

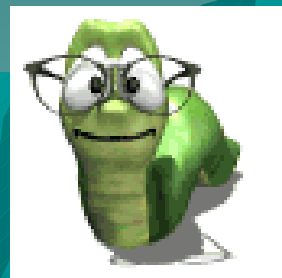
***Taenia solium* cysticercosis/  
taeniosis complex and  
Epilepsy with special focus  
on Cameroon**

**Pr André P ZOLI**

*University of Dschang, PO Box 222, Dschang, Cameroon;*

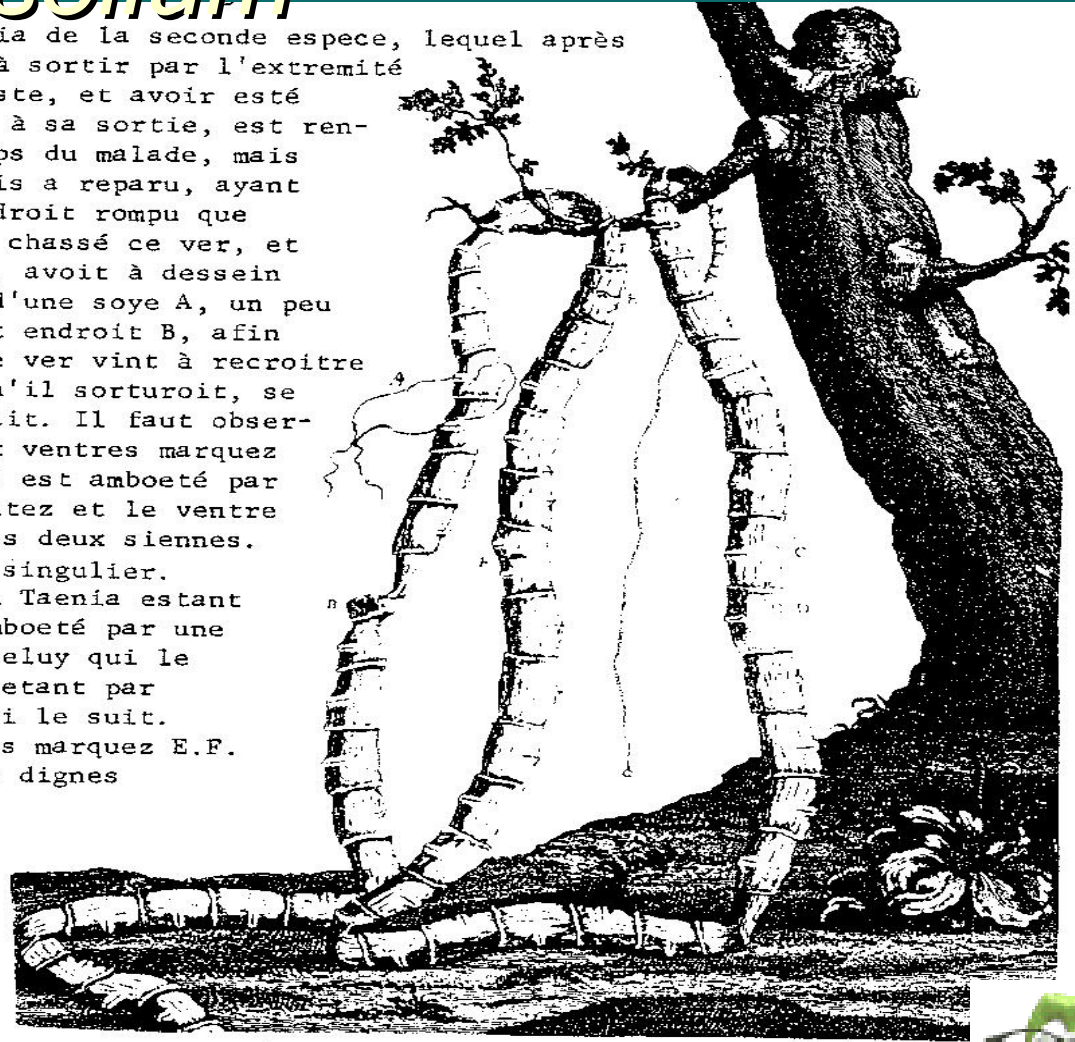
# History of Human *Taenia*

- ◆ Ancient Egyptian Era
- ◆ Ancient Greek-Roman Era
- ◆ 17th Century (Andry)



# Andry' s Representation of *T. solium*

"Morceau de Taenia de la seconde espece, lequel après avoir commencé à sortir par l'extremité opposée à la teste, et avoir esté rompu en dehors à sa sortie, est rentré dans le corps du malade, mais au bout d'un mois a reparu, ayant repoussé à l'endroit rompu que Mr.Andry, qui à chassé ce ver, et qui le conferve, avoit à dessein fait traverser d'une soye A, un peu au dessus de cet endroit B, afin qu'en cas que le ver vint à recroître l'on pût lors qu'il sorturoit, se convaincre du fait. Il faut observer icy les deux ventres marquez C.D: le ventre C est emboeté par ses deux extremittez et le ventre D emboeté par les deux siennes. Ce. qui est très singulier. Chaque ventre du Taenia estant regulierement emboeté par une extremité dans celuy qui le precede, et emboetant par l'autre celuy qui le suit. Les deux endroits marquez E.F. sont encore tres dignes s'attention"

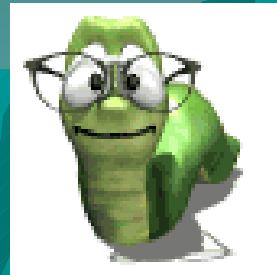


A tapeworm (from N.Andry, 1718)



