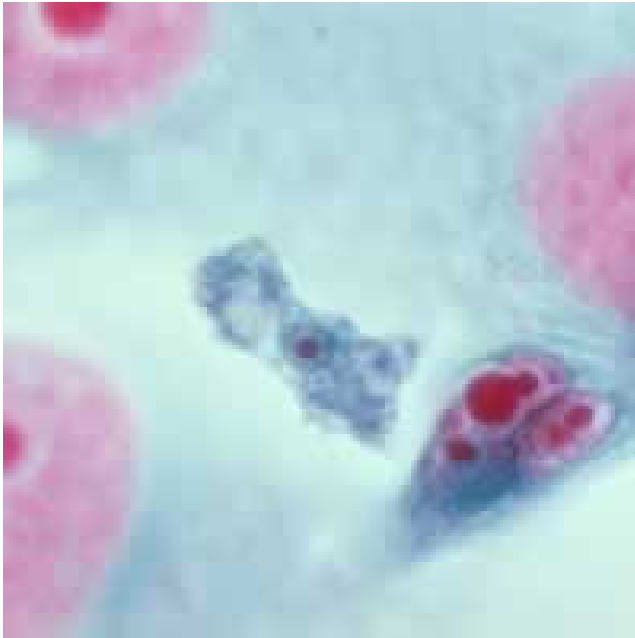


*Dr Jean-Louis Bourges  
Hôtel-Dieu Paris France*

Kontakt lencse



***Acanthamoeba castellani* - keratitis, fekélyek, granulomás encephalitis - immunszuppresszáltak**



## Vér / szöveti

Ameba/rhizopoda

**Naegleria**

**Acanthameba**

Flagellata/mastigophora

**Trypanosoma**

T. brucei gambiense/rhodesiense → álomkór

T. cruzi → Chagas kór

**Leishmania**

L. donovani → visceralis, Kala-azar

L. tropica → cutan, Aleppo fekély

L. brasiliensis → muco-cutan, Espundia

Sporozoa (apicomplexa)

**Plasmodia sp.**

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

**MALARIA**

**Toxoplasma gondii**

toxoplasmosis



**Szöveti**

**Sporozoa/apicomplexa**

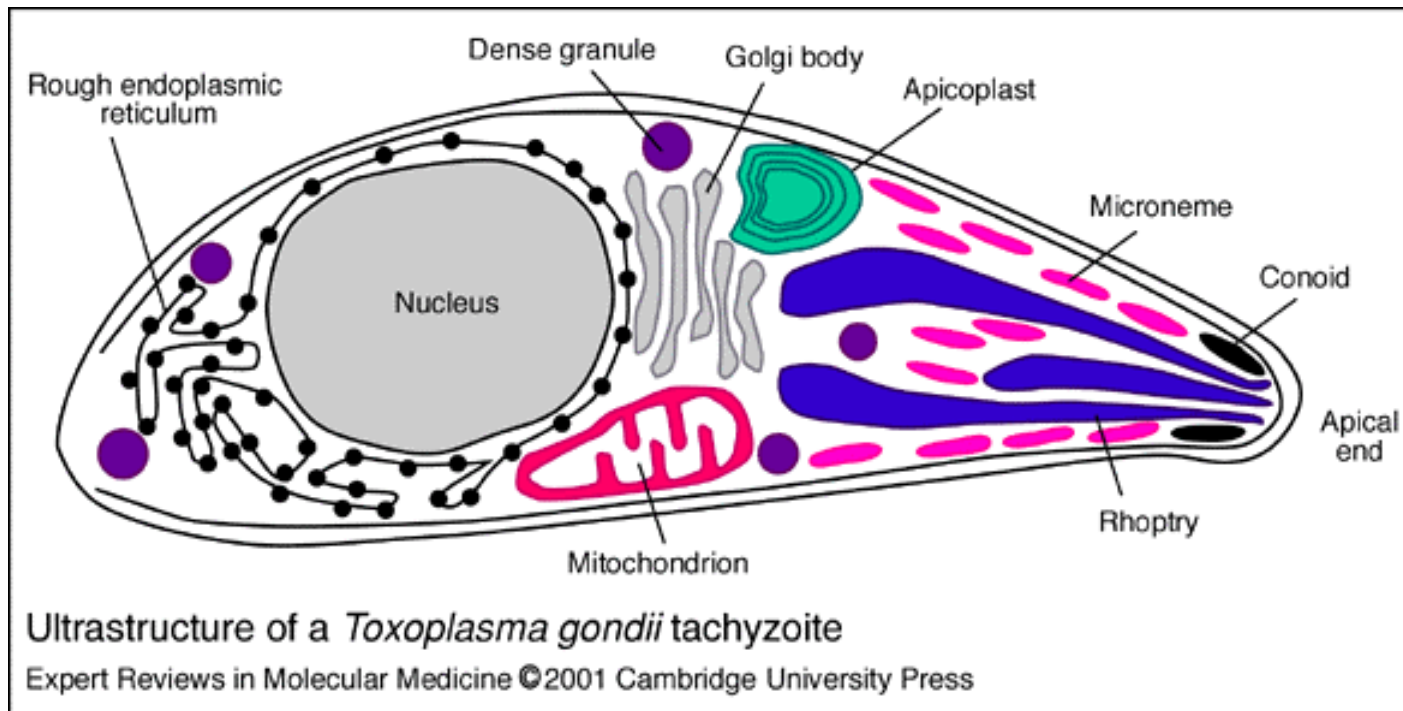
**Toxoplasma gondii**

# Toxoplasma gondii

## Morphologia (1)

tachyzoit: 4-7  $\mu\text{m}$

„újhold”, „banán” - alak



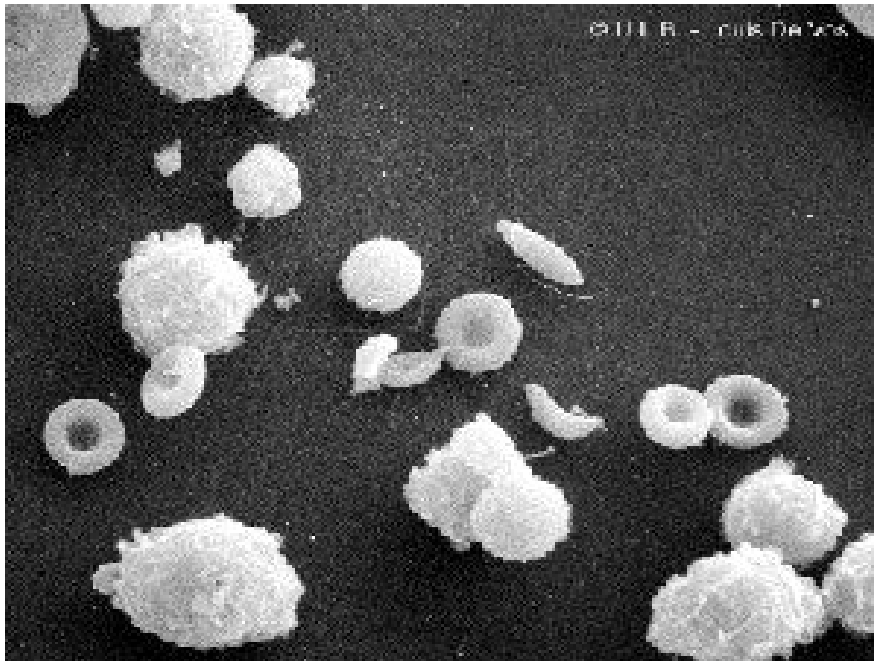


# Toxoplasma gondii

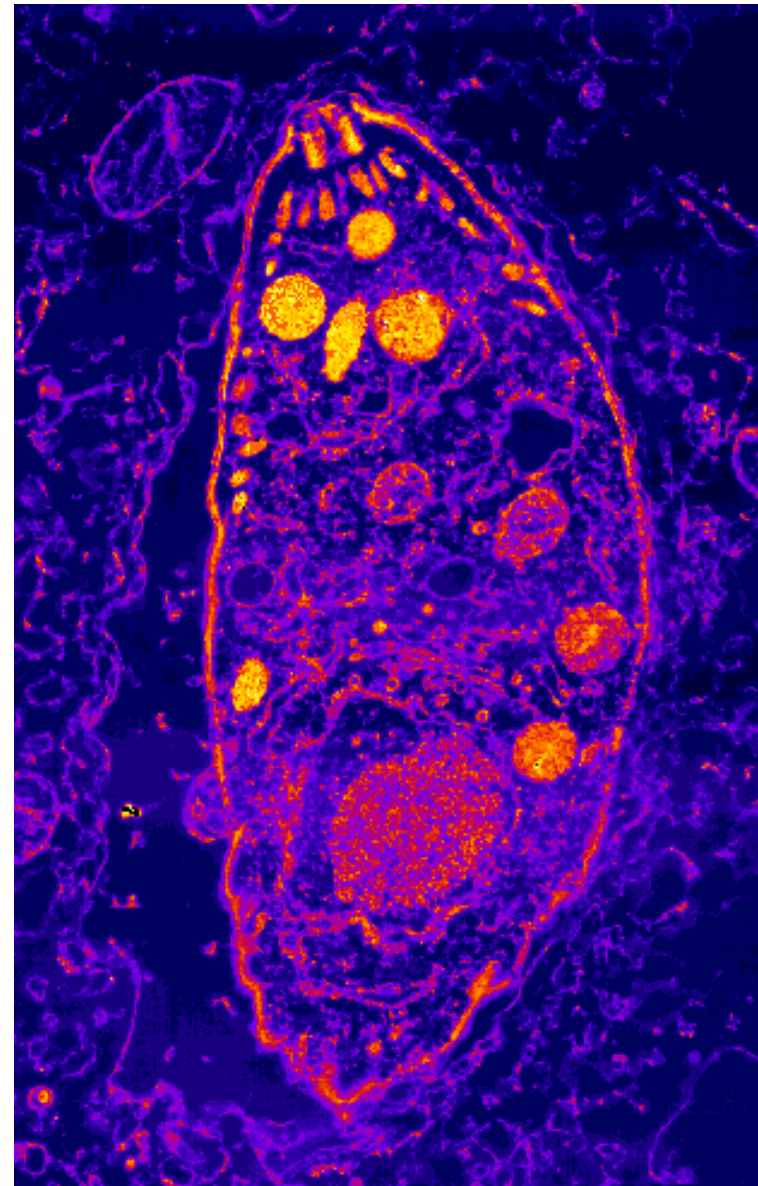
## Morphologia (1)

tachyzoites: 4-7  $\mu\text{m}$

„kifli”



[www.laves.niedersachsen.de](http://www.laves.niedersachsen.de)



[www.i-ddi.org](http://www.i-ddi.org)

# Toxoplasma gondii

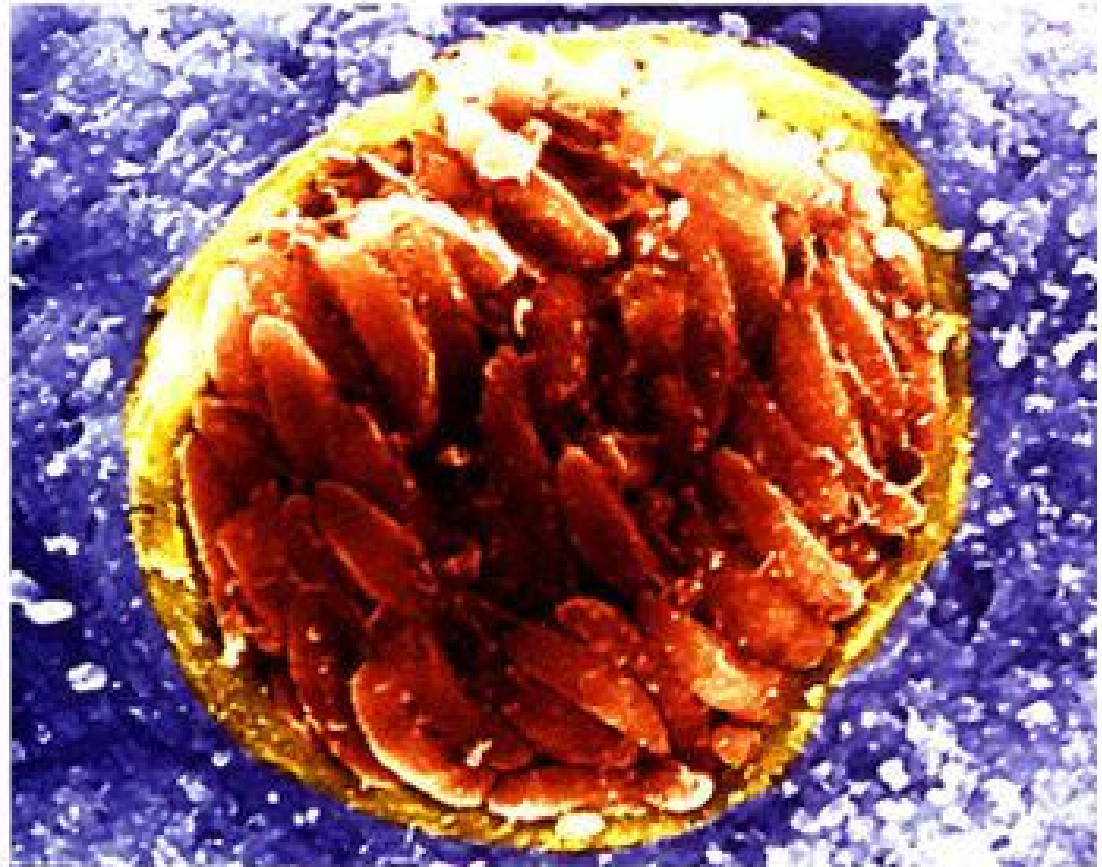
## Morphologia (2)

Cysta – szöveti,  
izomzat, agy

Cysta (vékony fal)  
benne sok-sok

Bradyzoit

Méret: **20 - 60  $\mu\text{m}$**



# Toxoplasma gondii

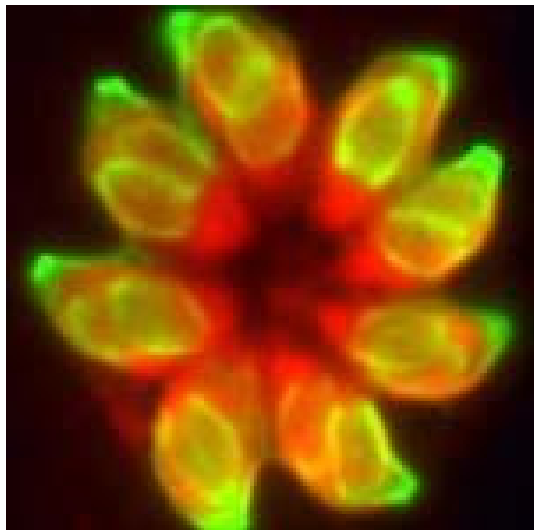
## Morphologia (3)

Oocysta

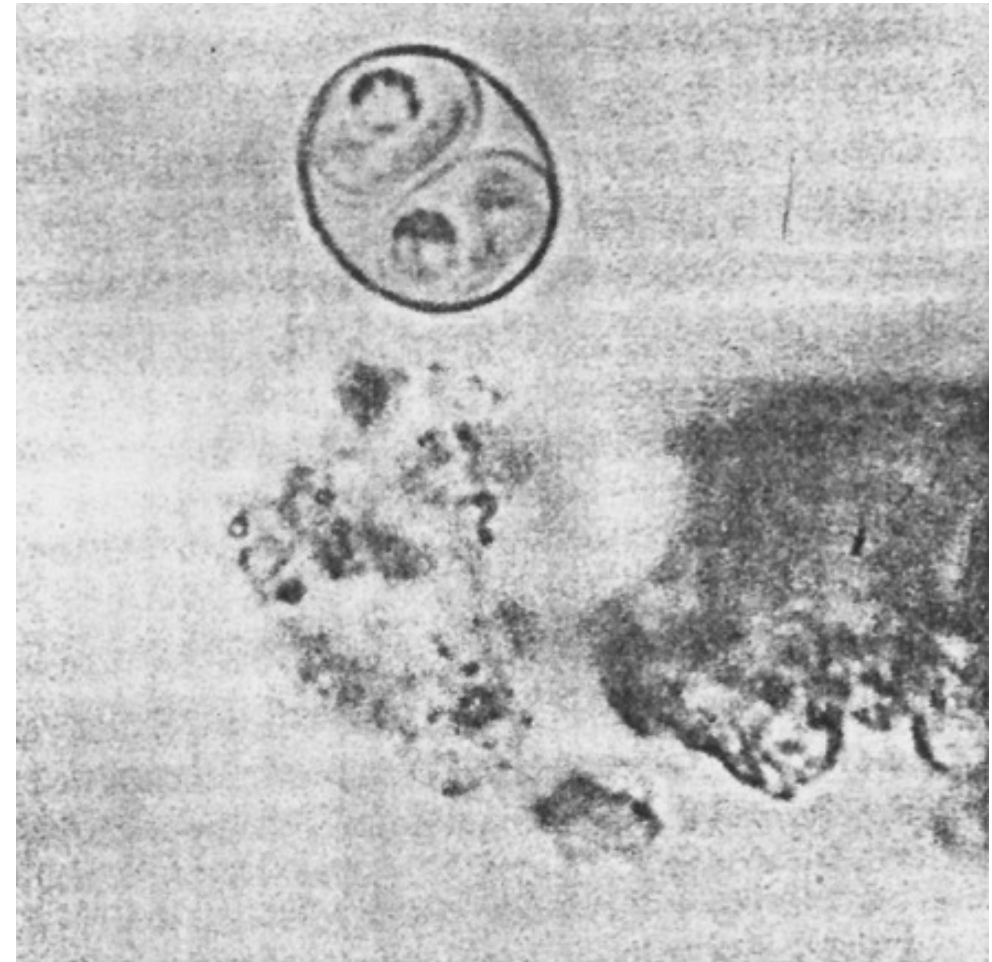
benne 8 infectiv sporozoit

Méret: ca. 12  $\mu\text{m}$

Macska széklet



[www.biotech-weblog.com](http://www.biotech-weblog.com)



Oocyst of *Toxoplasma gondii* from cat faeces.

It is 10 to 13 by 9 to 11  $\mu\text{m}$ .

(Photograph by Harley Sheffield)

[www.parsa.ac.za](http://www.parsa.ac.za)

[teaching.path.cam.ac.uk](http://teaching.path.cam.ac.uk)

# Toxoplasma gondii

[www-ijr.ujf-grenoble.fr](http://www-ijr.ujf-grenoble.fr)

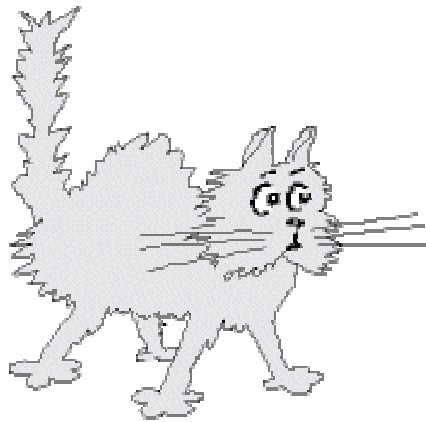
## Morphologia (3)

Oocysta

benne 8 infectiv sporozoit

Méret: ca. 12  $\mu\text{m}$

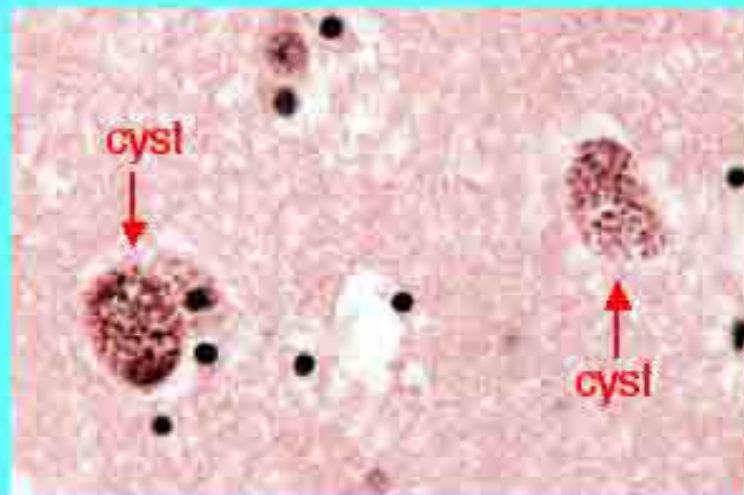
Macska széklet



[www.parsa.ac.za](http://www.parsa.ac.za)



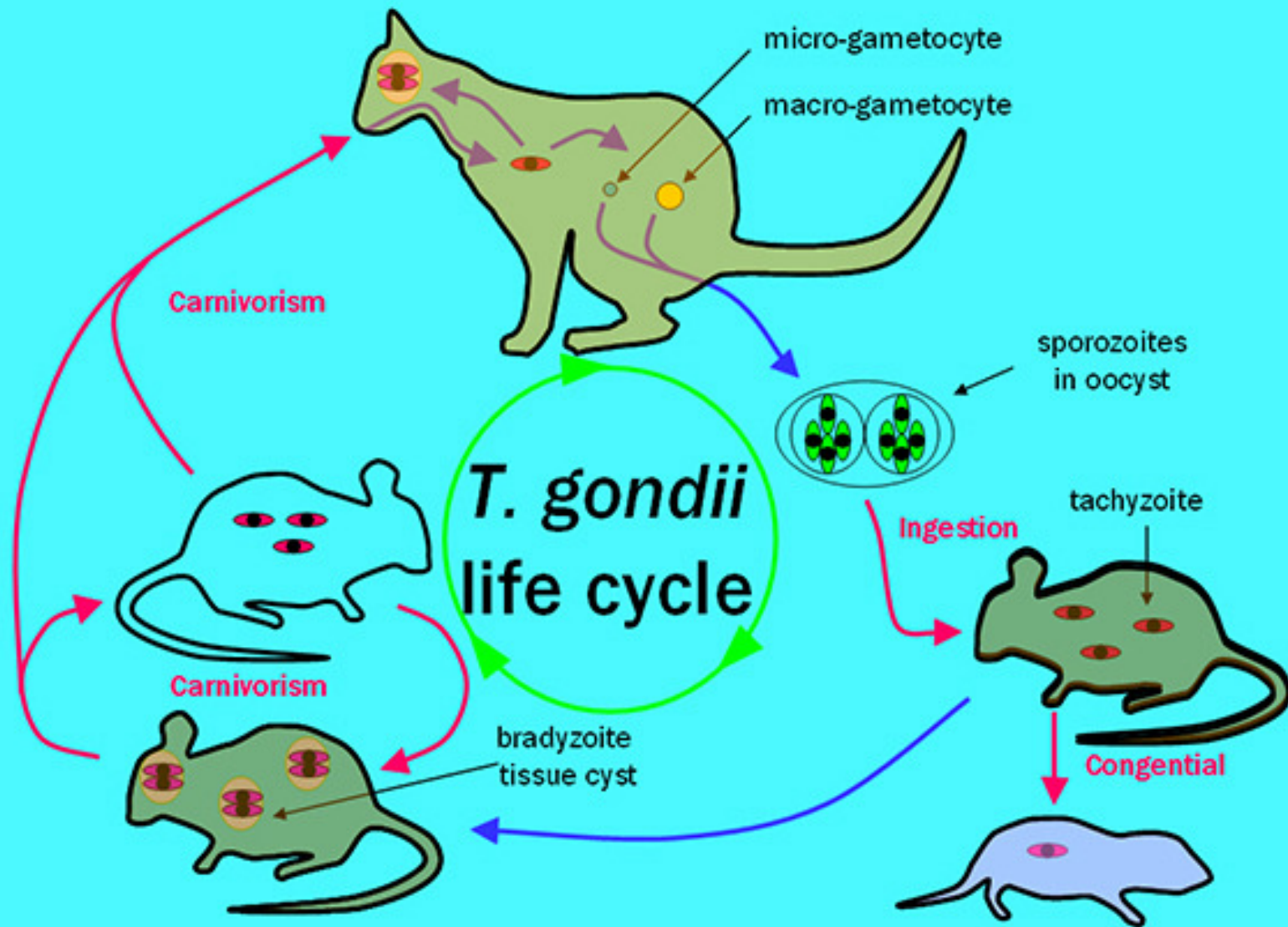
# *Toxoplasma gondii*



*T. gondii* bradyzoites  
in mouse brain  
tissue cysts



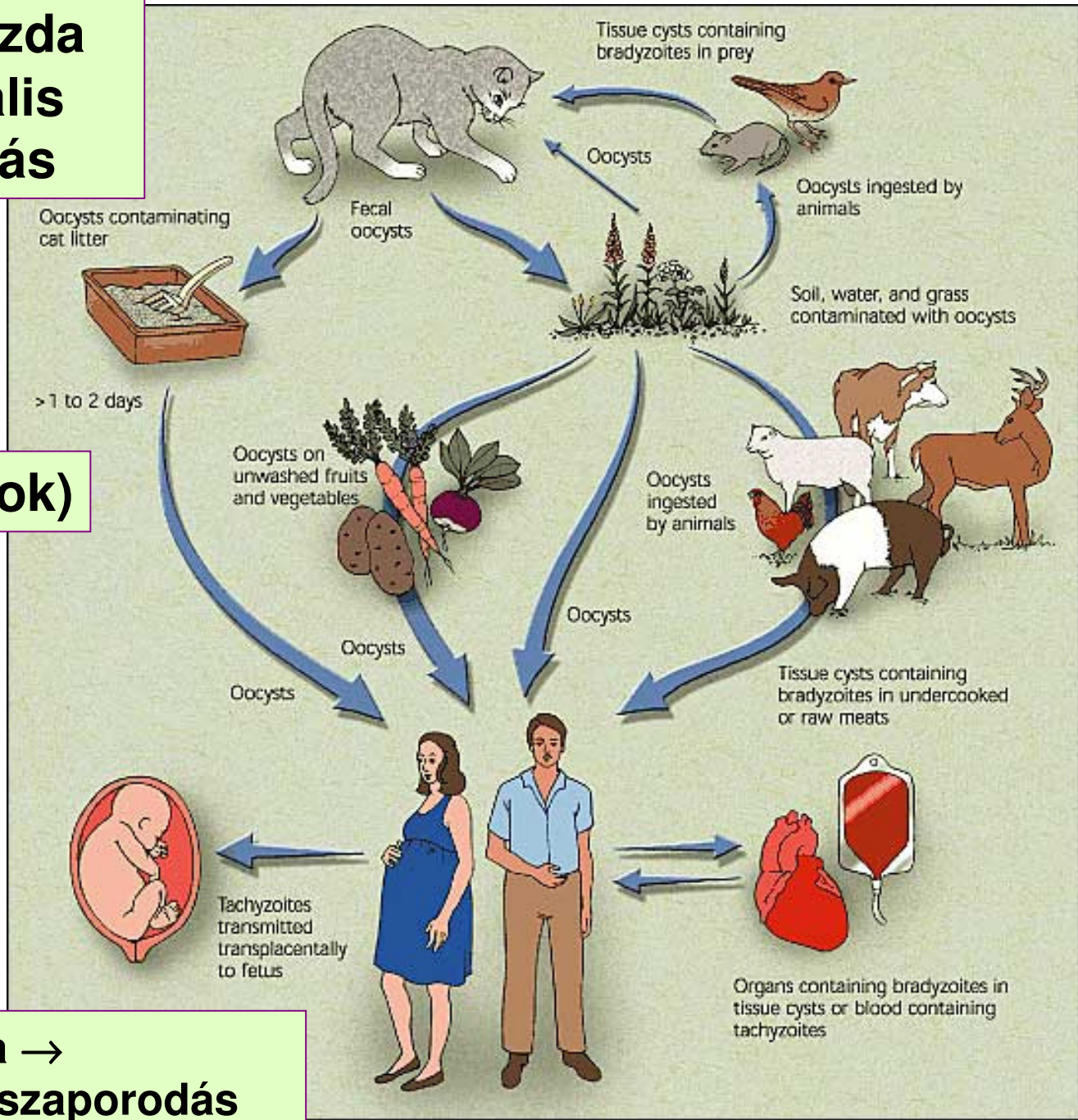
*T. gondii* tachyzoites  
in leukocyte



# *Toxoplasma gondii* life cycle

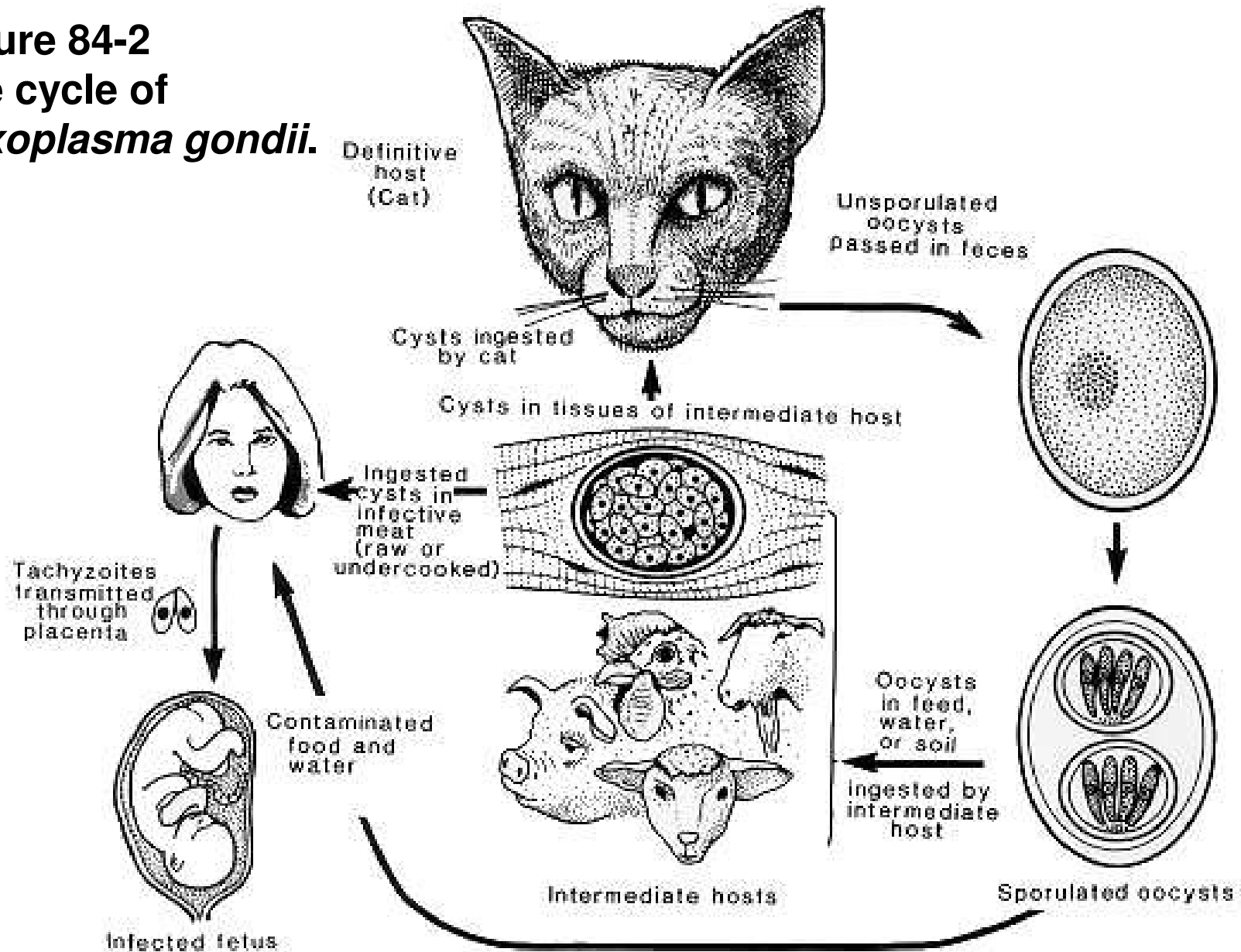
**Végső gazda  
→ szexuális  
szaporodás**

**Forrás(ok)**



**Közti gazda →  
aszexuális szaporodás**

**Figure 84-2**  
**Life cycle of**  
***Toxoplasma gondii*.**





# Toxoplasma gondii

## Forrás(ok)

### Oocysta –

Macska alom

élelmiszer, zöldség (macska széklettel szennyezett)

### Bradyzoit – szöveti cysta

Hús! (hőkezelés!)

## Transmissio

Emberről emberre csak vertikálisan

### Transplacentalis

## Virulencia faktor?

A toxoplasma sejtek aktív szaporodása direkt károsítja a gazdasejteket ⇒ necrosis!

# Toxoplasma gondii

## Pathogenesis

### Obligát intracellularis

epithel sejtek (bél) → mesenterialis nyirokcsomók → →  
nyirok-, vér

Minden sejt fogékony, minden sejtben szaporodhat → necrosis  
Érzékeny szerveink: szem, szív, parenchymás szervek...

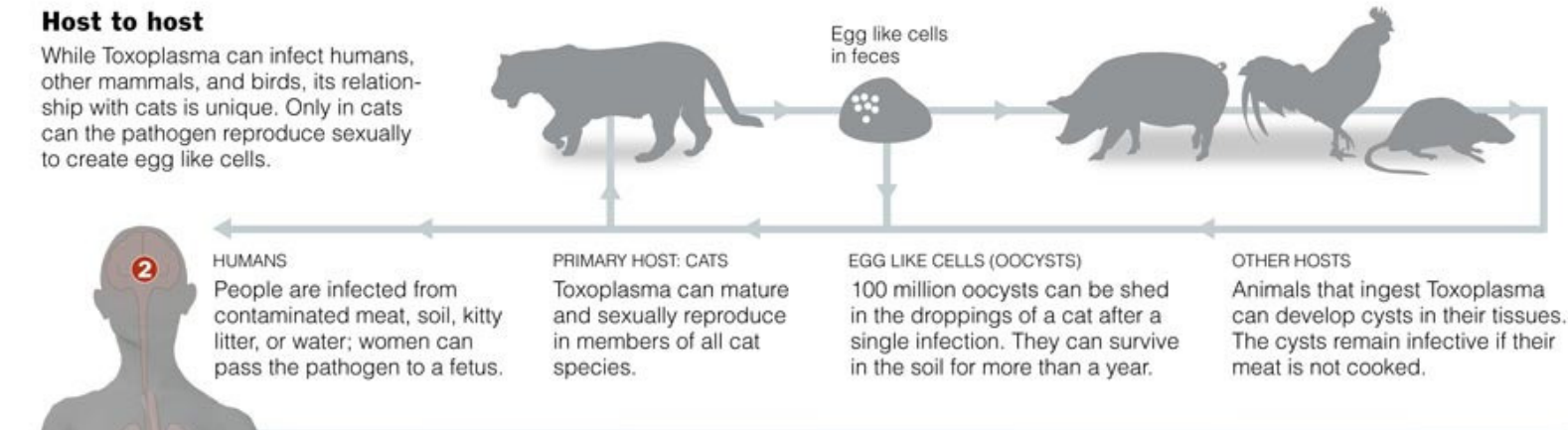
Központi Idegrendszer  
Dendritikus sejtek

## A Ubiquitous Pathogen That Keeps Its Host Healthy

The single-celled pathogen *Toxoplasma gondii* can enter the most protected parts of its host body while remaining largely undetected. In most cases it lives as a harmless tenant, but in fetuses or in people with compromised immune systems it can cause severe damage.

### Host to host

While *Toxoplasma* can infect humans, other mammals, and birds, its relationship with cats is unique. Only in cats can the pathogen reproduce sexually to create egg like cells.



#### HUMANS

People are infected from contaminated meat, soil, kitty litter, or water; women can pass the pathogen to a fetus.

