



University of
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Medical
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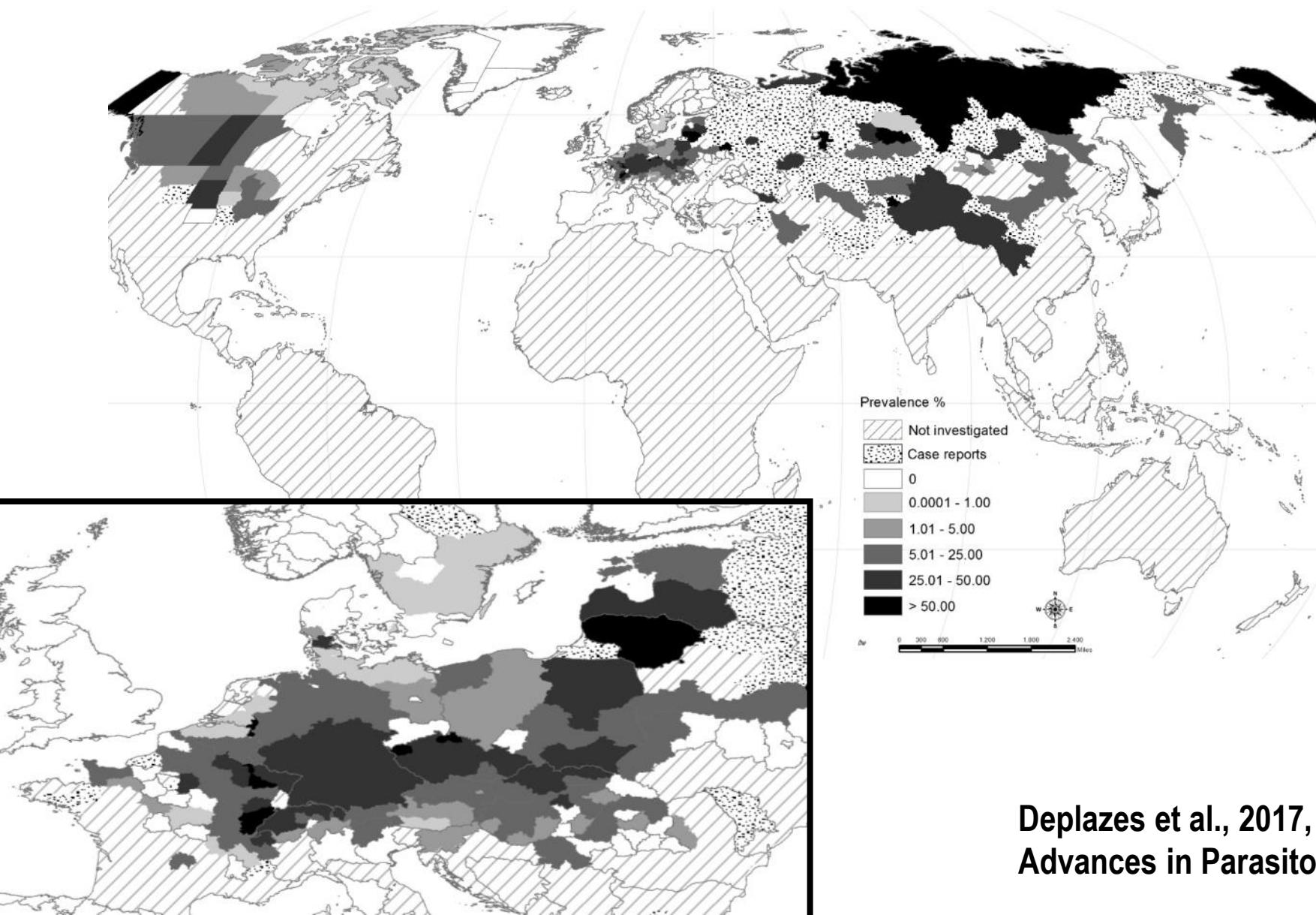
vetsuisse-faculty

Swiss TPH Winter Symposium 2017
Helminth Infection – from Transmission to Control

Echinococcus multilocularis Diagnosis

Peter Deplazes

Global distribution of *E. multilocularis*



Deplazes et al., 2017,
Advances in Parasitol

Emerging alveolar echinococcosis

Estimated numbers of new AE cases per year:

Europe: 100-200

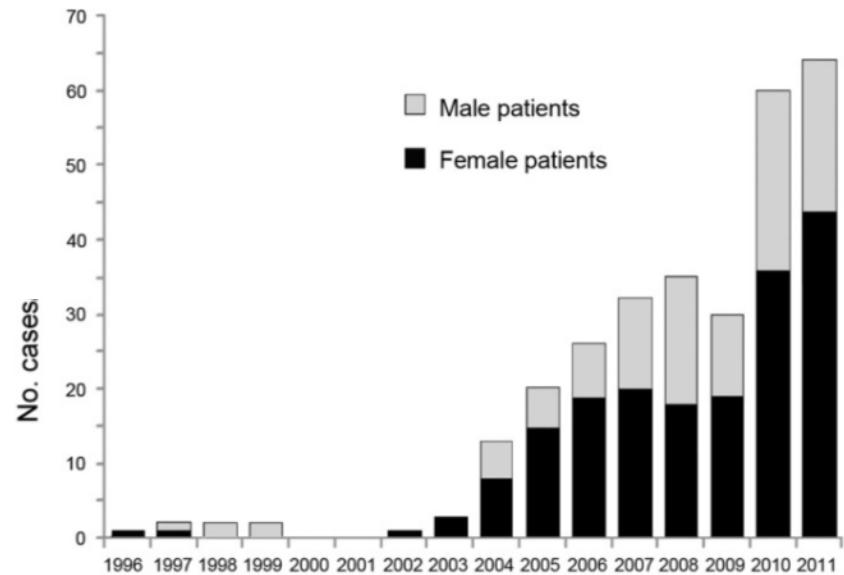
Significant increase in
Switzerland,
Austria,
Poland,
Lithuania

Russia: 1100

China: 17 000 (91%)

Torgerson et al., 2010; Gottstein et al.
2015

Number of AE cases reported in Kyrgyzstan, by patient sex, 1995–2011, Usualieva et al., 2013, EID