# 18<sup>th</sup> & 19<sup>th</sup> Century

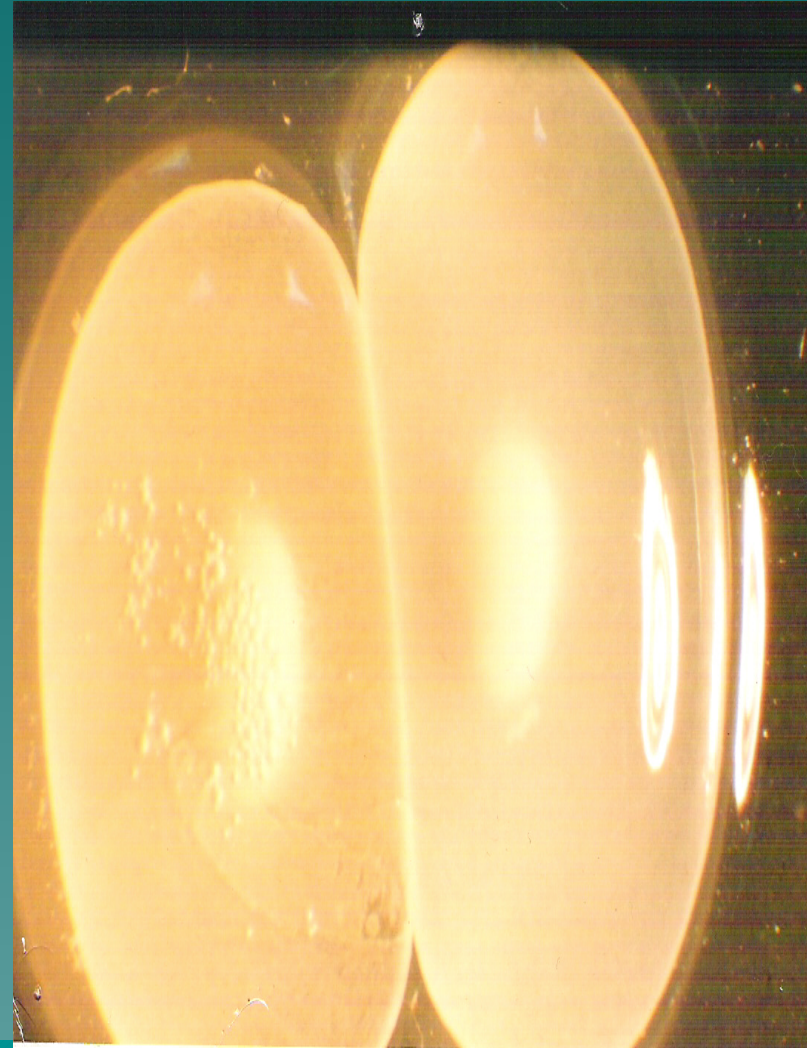
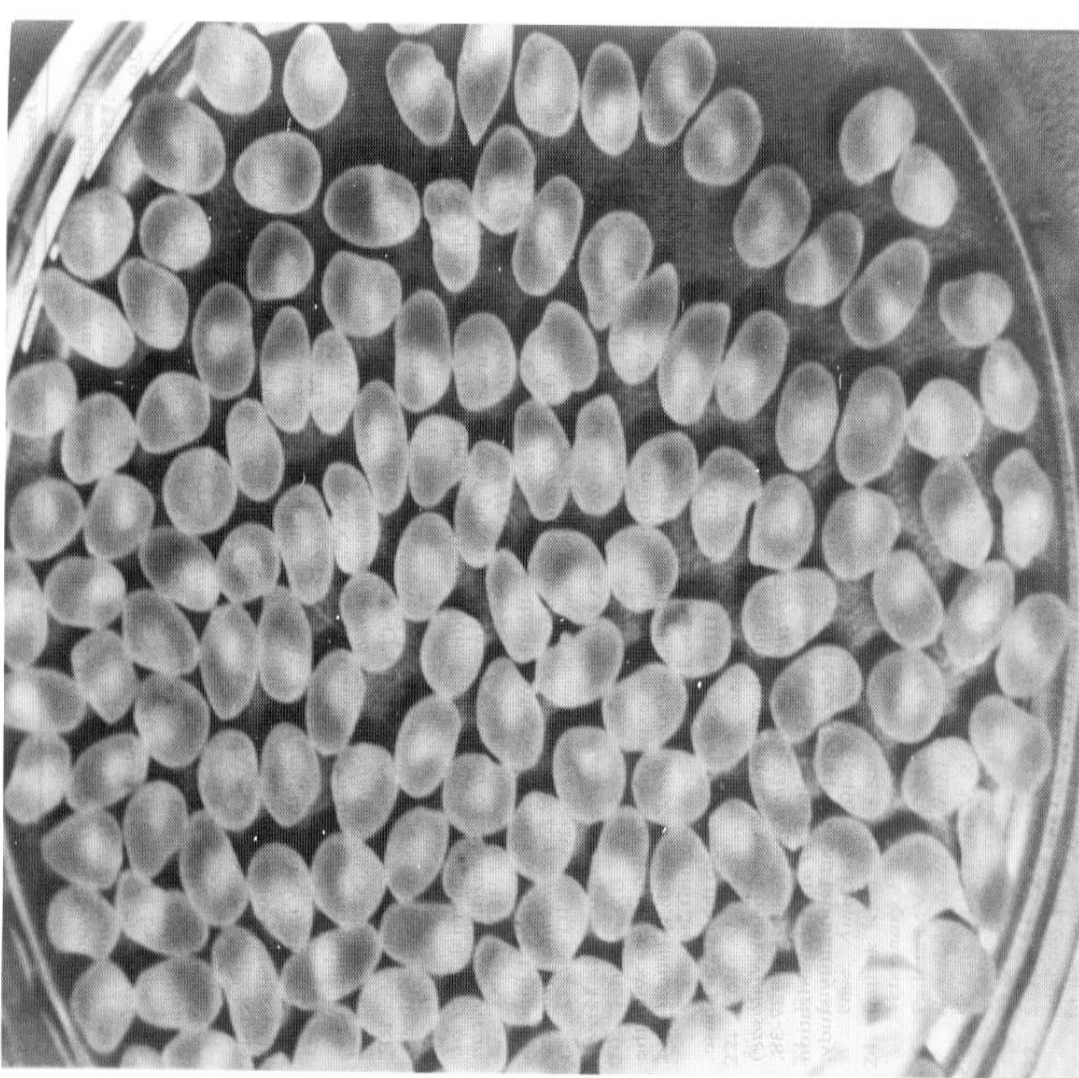
- ◆ Göze: distinguished the two *Taenia* species in Man: *T. saginata* & *T. solium*
- ◆ Van Beneden: Described the biological cycle of *T. solium*
- ◆ Kuchenmester: Made the difference between the two *Taenia* species & described the 2<sup>nd</sup> part of the biological cycle
- ◆ Gresinger: Described Human Cysticercosis







# Morphology (encysted larvae)



# TRANSMISSION (Infection)

## ● Final Host:

- poor meat inspection and control
- Consumption of raw or insufficiently cooked measly pork
- Preference for infested pork (case of a village in Fontem)
- Papuan New Guineans: Consumption of human brain