#### PRIMARY HOST: CATS

*Toxoplasma* can mature and sexually reproduce in members of all cat species.

#### EGG LIKE CELLS (OOCYSTS)

100 million oocysts can be shed in the droppings of a cat after a single infection. They can survive in the soil for more than a year.

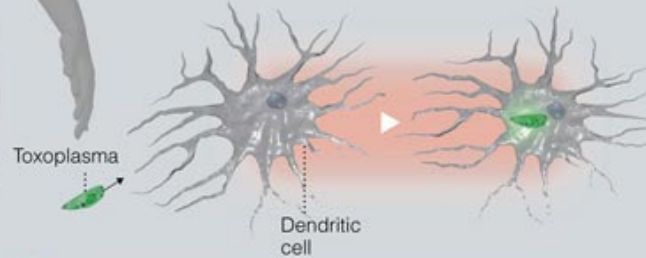
#### OTHER HOSTS

Animals that ingest *Toxoplasma* can develop cysts in their tissues. The cysts remain infective if their meat is not cooked.

### Cell to cell

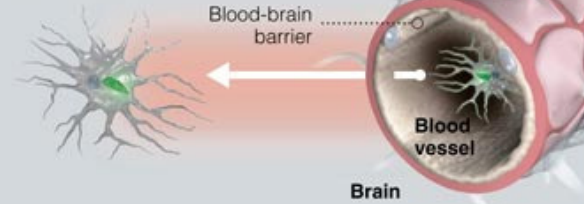
#### 1 Rapid spread

Within hours of infection, *Toxoplasma* can move to widely separated parts of the body. It does this by entering and controlling dendritic immune cells in the intestine.



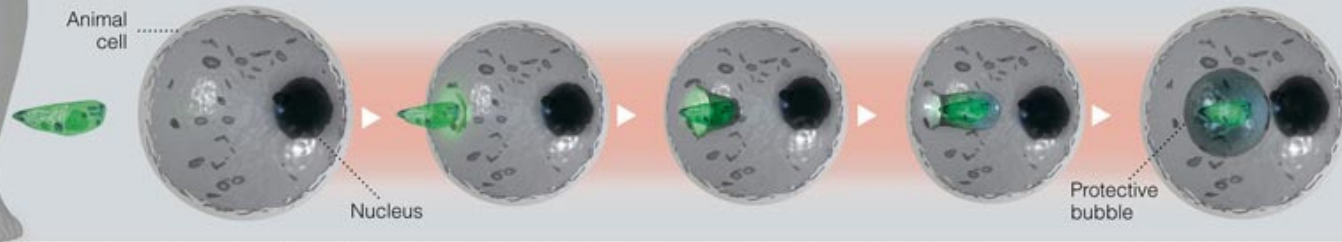
#### 2 Crossing protected barriers

After *Toxoplasma* takes control of a dendritic cell, it can use the cell as a Trojan horse to cross protected barriers. In this way it can reach defended organs like the brain.



#### 3 Entering a cell

*Toxoplasma* can infect almost every type of cell. It enters by pushing against the membrane and pulling it over itself. The cell seals behind, leaving the pathogen in a protective bubble.



# Toxoplasma gondii

<http://www.iwf.de/iwf/do/mkat/details.aspx?GUID=444C4755494400B9D8364493893800DBCC299C0301030061F44C86AB00000000&Action=Quicklink&Search=Medizin;%20Innere%20Medizin;%20Infektionskrankheiten;&SearchIn=Klassifikation&Offset=10>

# Toxoplasma gondii

## **Kórképek – toxoplasmosis**

### **Immunkompetens**

- Tünetmentes
- Enyhe fertőzés:  
lymphadenopathia, láz, izomfájdalom, fejfájás...

### **Immunkárosodott, AIDS**

Encephalitis, myocarditis, pneumonia

### **Congenitalis – abortus!**

Agy és Retina

súlyos forma – tetrád:

- 1) Retinochoroiditis
- 2) Hydrocephalus
- 3) Görcsök
- 4) Intracerebralis meszesedés

# Toxoplasma gondii

Enyhe fertőzés – bőrtünetek





[www.dermis.net](http://www.dermis.net)

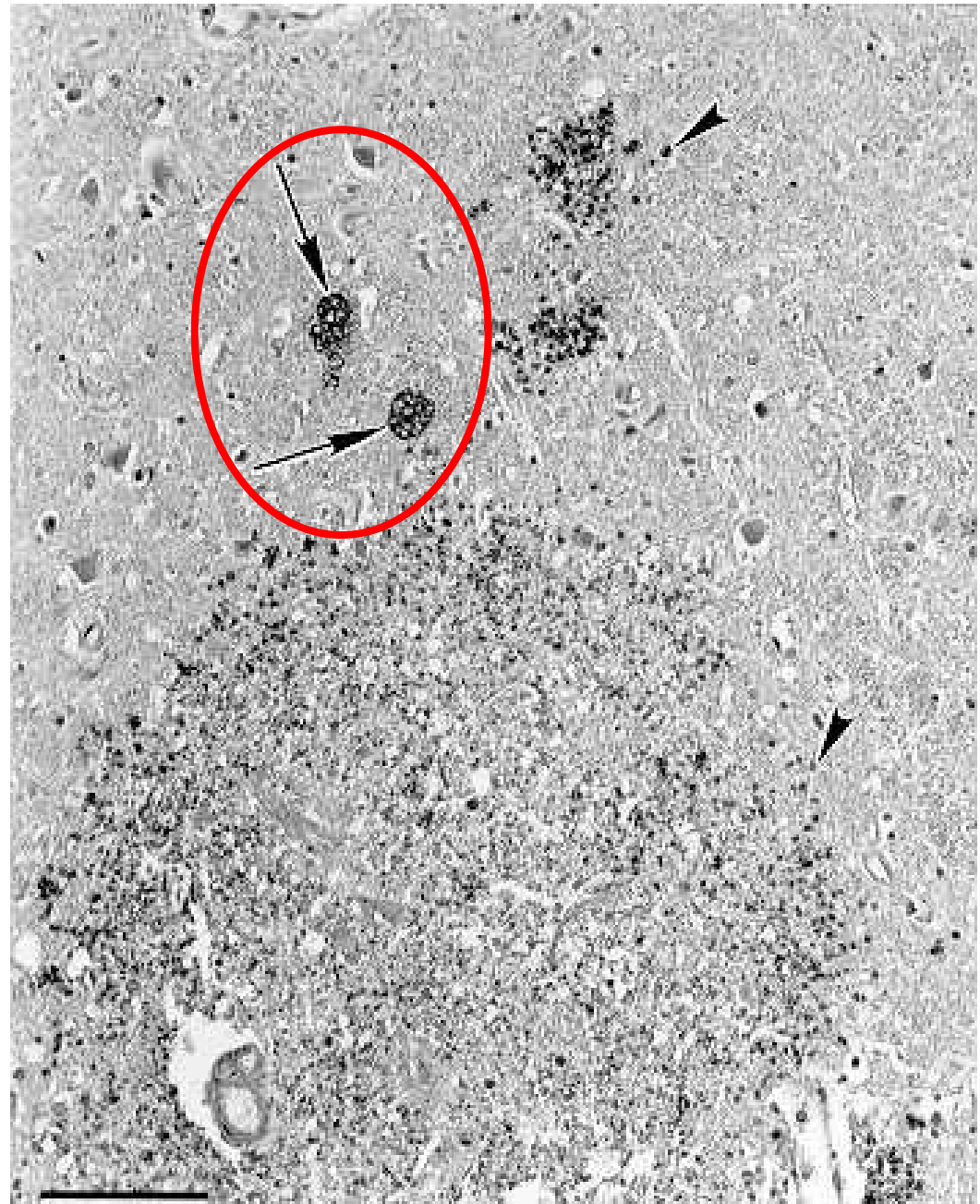


# Toxoplasma gondii

## **FIGURE 84-6 Section of brain from an AIDS patient with fatal toxoplasmosis.**

Note a large focus of necrosis, 2 tissue cysts (arrows) and numerous tachyzoites (arrowheads - all black dots are tachyzoites).

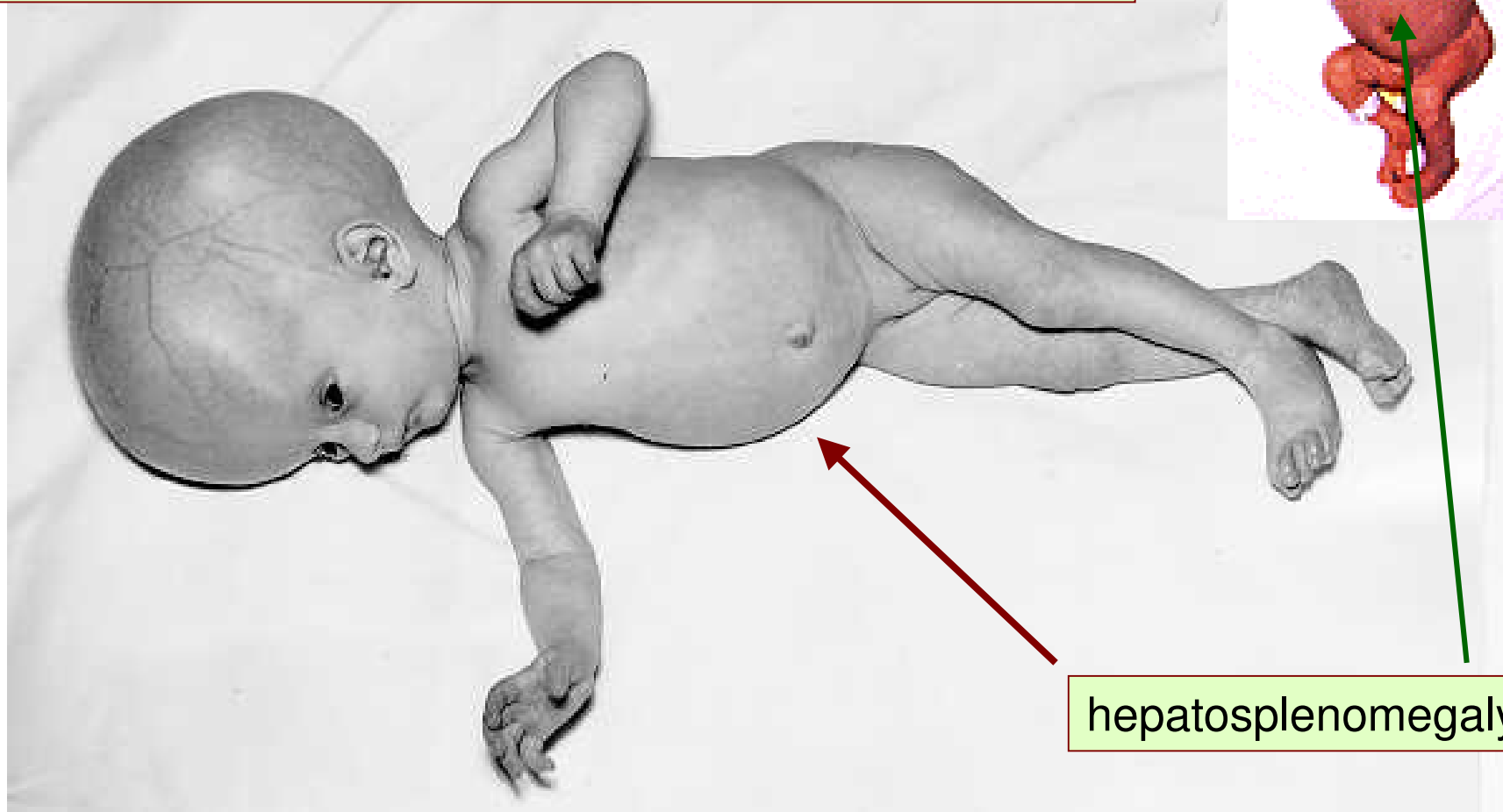
Immunohistochemical stain with anti-T gondii serum Bar - 100  $\mu$ m.





# Toxoplasma gondii

**FIGURE 84-1 Girl with hydrocephalus due to congenital toxoplasmosis.** (From Dubey JP, and Beattie CP. Toxoplasmosis of animals and Man. CRC Press, Boca Raton, Florida, 52, 1988.)



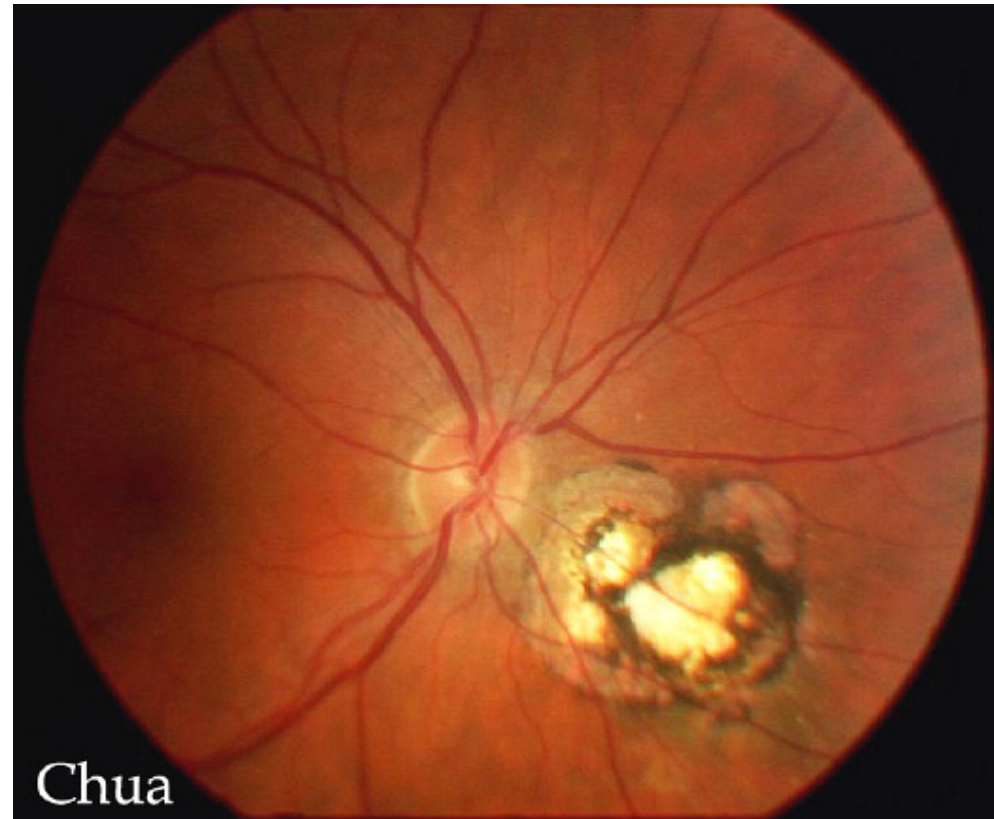
hepatosplenomegaly

Congenitalis toxoplasmosis, microphthalmia, hydrocephalus sárgaság (icterus)



Intracranialis meszesedés

# Toxoplasma gondii



chorioretinitis, uveitis - hegesedések

# Toxoplasmosis

## Diagnosis

Histologia

**Szerologia** – acut, friss fertőzés

IgM vagy 4-16x titer↑ (2 - 4 hetes intervallum!)

**Direkt kimutatás: Giemsa, IF, PCR**

## Therapia

**spiramycine** terhesség alatti, primer fertőzés (3%)

Fertőzött újszülött: pyrimethamine + folsav 1 éves korig

## Preventio

**Terhesek szűrése, fogékonyak (ki)szűrése**

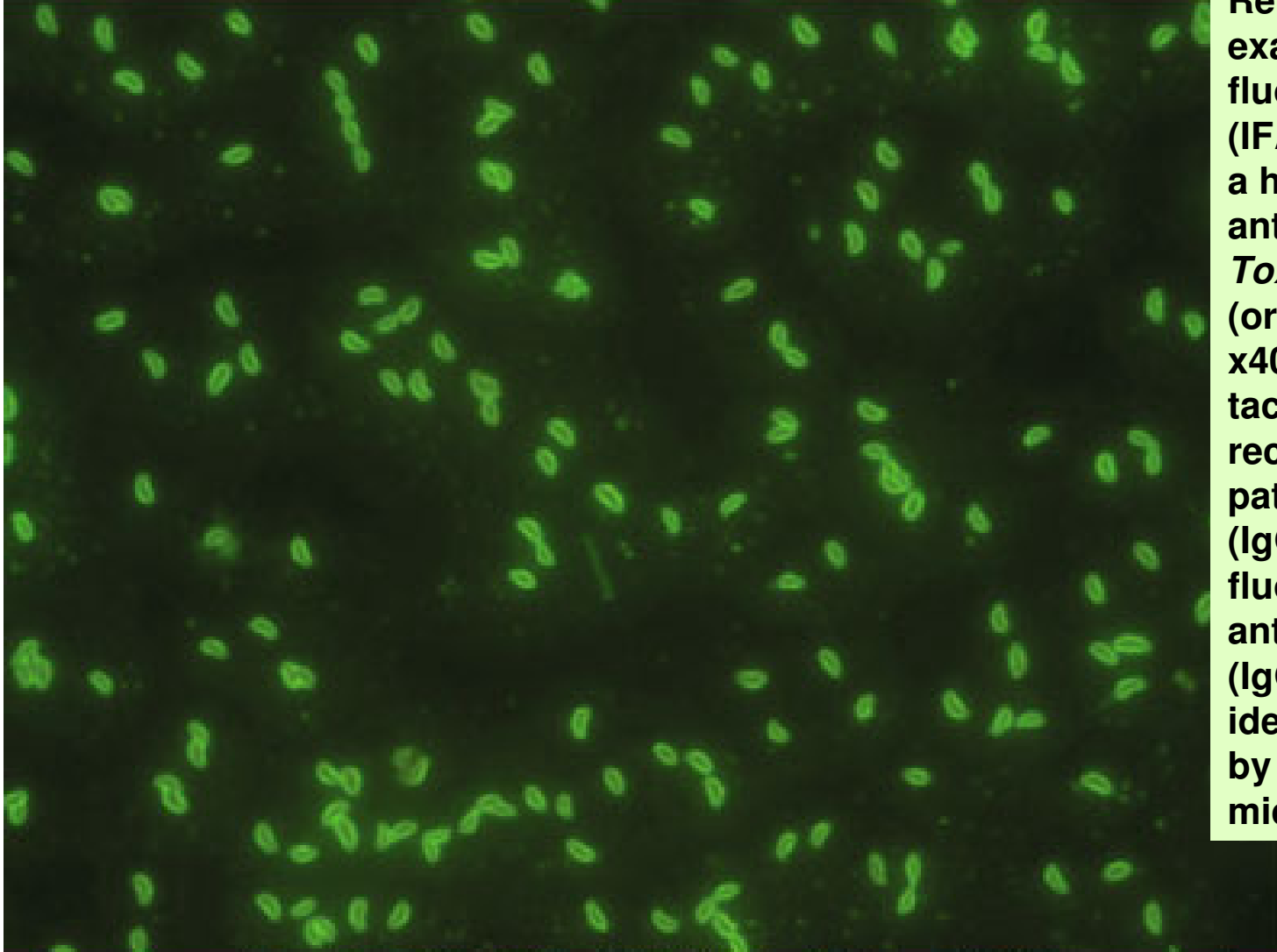
**szűrés: ELISA IgG, IgM, IgA**

Követés: újszülött 1 éves korig

macskatartás



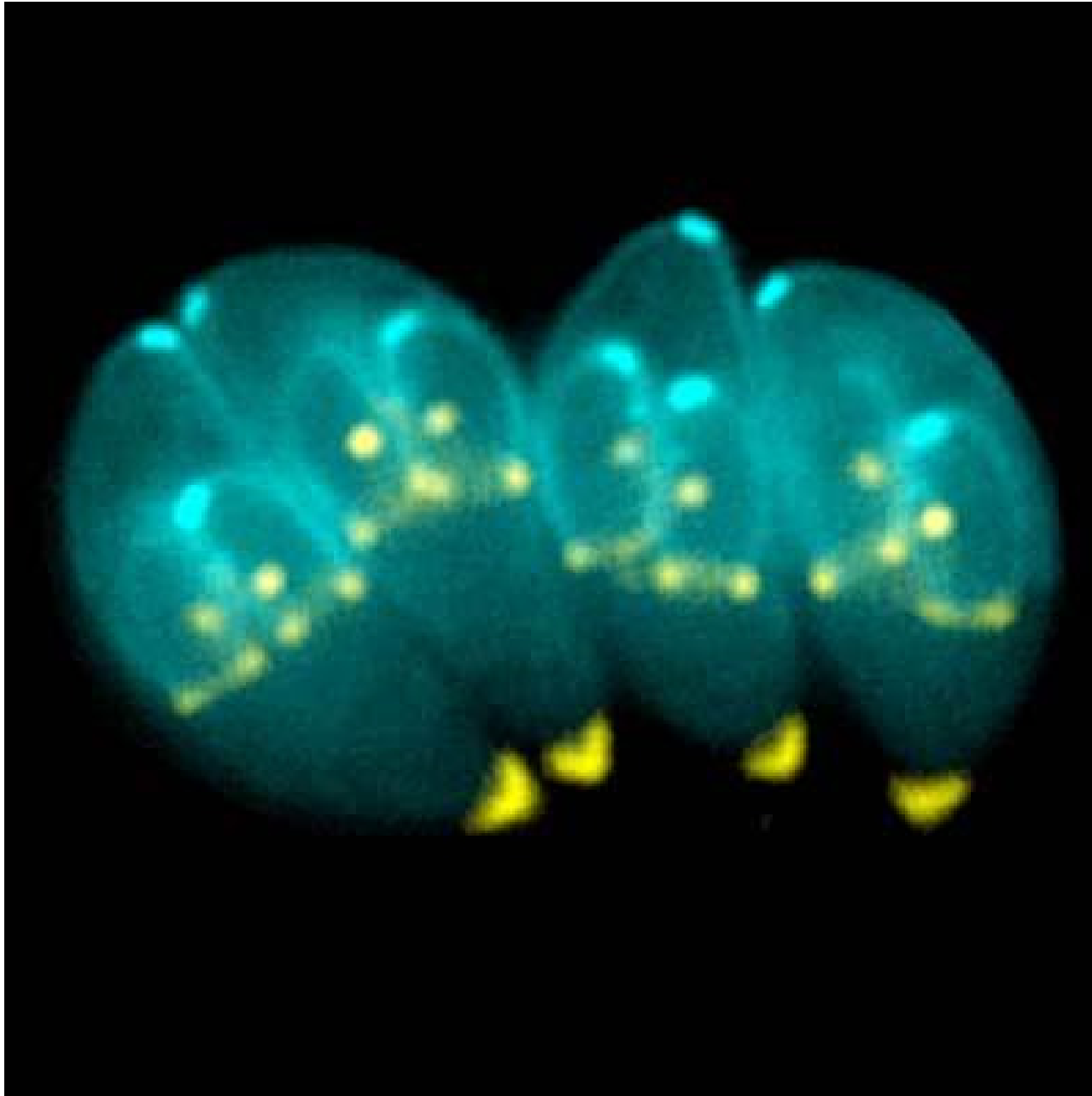
**Fig. 143** *Toxoplasma gondii* parasites in Giemsa-stained smear. These parasites cause both mild and severe foetal infections leading to still births or congenital deformities involving the liver, spleen, choroid and retina. Adult infection is usually mild with generalized lymphadenopathy. *T. gondii* also causes severe infections in immunocompromised hosts. Serological tests (toxoplasma dye test) provide evidence of current and past infections. Pyremethamine, co-trimoxazole, sulphonamides and spiramycin have all been used for treatment with variable success.  $\times 2,800$ .



Representative example of indirect fluorescent assay (IFA) in a patient with a high titer of IgG antibody to *Toxoplasma gondii* (original magnification x400). Fixed tachyzoites are recognized by the patient's antibody (IgG), and a fluorescent-labeled anti-human antibody (IgG) is added next to identify the antibody by fluorescent microscopy.

Source: Infect Med © 2002 Cliggott Publishing, Division of SCP Communications

If no antibody against the *T gondii* tachyzoite is seen, no fluorescence is present. (Photomicrographs and IFA preparation by Parkland Memorial Health and Hospital System Humoral Immunology Laboratory.)

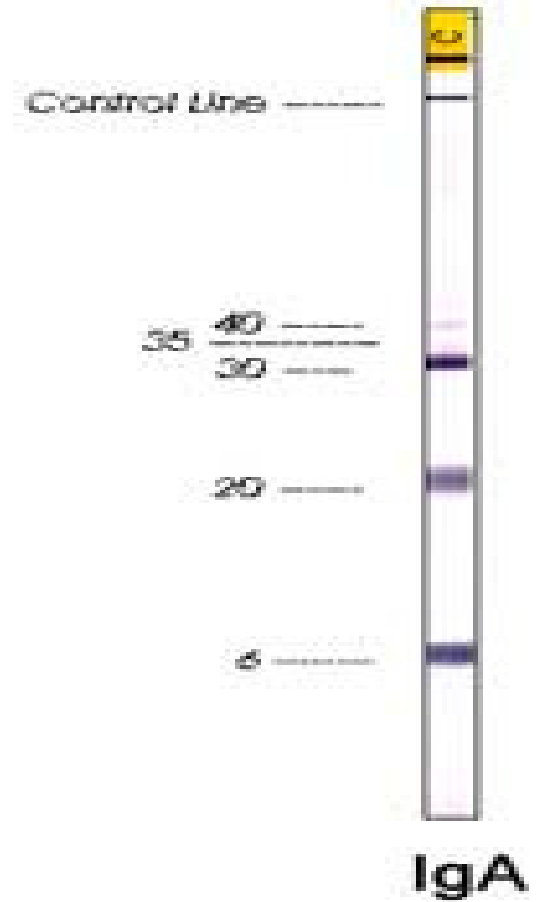
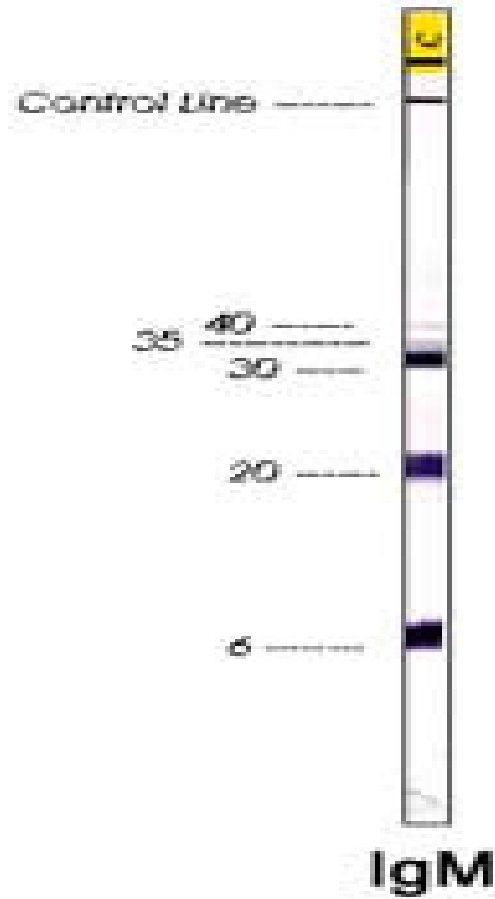
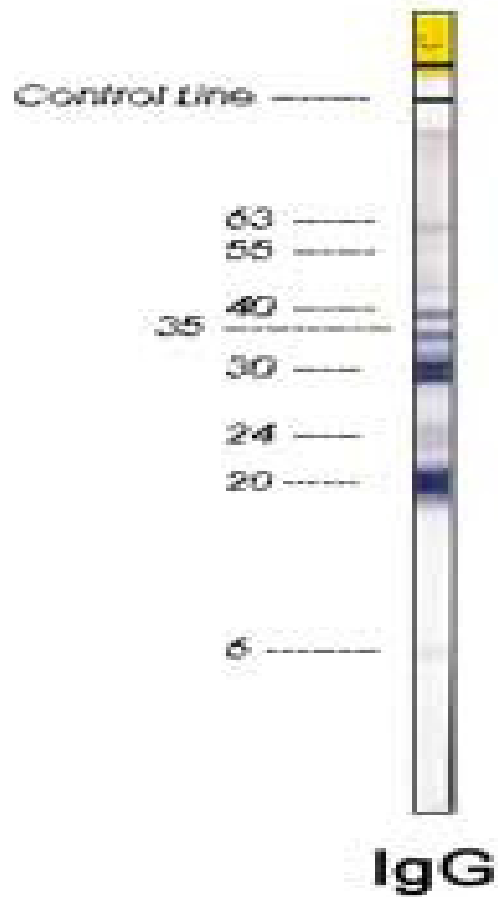


Credit: Image provided  
by Ke Hu and John  
Murray.

DOI:  
10.1371/journal.ppat.0  
020020.g001

[www.msgpp.org](http://www.msgpp.org)

# Congenitalis toxoplasmosis- szerológia konfirmálás: WB





# Vektor útján terjedő Vér / szöveti Protozoonok

Flagellata/mastigophora

**Trypanosoma spp.**

T. brucei gambiense/rhodesiense → álomkór

T. cruzi → Chagas kór

**Leishmania spp.**

L. donovani → visceralis, Kala-azar

L. tropica → cutan, Aleppo fekély

L. brasiliensis → muco-cutan, Espundia

Sporozoa (apicomplexa)

**Plasmodia spp.**

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

**MALARIA**



Sporozoa/apicomplexa

Plasmodium spp.

Vér és szöveti

Malaria

# Malaria történelem



**Alphonse LAVERAN**



**Ronald Ross**

Kína: 1700 i.e.

Europa: 500 i.e. Hippocrates

XIX–XX. Sz.: 4 Nobel – díj

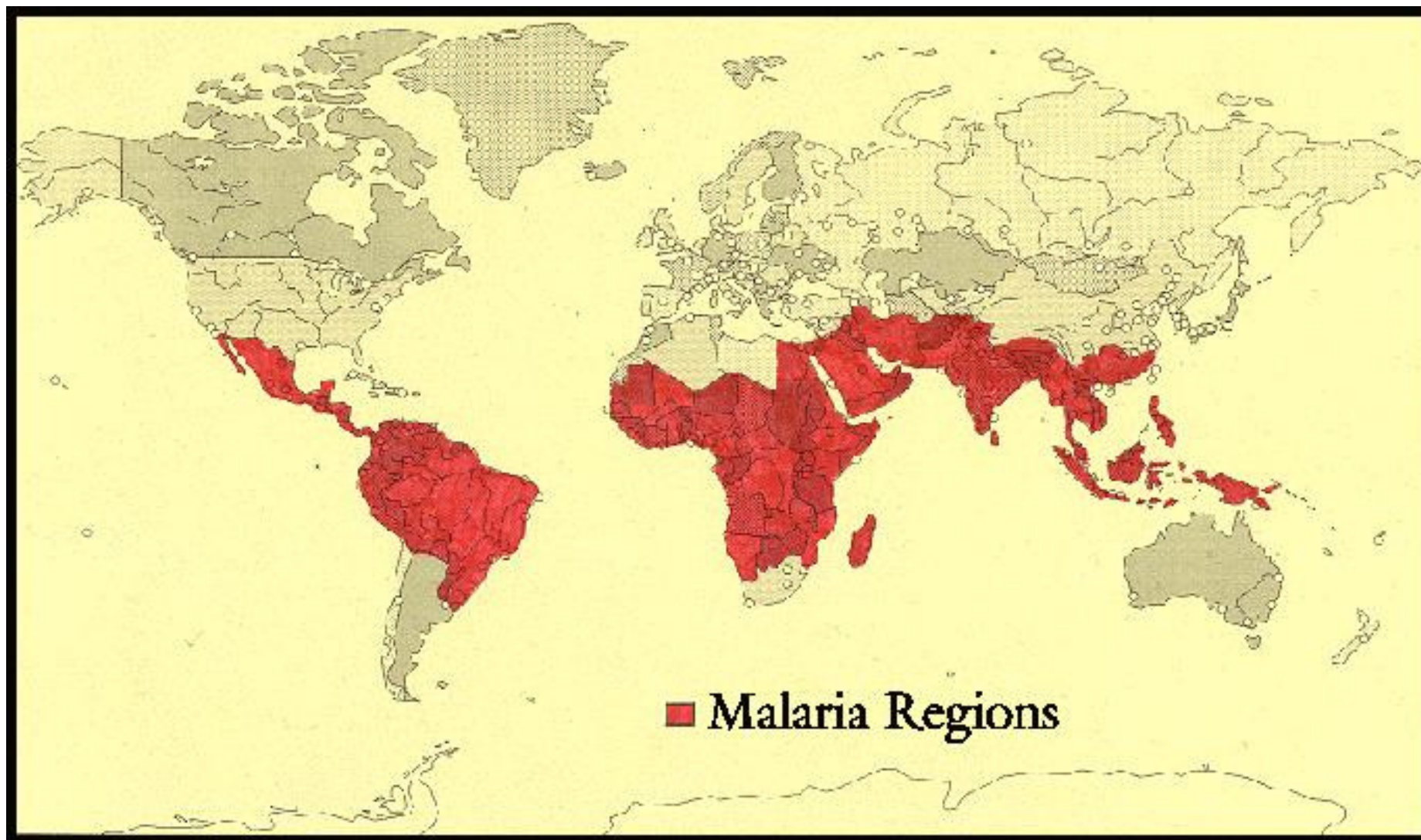
Laveran 1880- **Plasmodium**

Ross 1897- **Anopheles** vektor

Wagner-Jauregg 1927-neurosyphilis **malaria Th**

Müller 1939- **DDT** rovarirtó

Európa és É – Amerika endémiás terület volt, **1960-as évekig**



# Malaria – vektor térkép



FIGURE 1. Global distribution (Robinson projection) of dominant or potentially important malaria vectors.