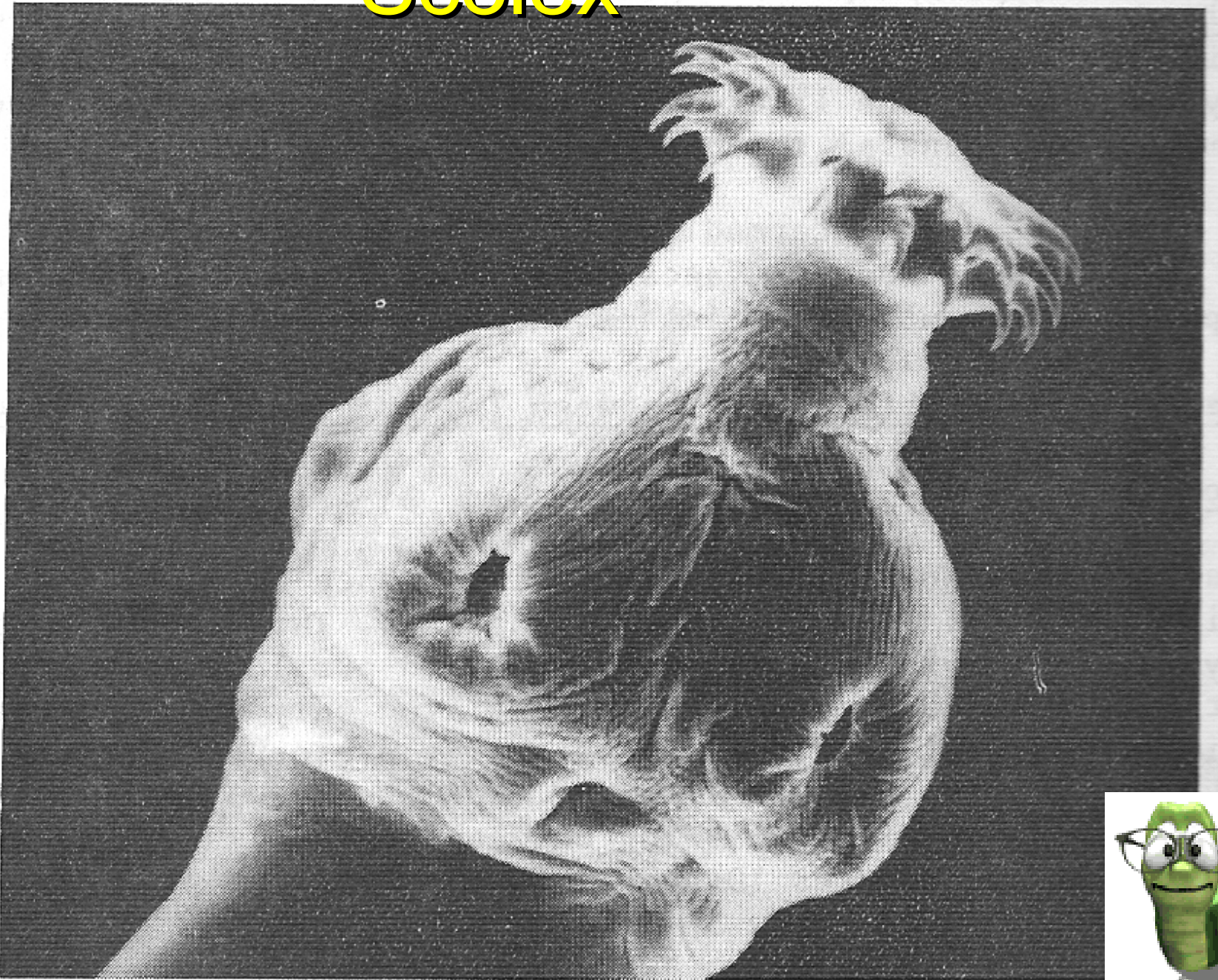


# Morphology (évagination)

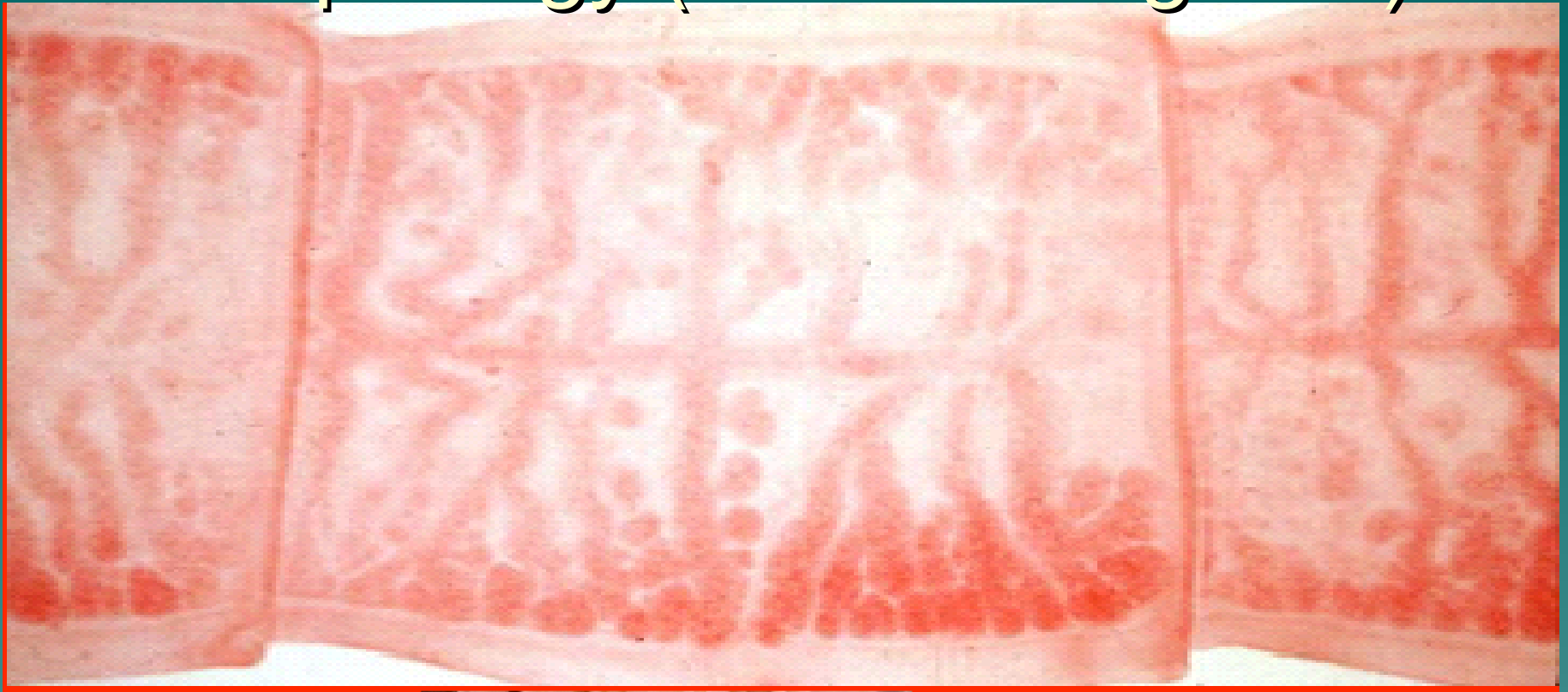




# Scolex



# Morphology (Mature Proglottis)



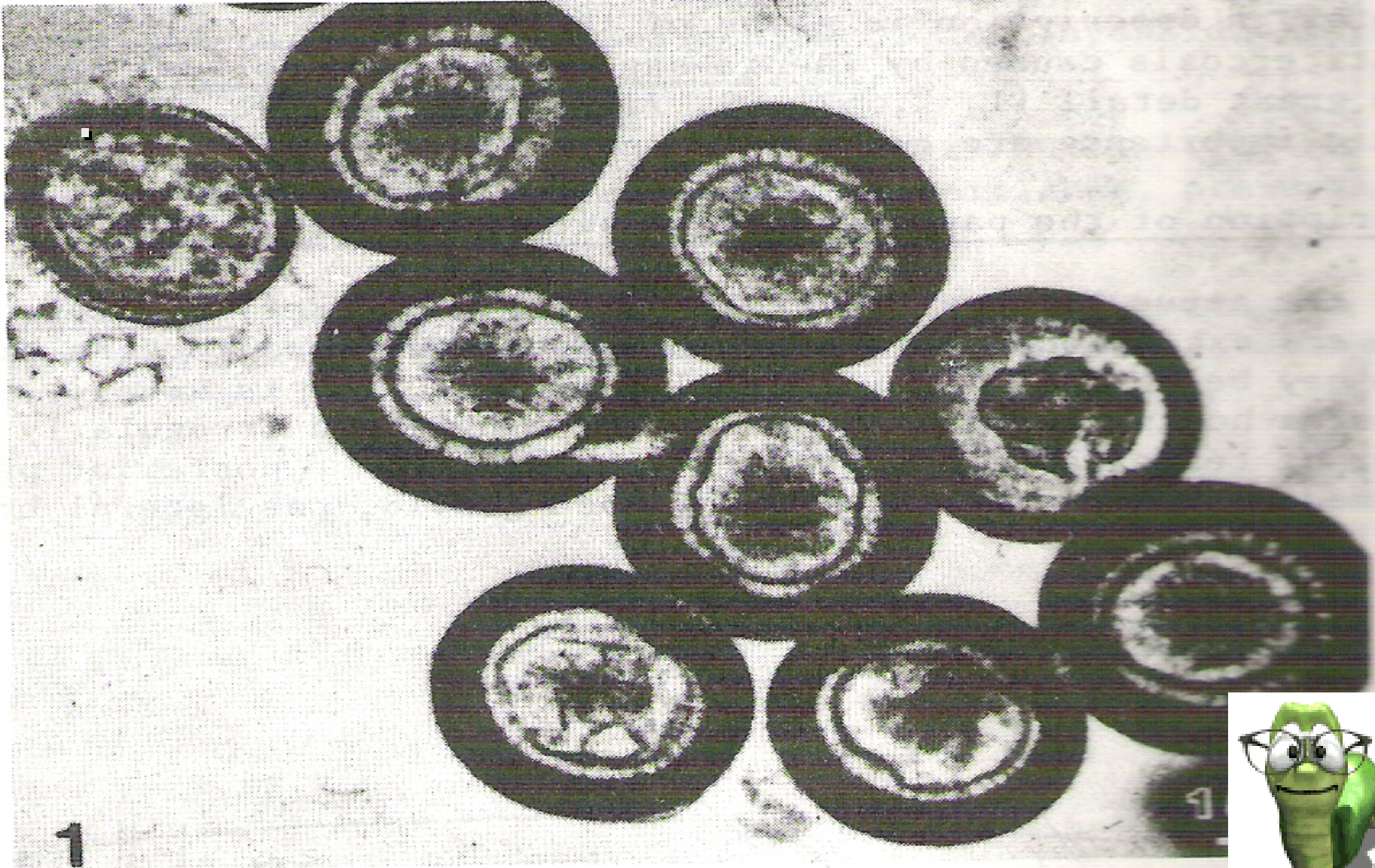
10/01/10

Prof. ZOLI André





# Morphology (egg)



# TRANSMISSION (Infection) TO NATURAL & ACCIDENTAL INTERMEDIARY HOST

## ◆ PIG

### Poor methods of pig husbandry

- Pig pen defecation
- Open air defecation
- Free roaming pigs

## ◆ MAN

- contaminated vegetables, fruits, water etc....
- auto-infection
- "Muti" in south Africa
- poor household sanitation and hygiene