# Plasmodium spp.

170 ismert faj  
4 human pathogen

**Transmissio:**  
vektor - 40 *Anopheles* faj

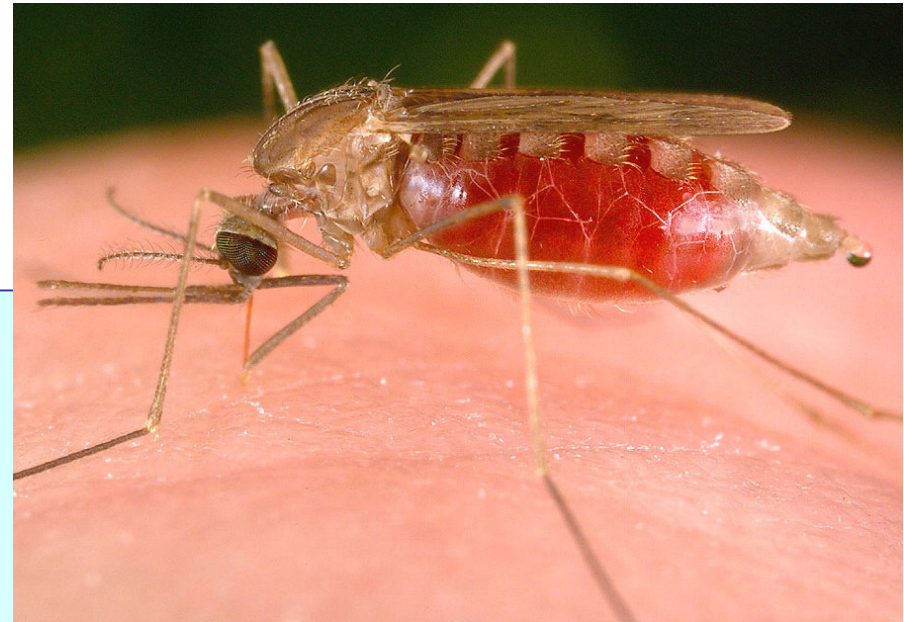
Komplex, 2 gazdás fejlődési ciklus: sporogonia, schizogonia

**human célsejtek:**

hepatocyták, vvt-k

500 millió fertőzött, 205 millió eset

2,7 millió haláleset/év; 1 millió gyermek – minden fél percben 1

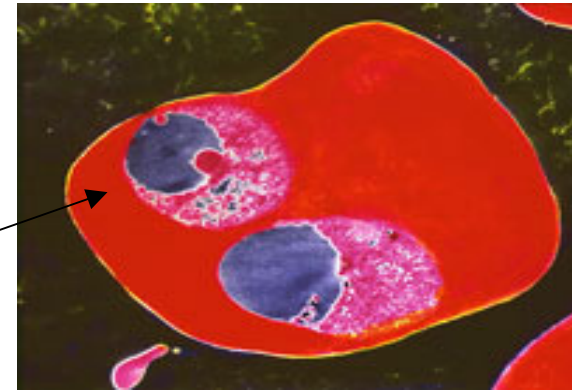


„Femme fatale”

## Human pathogen *Plasmodium* fajok

- ***P. malariae***  
(malaria quartana)
- ***P. ovale***
- ***P. vivax***  
(tertiana, relapsusok,  
máj hypnozoit  
forma!)
- ***P. falciparum***  
(malignus malaria)

Morphologia  
„pici” elfér a  
vvt-ben  
1 – 2  $\mu\text{m}$





# *P. falciparum*



marginal form



ring form



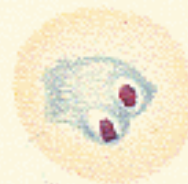
double dotted rings



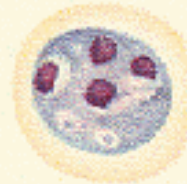
ring form



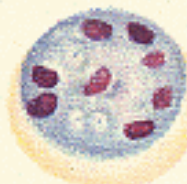
young trophozoite



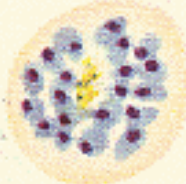
trophozoite



early schizont



schizont



mature schizont

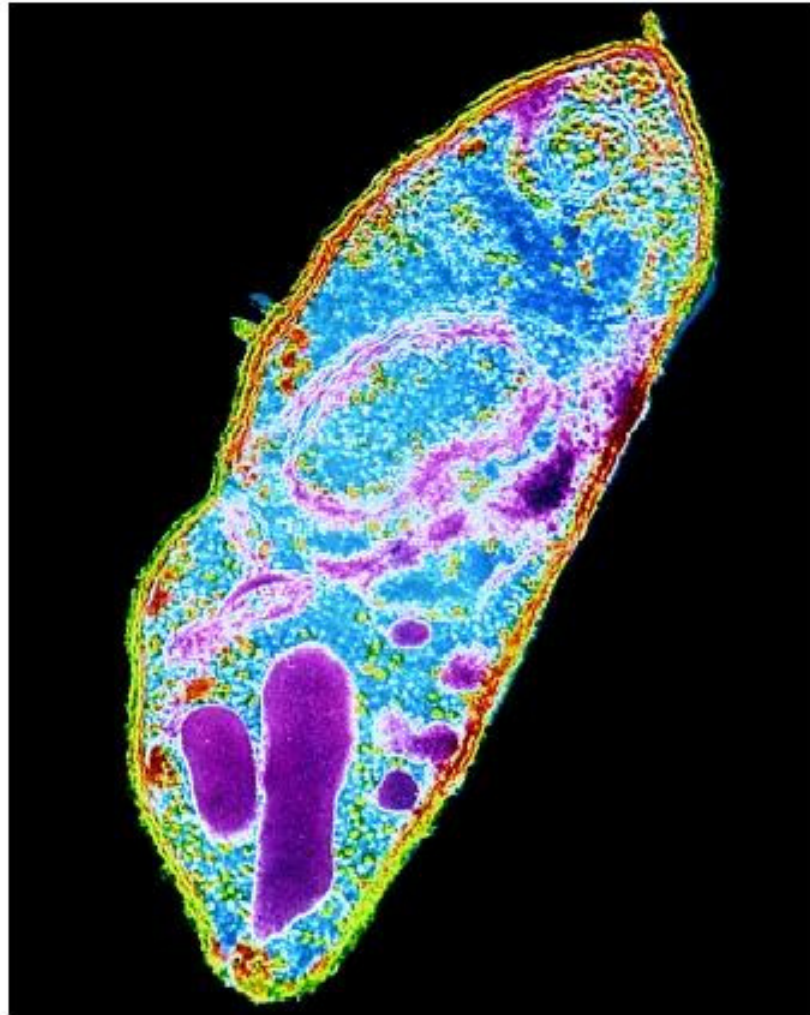


female gametocyte



male gametocyte

An electron micrograph of *Plasmodium falciparum*



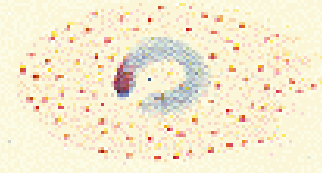
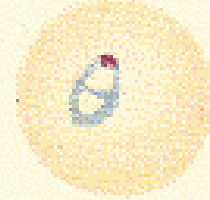
[www.biologyreference.com/.../biol\\_04\\_img0382.jpg](http://www.biologyreference.com/.../biol_04_img0382.jpg)

[www.jhsph.edu/bin/n/v/22malaria.jpg](http://www.jhsph.edu/bin/n/v/22malaria.jpg)



Male gametocyte of *Plasmodium falciparum* (yellow) surrounded by red blood cells

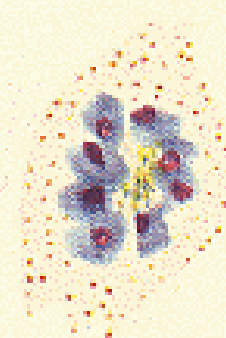
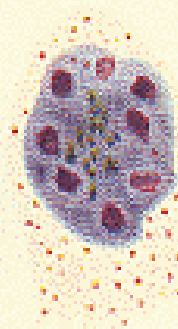
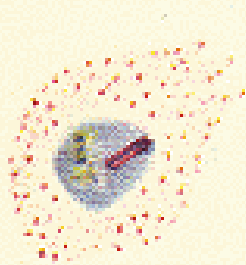
# *P. ovale*



young ring

older ring

comet form



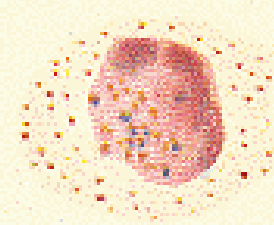
trophozoite

trophozoite

young schizont

schizont

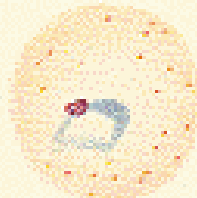
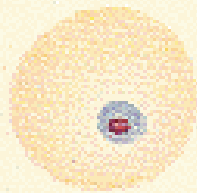
mature schizont



female gametocyte

male gametocyte

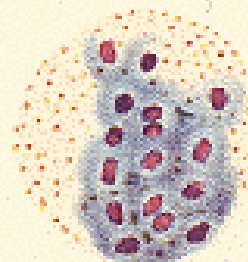
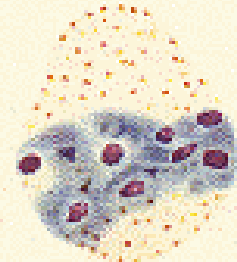
# *P. vivax*



ring form

mature ring form

trophozoite

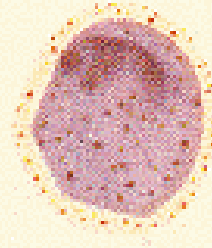
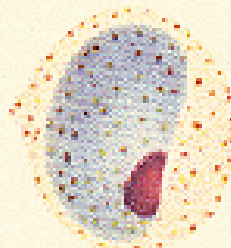
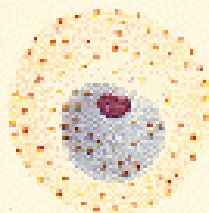


trophozoite

early schizont

schizont

mature schizont



developing gametocyte

female gametocyte

male gametocyte

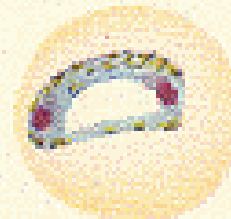
# *P. malariae*



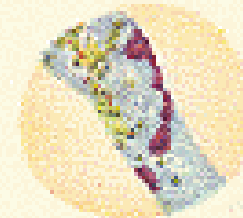
ring form



early band form



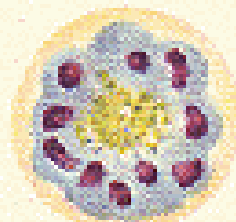
band form



early schizont



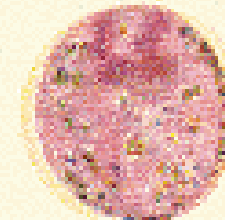
mature schizont



female gametocyte

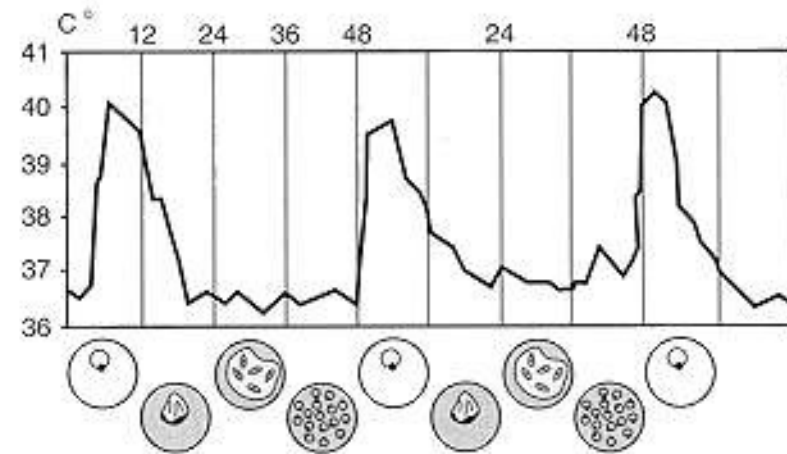


male gametocyte



Malaria tertiana  
*P. vivax*

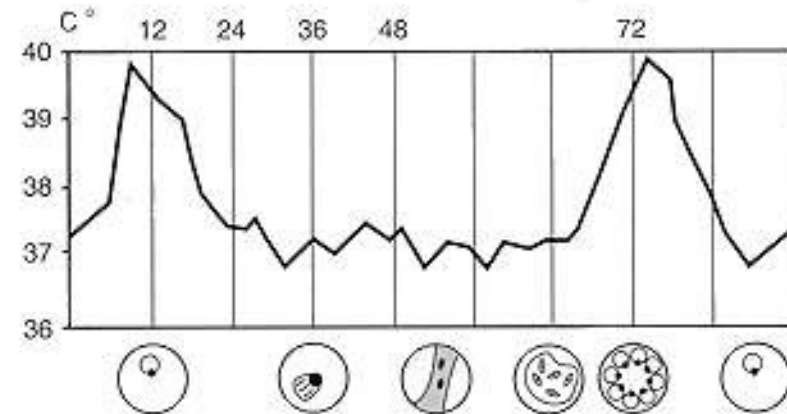
Typical temperature chart of *P. vivax* infection showing tertian periodicity related to the maturation and rupture of erythrocytic schizonts



**FIGURE 83-1 Typical temperature charts of malarial infections.**

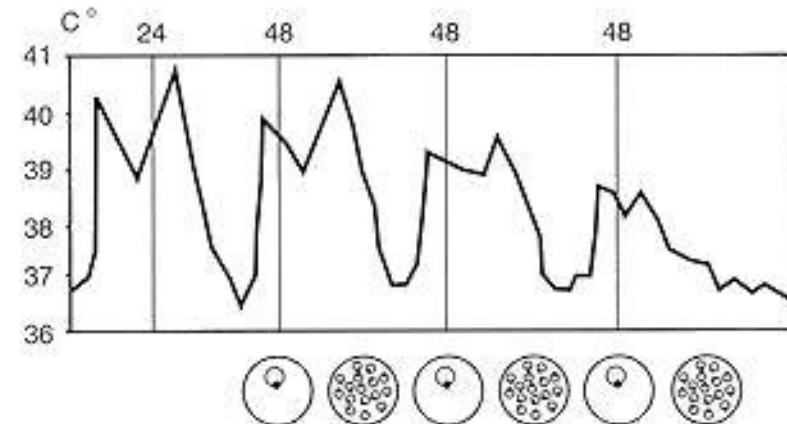
Malaria quartana  
*P. malariae*

Typical temperature chart of *P. malariae* infection showing quartan periodicity

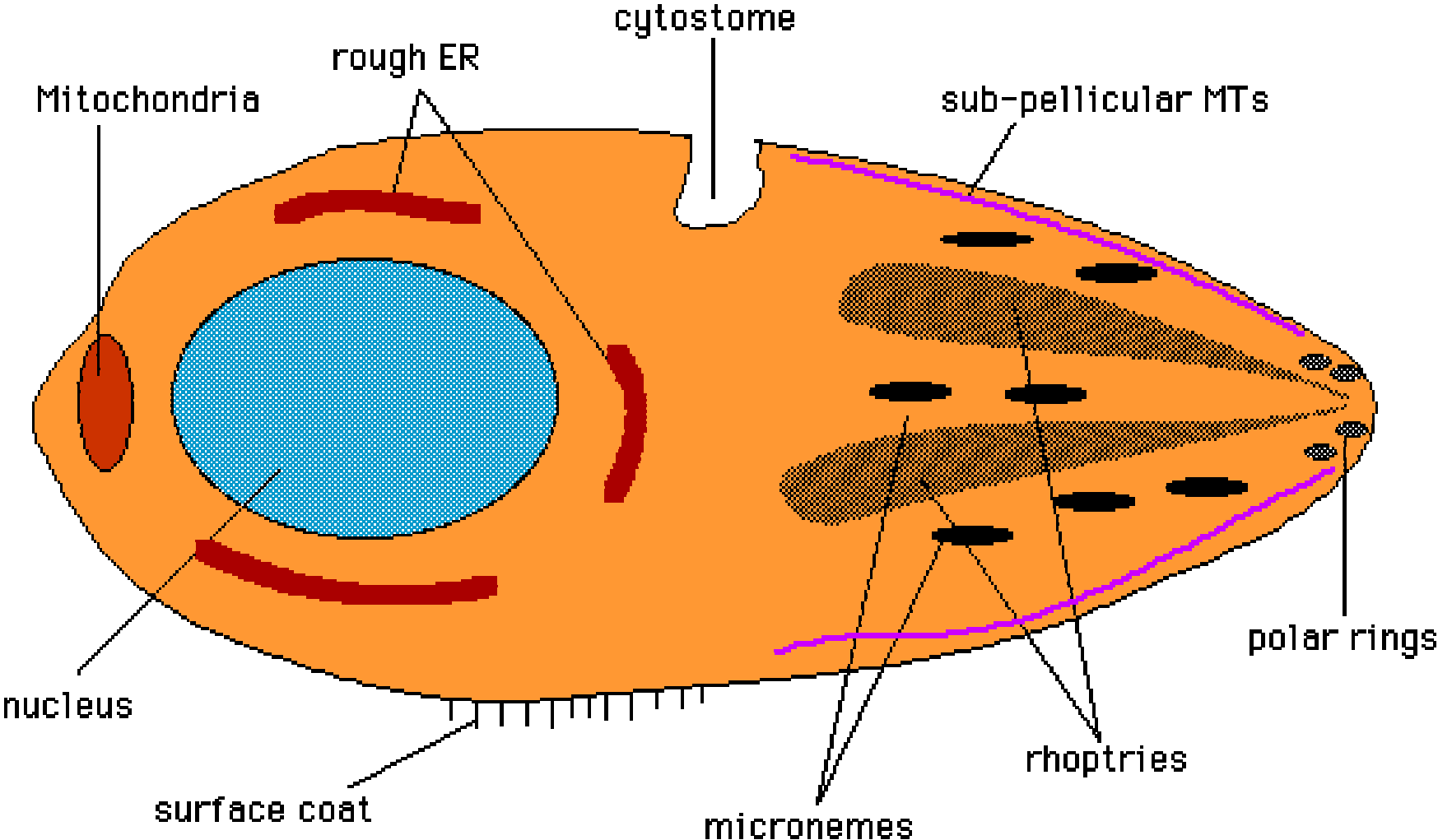


Szabálytalan  
Malaria tertiana  
Malignus malaria  
*P. falciparum*

Typical temperature chart of *P. falciparum* infection showing irregular tertian periodicity and the influence of successful treatment

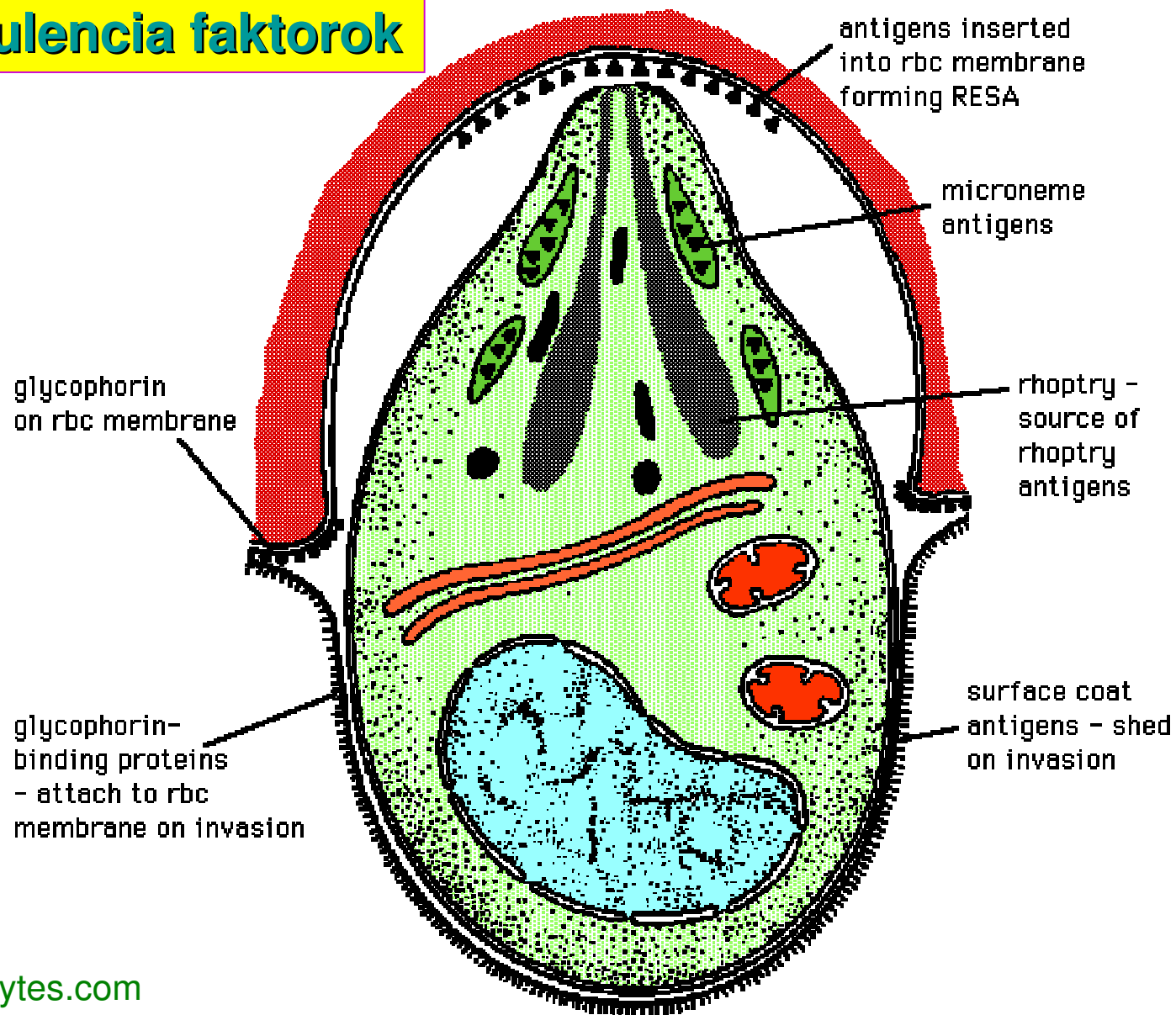


# MALARIA MEROZOITE



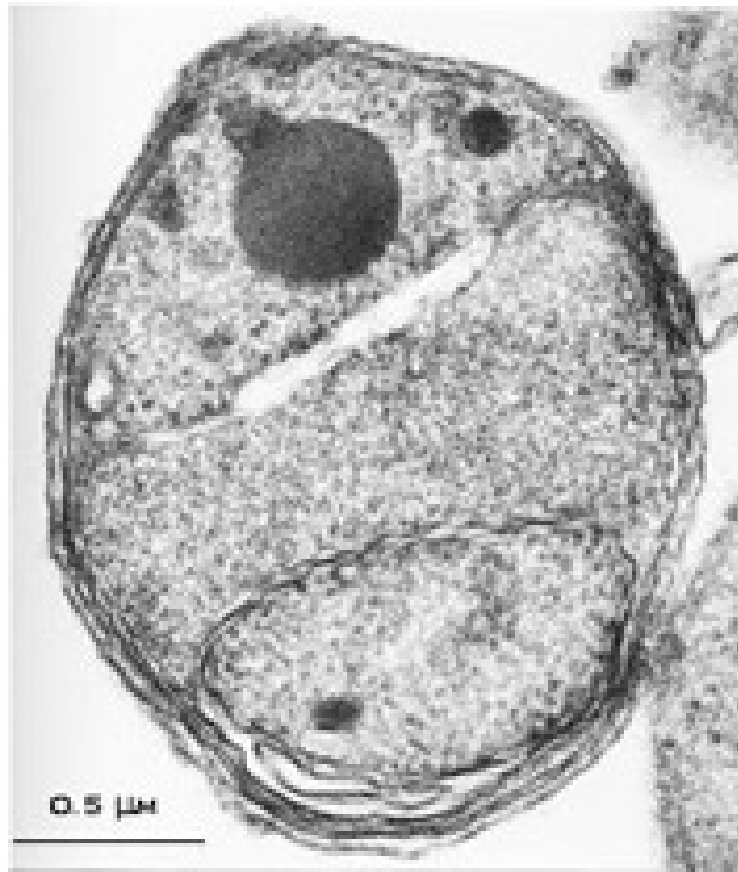
## Plasmodium sp. - antigens:

### Antigének, Virulencia faktorok





# Merozoit felszíni antigének - *Plasmodium*



Apical Merozoite Ag

AMA-1

Rhoptry

Microneme

MSP1

Merozoite Surface Protein

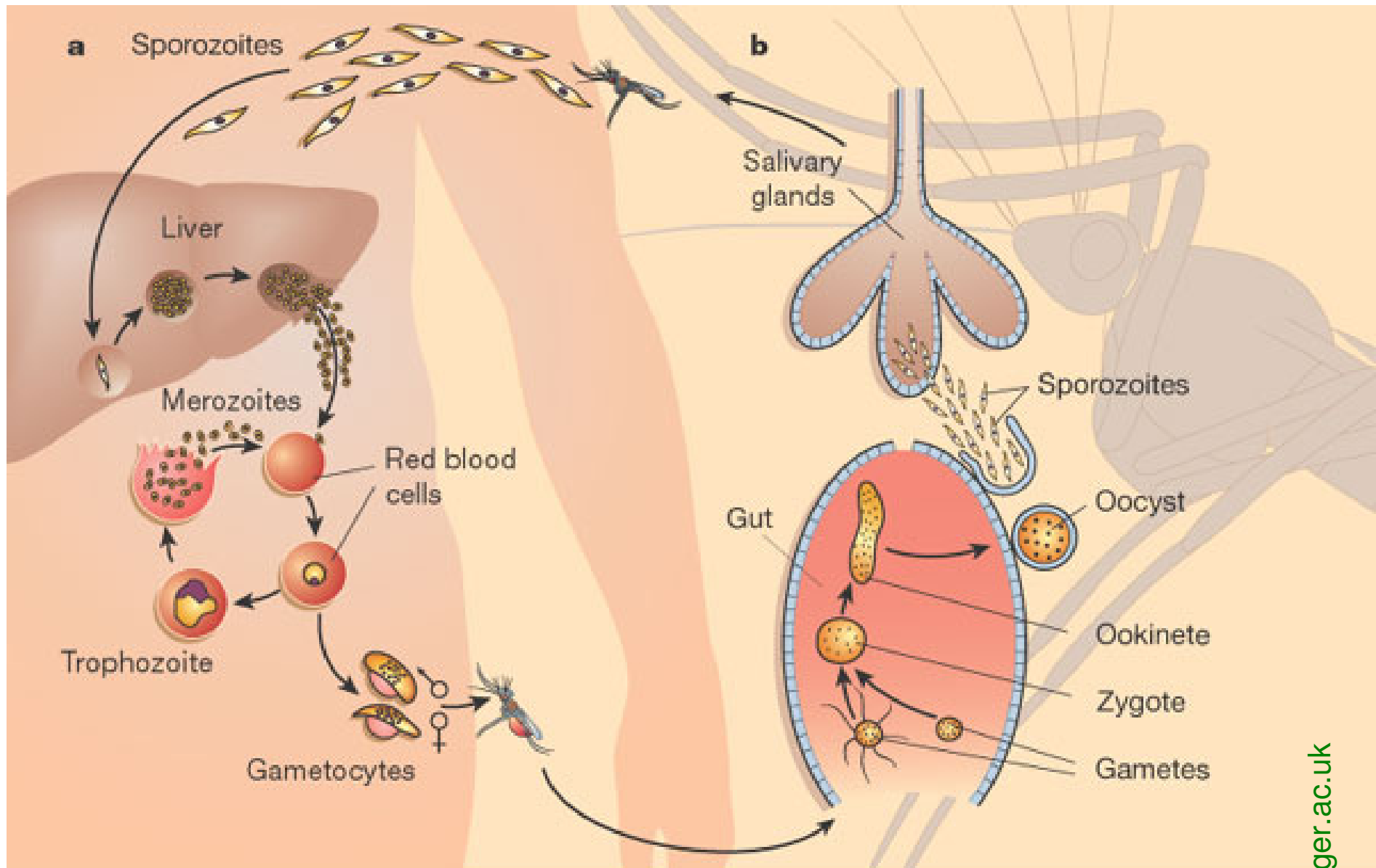
Nucleus

Surface coat

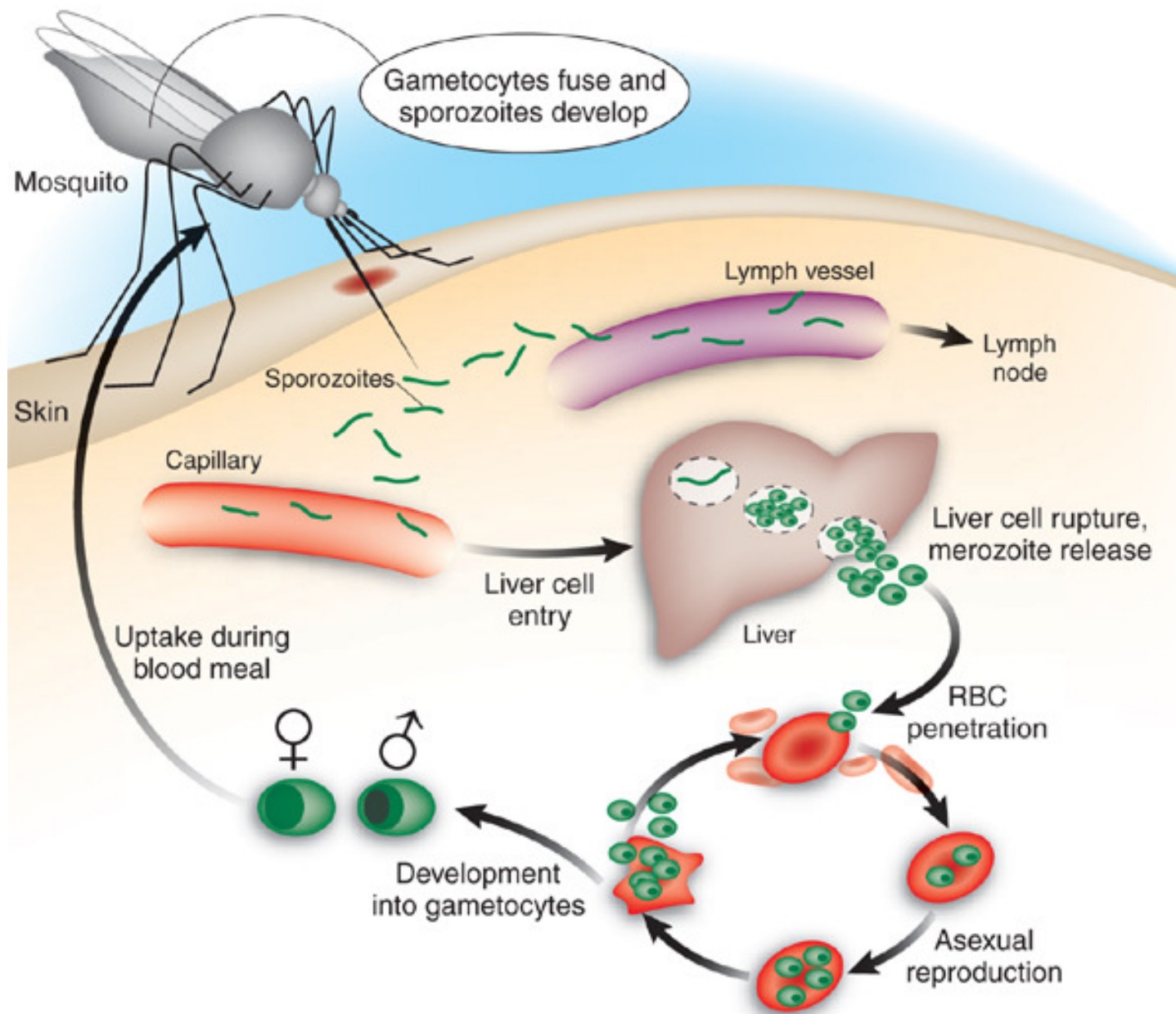
Mitochondrion

[www.pasteur.fr/.../merozoite-calque+photo.jpg](http://www.pasteur.fr/.../merozoite-calque+photo.jpg)

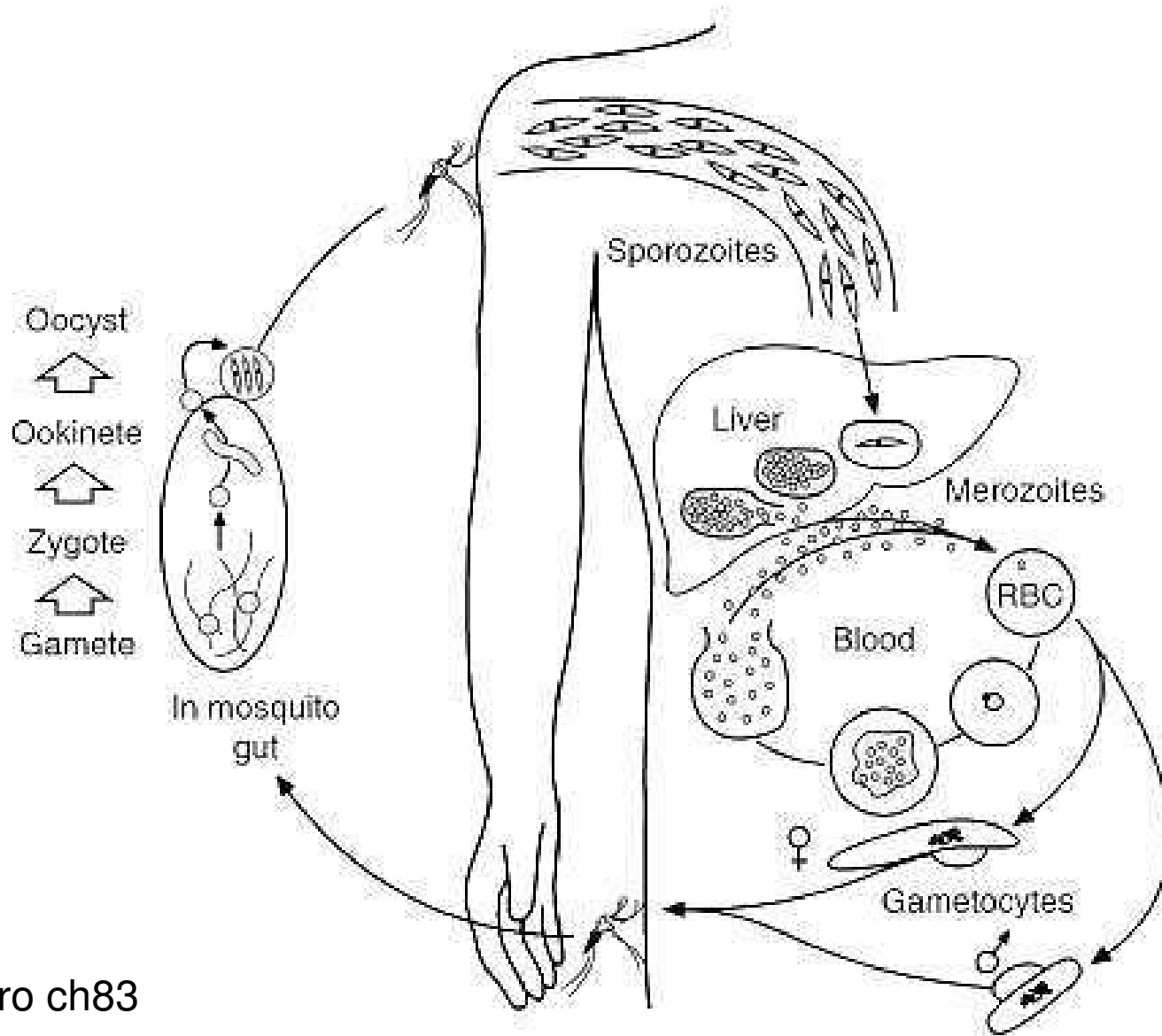
(Electron micrograph kindly provided by Dr. Peter David, Unité d'Immunologie Moléculaire des Parasites, I.P.)