# Defecation in Pig Sty (Ashong-Batibo)





# Defecation in Pig Sty (Ashong-Batibo)





# Free Roaming Pigs (Dschang Town)





# Free Roaming Pigs (Yagoua, Far-North)





# Localisation in pigs (Tongue)





# Localisation in pigs (Muscle)



# Localisation( Heart of Pig)



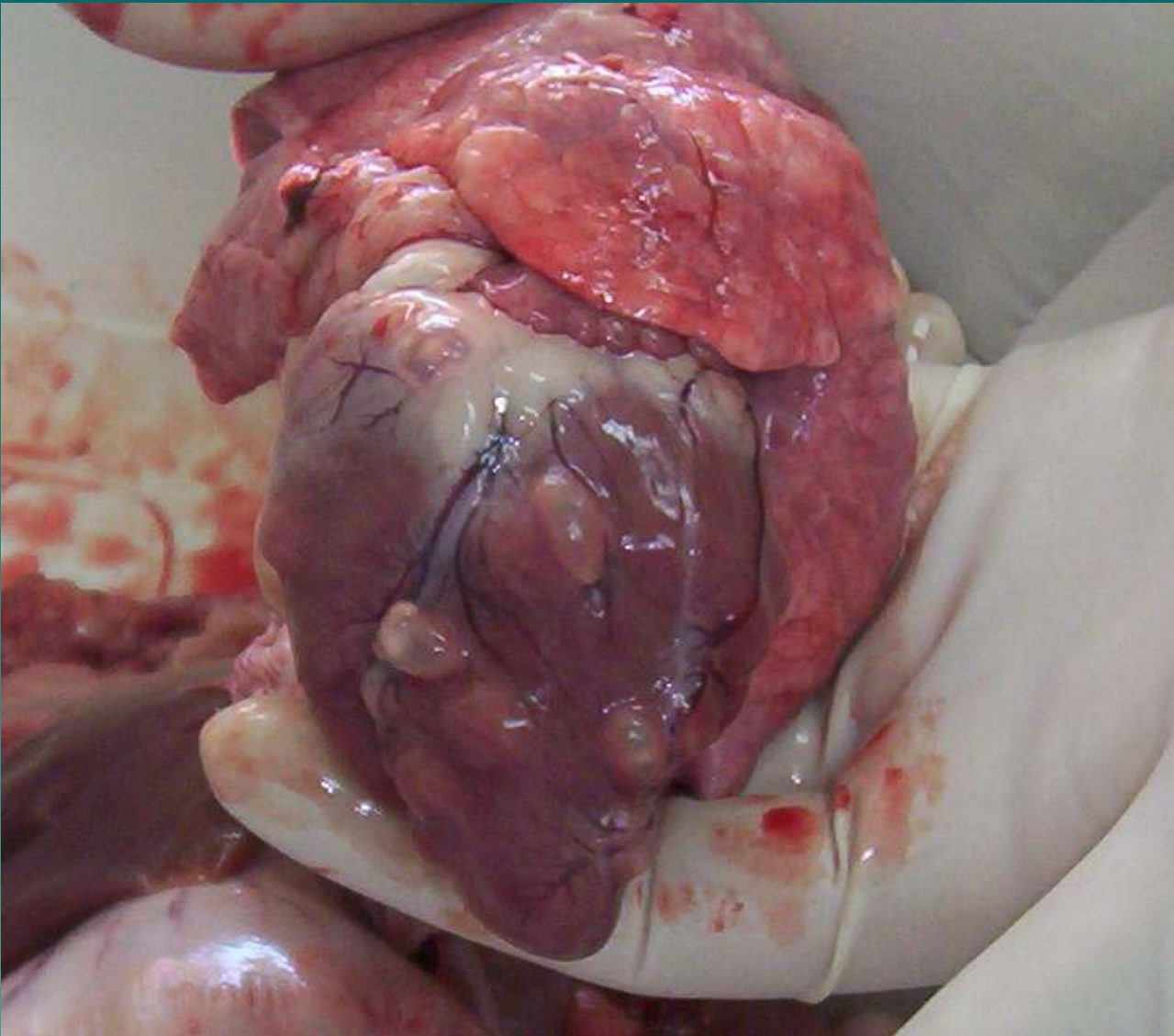
10/01/10

Prof. ZOLI André,





# Localisation( Heart of Pig)





# Localisation (Liver)



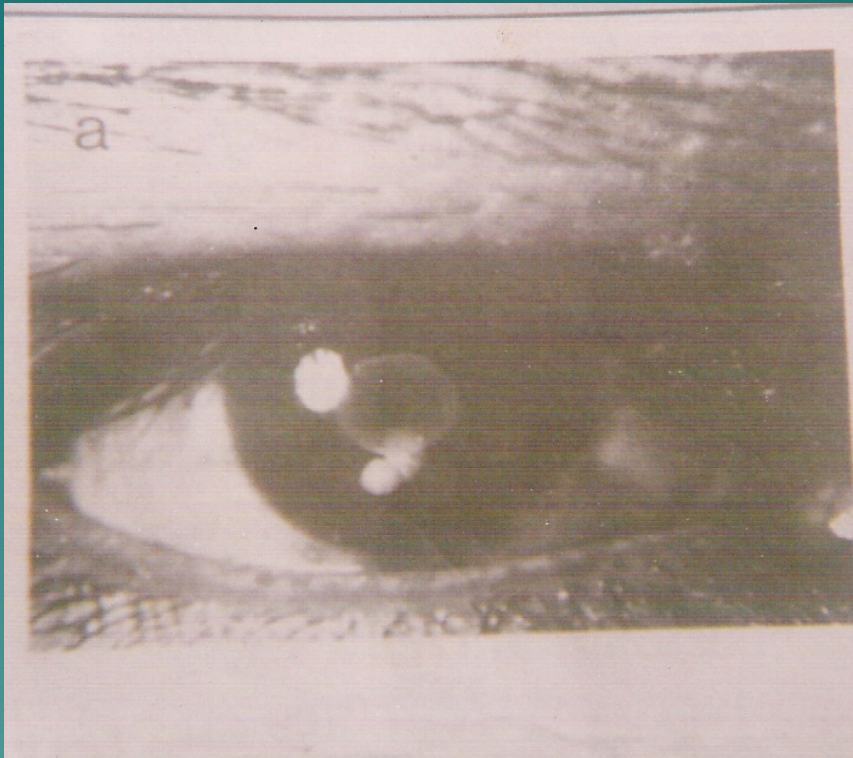
10/01/10

Prof. ZOLI André



# Localisation In **Man** (eye and tongue)

## ◆ **Eye**



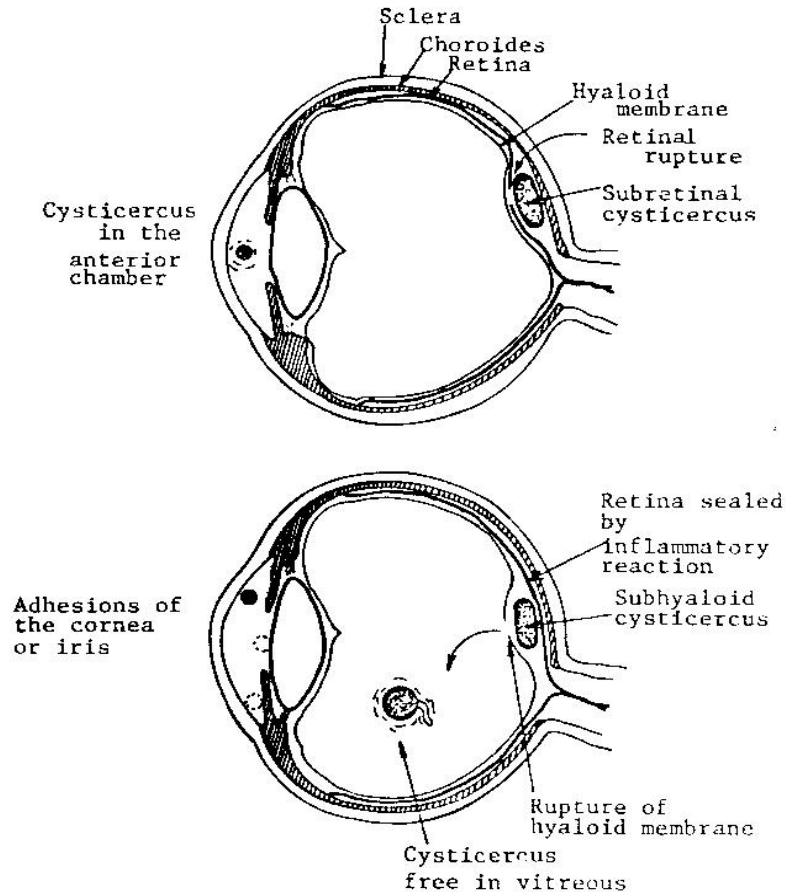