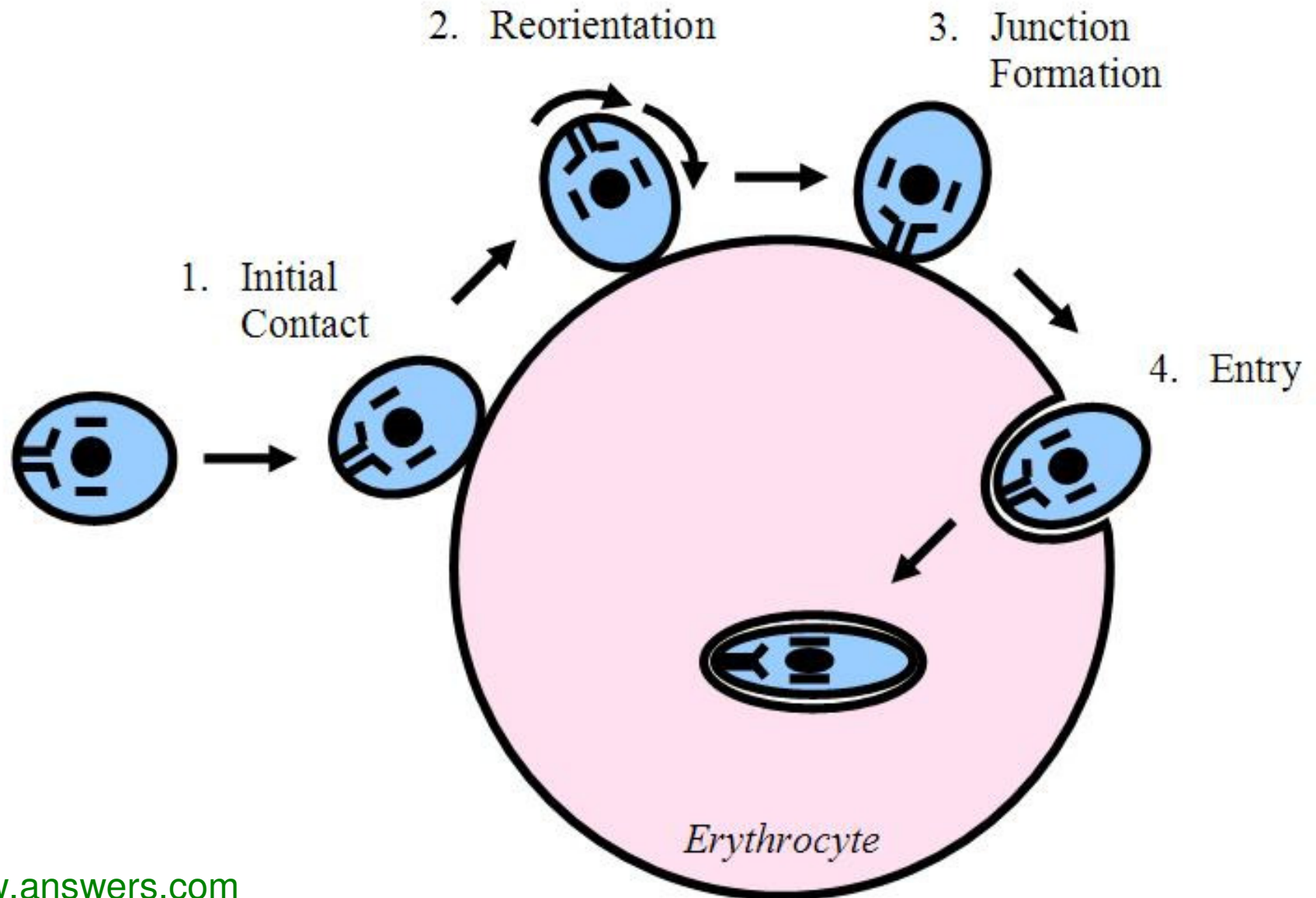
***Plasmodium* életciklus (*Anopheles*, ember)  
 aszexualis: schizogonia, szexualis: sporogonia**



**FIGURE 83-3 Life cycle of malaria parasite.**



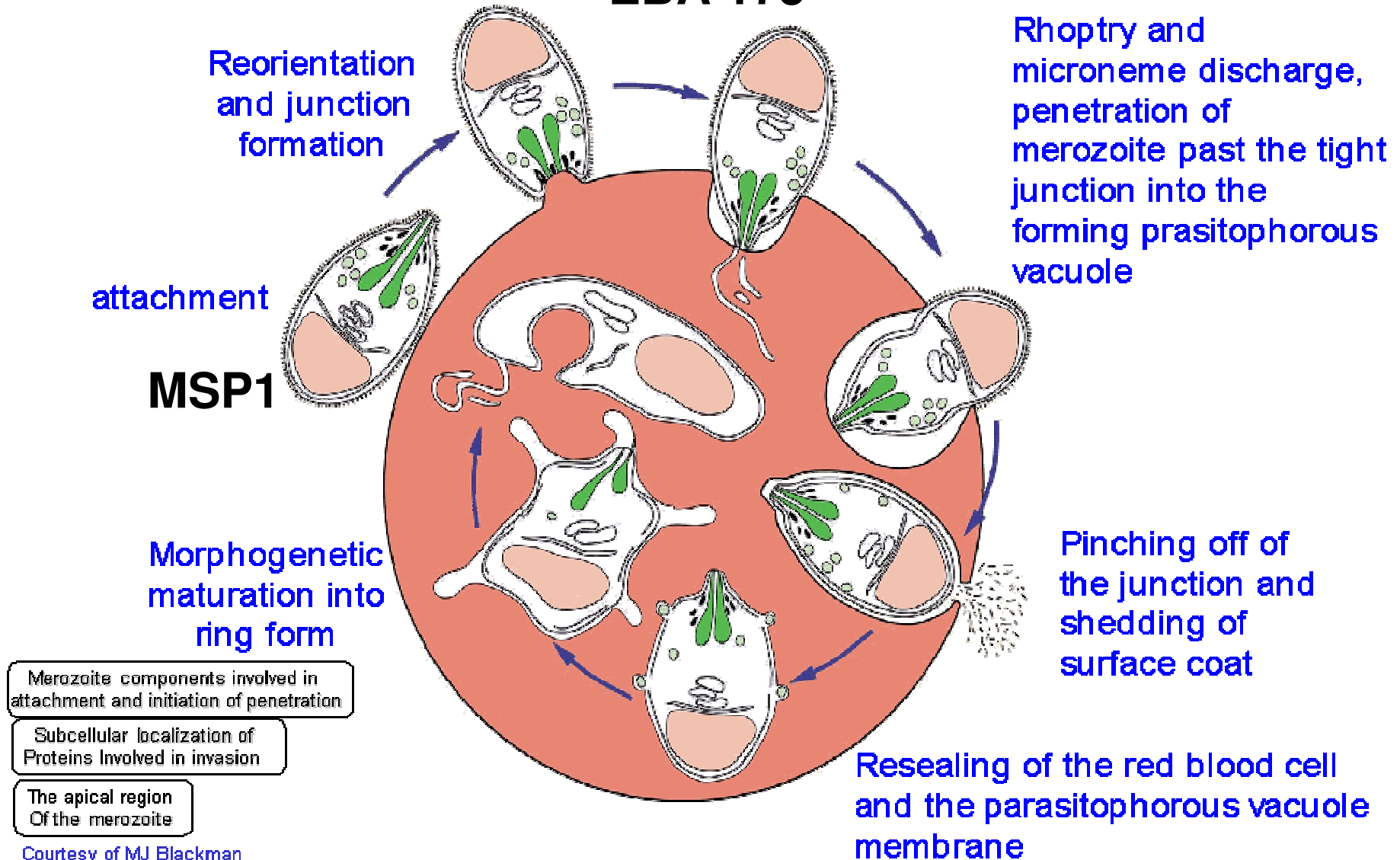
*Plasmodium falciparum* behatolás a vvt-be – egyszerűsített



# Plasmodium - gazdasejt interakció (Duffy Ag, glycophorin- szíálsav)

## Invasion of erythrocyte by the merozoite

### EBA 175

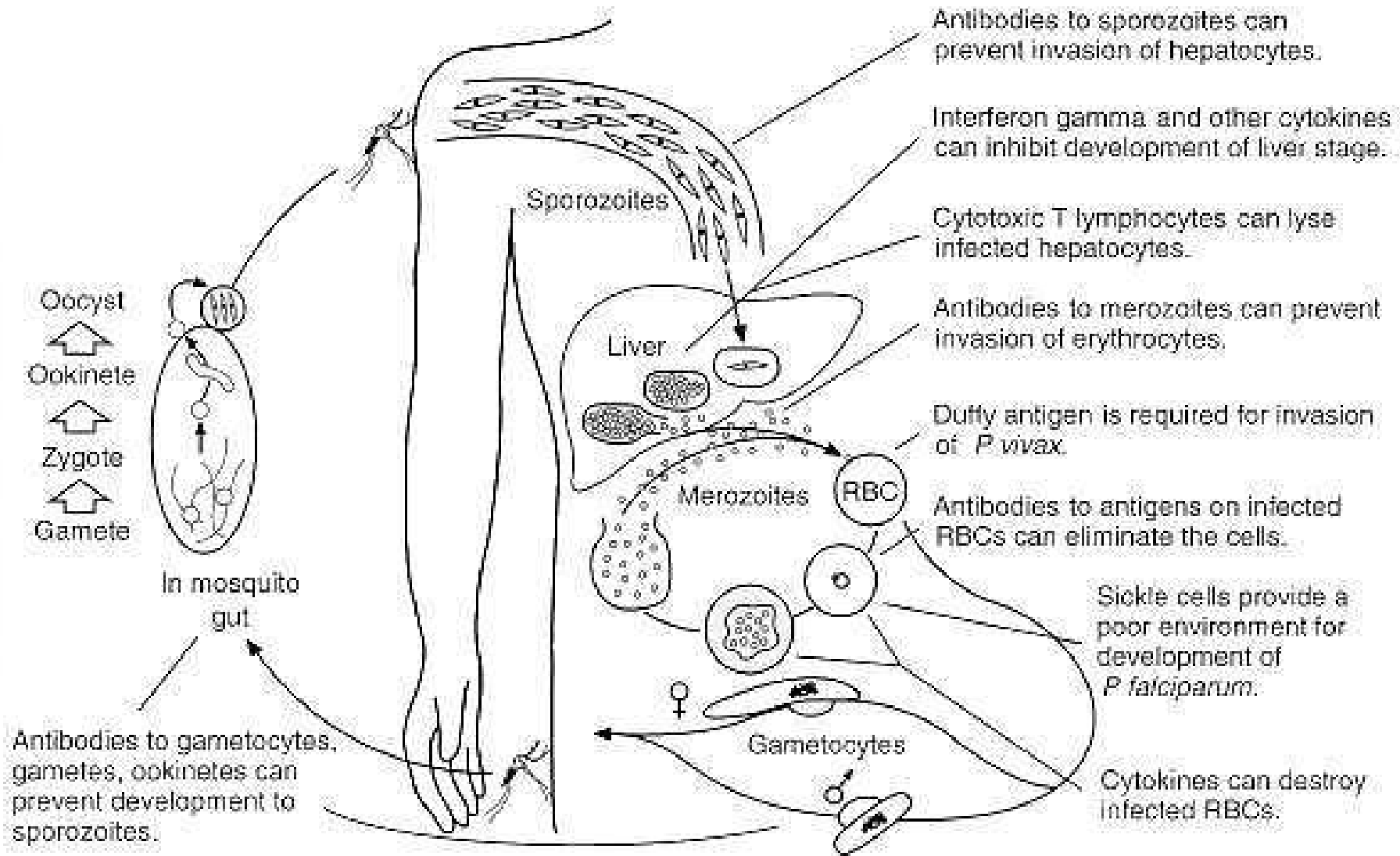


http://www.iwf.de/iwf/do/mkat/details.aspx?GUID=444C4755494400B9D8364493893800DBCC299C0301030061F44C867100000000&Action=Quicklink&Search=Medizin;%20Innere%20Medizin;%20Infektionskrankheiten;&SearchIn=Klassifikation&Offset=10

Malaria, eng, 10 min

<http://www.iwf.de/iwf/do/mkat/details.aspx?GUID=444C47554944001AEB9A3F65AA31002287A1920301030061F44C863003000000&Action=Quicklink&Search=medicine;%20internal%20medicine;%20infectious%20diseases;&SearchIn=Klassifikation>

**FIGURE 83-5 Host defense against malaria.**





# Malaria – kórkép, a betegség lefolyása

**Incubatio:** 7–40 nap

Influenza szerű bevezető tünetek  
anaemia, sárgaság (icterus),  
hepatosplenomegalia, hidegrázás,  
láz (3–7 óra), fejfájás, profuse  
izzadás, alvás 2–4 óra

**szövődmények:**

”blackwater fever”, feketevízláz  
veseelégtelenség,  
**cerebralis malaria**



## Cerebralis malaria



**coma, görcsök, halál**

## Cerebralis malaria - pathogenesis

### *P. falciparum*

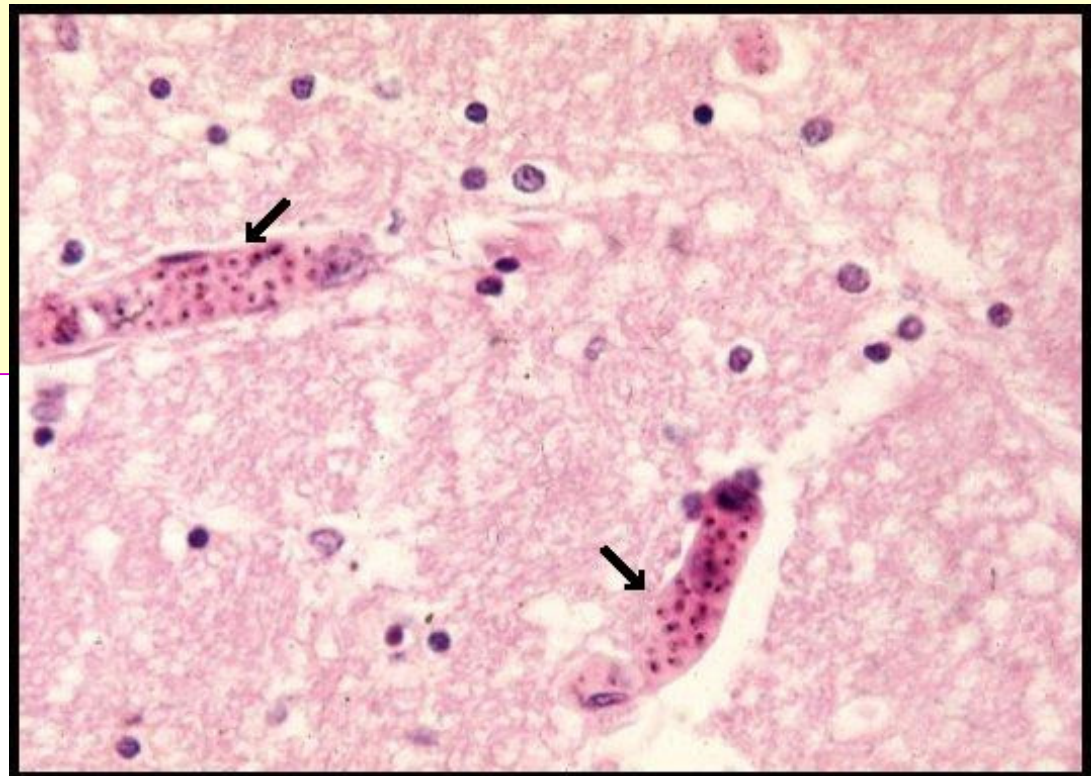
Minden életkorú és nagyszámú vvt fertőzött - 50 % !

Ragacsossá válnak a vvt-k

Adhesio a vascularis endothel sejtekhez (occlusio, elzáródás)

Macrophag stimulatio

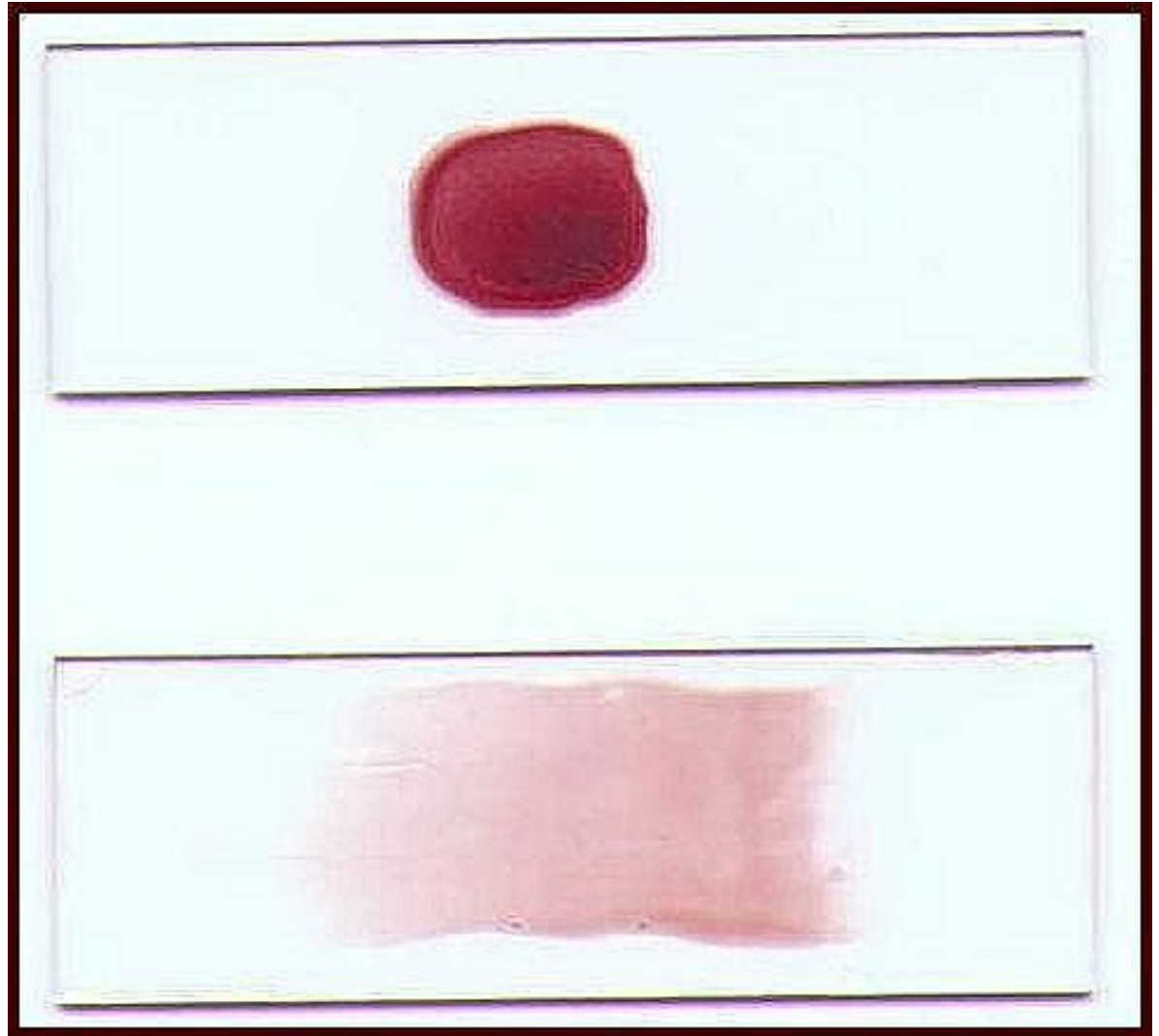
↑ permeability  
(vasodilatatio)



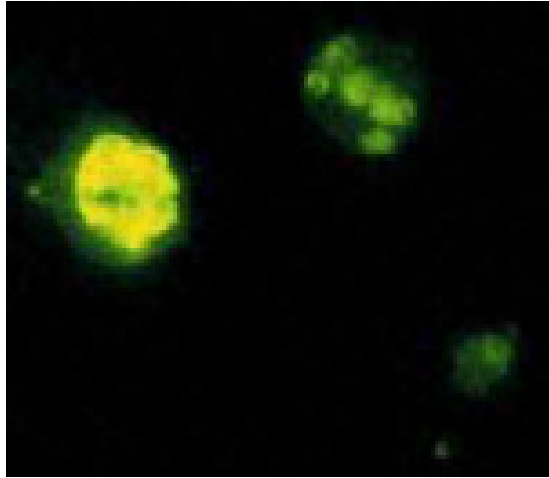
# Diagnosis

Vérkenet!  
0, 6, 12, 24 óránként

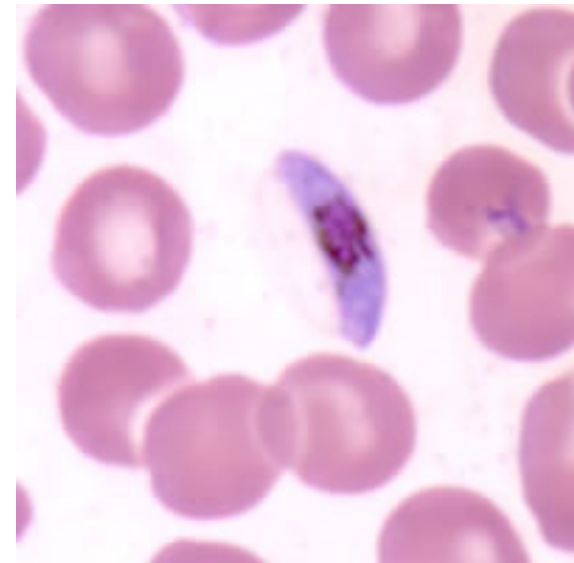
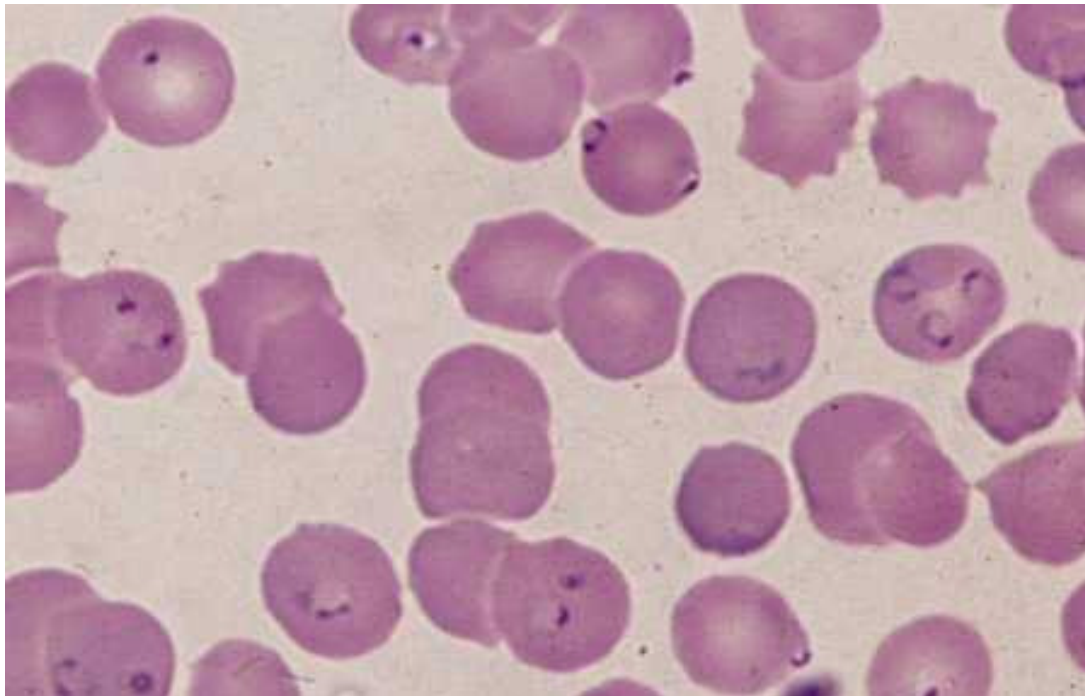
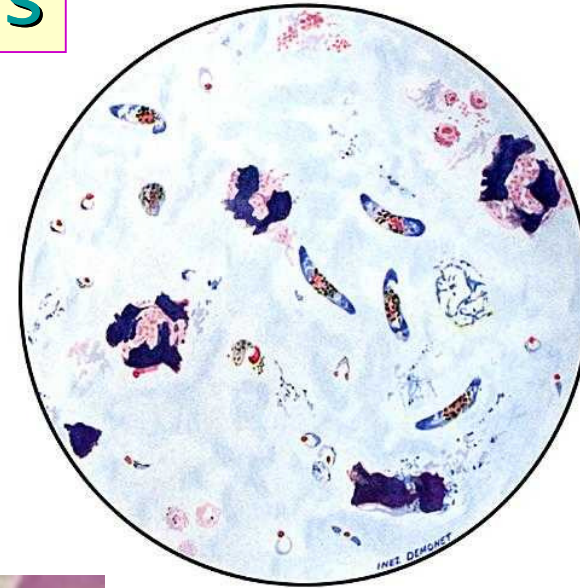
Vastagcsepp  
vérkenet (vékonyfilm)  
Giemsa- festés  
(40 perc!)



# Diagnosis

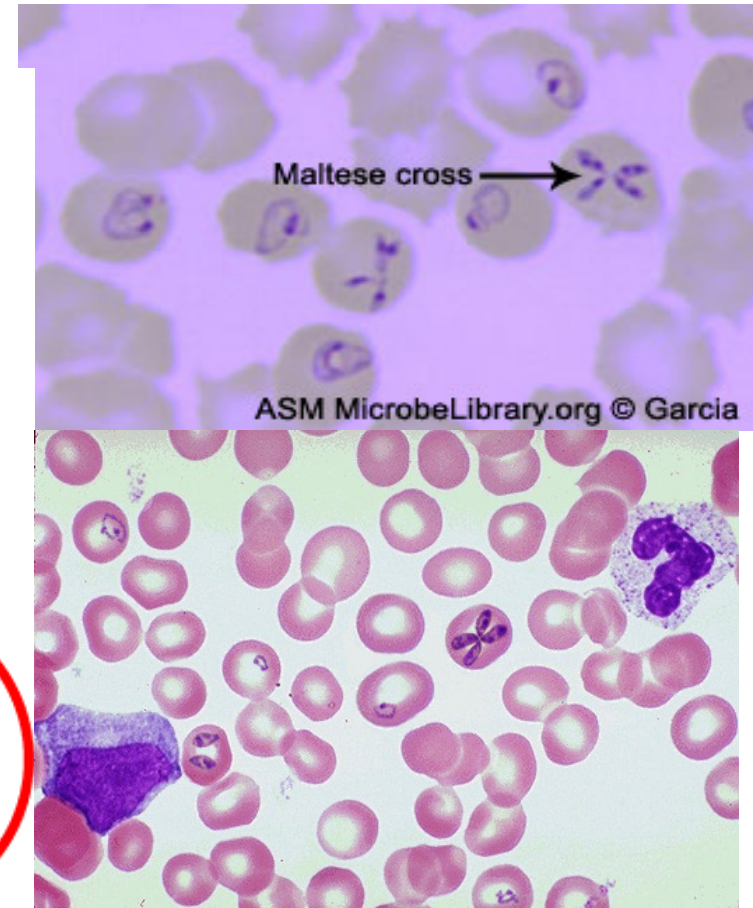
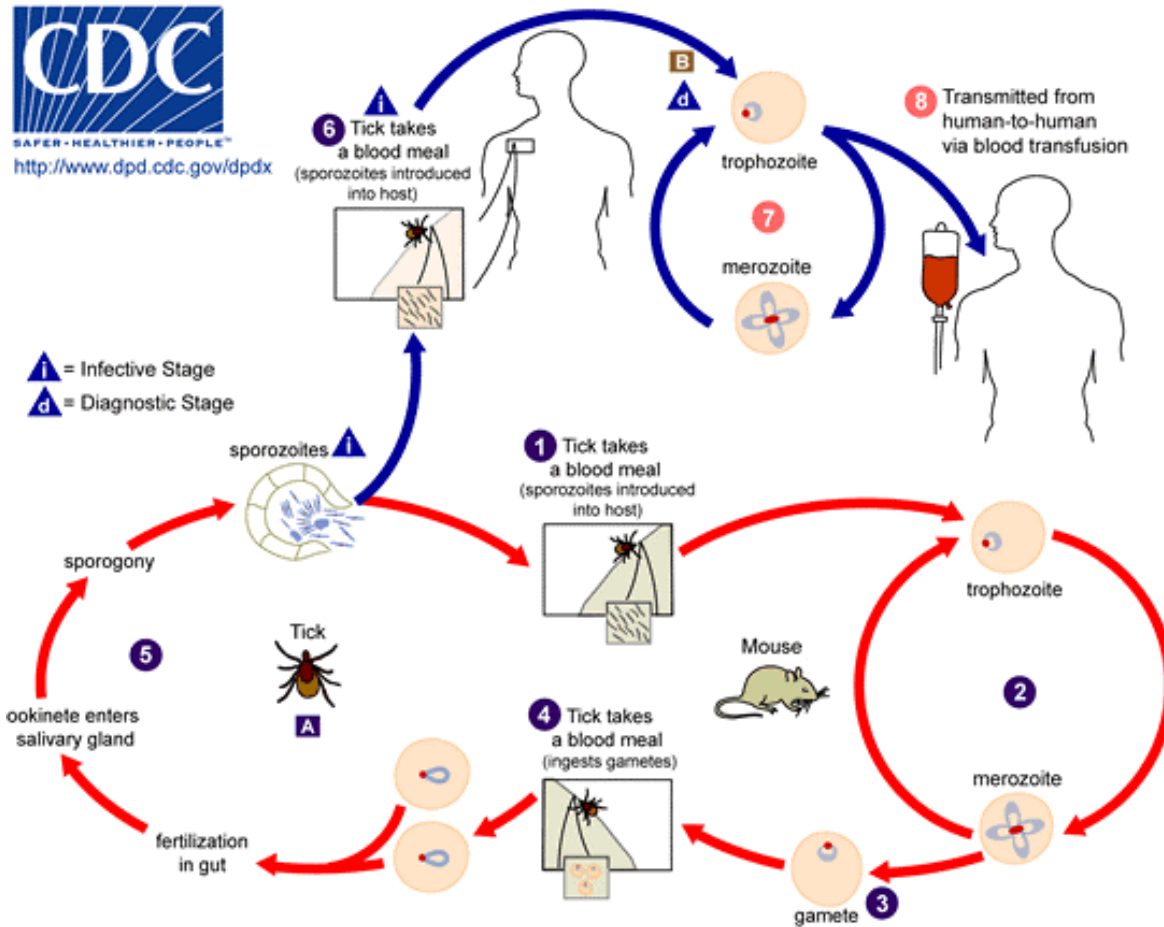


DIF



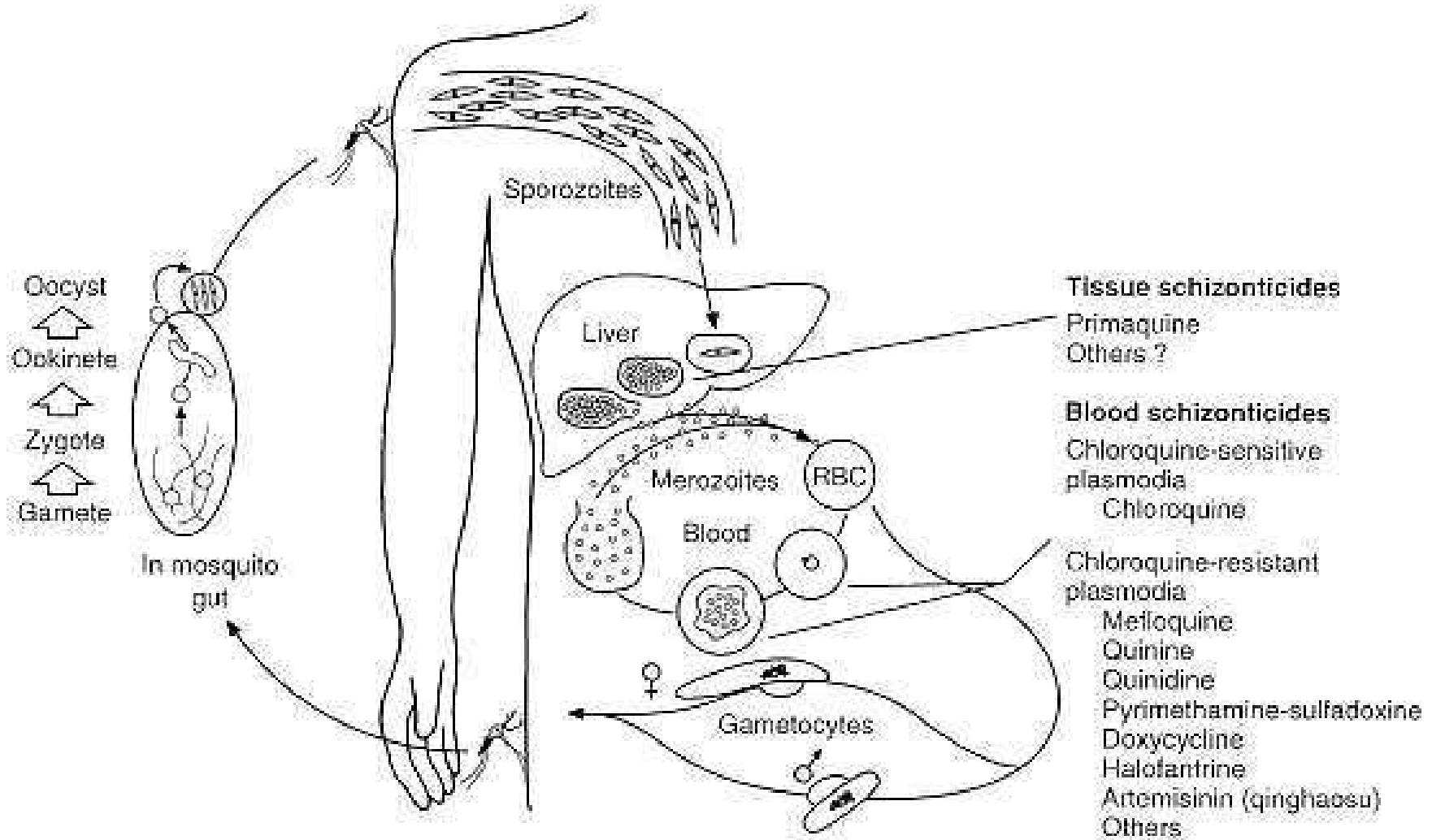
# Differential Dg: *Babesia!*

Mérsékelt égöv, szezonalitás, immunkárosodottak (risk)



**FIGURE 83-7 Treatment of acute malaria.**

# Therapia



# Malaria – a kezelés alapelvei

## Kemoprofilaxis

Antimalariás szerek kombinációja

Species – függő

**(chloroquine R vagy S, vagy MDR!)**

beteg status (oralis vagy iv), életkor  
Hypnozoit? (*P. vivax*, *P. ovale*)

artemisininek **MDR *P. falciparum*** esetén

Malária endémiás területen minden lázas állapot  
maláriának tekintendő: (amíg ki nem derül az ellenkezője...)

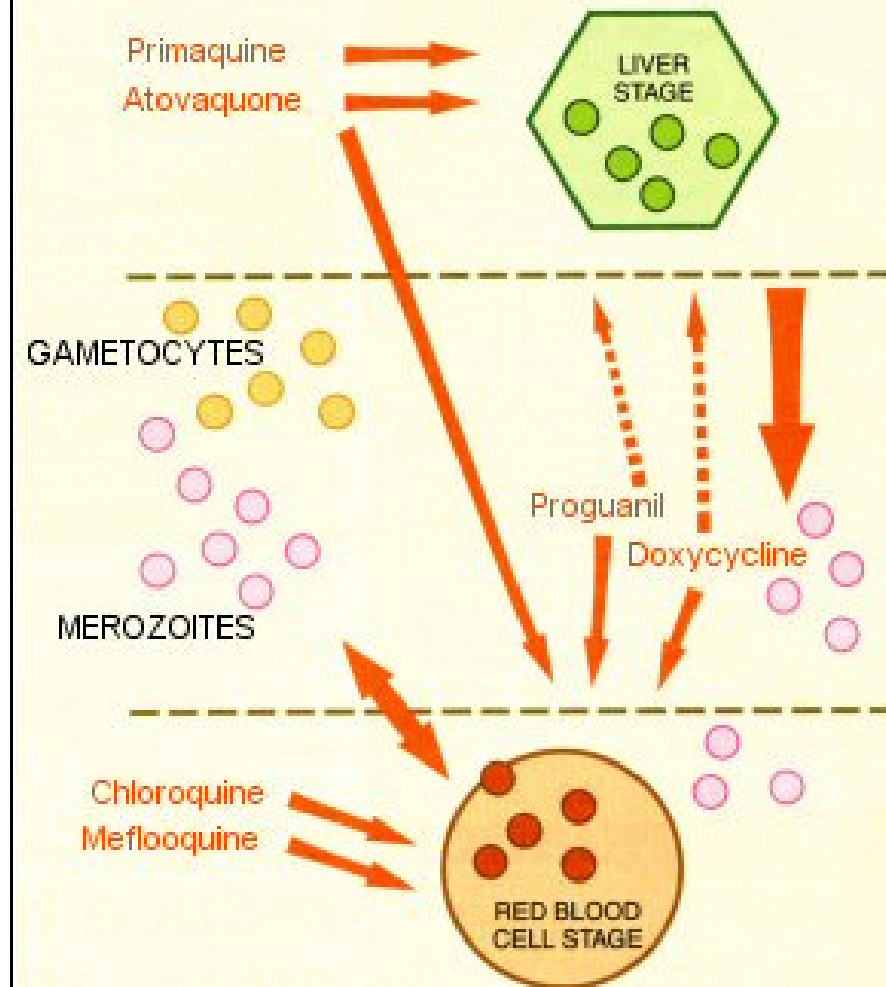
atovaquone/proguanil (Malarone)

4 tableta/nap 3 napig, és **orvost kell keresni!**

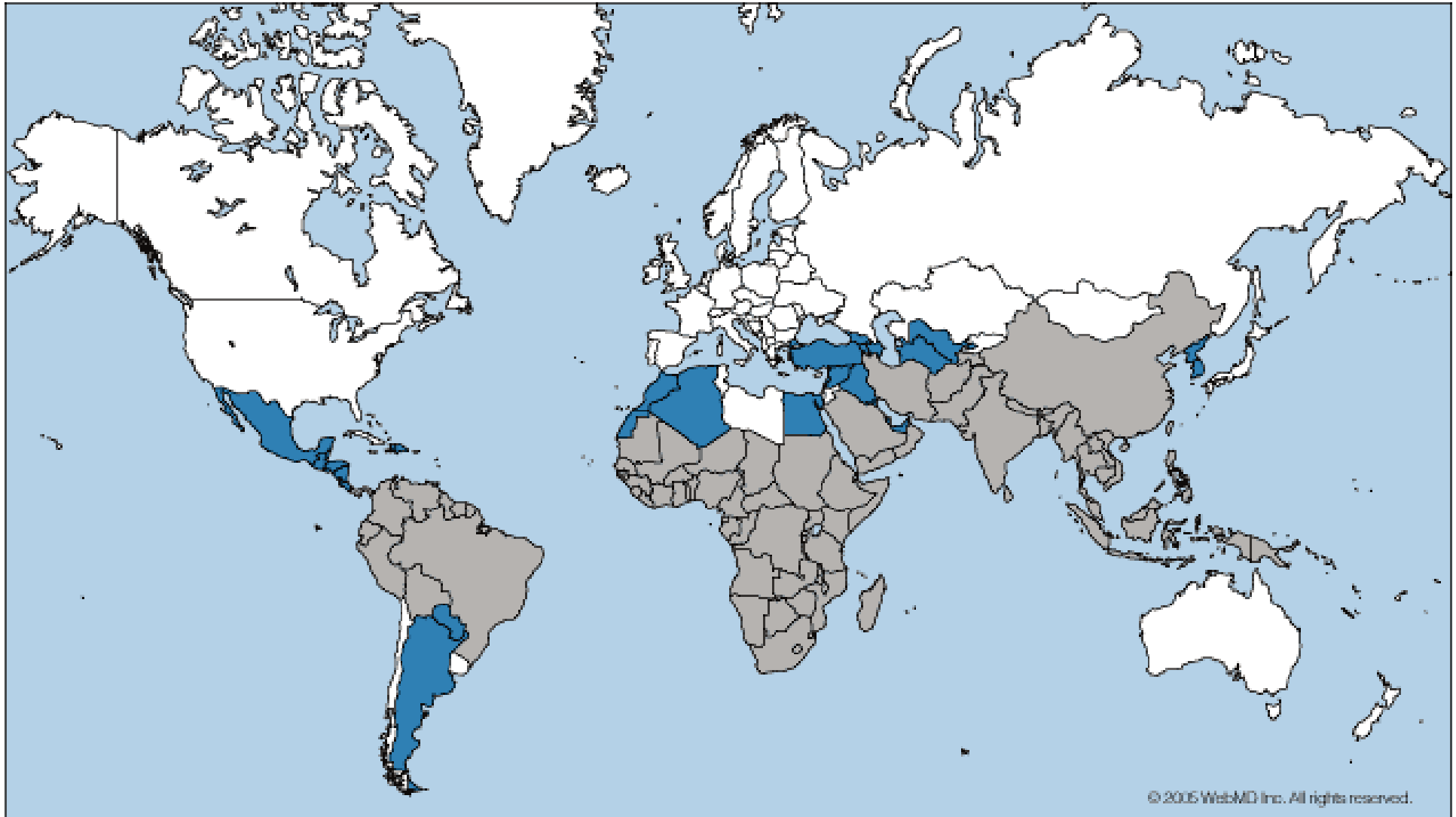




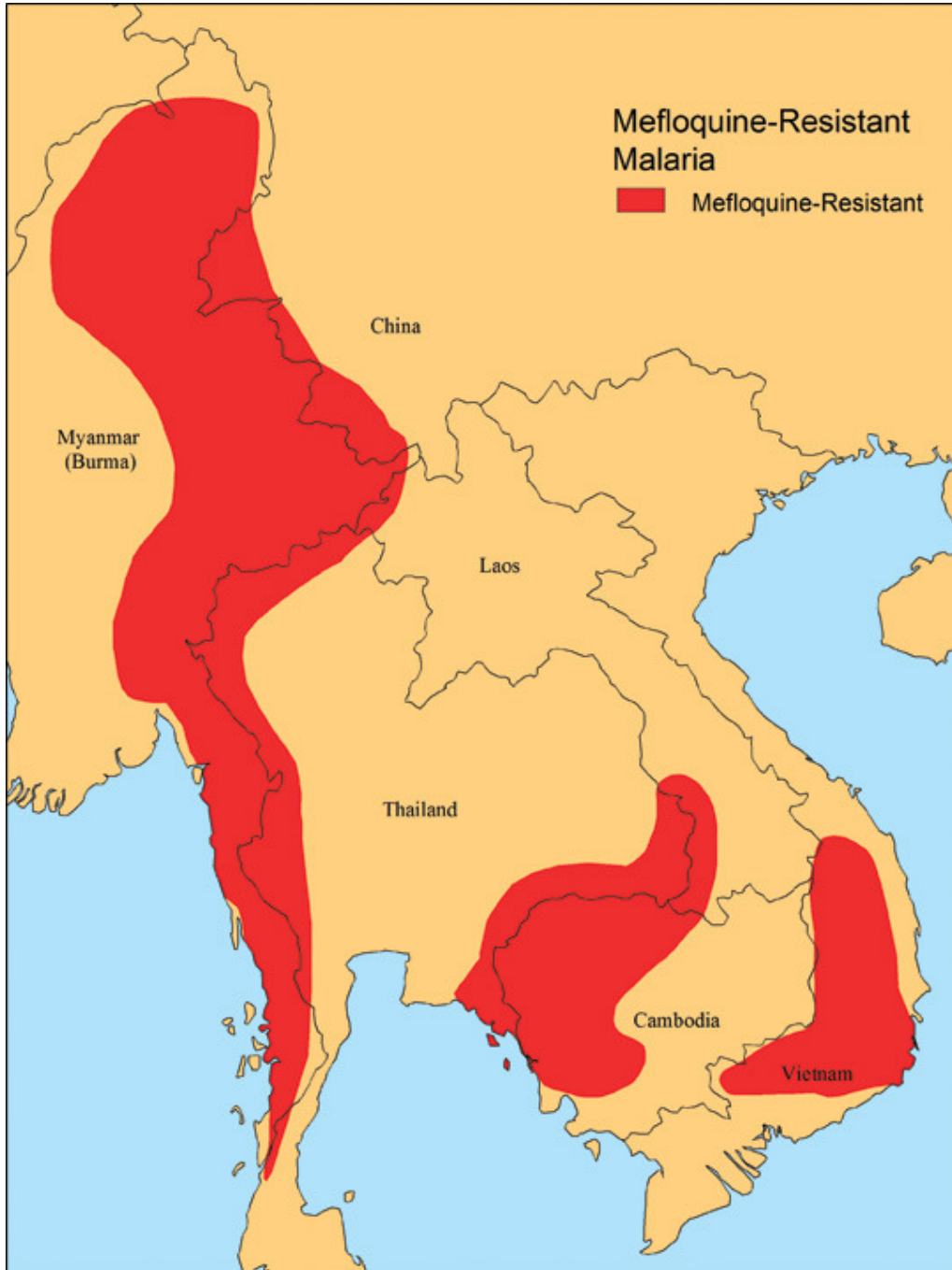
### Stages in the plasmodium life cycle when anti-malarial drugs act



**This map displays the distribution of the chloroquine-resistant malaria (gray areas) and chloroquine-sensitive malaria (blue areas) in the Americas and in Asia, Europe, and Africa.**



<http://www.acpmedicine.com/sample2/ch0007-f6.htm>



**MAP 4-09**  
**Geographic**  
**distribution of**  
**mefloquine-**  
**resistant malaria.**

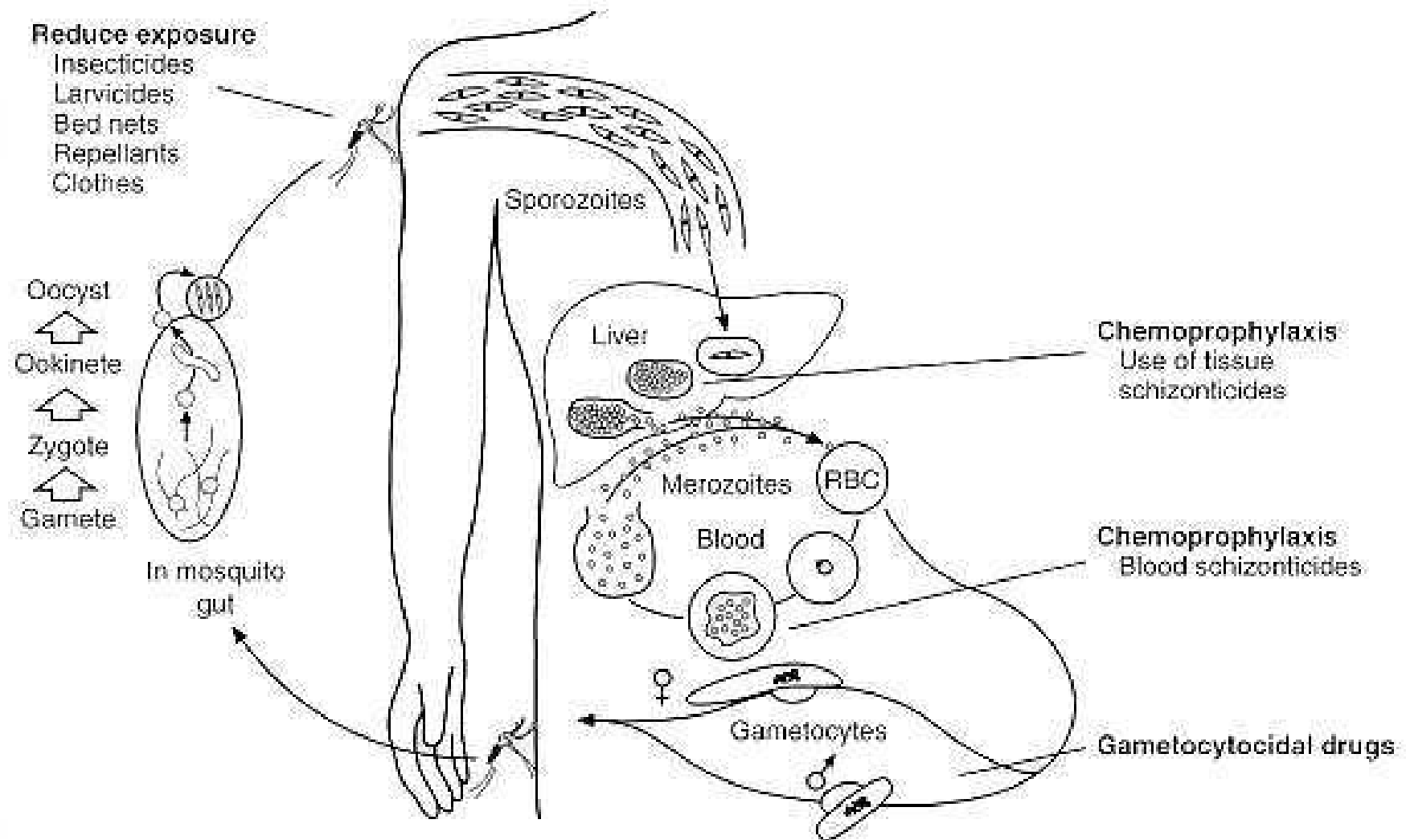




**MAP 4-07**  
**Malaria-endemic**  
**countries in the**  
**Western**  
**Hemisphere.**

[wwwn.cdc.gov/travel/](http://wwwn.cdc.gov/travel/)

**FIGURE 83-8 Strategies for prevention of malaria.**



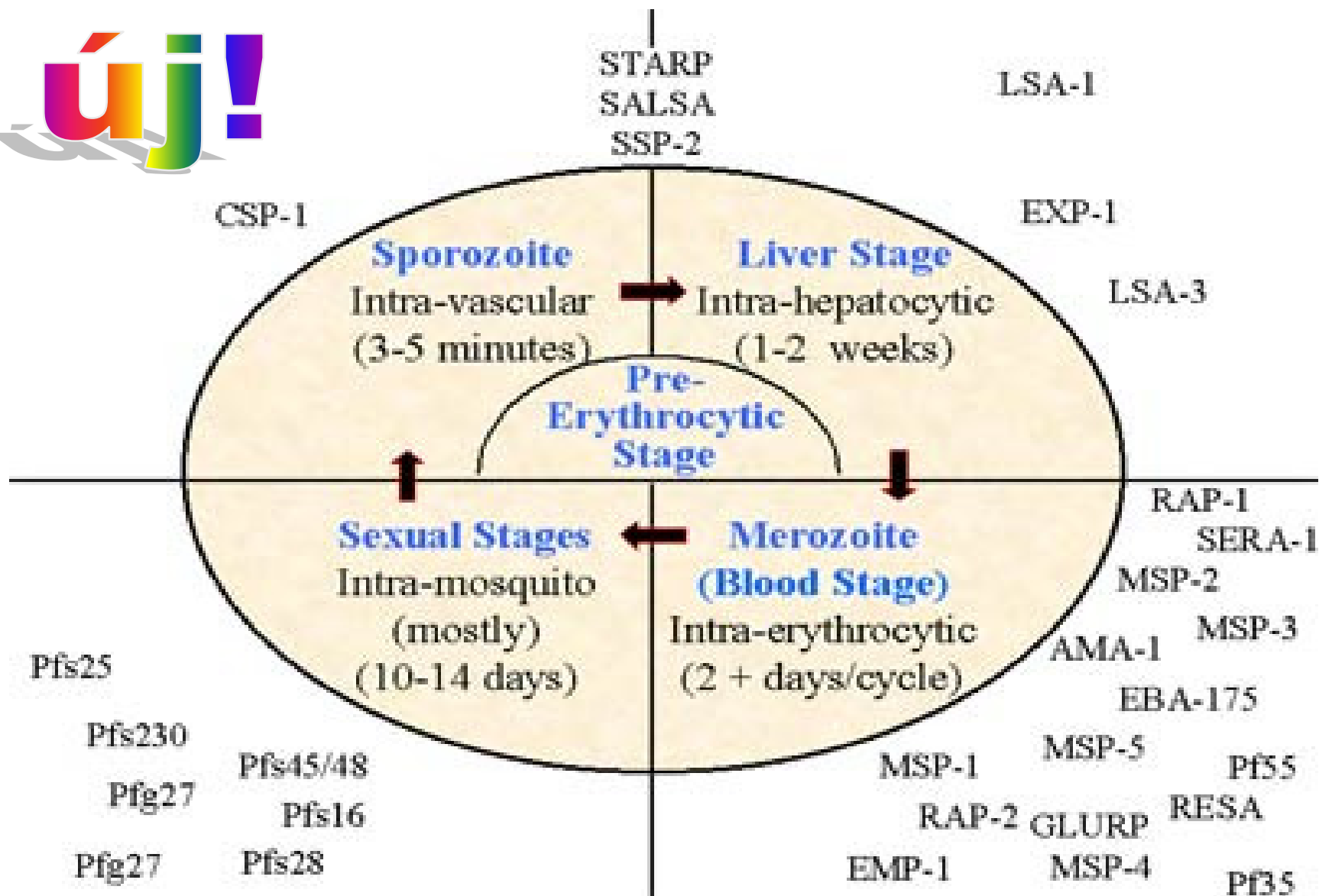
# Malaria megelőzés – expozíciós profilaxis



- Szúnyogháló, baldachin, rovarirtóval impregnált
- Rovarriasztók, repellensek
- Mocsarak lecsapolása, szúnyog élőhelyek felszámolása



**jövő – védőoltás, zajlik a klinikai kipróbálás**  
 (elérhető, gyermekeknek 2010; 50% effektív 2015; 80% 2025)





# Malaria védőoltás: RTS,S/ASo2

Mosquirix®

Anticircumsporozoite

Benne:

Recombináns protein



Működése

Ellenanyag termelést indukál, T sejteket aktivál

Eredmény (remélhetőleg)

Fejlődési szakasz a májban nincs

# Malaria védőoltás: klinikai kipróbálás gyermekeken (Afrika)

- 2008 IIB kipróbálási fázis befejeződött 2008-ban RTS,S/ASo2!
- klinikai előfordulás 53 % ↓ (új adjuváns! Régi 35%)
- Malária fertőzések 65 % ↓
- Malária klinikai epizódok 59% ↓
- Licenz benyújtása 2011 – piac 2012?
- Source: Malaria Vaccine Initiative, <http://www.malariavaccine.org/>



# Malaria vaccina: klinikai kipróbálás gyermeken (Afrika)

- biztonságosnak tűnik (kb. 2 év)!
- maláriás klinikai epizódok száma 35 %↓
- Súlyos esetek száma ca. 50 %↓
- *P. falciparum* esetek száma ca. 30 %↓
- III fázis: 2009 tavasz elkezdődött
- 7 Afrikai országban: Burkina Faso, Gabon, Ghana, Kenya, Malawi, Mozambique, Tanzania
- Terv: 16.000 gyermek, 2 csoport:
  - 6 – 12 hetes életkor (köt. oltásokkal)
  - 5 – 17 hónapos életkor
- November 2009 – Pan-African Malaria Conference: 5.000 oltása megtörtént!
- Forrás: Malaria Vaccine Initiative, <http://www.malariavaccine.org/>



# Vektor útján terjedő Vér / szöveti Protozoonok

Flagellata/mastigophora

**Trypanosoma spp.**

T. brucei gambiense/rhodesiense → álomkór

T. cruzi → Chagas kór

**Leishmania spp.**

L. donovani → visceralis, Kala-azar

L. tropica → cutan, Aleppo fekély

L. brasiliensis → muco-cutan, Espundia

Sporozoa (apicomplexa)

**Plasmodia spp.**

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

**MALARIA**



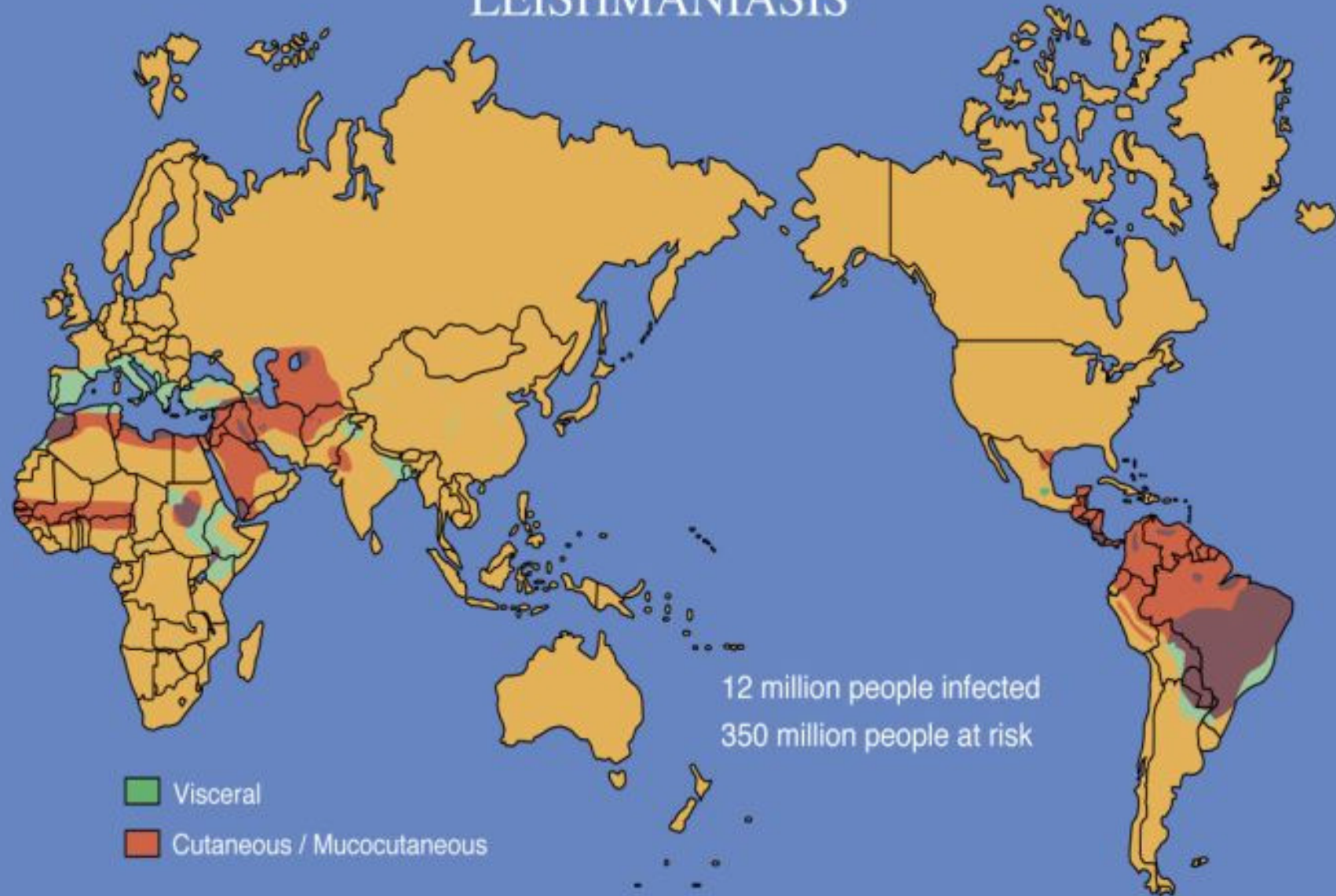
# Flagellata

Vér és Szöveti

Haemoflagellates I.

*Leishmania* spp.

# LEISHMANIASIS



# Visceralis Leishmaniasis (VL) = Kala - azar = dum-dum láz

## **Kórokozók**

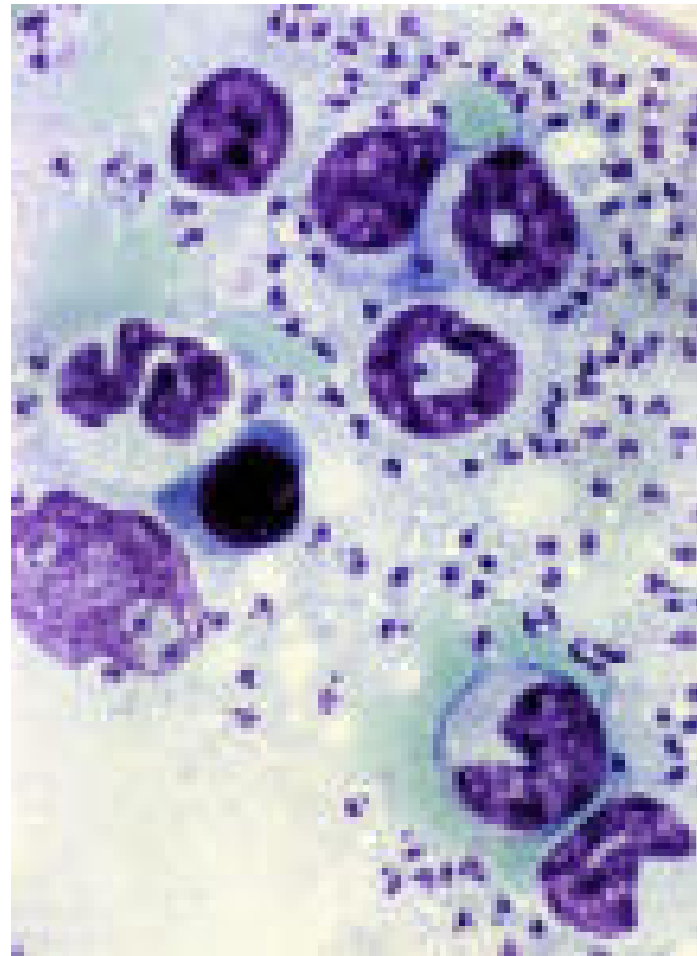
### **Óvilág**

**L. donovani**

**L. infantum**

### **Újvilág**

**L. chagasi = L. infantum?**



# Cutan, Muco-cutan Leishmaniasis

## Kórokozók

### Óvilág

L. tropica  
L. major  
L. aethiopica

### Újvilág

L. mexicana (chiclero fekély)  
L. amazonensis  
L. peruviana (uta)  
L. braziliensis  
L. panamensis } (Espundia)  
L. guyanensis }  
etc.

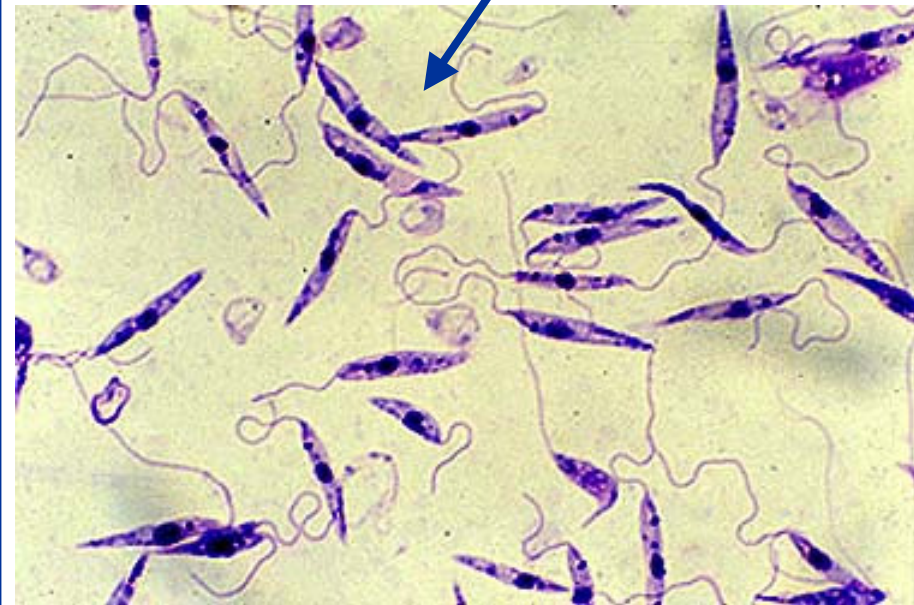
## Morphologia – egyformák!