## ◆ **Tongue**



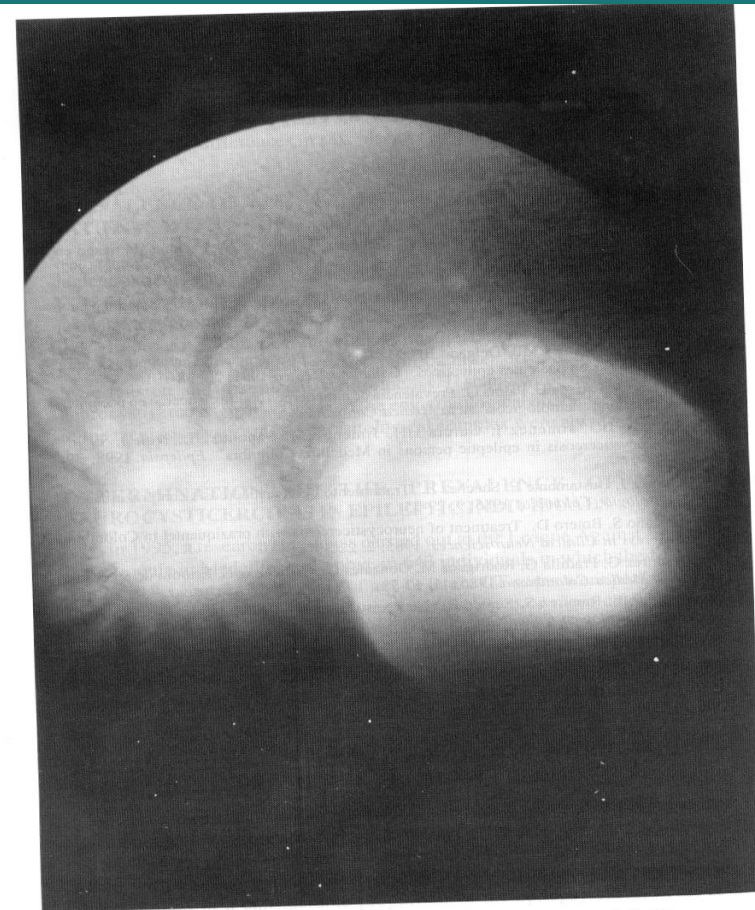


# Localisation (eye)

## ◆ Intravitreal Cyst



**Figure 8-4.** Diagram showing the ocular cysticercus. The inflammatory reaction caused by the parasite in the anterior chamber allows its adherence to the cornea, lens, or iris. The parasite moves from its subretinal location through the retina and hyaloid membrane to become free in the vitreous.



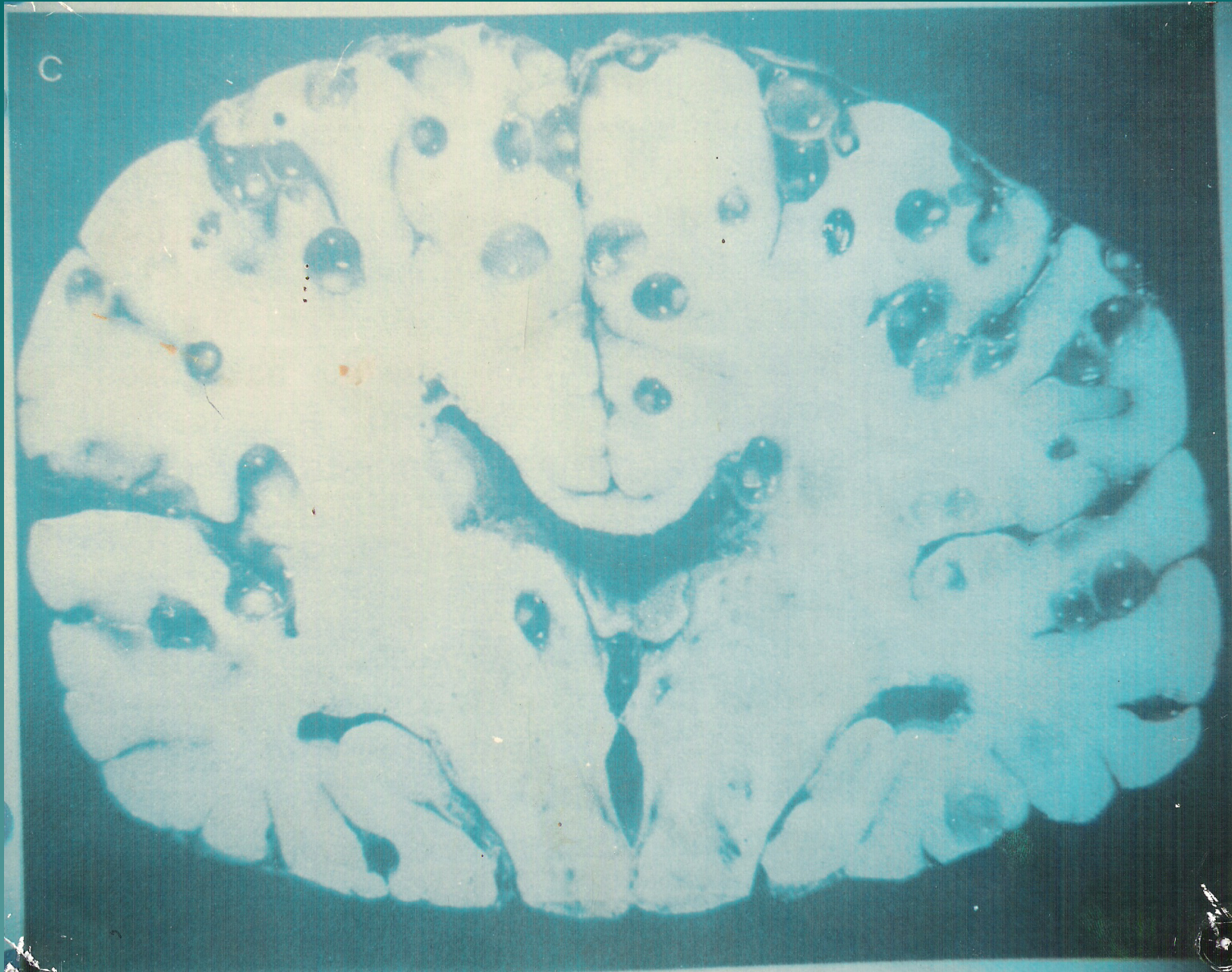
*Intravitreal cysticercosis (Photo: Cysticercosis Working Group in Perú).*