### Méret:

2-5  $\mu\text{m}$  amastigota

15-20  $\mu\text{m}$  promastigota

**Flagella!**

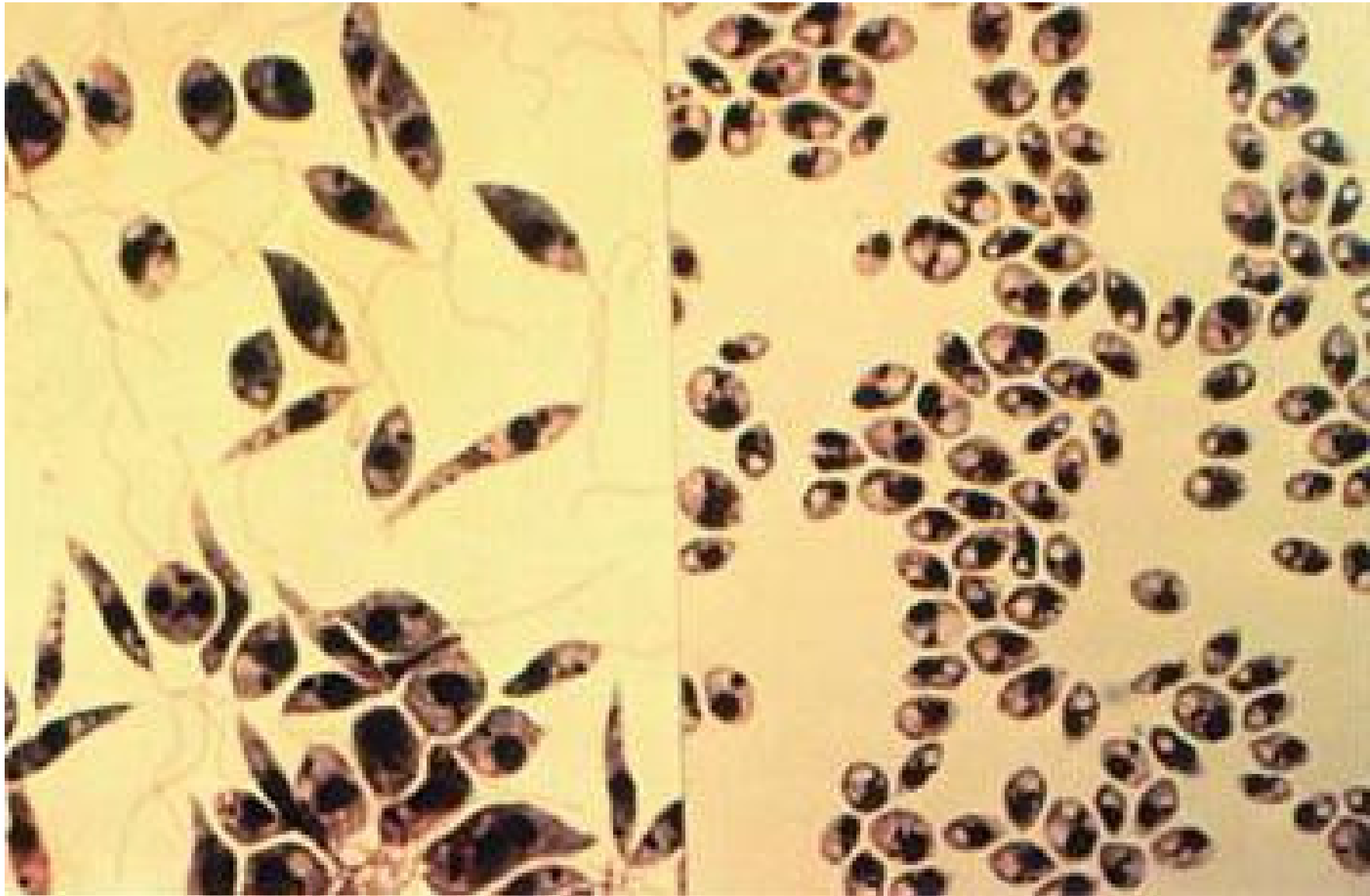




# Leishmania

15-20  $\mu\text{m}$  promastigota

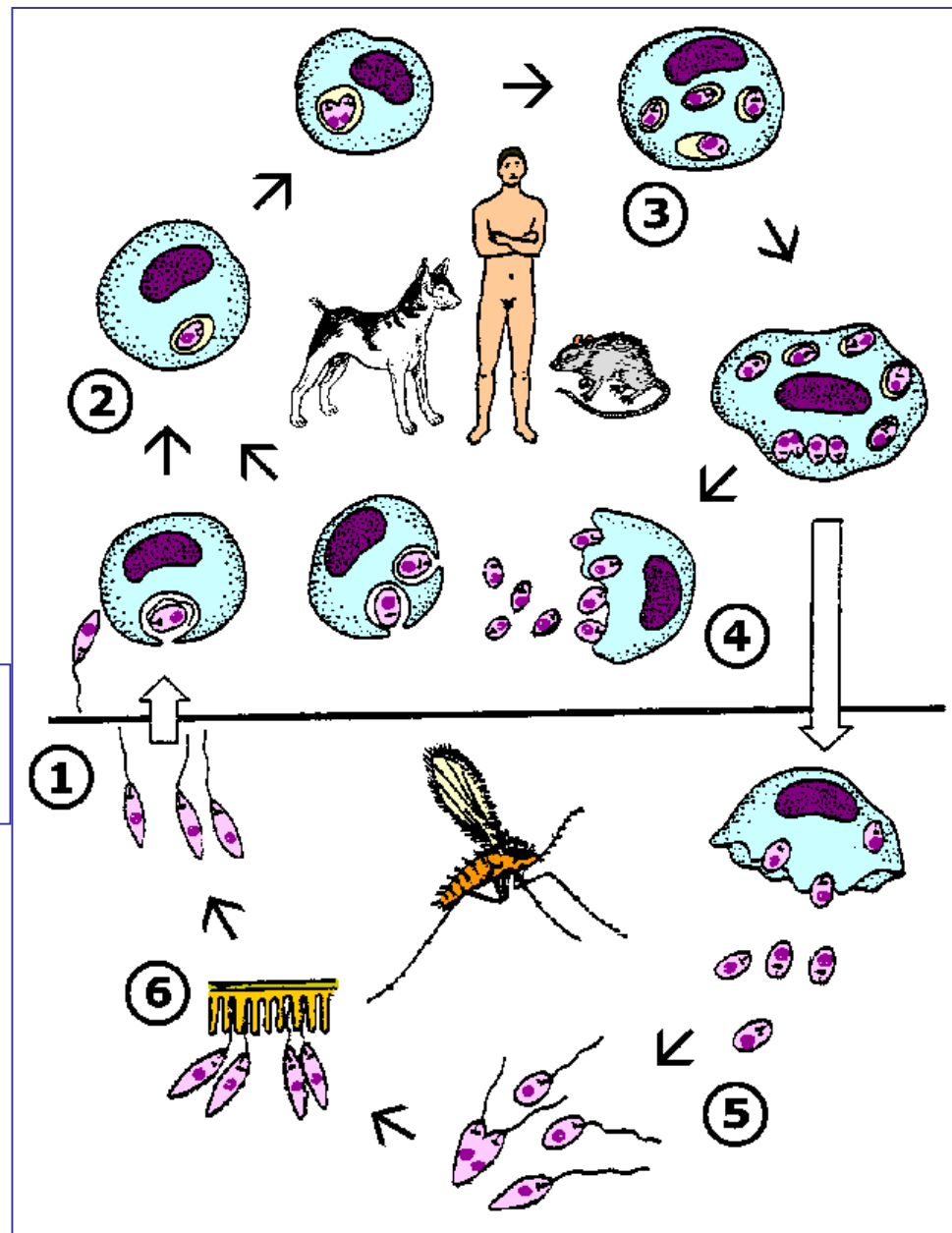
2-5  $\mu\text{m}$  amastigota



# Leishmania élelciklus

Amastigota

Promastigota  
flagellated



**Transmissio**  
Vektor  
lepkeszúnyog  
*Phlebotomus*,  
*Lutzomyia spp.*

# Leishmania

**Pathogenesis, pathomechanismus**  
**intracellularis** protozoon

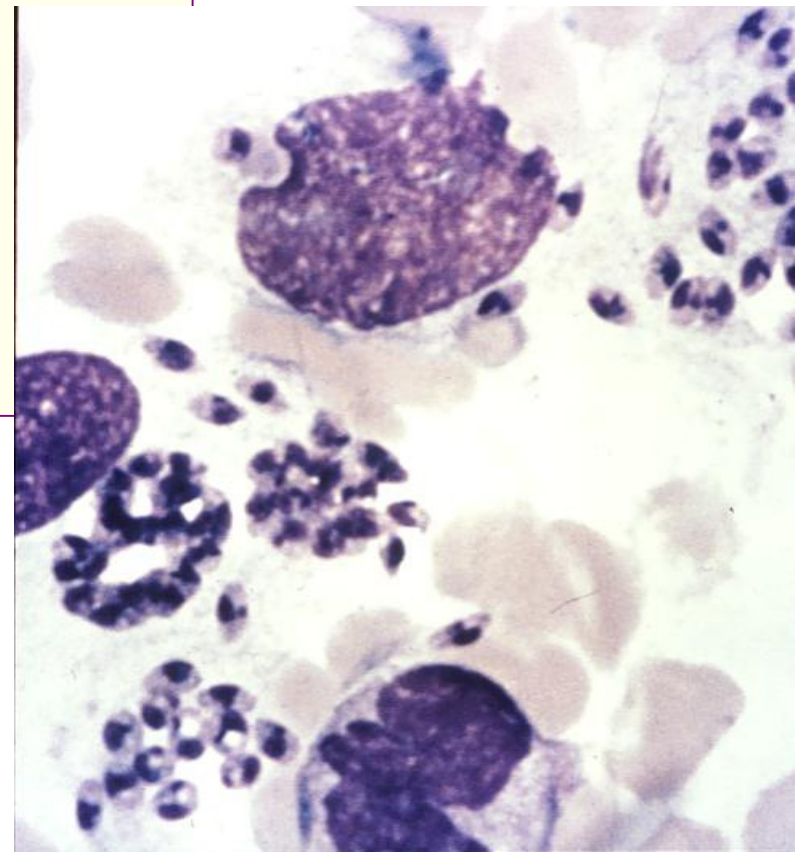
bőr, RES

**Macrophagok**

- invasio

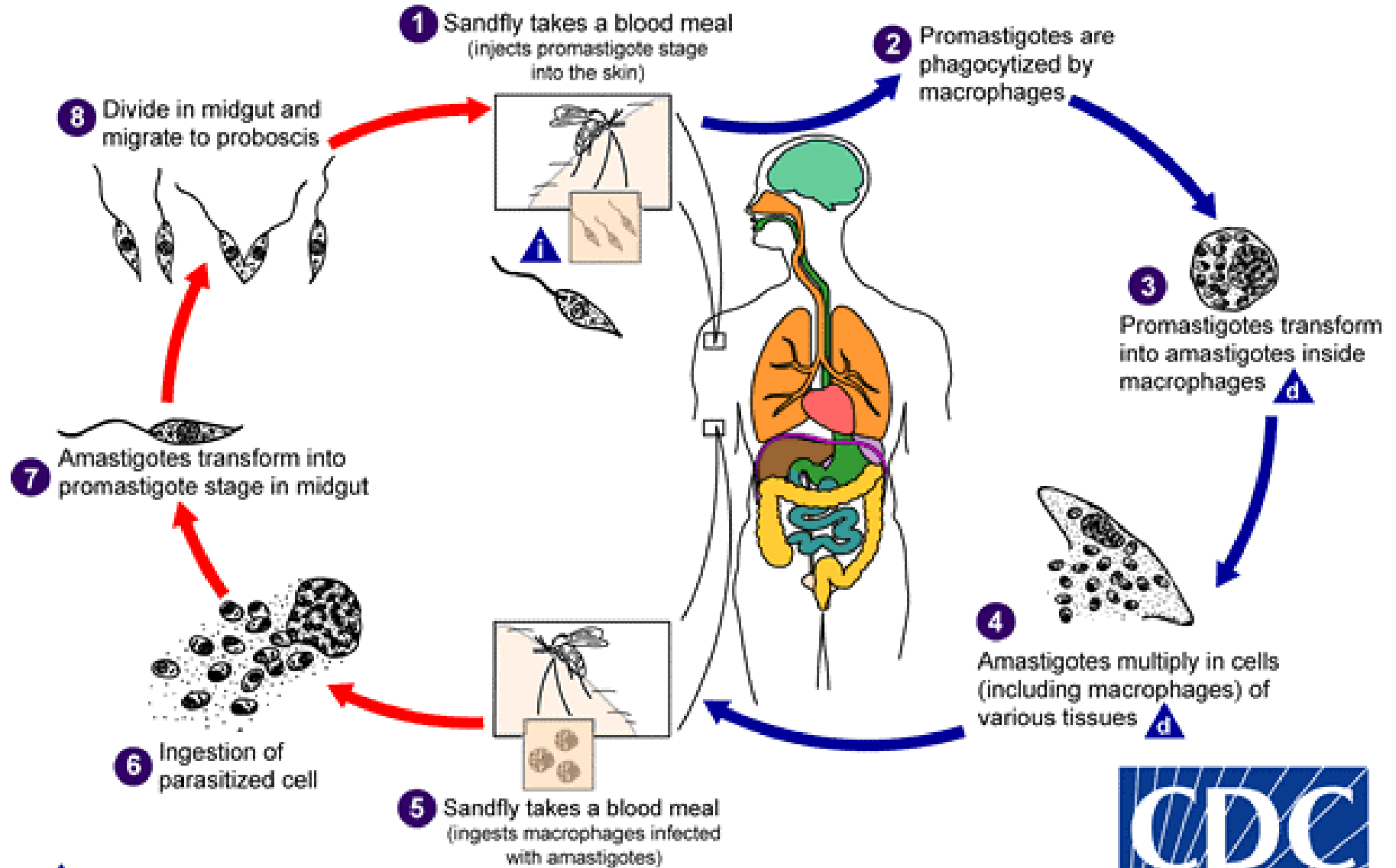
**Virulencia faktorok**

gp63, lipophosphoglycan LPG



## Sandfly Stages

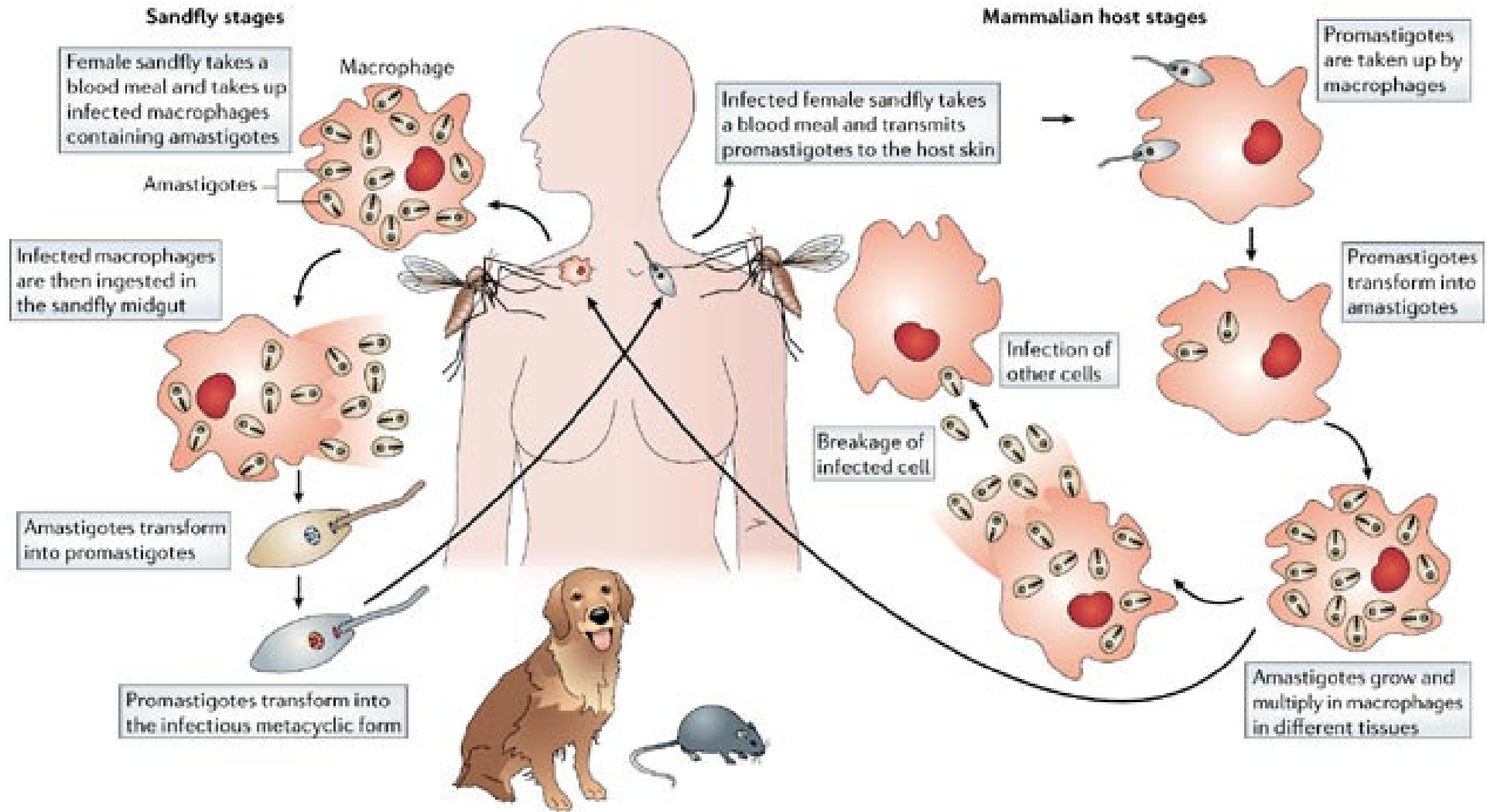
## Human Stages



**i** = Infective Stage  
**d** = Diagnostic Stage



# Leishmania



The reservoir hosts of most ***Leishmania*** species from which parasites are transmitted to humans are rodents and canids (zoonotic leishmaniasis); only in some species (for example, ***L. tropica*** in urban areas) is transmission from infected to non-infected humans (anthroponotic leishmaniasis).

***Leishmania*** parasites are transmitted by the bites of infected female sandflies, which inject metacyclic promastigotes into the skin. Promastigotes enter macrophages, where they transform into replicating amastigotes. Infected macrophages are taken up by sandflies, where parasites are transformed into the infective metacyclic promastigote form.

***Leishmania* promastigote** - macrophagok  
invasioja (gp63, lipophosphoglycan LPG)



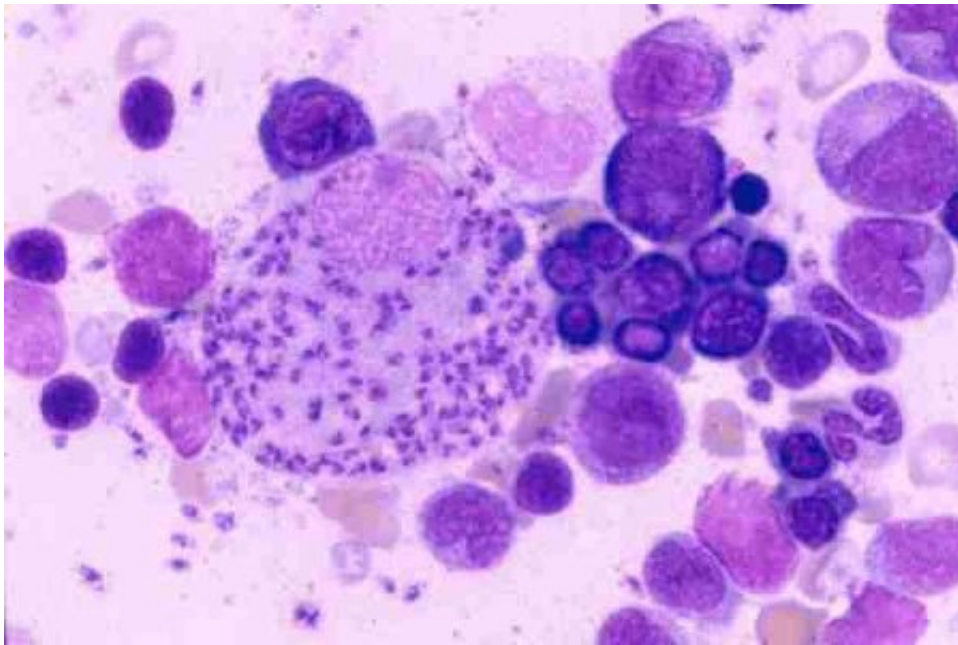
**lepkészűnyog 1-2 mm**

**video**



# ***Leishmania*** amastigota macrophag invasio

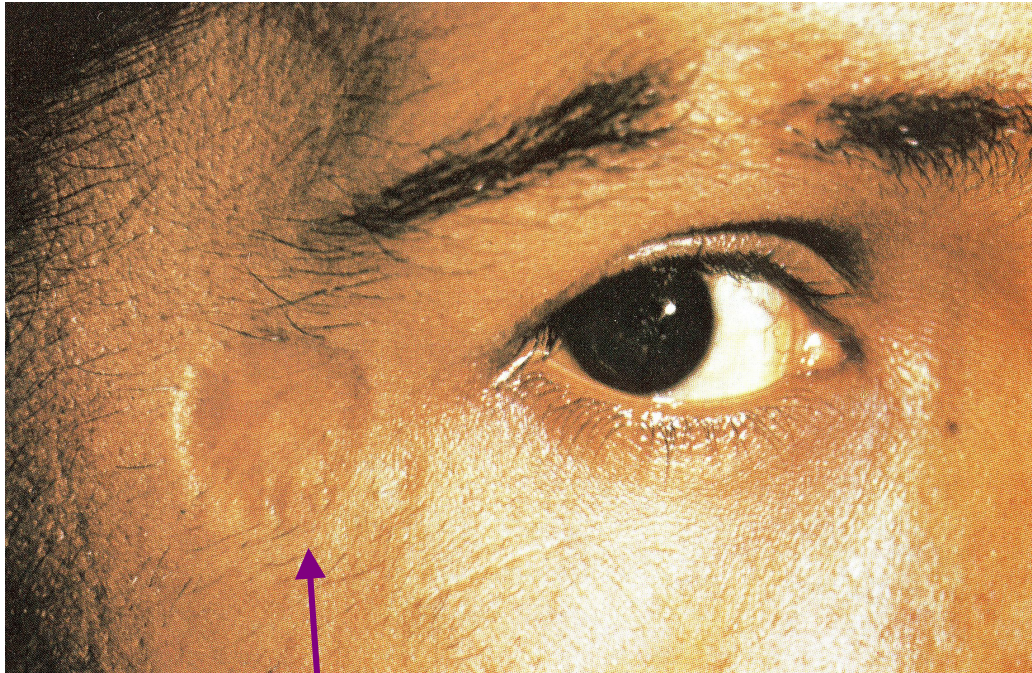
**video**



<http://www.iwf.de/iwf/do/mkat/details.aspx?GUID=444C47554944001AEB9A3F65AA31002287A1920301030061F44C868001000000&Action=Quicklink&Search=medicine;%20medical%20microbiology;&SearchIn=Klassifikation&Offset=30>



# Cutan, Muco-cutan Leishmaniasis



R131 - heg

R130 – bőr;  
L. tropica

Bőrön csomók,  
(1-5 cm) fekélyesedés



# Cutan, Muco-cutan Leishmaniasis



R1312 – 133



**Espundia – *L. brasiliensis***  
**Fresh, untreated lesions on**  
**nasal mucosa and ulceration**



**Mucocutaneous leishmaniasis. Young man with healed prior lesions of cutaneous leishmaniasis on the arms caused by *L. braziliensis*, now presenting with new lesions of the nasal mucosa.**

# Cutan, Muco-cutan Leishmaniasis



cutan



Muco-cutan

# Cutan, Muco-cutan Leishmaniasis

Roche Atlas



**R134 – fül;  
L. tropica mexicana  
Chiclero fekély**

# Cutan, Muco-cutan Leishmaniasis



[news.bbc.co.uk](http://news.bbc.co.uk)

[www3.baylor.edu](http://www3.baylor.edu)

# Cutan, Muco-cutan Leishmaniasis



Patienten har diffus **kutan Leishmaniasis**. Ett tillstånd som liknar, och ofta misstas för, Lepra. (Etiopien) WHO/TDR/CRUMP [www.vif.se](http://www.vif.se)

# Cutan, Muco-cutan Leishmaniasis

## Diagnosis

Direkt kimutatás - mikroszkópos

Minta:

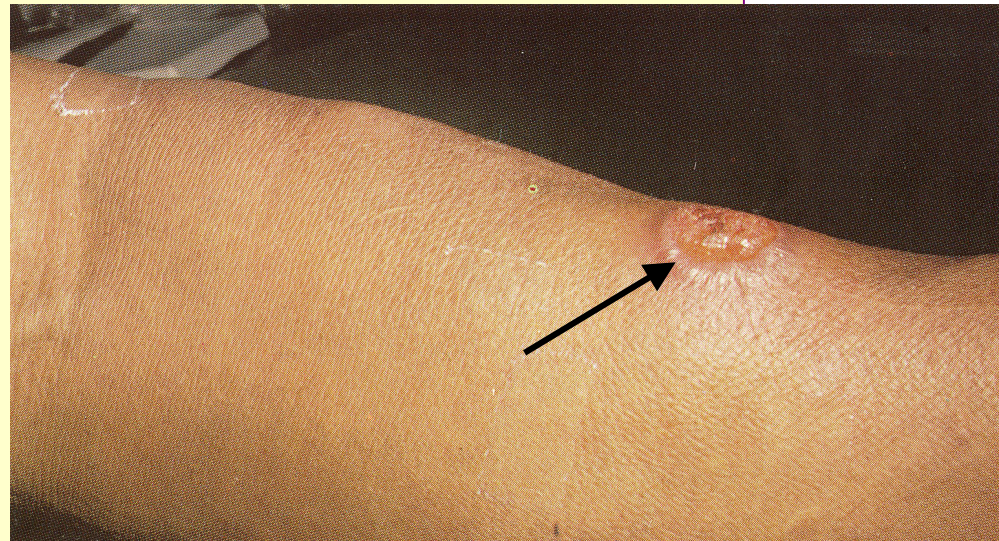
**bőr** vagy nyirokcsomó biopszia (határ!)

Giemsa - festés

PCR

Ag kimutatás (ELISA, IF)

Montenegro bőr test  
(IV. típus, +: élethosszig)



## Therapia

Antimon származékok (Pentamidine), amphotericin B  
(toxikus mellékhatások!)

## Preventio

rovarirtás



# Visceralis Leishmaniasis (VL) = Kala - azar

## **Kórokozók**

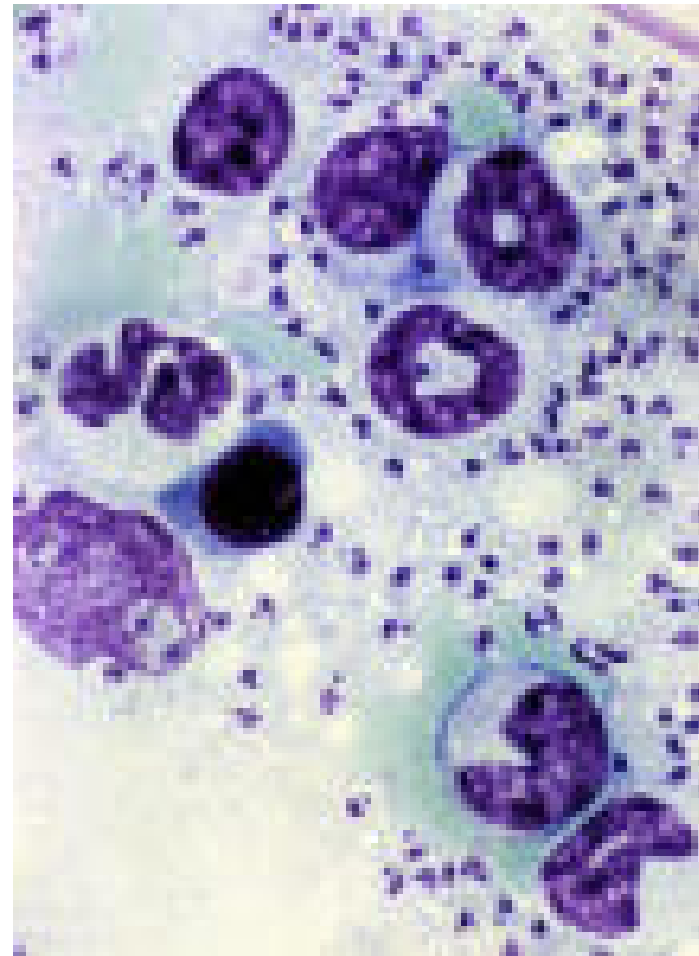
### **Óvilág**

**L. donovani**

**L. infantum**

### **Újvilág**

**L. chagasi = L. infantum?**



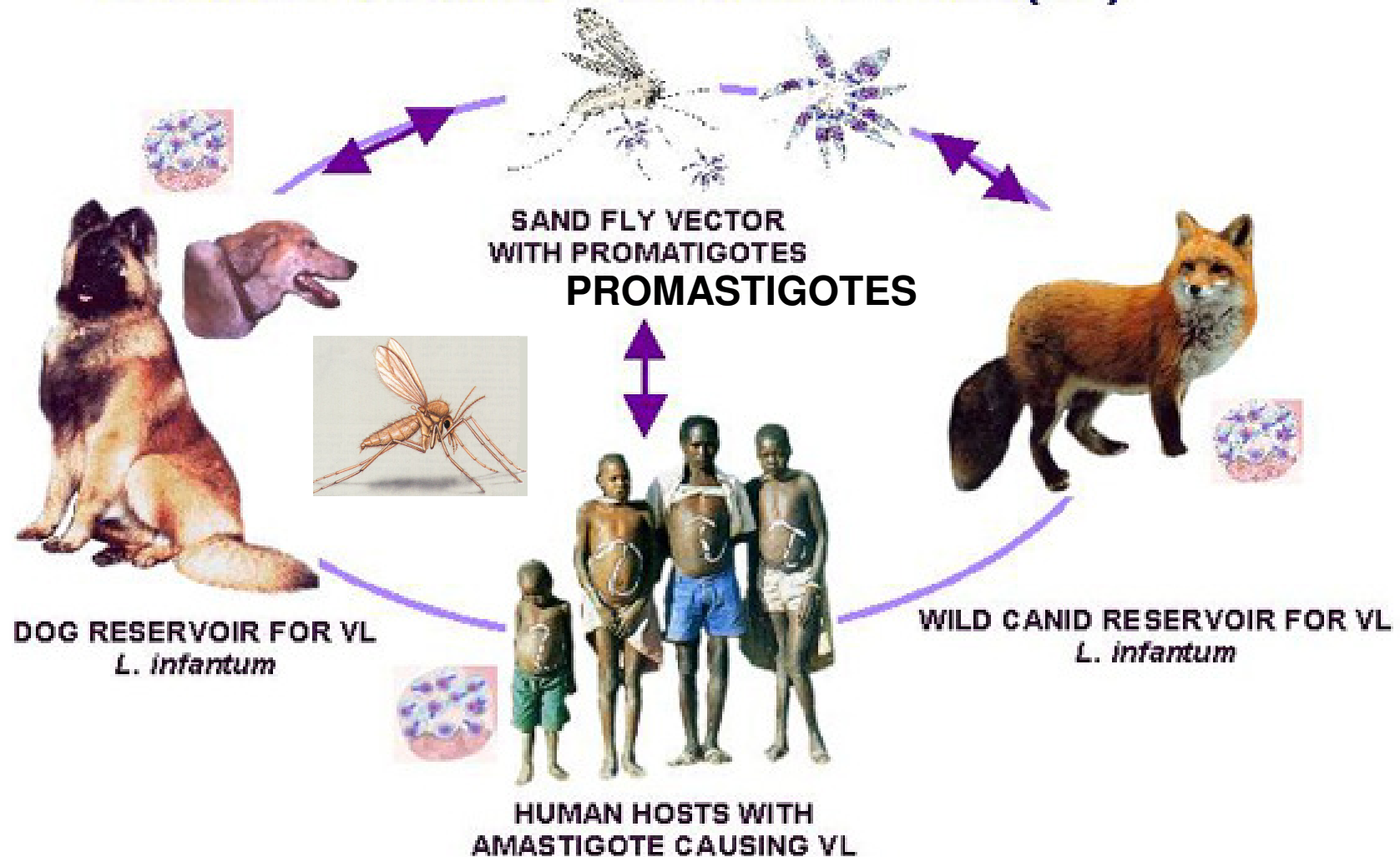
*Leishmania donovani* in  
the promastigote stage (©  
(2000) WHO/TDR Sinclair Stammers).

[www.nature.com](http://www.nature.com)



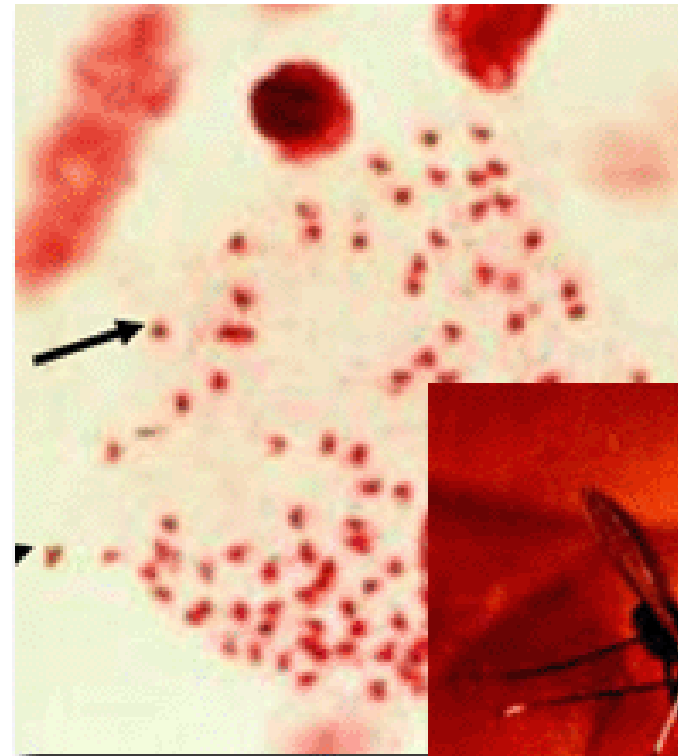
# *Leishmania infantum* – mediterrán medence

## LIFE CYCLE OF *LEISHMANIA* CAUSING VISCERAL LEISHMANIASIS (VL)

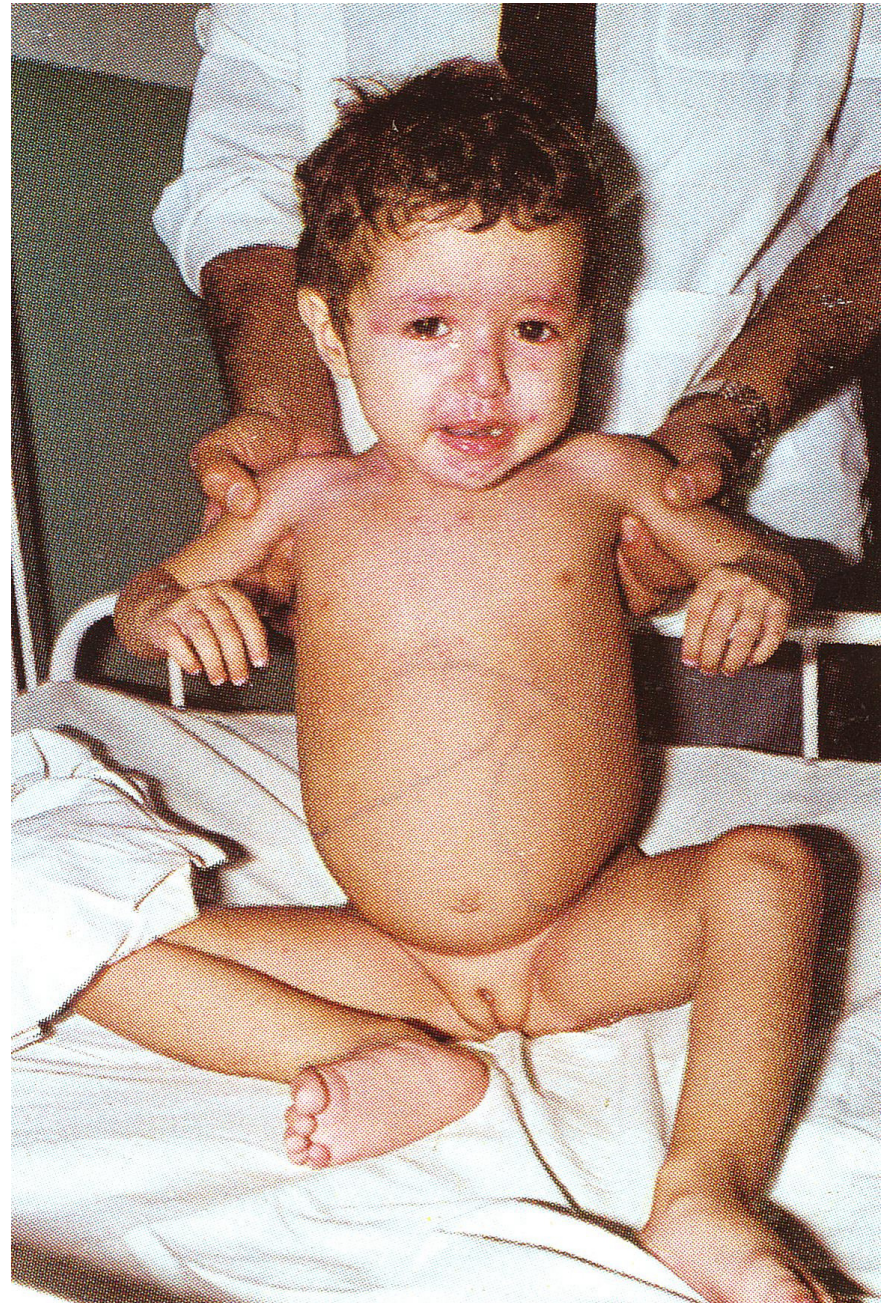
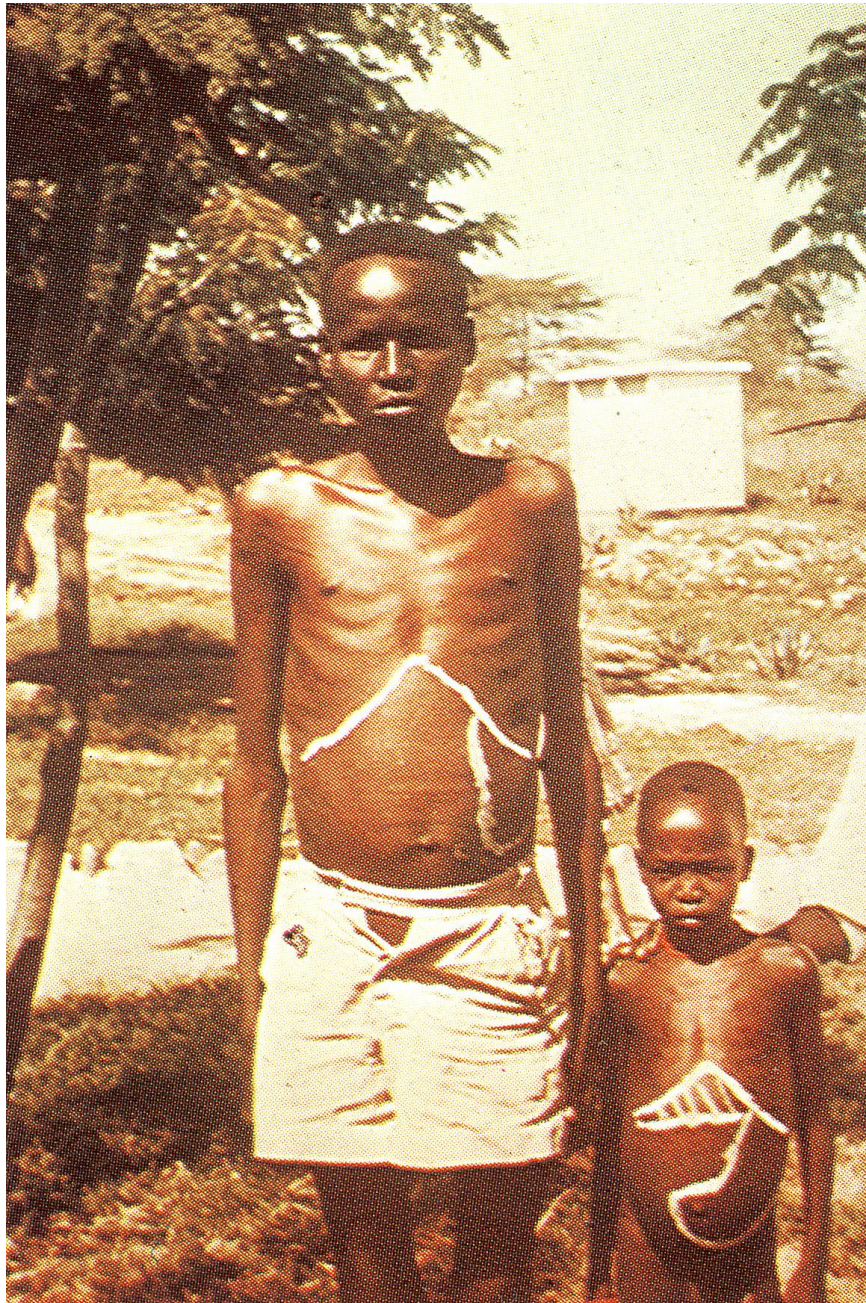


# Visceralis Leishmaniasis (VL) = Kala - azar

## *Leishmaniasis*



W178-181 Kala-azar – hepatosplenomegaly



# Visceral Leishmaniasis (VL) = Kala - azar



**FIGURE 82-12** Visceral leishmaniasis in a child from Honduras with marked emaciation and hepatosplenomegaly. (Courtesy of Carlos Ponce.)

# Visceralis Leishmaniasis (VL) = Kala - azar



PKDL = Post Kala-azar Dermal Leishmanoid



# Visceralis Leishmaniasis (VL) = Kala - azar

## Diagnosis

Direkt kimutatás - mikroszkópos

Minta:

**Csontvelő**, lép vagy nyirokcsomó biopszia

Giemsa - festés

PCR

Ag kimutatás (ELISA, IF, HAI)

Montenegro bőr test

(Type IV., +: life-long)

## Therapia

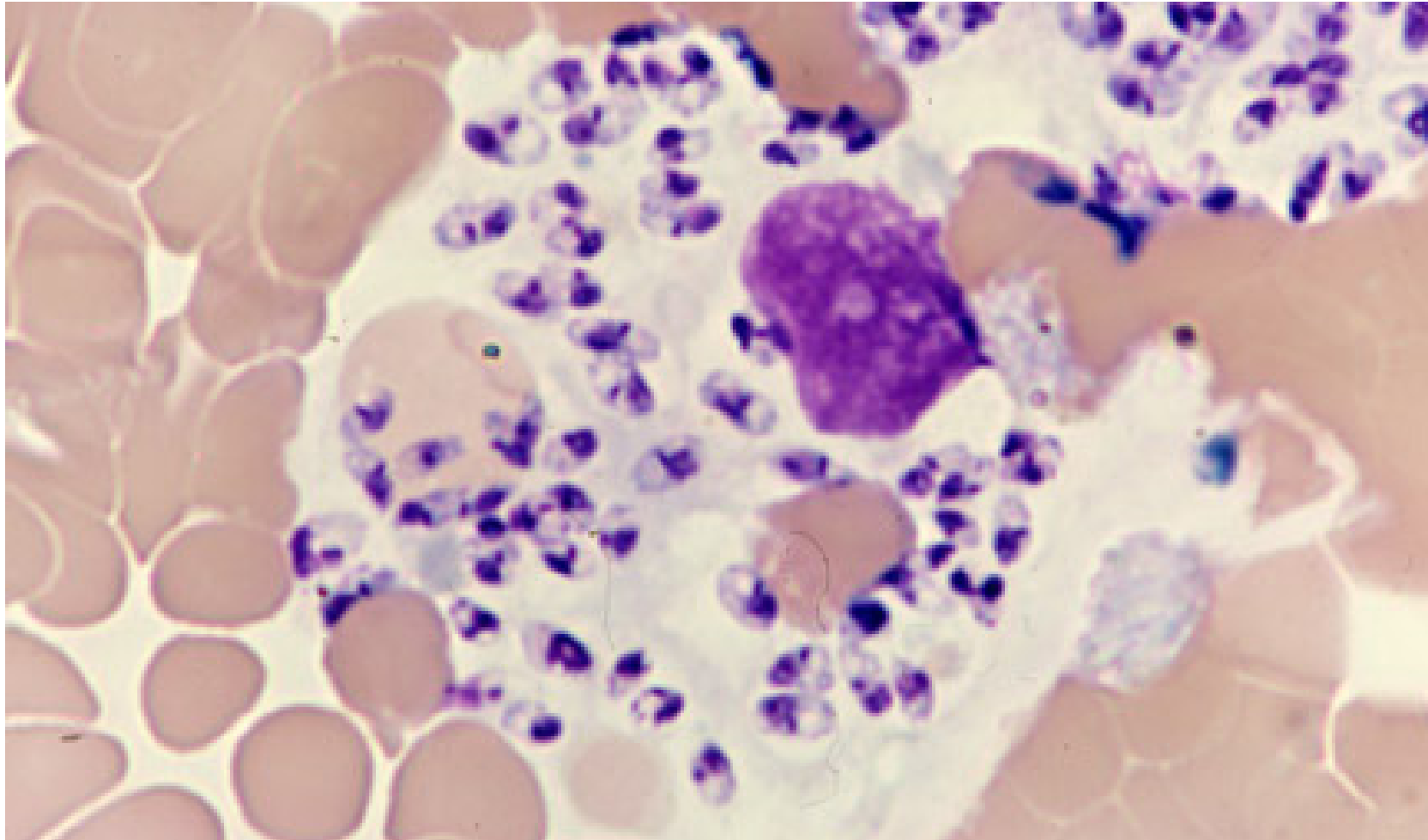
Antimon származékok, amphotericin B, IFN- $\gamma$

**ÚJ! orális miltefosine**

## Preventio

insecticidek





Leishmaniasis. Marrow film. Macrophage engorged with the amastigotes of *Leishmania donovani*.

Source: Lichtman MA, Shafer MS, Felgar RE, Wang N:  
*Lichtman's Atlas of Hematology*: <http://www.accessmedicine.com>

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# Vektorok útján terjedő Vér / szöveti Protozoonok

Flagellata/mastigophora

## **Trypanosoma spp.**

T. brucei gambiense/rhodesiense → **álomkór**

T. cruzi → **Chagas kór**

## **Leishmania sp.**

L. donovani → visceralis, **Kala-azar**

L. tropica → cutan, **Aleppo fekély**

L. brasiliensis → muco-cutan, **Espundia**

## **Sporozoa (apicomplexa)**

### **Plasmodia sp.**

Plasmodium malariae, P. vivax, P. ovale, P. falciparum

**MALARIA**



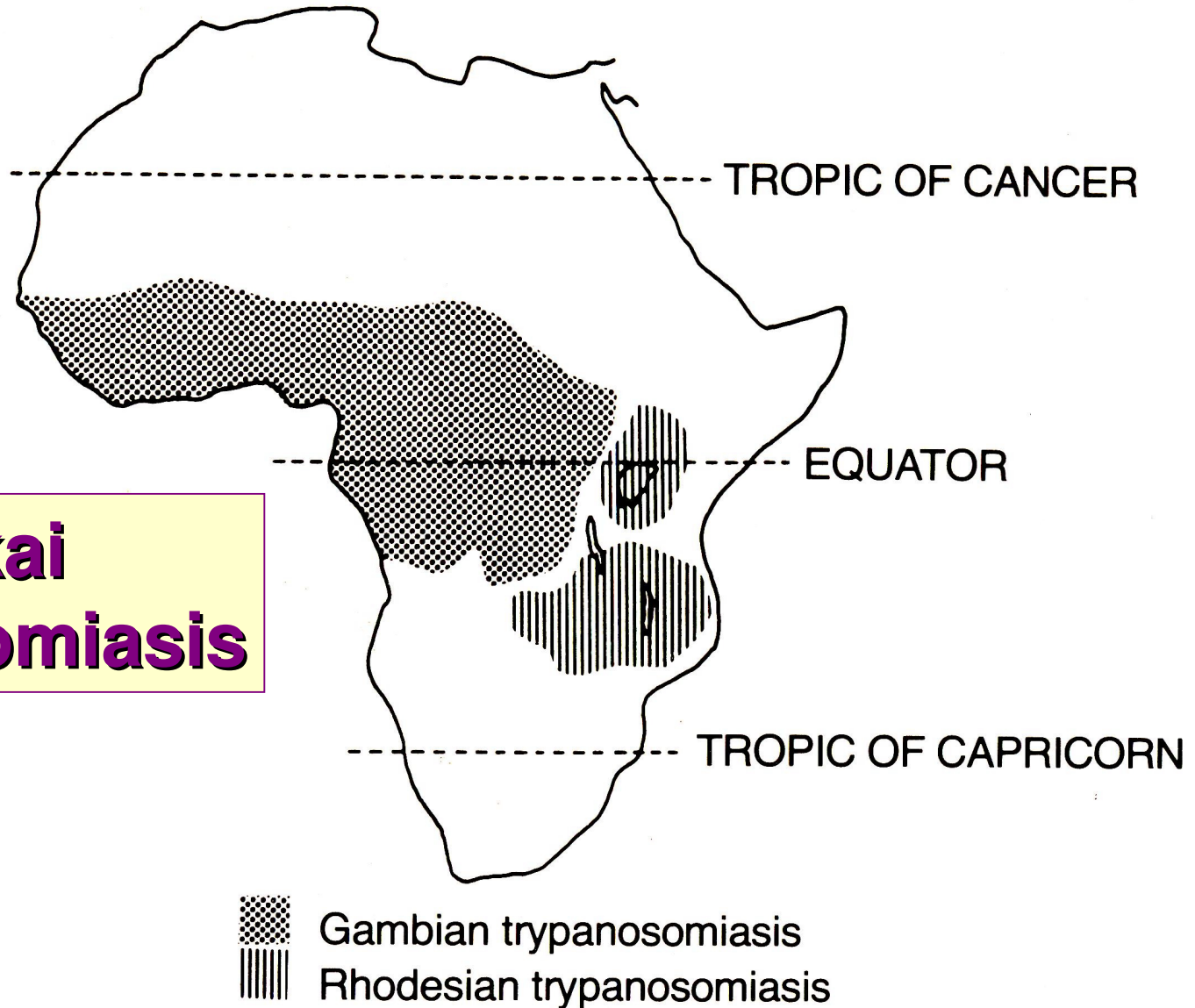
# Flagellata

Vér és Szöveti

Haemoflagellates II.

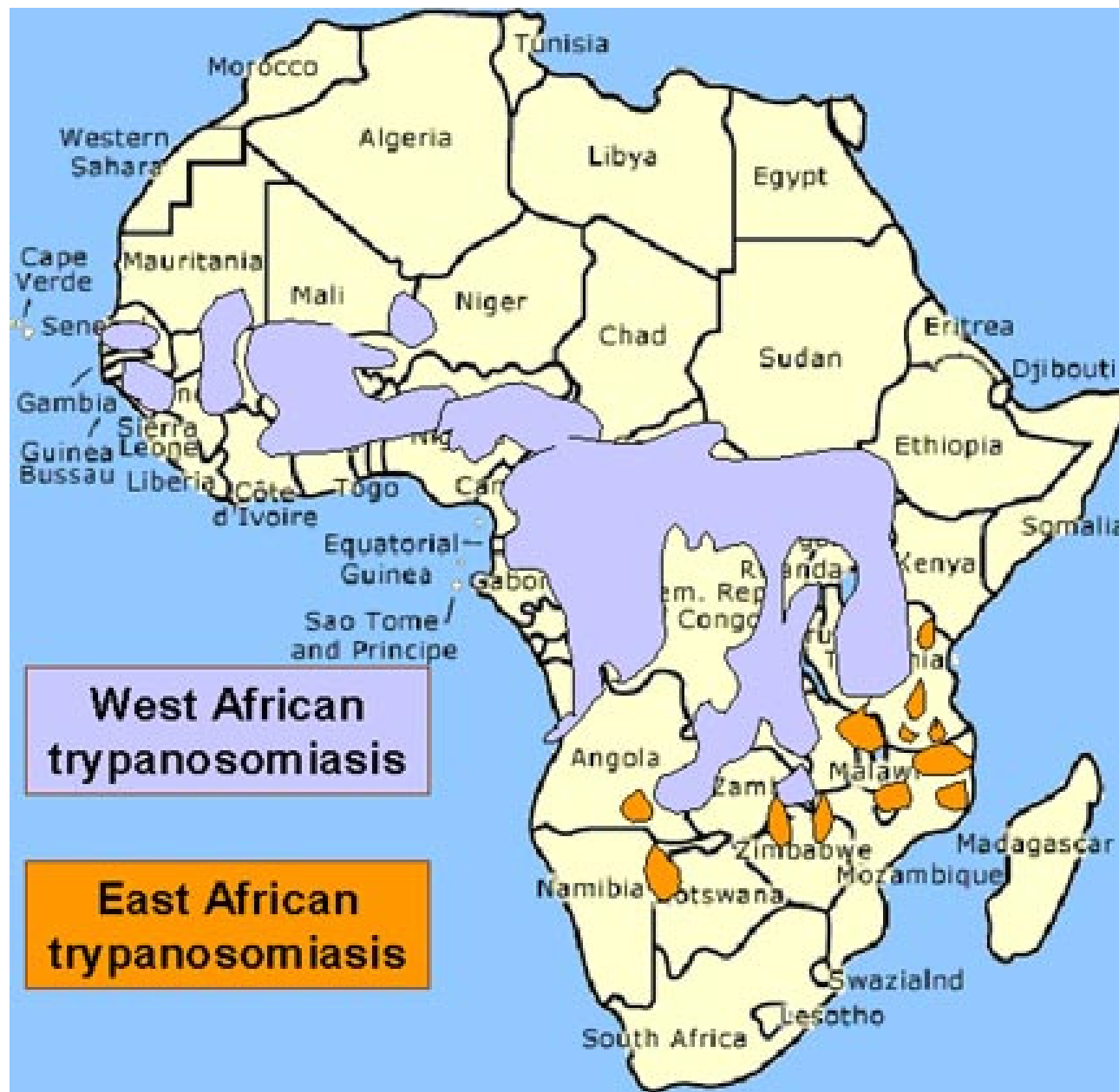
Trypanosoma spp.

**Afrikai  
trypanosomiasis**



**674** Distribution in Africa of human trypanosomiases, Gambian and Rhodesian (from Faust).

# *Trypanosoma brucei*- endemic areas

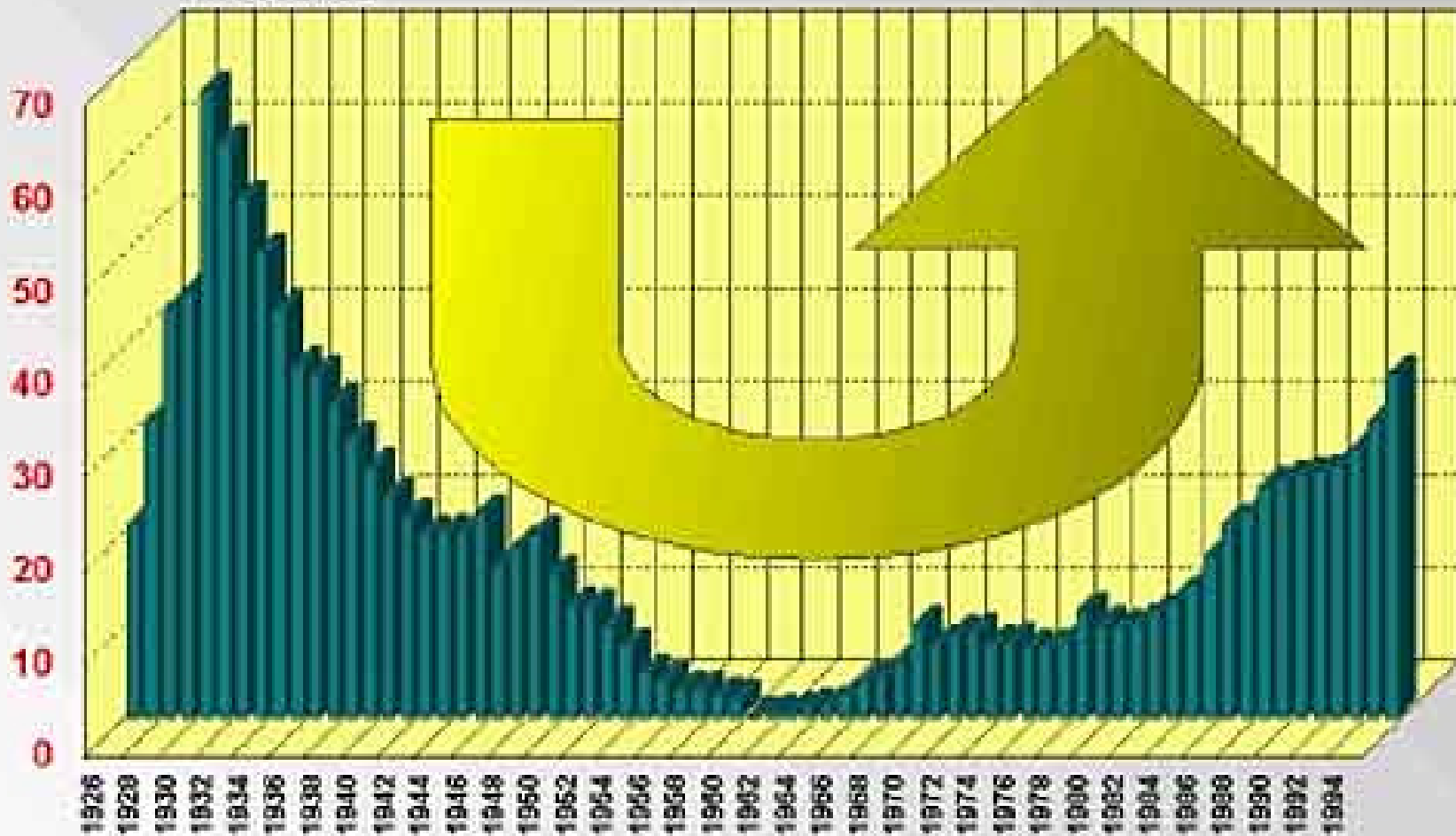


***Trypanosoma brucei* - emerging disease  
2004: 500000 cases (WHO estimated cases)**

**Trypanosomiasis in Central Africa**

1926 - 1995

Thousands



**Trypanosoma**

**brucei**

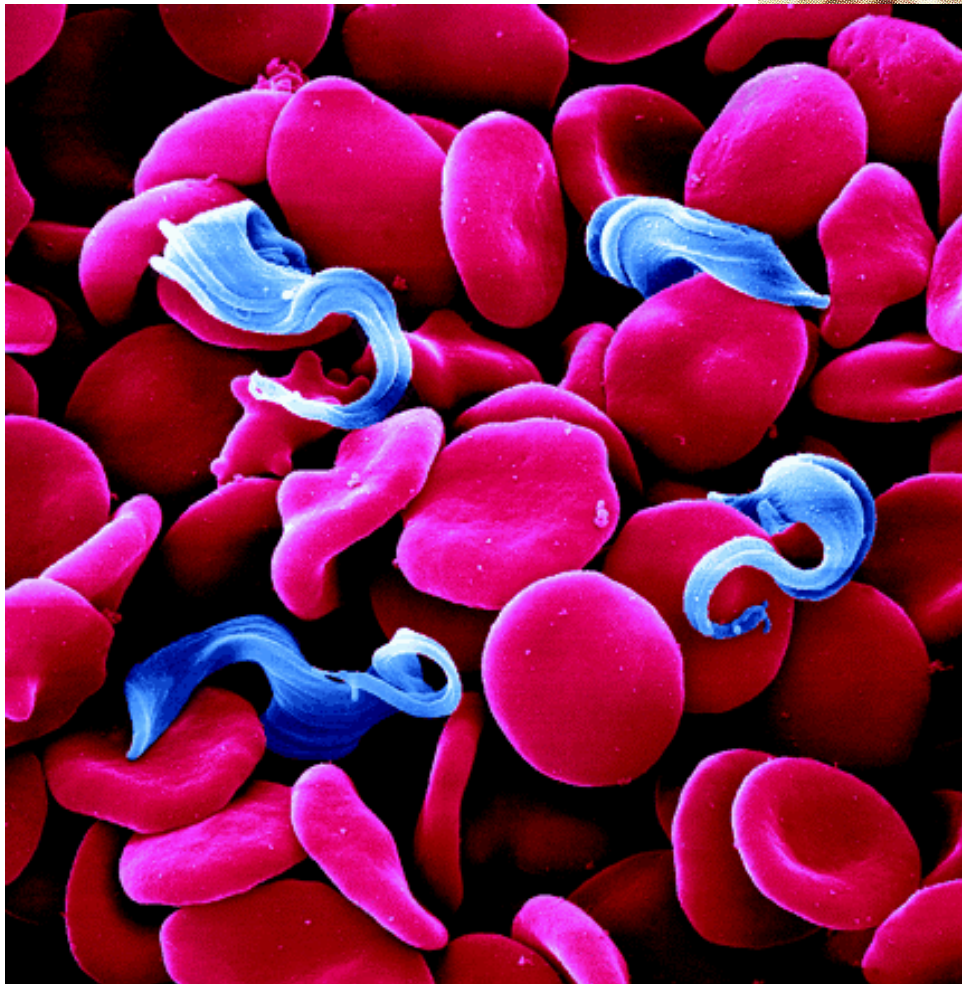
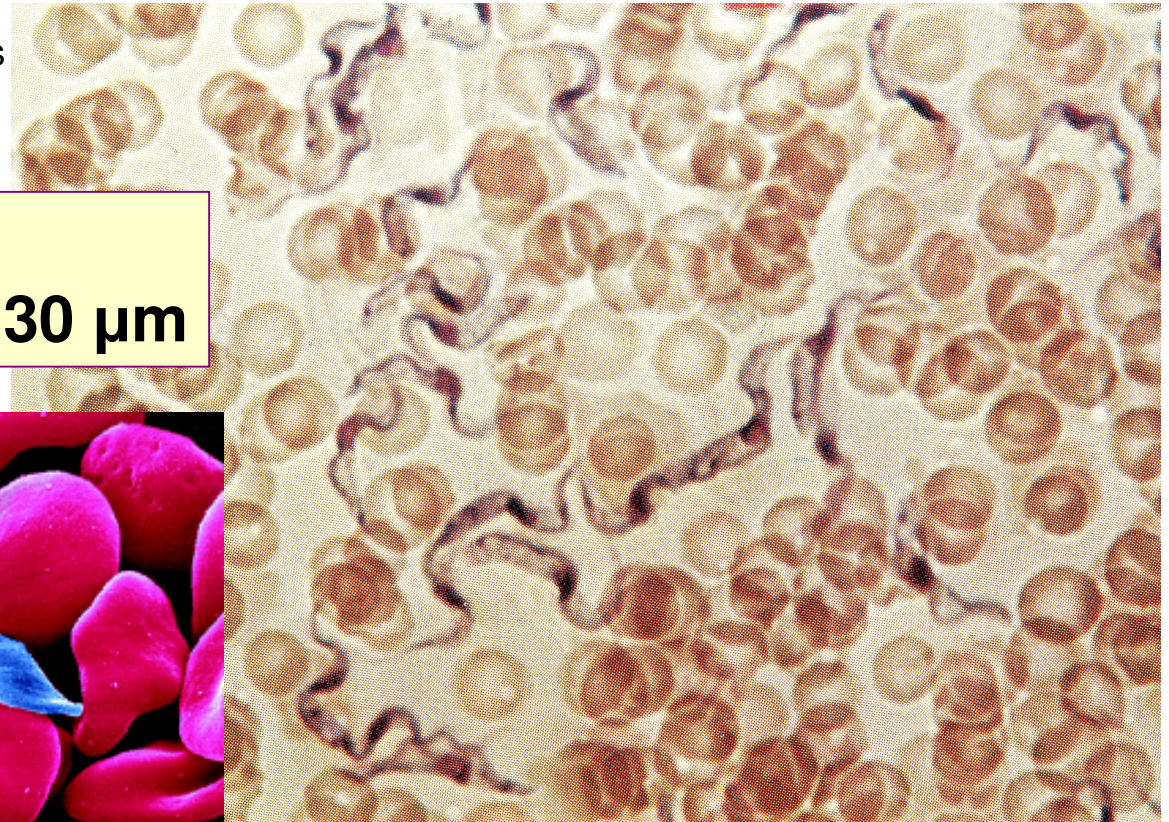
**gambiense et rhodesiense**

# T. brucei

Roche Atlas

## Morphologia

méret: 10 – 40  $\mu\text{m}$ , átlag 30  $\mu\text{m}$

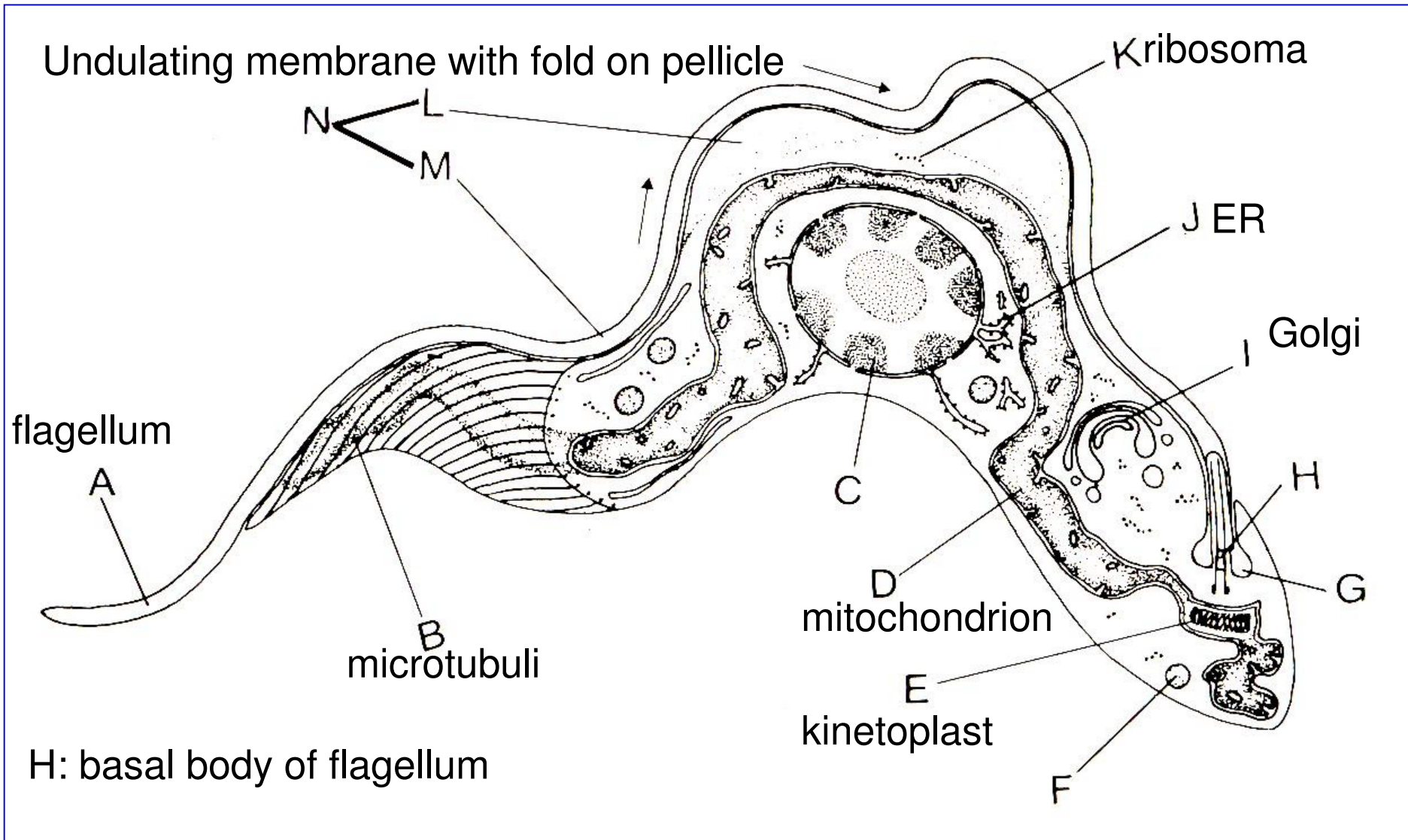


Parasitic *Trypanosoma brucei* surrounded by red blood cells in a smear of infected blood.

(Courtesy: Jürgen Berger and Dr. Peter Overath, Max Planck Institute for Developmental Biology, Tübingen.)



# W126 *T. brucei gambiense* - ultrastructura



# T. brucei

Roche Atlas

## Forrás

Reservoir  
(állati, házi, vad; és ember)

## Transmissio

Vektor – tse-tse légy  
(*Glossina* spp.)

## Szaporodás

vér

KIR

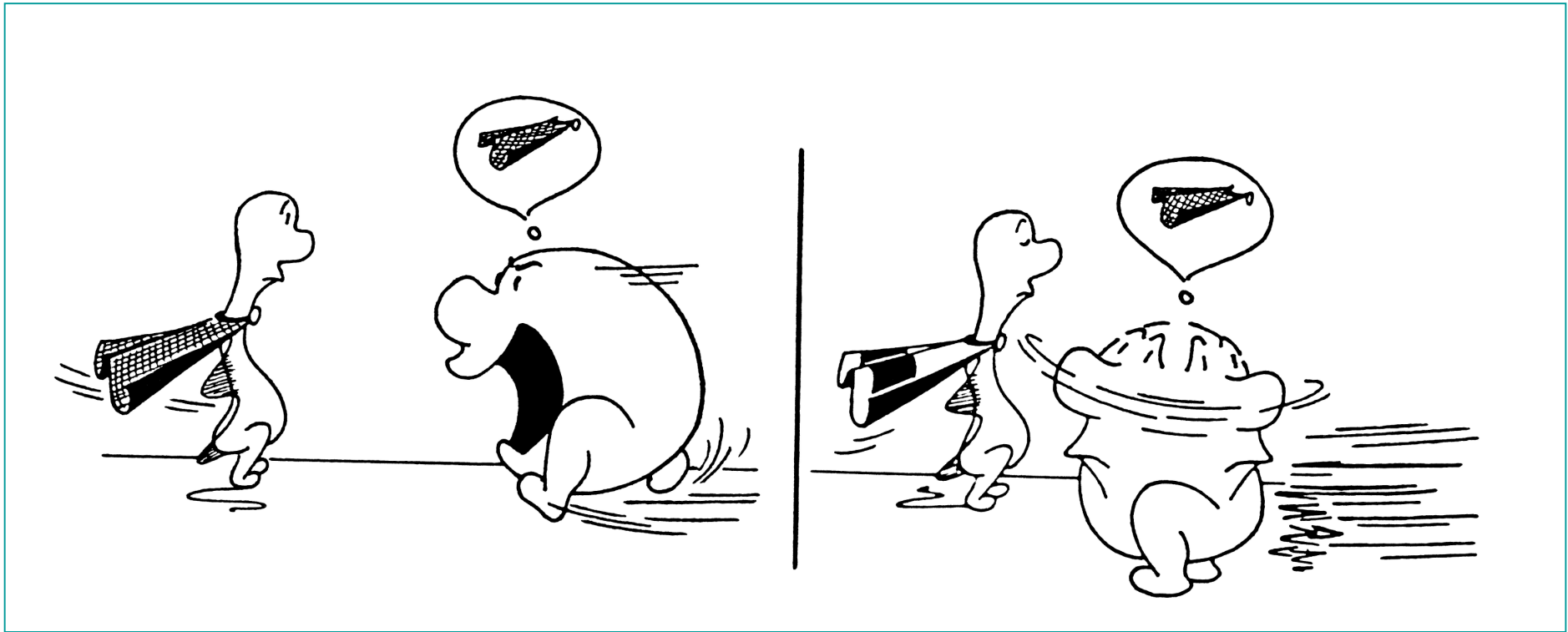
Ag-variatio!



Glossina  
morsitans

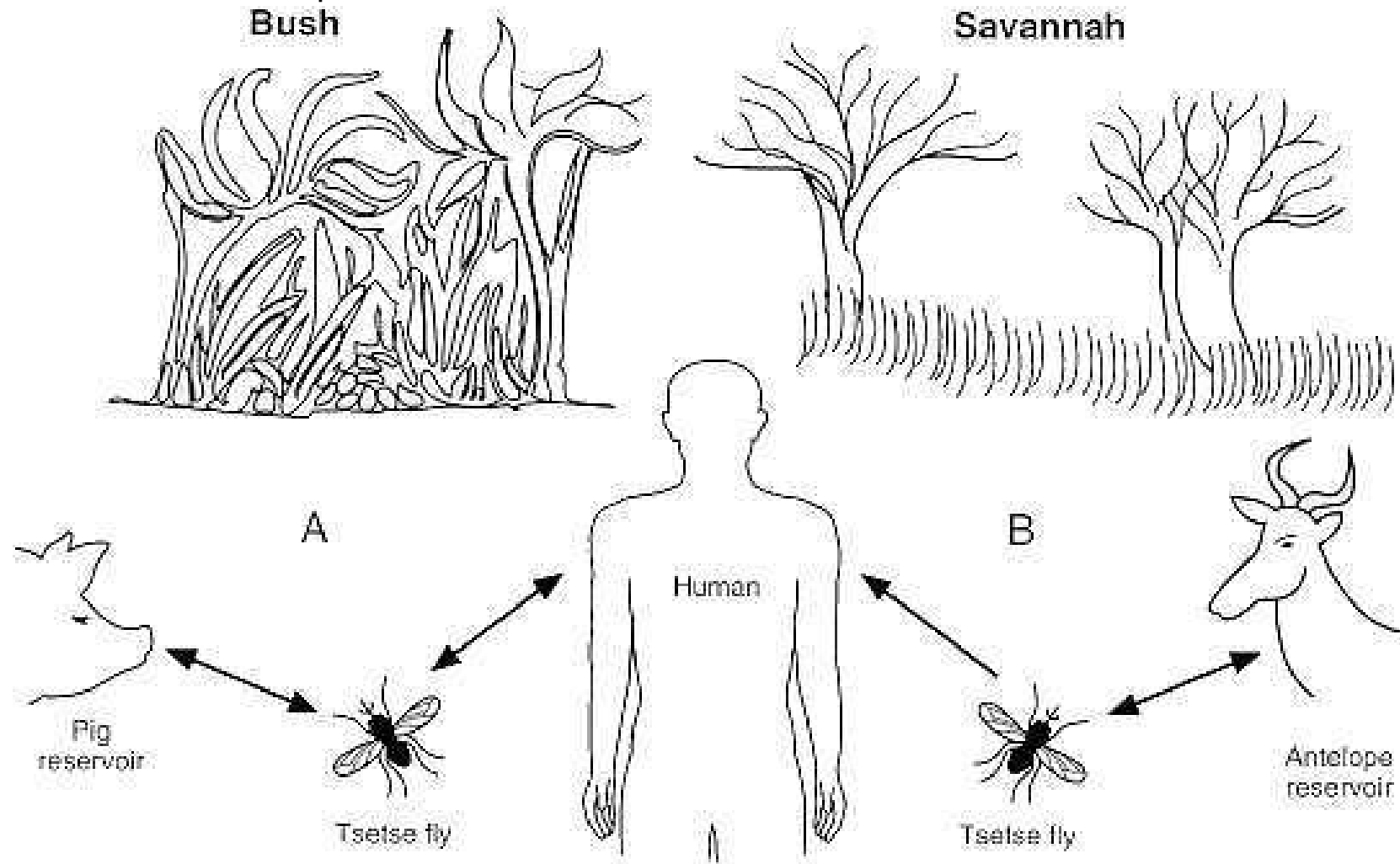


*Trypanosomák  
ruhásszekrénye:  
Egy jól felszerelt,  
változatos ruhatár és  
a kifinomult,  
választékos  
öltözködési stílus élet-  
halál kérdése...*



*A felismerhetetlenség titka: a gyors és gyakori köpenyváltás...*

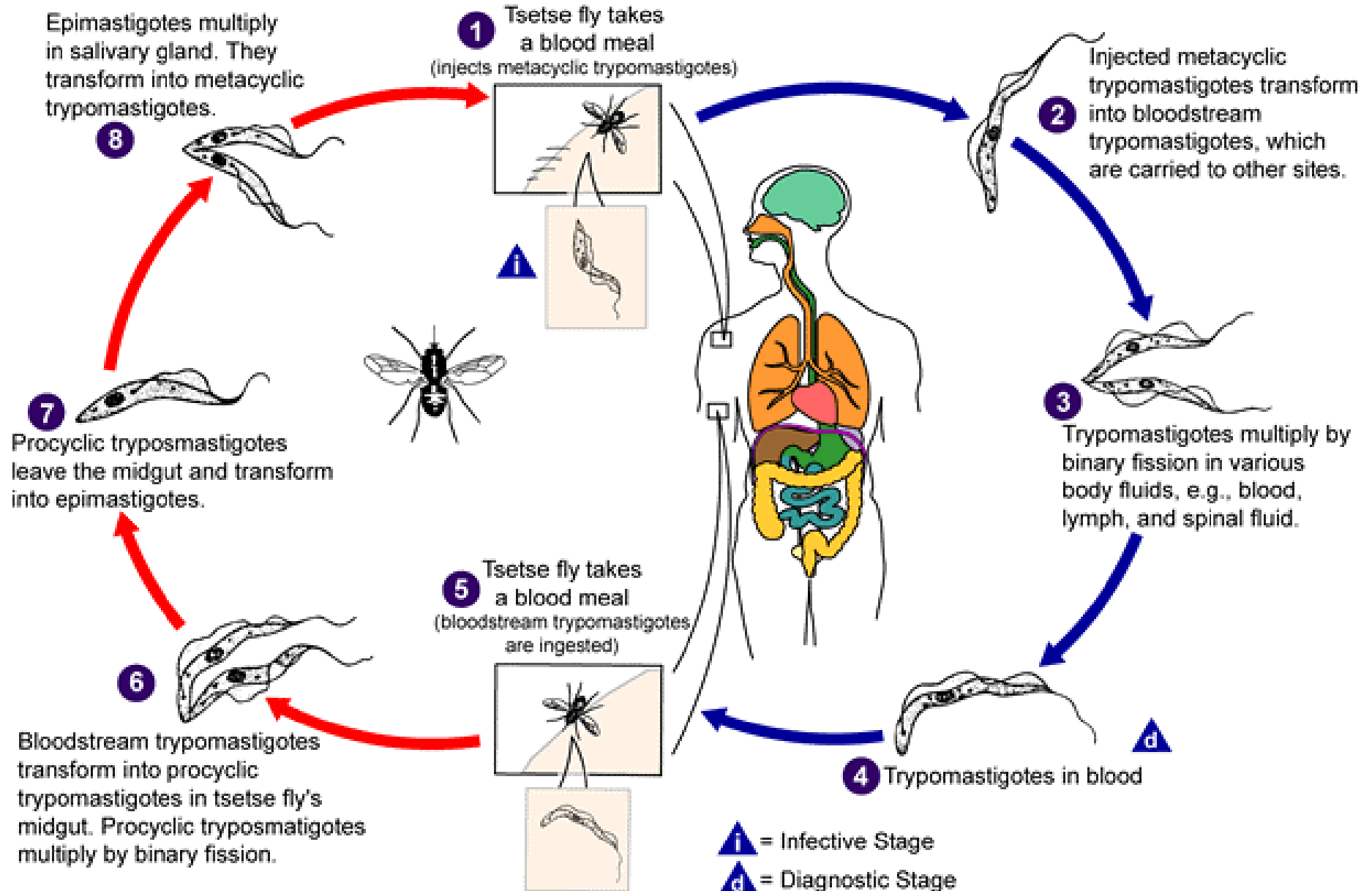
**FIGURE 82-7 Domestic and wild cycles of Gambian and Rhodesian types of African sleeping sickness.** (A) in West Africa, riverine tsetse flies (*palpalis* group) living in the bush transmit the Gambian forms to humans (man-fly cycle) and sometimes to domestic animals, particularly pigs. (B) In East Africa, *morsitans* group tsetse flies of the open savannah transmit the Rhodesian form to various mammals, mainly antelopes, and to humans. The Gambian cycle can result in an epidemic.