# Localisation (Sub-cutaneous)





# Localisation in Man (CNS)



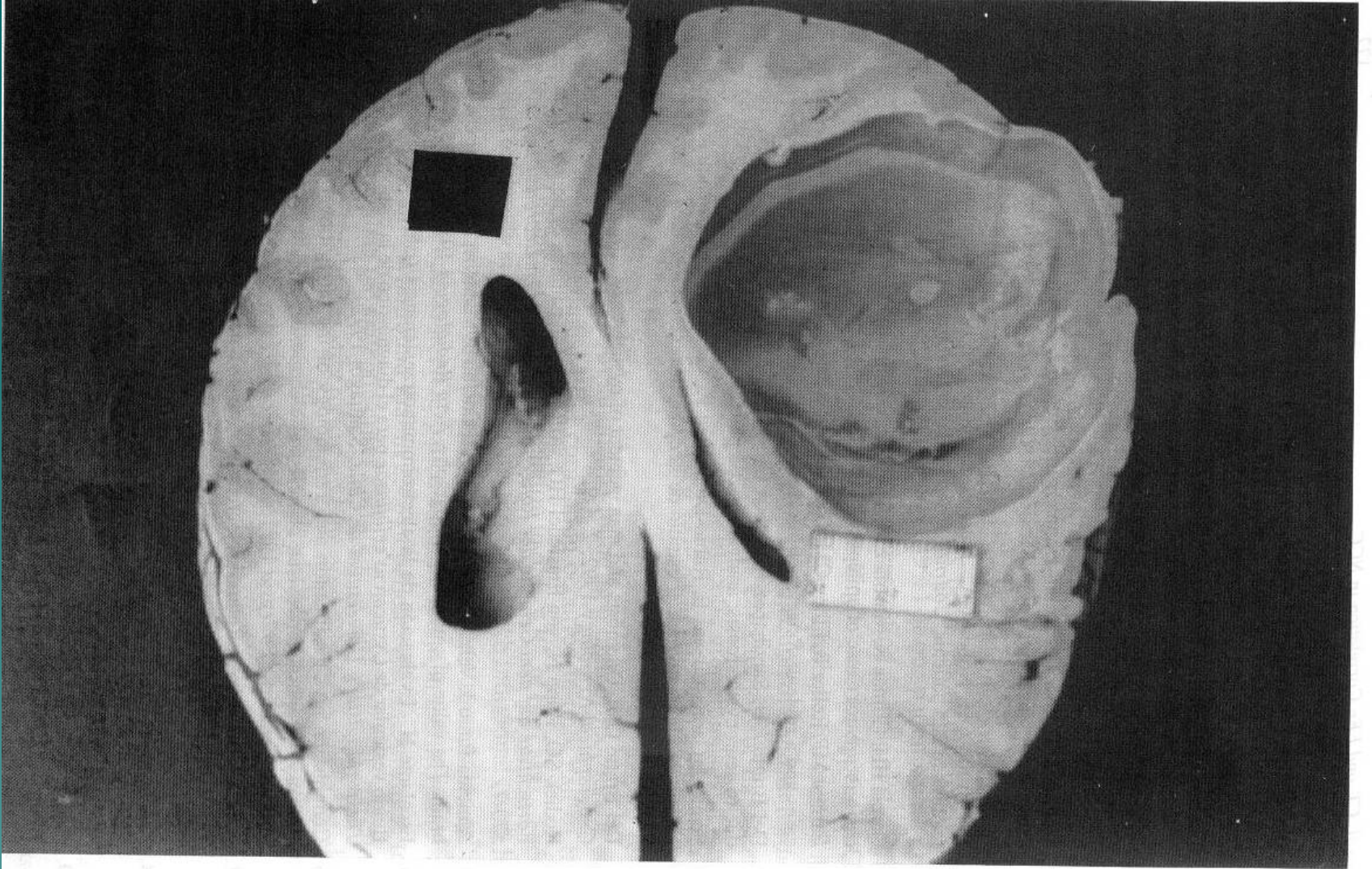


# *Neurocysticercosis--"swiss-cheese brain"*





# Localisation (CNS)



*Giant intraparenchymal cysticercus (Photo: Department of Pathology, Instituto de Ciencias Neurológicas, Lima, Perú).*



KENONE ELISE

HOPITAL CENTRAL YDE  
SENAOIS AR, STAR  
VE-1A  
H-SP-CR

3872  
01-JAN-1969  
13-MAY-2001  
15:41:30.0  
TP -40.0  
IMA 11  
SIO 12

R

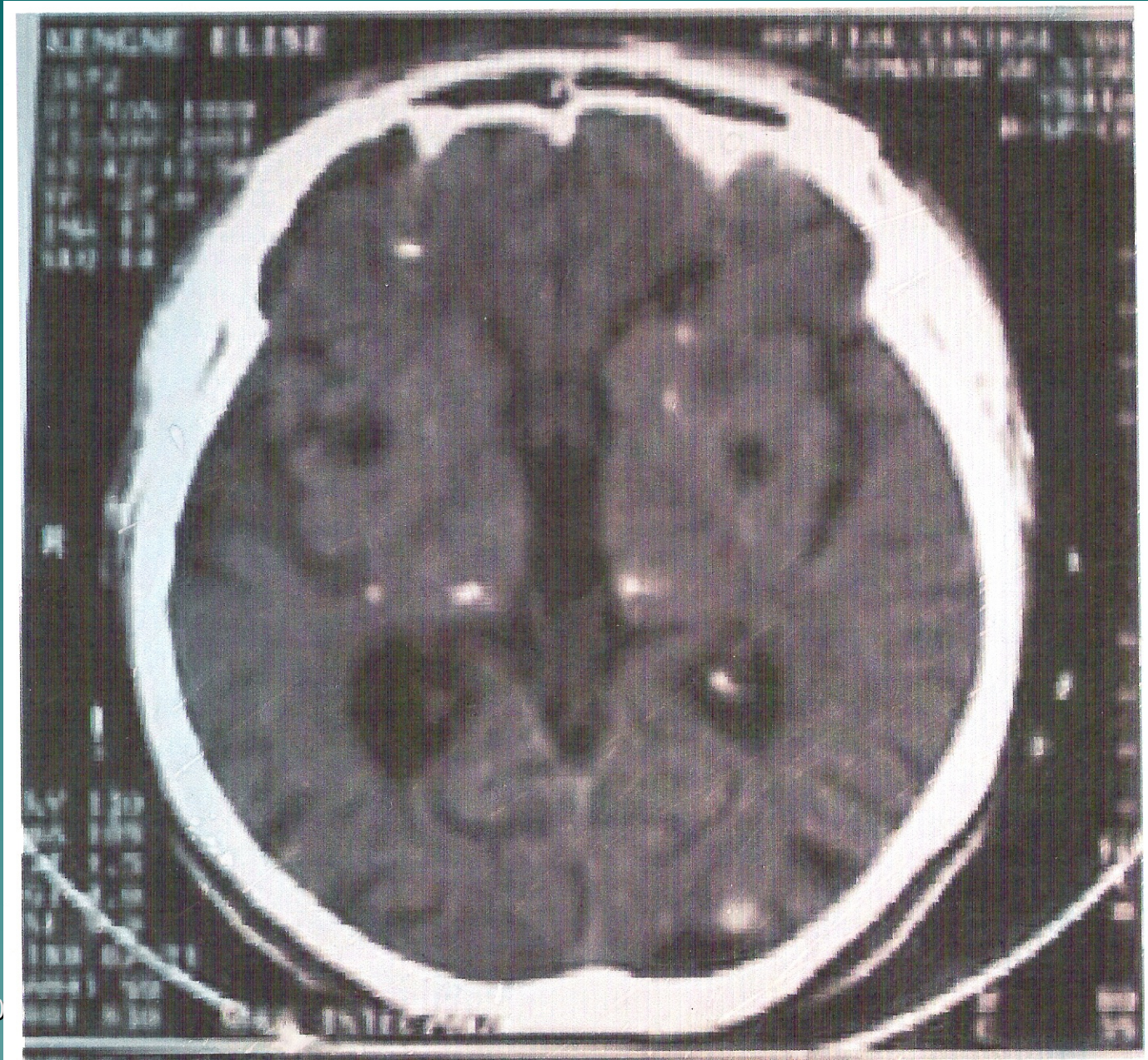
KV 130  
MA 105  
CA 1.0  
DI 4.0  
SI 5.0  
189 07-21  
AM41 50  
001 834