# T. brucei

## Tsetse fly Stages

## Human Stages



# T. brucei

## Kórkép – álmokór

Demyelinizáció, encephalitis – autoimmun (?)

### Szakaszai:

**Primer chancer** – csípés helyén

Lymphadenopathia

Encephalopathia





**Trypanosomal chancre on shoulder of patient 1, with lymphangitis toward axilla.**

**Trypanosomal chancre on throat of patient 2**

**Primer chancre**



**Trypanosomal chancre in child (C/O WHO)**



## Kórkép – álomkór

Demyelinizáció encephalitis – autoimmun (?)

### Szakaszai:

Primer chancer

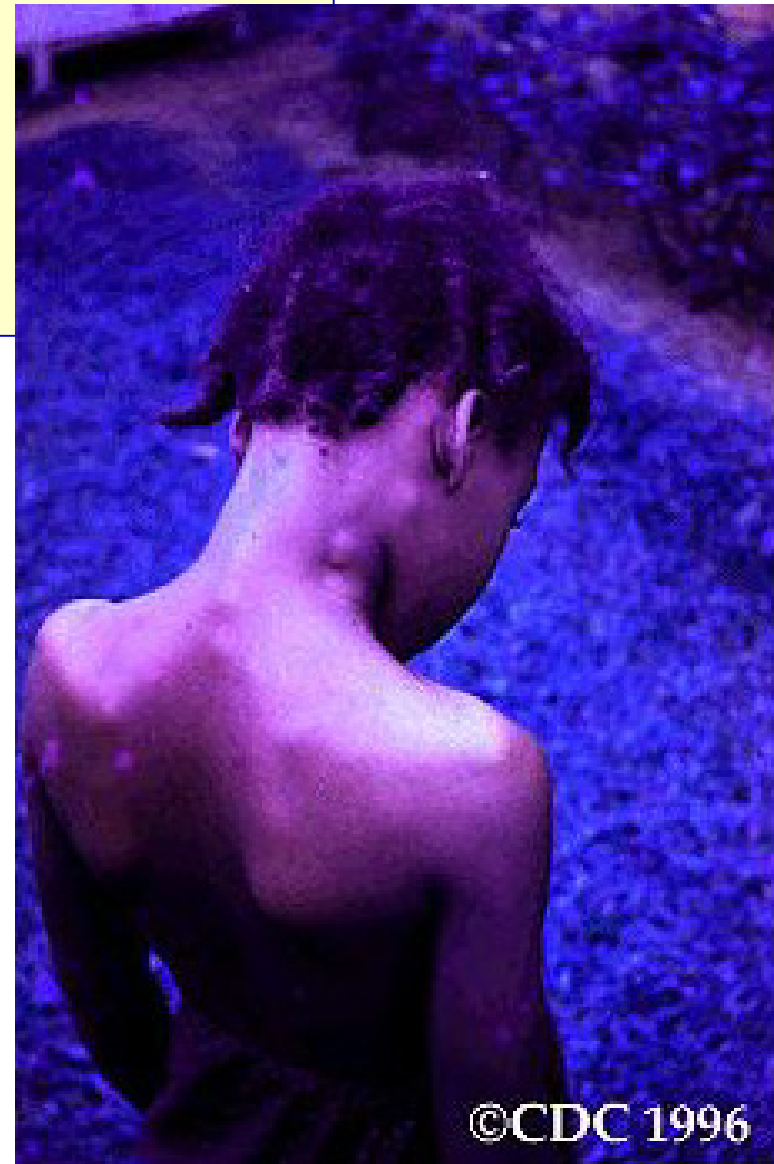
**Lymphadenopathia**

Encephalopathia

# T. brucei



Winterbottom's sign



©CDC 1996

# T. brucei

## Szakaszai:

Primer chancer

Lymphadenopathia

**Encephalopathia**

Invázió a központi Idegrendszerbe,  
rhodesiense fertőzés esetén:  
4-8 hónap



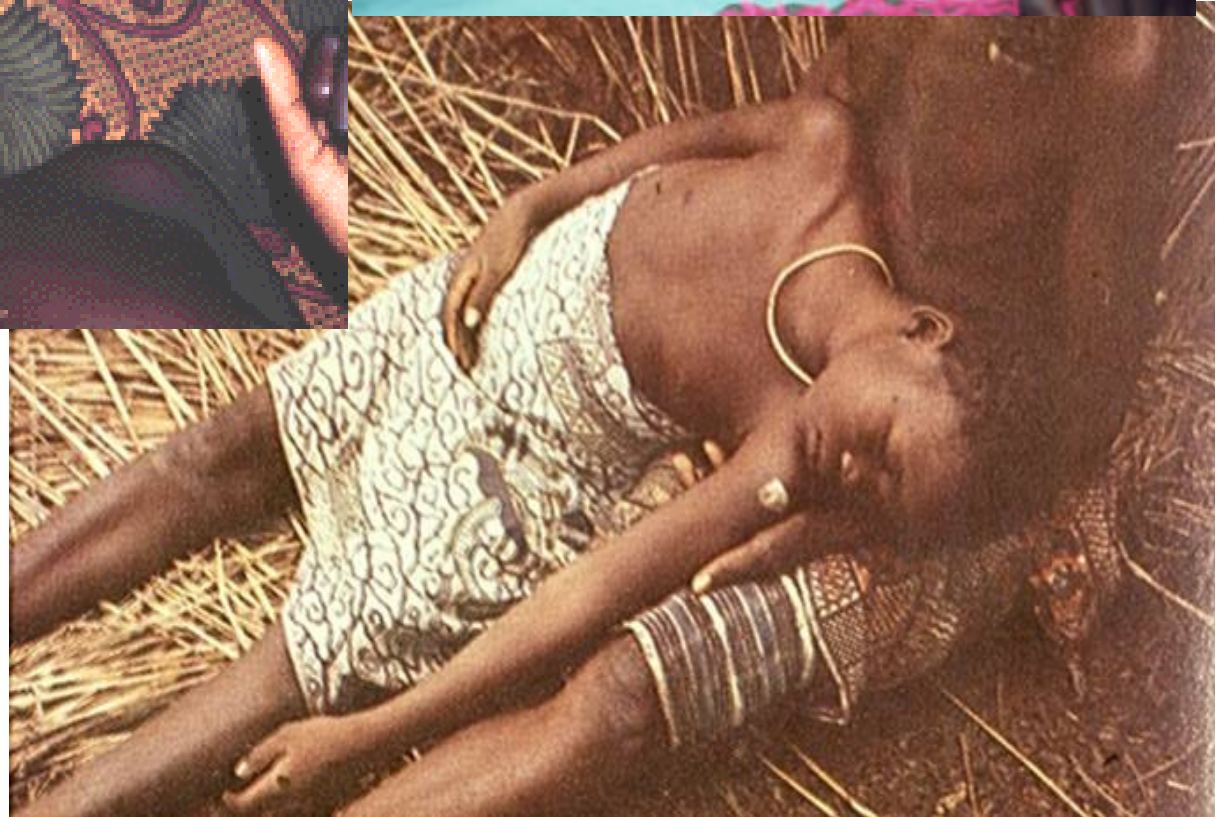
Gambiense fertőzés:

A meningoencephalitis kialakulása évekig is eltarthat

# Encephalopathia



# Encephalopathy



# T. brucei

## Diagnosis

Direkt kimutatás – mikroszkóp

Vérkenet – Giemsa

liquor

IF



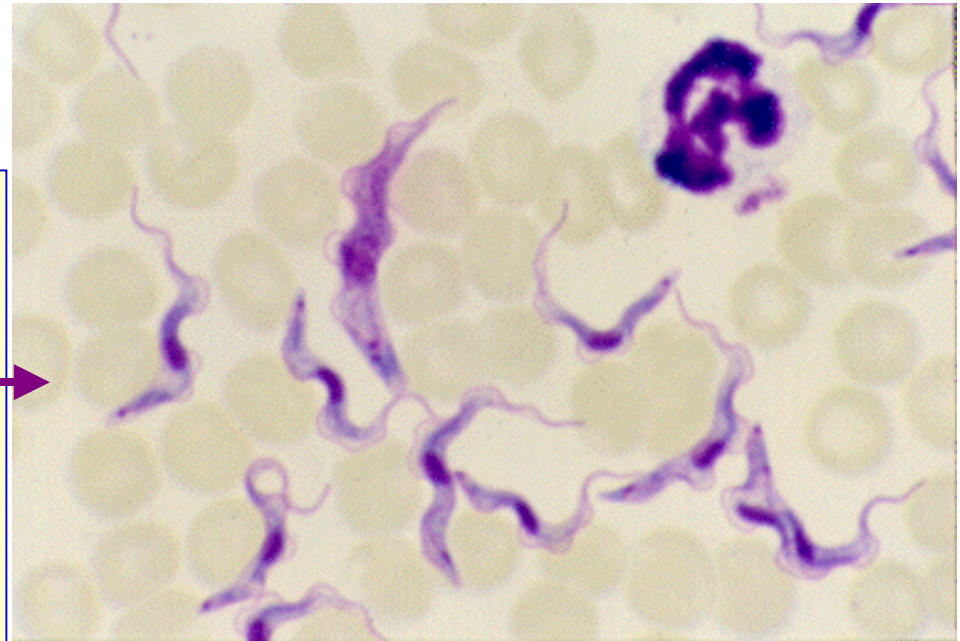
## Therapia

Arzén származékok  
(suramin, pentamidine)

## Preventio

Insecticidek

Csapdák

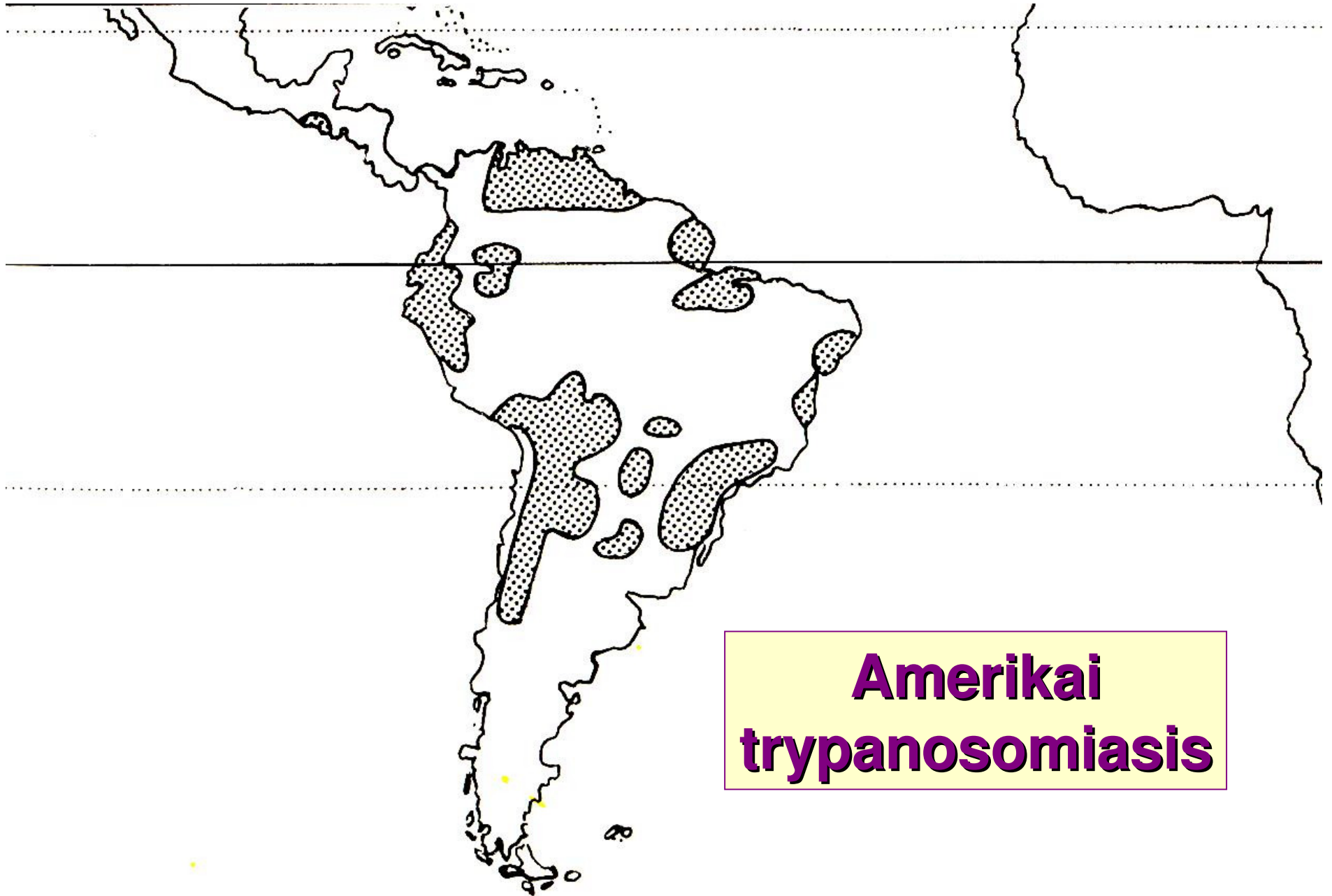


T. brucei fluorescently stained for DNA  
and tubulin and viewed at 1000x  
magnification

[www.biology.ed.ac.uk/.../images/random/Fig05.jpg](http://www.biology.ed.ac.uk/.../images/random/Fig05.jpg)

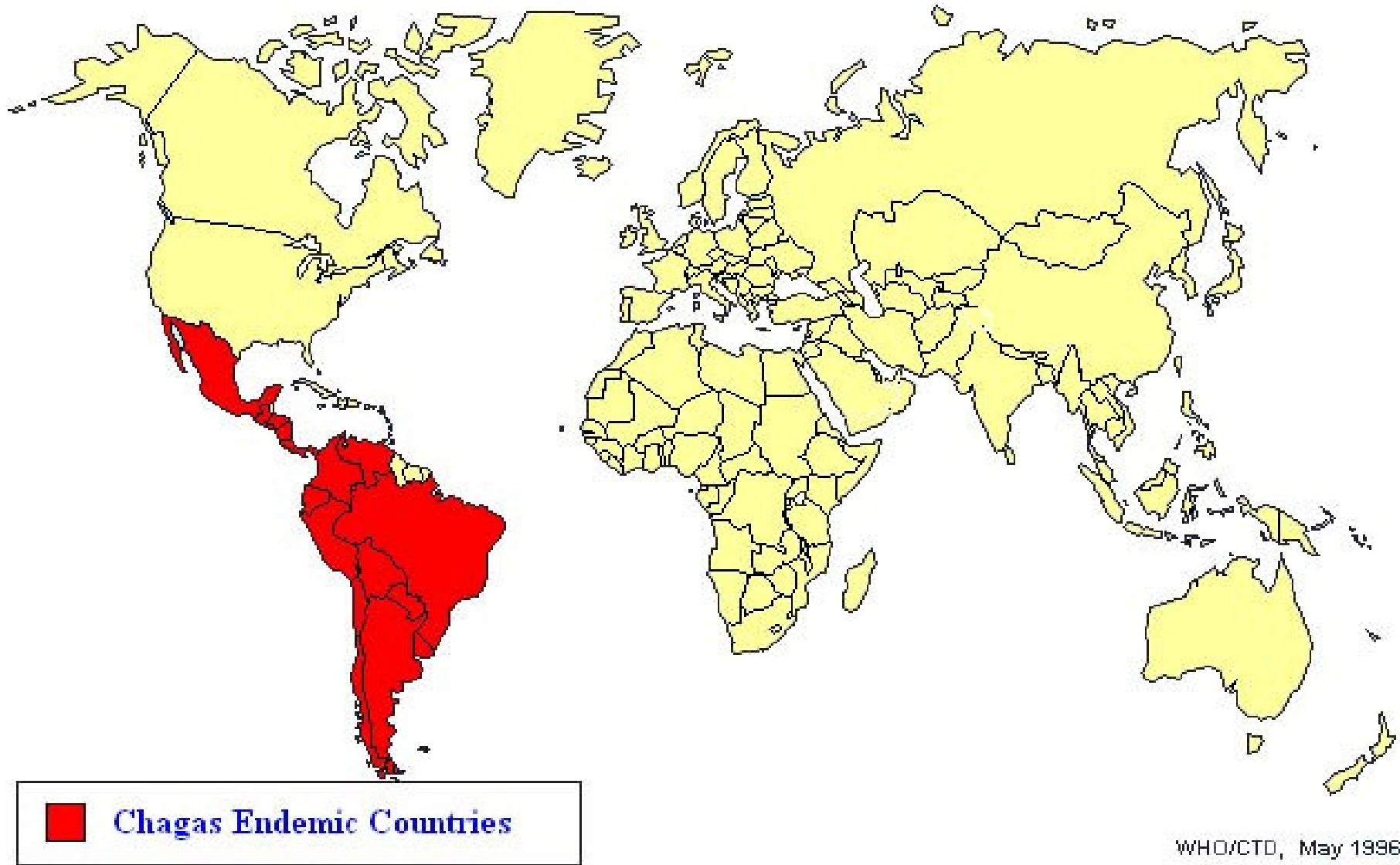
**Trypanosoma**

**cruzi**



**Amerikai  
trypanosomiasis**

## Chagas Disease





# T. cruzi

## Morphologia

u. olyan

## Forrás

zoonosis

(állatok, házi, vad)

## Transmissio

Vektor – Triatoma spp.  
„rablópoloska” ürüléke

congenitalis

Transfusio!



# T. cruzi

[www.biosci.ohio-state.edu](http://www.biosci.ohio-state.edu)



## Forrás

zoonosis  
(állatok, házi, vad)

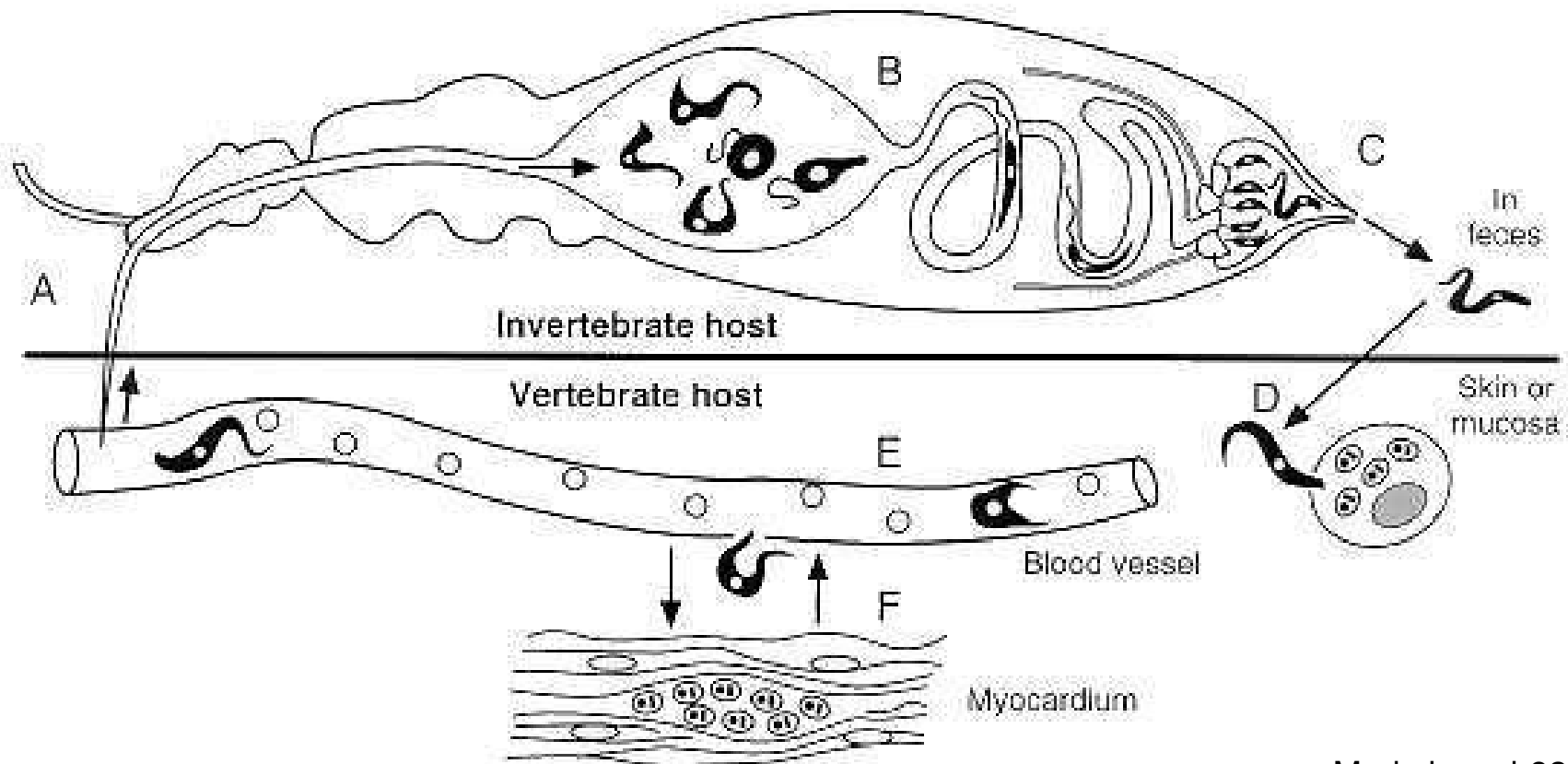
## Transmissio

Vektor – Triatoma spp.  
„rablópoloska” ürüléke

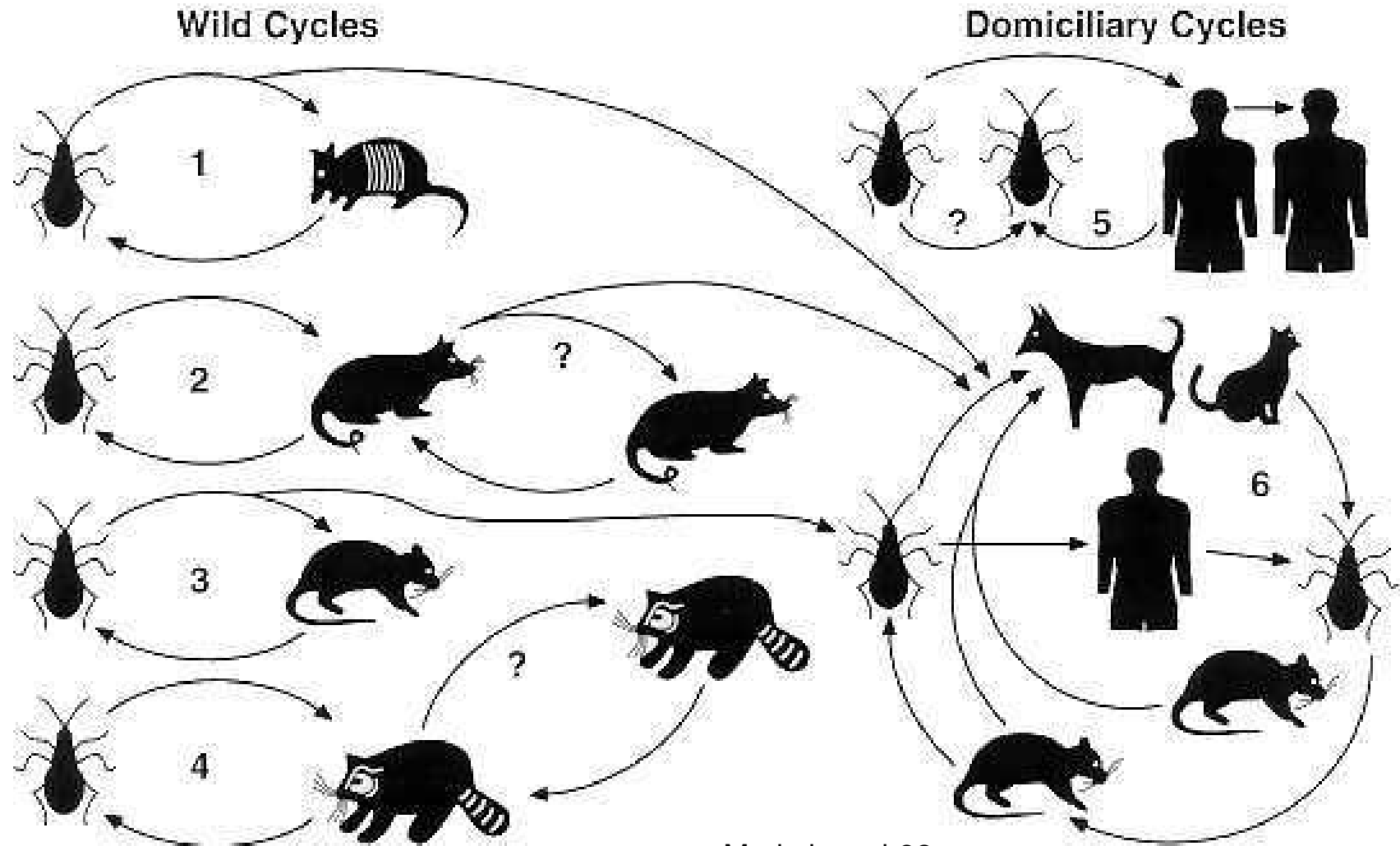
congenitalis  
Transfusio!



**FIGURE 82-3 Life cycle of *T cruzi* in the intestine of a triatomine bug and in the vertebrate host.** After entering the bug in infected blood (A) the trypanosomes transform to epimastigotes in the stomach and midgut. B) Epimastigotes attach to the walls of the rectal sac and produce infective metacyclic trypomastigotes, which are eliminated with feces (C) and enter the vertebrate host through breaks in the skin. The parasites transform to amastigotes inside local cells (D), and multiply to release blood typanosomes, which invade other tissues (E & F).



**FIGURE 82-6 Wild and domiciliary life cycles of Chagas disease. Some triatomine bugs transmit *T cruzi* to various wild animals (cycles 1-4). Other bugs are adapted to houses and transmit the parasite among humans and domestic animals (cycles 5 and 6).**



# T. cruzi

## **Szaporodás**

Intracellularis

Belső szervek és szövetek:

**szív és símaizom**

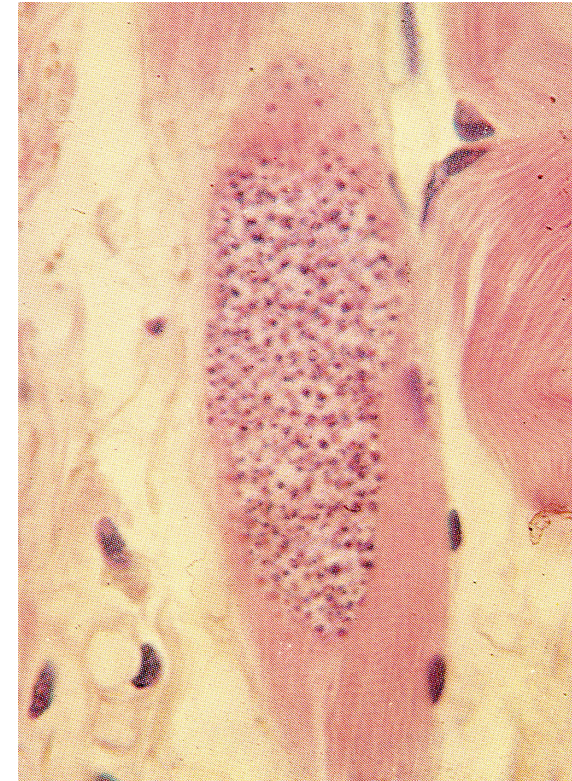
Monocyták, RES

## **Virulencia faktorok, pathogenesis**

Sejtek – adhesio és penetratio

Felszíni glycoproteinek

Szérumfaktorok (gazda!)



Amastigotes in heart muscle.

# T. cruzi

## Kórképek – Chagas kór

### Acut

A behatolási kapuban:

Bőr: „**chagoma**” (kicsi tumor)

Conjunctiva: Romana jel (unilateralis bipalpebralis oedema)

+ nyirokcsomó duzzanat

Subclinicus

Tünetmentes hordozó

### Chronicus

hepatosplenomegalia

myocardiopathia

szívelégtelenség

megacolon



# T. cruzi

Medmicro ch82

## Kórképek – Chagas kór

### Acut

Behatolási kapuban:

Bőr: „chagoma” (kicsi tumor)

Conjunctiva: **Romana jel**

+ nyirokcsomó duzzanat

Subclanicus

Tünetmentes hordozók

### Chronicus

hepatosplenomegalia

myocardiopathia

szívelégtelenség

megacolon



**FIGURE 82-2** Romana's sign in an acute case of Chagas disease.

# Romana je1

[www.vif.se](http://www.vif.se)



Child with Romana's sign: unilateral conjunctivitis, palpebral and periorbital edema and preauricular lymphadenopathy. AFIP 62-3934-6.

[tmcr.usuhs.mil](http://tmcr.usuhs.mil)



# T. cruzi

## Kórképek – Chagas kór

Tünetmentes hordozók

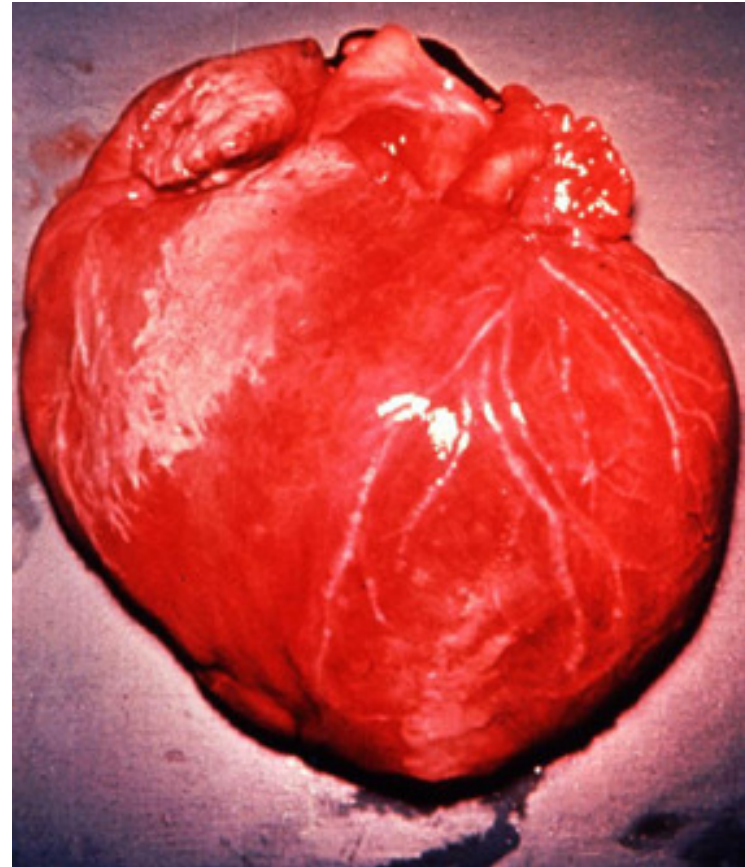
**Chronicus**

hepatosplenomegalia

**myocardiopathia**

**szívelégtelenség**

megacolon



# T. cruzi

myocardiopathia  
szívelégtelenség

**Figure 7: Large ventricular apical aneurysm in chronic Chagas' disease**



**Figure 8: Cardiomegaly in chronic Chagas' disease**

[www.health.gov.mt/.../issue5/2839/fig04.jpg](http://www.health.gov.mt/.../issue5/2839/fig04.jpg)

# T. cruzi

[www.health.gov.mt/.../issue5/2839/fig04.jpg](http://www.health.gov.mt/.../issue5/2839/fig04.jpg)

## Kórképek – Chagas kór

Tünetmentes hordozók

### Chronicus

hepatosplenomegalia

myocardiopathia

szívelégtelenség

**megacolon**



# T. cruzi

## Diagnosis

Direkt kimutatás – mikroszkópos

Vérkenet – Giemsa

Biopszia

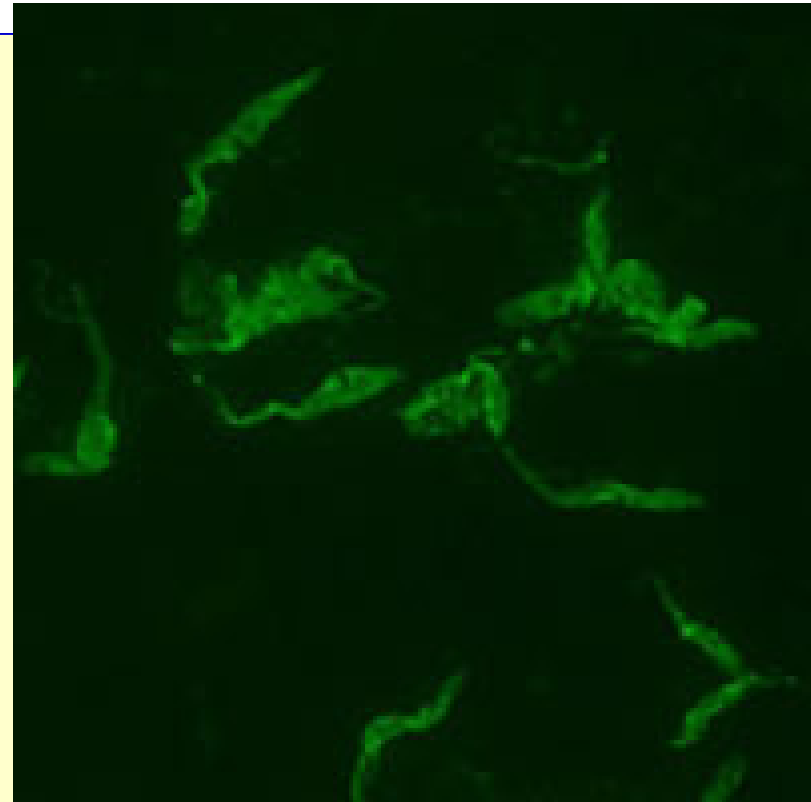
DIF →

PCR

szerologia

Xenodiagnosis

(rablópoloskát fertőzni)



## Therapia

Nitrofurán származékok(?) – hatékony szer kellene!

## Preventio

Insecticidek, csapdák, tájékoztatás

VÉGE



Mauritius, 2006