142  
48



# Localisation (CNS)



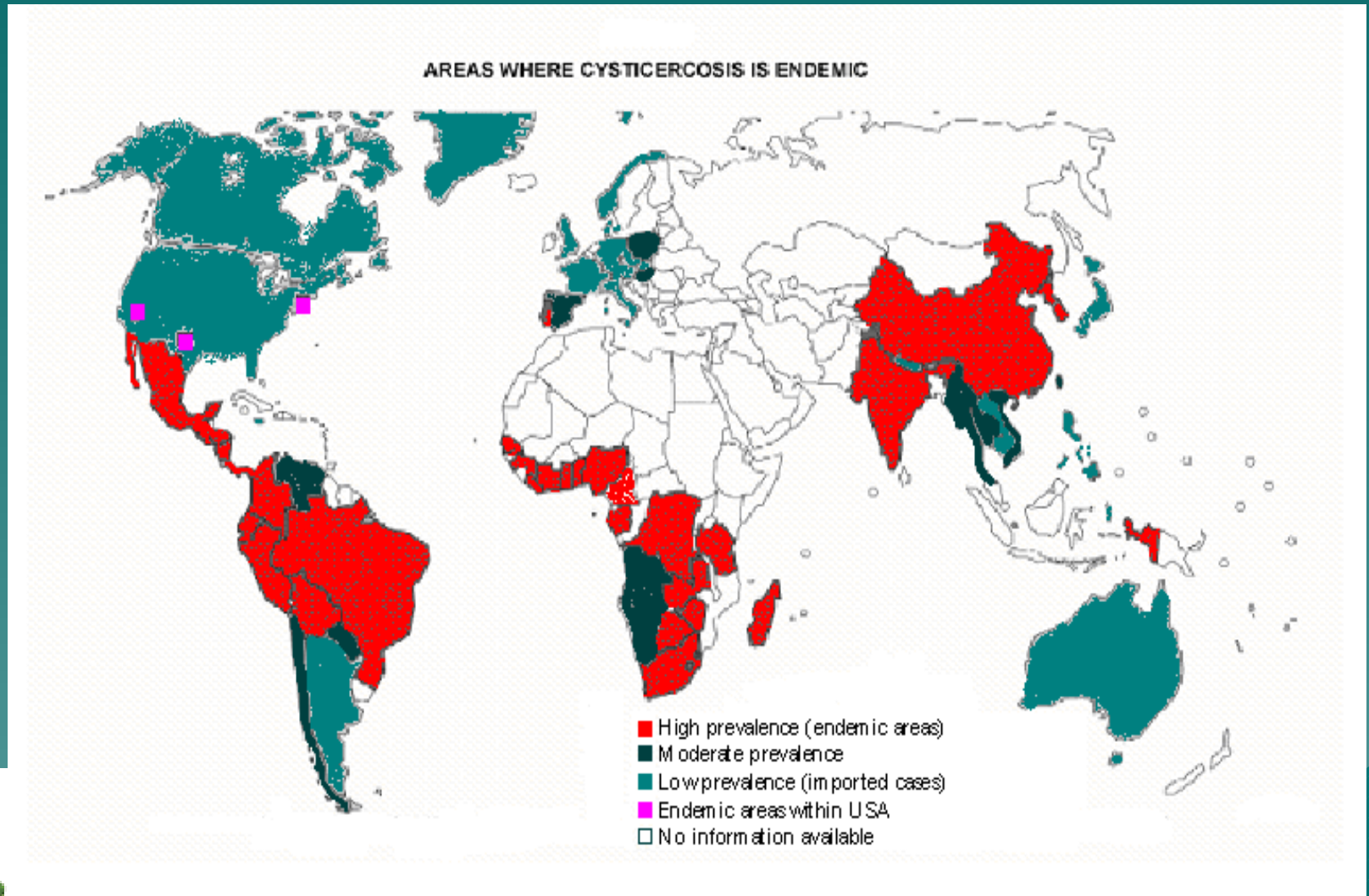


# Symptoms

## Symptômes et signes de la NCC (Cameron et Durack, 1991)

Symptômes et signes	Fréquence (%)
Mal de tête	23-98
Epilepsie	37-92
Oedème papillaire	48-84
Signes méningés	29-33
Nausées/vomissements	74-80
Altération de l'état mental	9-47
Démence	1-6
Psychose	1-17
Déficits focaux sensoriels ou moteurs	3-36
Paralysie du nerf crânien	1-36
Altération de la vision	5-34
Ataxie	5-24
Compression de la moëlle épinière	<1

# EPIDEMIOLOGY





# Prevalence of Porcine and Human Cysticercosis in Central Africa

country	Prevalence in pigs		Prevalence in man	
	%	Reference	%	Reference
Angola	0-6.8 <sup>1</sup>	Kama, 1998	?	
Burundi	2-39 <sup>1</sup>	Newell et al., 1997	2.8 <sup>o</sup>	Newell et al., 1997
Chad	6.8 <sup>1</sup>	Graber&Chailloux, 1970	?	
	25.7 <sup>2</sup>	Assana et al.,2001		
Congo	0.1-8.1	Pandey & Mbemba, 1976	3*	Fain, 1997
	10-30 <sup>1</sup>	Chartier et al., 1997		
Rwanda	20 <sup>1</sup>	Thienpont et al., 1959	7**	Vanderick et al., 1972

<sup>1</sup> Classical meat inspection, <sup>2</sup> Tongue examination; \*: presence of cysticerci; \*\*:based on autopsies; <sup>o</sup>:serology

# Prevalence of porcine cysticercosis in Cameroon based on different detection methods

Locality	Prevalence (%)				Reference
	Tongue Inspection	Carcass inspection	Serology		
			Ag-ELISA	Ab-ELISA	
Garoua <sup>a</sup>	-	12	-	-	Awa et al., 1999
Menoua <sup>b</sup>	24.6	19.9	-	38	Zoli et al., 1987
	6.3	-	11.0	21.8	Pouedet et al., 2002
Mifi <sup>b</sup> and Bamboutos <sup>b</sup>	-	2.3	11.2	21.8	Nguekam, 1998
Extreme North <sup>c</sup>	20.5	15.7	39.8	-	Assana et al., 2001
North- West <sup>c</sup>	4.4	-	27	-	Shey-Njila et al., 2003
Ngaoundere <sup>a</sup>	7.8	-	22.4	-	Unpubl. results, 2002

<sup>a</sup> Town, <sup>b</sup> Division <sup>c</sup> Province





# Prevalence of Human Cysticercosis in Cameroon

Province		Prevalence	Reference:
West	Menoua	2.4 <sup>0</sup>	Zoli <i>et al.</i> , 1987
		1.0-3.0 <sup>+</sup>	Nguekam <i>et al</i> 2002
	Bamboutos	0.6-1.9 <sup>+</sup>	Tchinda 2000
North-West	Momo	0.0-1.02 <sup>+</sup>	Shey-Njila, 2001
Far North	Mayo-Danay	0.49-4.52 <sup>+</sup>	Zoli <i>et al.</i> , 2003
	Mayo-Sava	4.4-4.60 <sup>+</sup>	Nasaar L. 2003

<sup>0</sup> Ab-ELISA + Ag-ELISA

# IMPACT

- ◆ Economic
  - Porcine Cysticercosis
  - Human Cysticercosis
- ◆ Social: Neurocysticercosis
  - Discrimination (epileptics)
  - Educational & professional Problems
  - Cost for the family



# Estimated economic losses (in Euro) due to pig cysticercosis in 10 West and Central African countries

Country	Porcine Population #	Average prevalence (%) of cysticercosis	Estimated loss* (in Euro)
Angola	800000	3.4	408,000
Burkina Faso	587 000	0.6	52,830
Burundi	71000	20.5	218,325
Cameroon	1410000	9.75	2,062,125
Chad	23000	16.25	56,063
DR Congo	1180000	12.1	2,141,700
Ghana	339000	11.7	594,945
Nigeria	7 600 000	15.3	17,442,000
Senegal	320000	1.2	57,600
Togo	850 000	17	2,167,500
<b>Total</b>	<b>13,180,000</b>	<b>12</b>	<b>25,201,088</b>

# FAO, 1999; \* 30 % of the value of an adult pig: 15 €



# Estimated economic losses (in euros) due to the treatment of neurocysticercosis patients in Cameroon.

Province	Estimated population (1999)*	Seroprevalence (Ag-ELISA) in general Population	Cost of Treatment (in Euro)
West	1 872 234	13 105	3 407 300
North-West	1 738 503	12 169	3 163 940
North	1 159 002	8 113	2 109 380
Far-North	2 570 607	17 994	4 678 440
Cameroon	14 859 000	104 013	27 043 380



# Estimated numbers of epileptic population, epilepsy due to neurocysticercosis and consultation costs in Cameroon.

Region of Survey	Estimated Epileptic Population	Estimation of seropositive in epileptic population (Ab-ELISA)	Estimated Economic losses (in Euro)	
			Traditional Consultation	Consultation in public hospitals
West	29 956	13 360	2 444 880	120 240
North West	27 816	12 406	2 270 298	111 654
North	18 544	8 271	1 513 593	74 439
Far-North	41 130	18 344	3 356 952	165 096
<b>Cameroon</b>	<b>237 744</b>	<b>106 033</b>	<b>19 404 039</b>	<b>954 297</b>

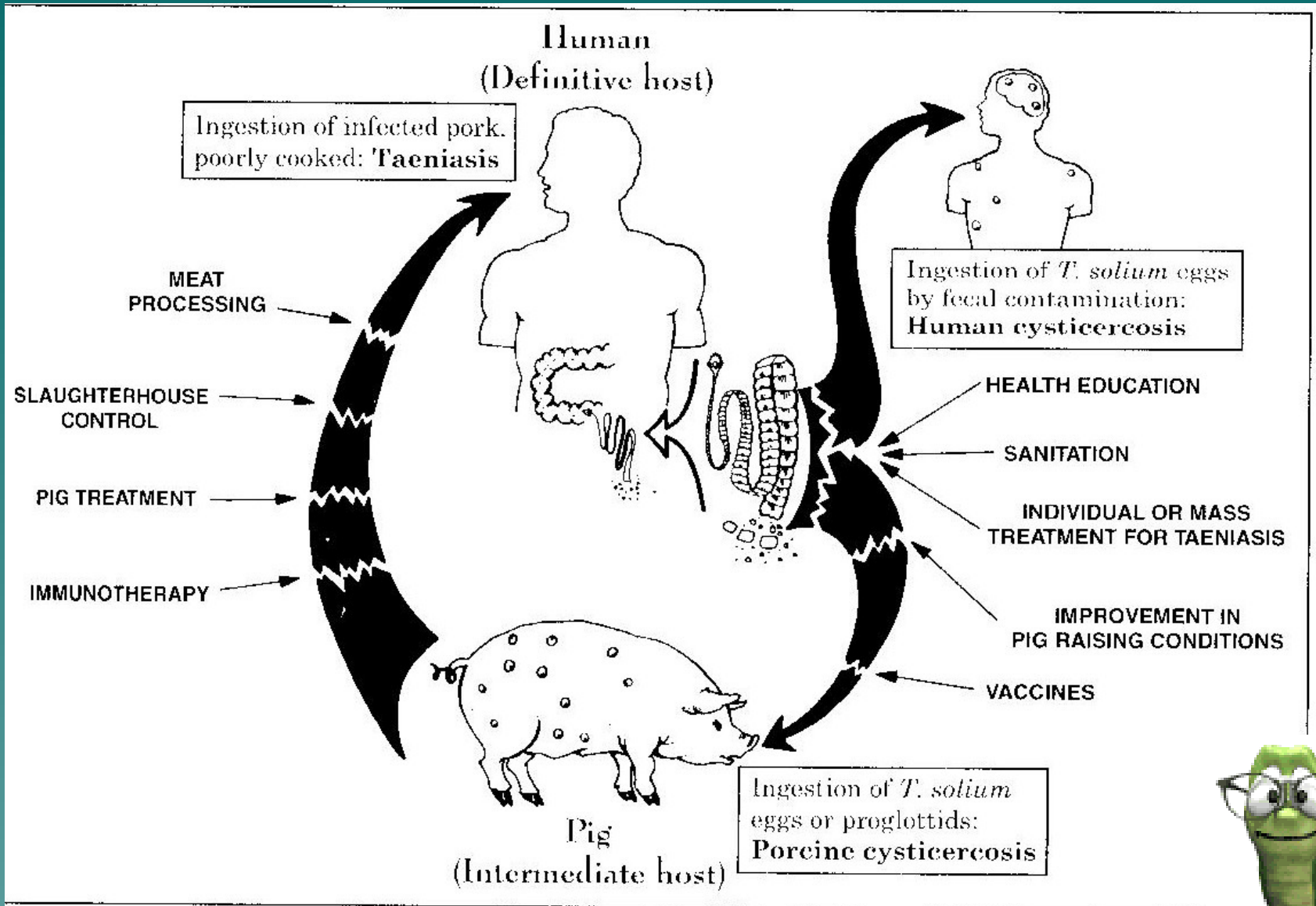
# CONTROL: *T. solium*: GOOD CANDIDATE FOR ERADICATION

- ◆ Tapeworm carriers: only source of infection for pigs
- ◆ porcine population can be managed relatively easily
- ◆ no significant wildlife reservoir exists
- ◆ practical intervention methods are available at various levels of the life cycle of the parasite





# Biological cycle of *Taenia solium*



# VACCINATION OF PIGS AGAINST *TAENIA SOLIUM* CYSTICERCOSIS

	Protection rate (%) using		
	crude ag.	purified ag.	recomb. ag.
heterologous ( <i>T. crassiceps</i> )	50	96	74-93*
homologous ( <i>T. solium</i> )	65-75	99	100°

ag.: antigen; recomb: recombinant; \*: *T. ovis* °: Lightowers, 2002;

Independent trials using Tso1-18 and/or TSOL45-1A in Cameroon and Mexico offering protection of **97.1-100%**.



# *T.SOLIUM* TAENIASIS-CYSTICERCOSIS: POVERTY RELATED DISEASE

- ◆ Will gradually disappear when living standards improve
  - improved hygiene and swine husbandry
- ◆ Control strategy
  - Short term/low cost: treatment of tapeworm carriers and health education (primary health care)
  - Longer term: combination of different control measures



# Visite du laboratoire par le Ministre Tchuente Maurice







THE UNIVERSITY OF DSCHANG  
of the UNIVERSITY OF DSCHANG



# Aknowledgements

- ◆ **The DGCD-Brussels**
- ◆ **The University of Dschang**
- ◆ **The Prince Leopold Institute of Tropical Medicine, Antwerp**
- ◆ **Wellcome trust (UK)**





# ***Thank You For Your Attention***