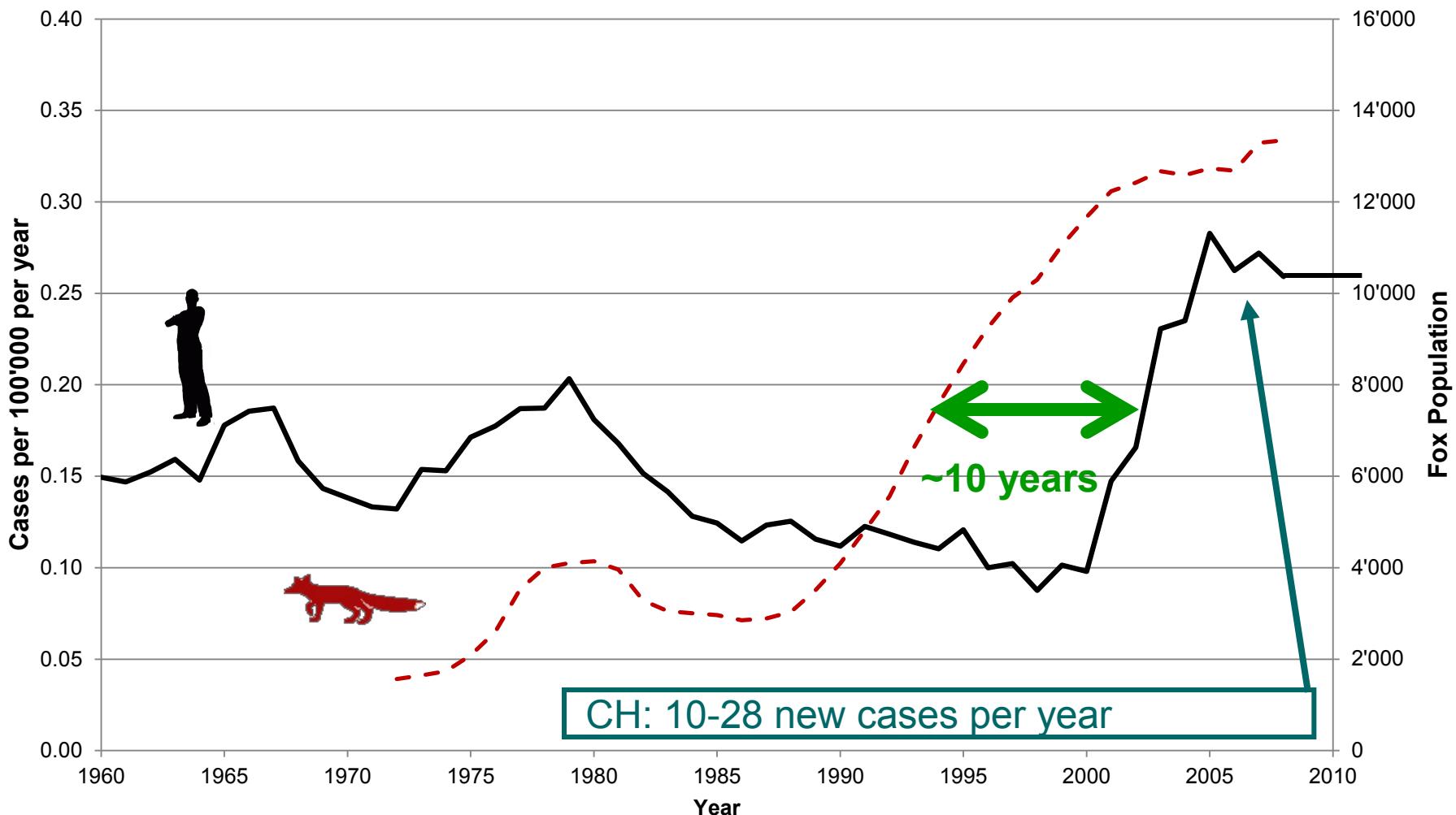


**Incidence: 0.02-----, 0.04-----0.2---- 1.1
/100 000**

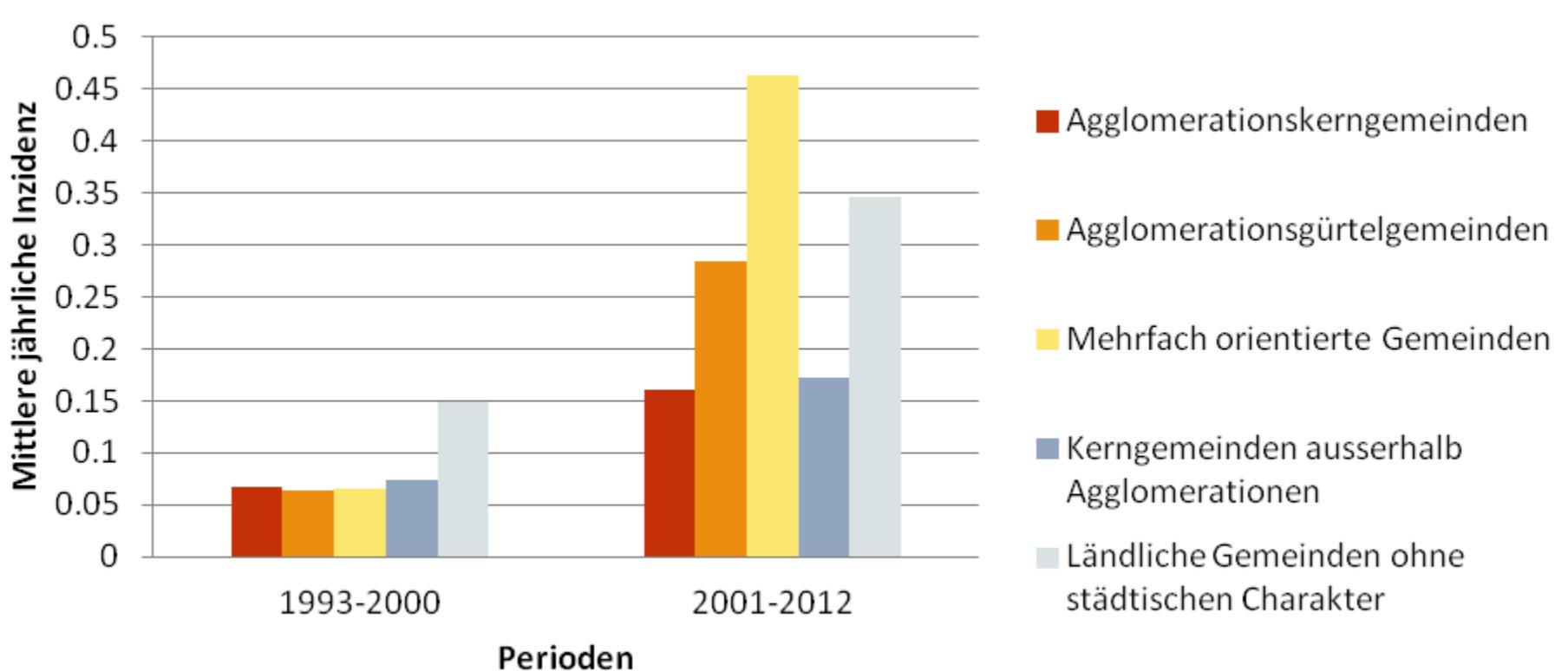
AE in Switzerland

(1960-2012)

(Schweiger et al. 2007)



Average annual incidences of alveolar echinococcosis in urban, periurban and rural areas in Switzerland



Echinococcus multilocularis: ways of transmission

Alveolar echinococcosis:

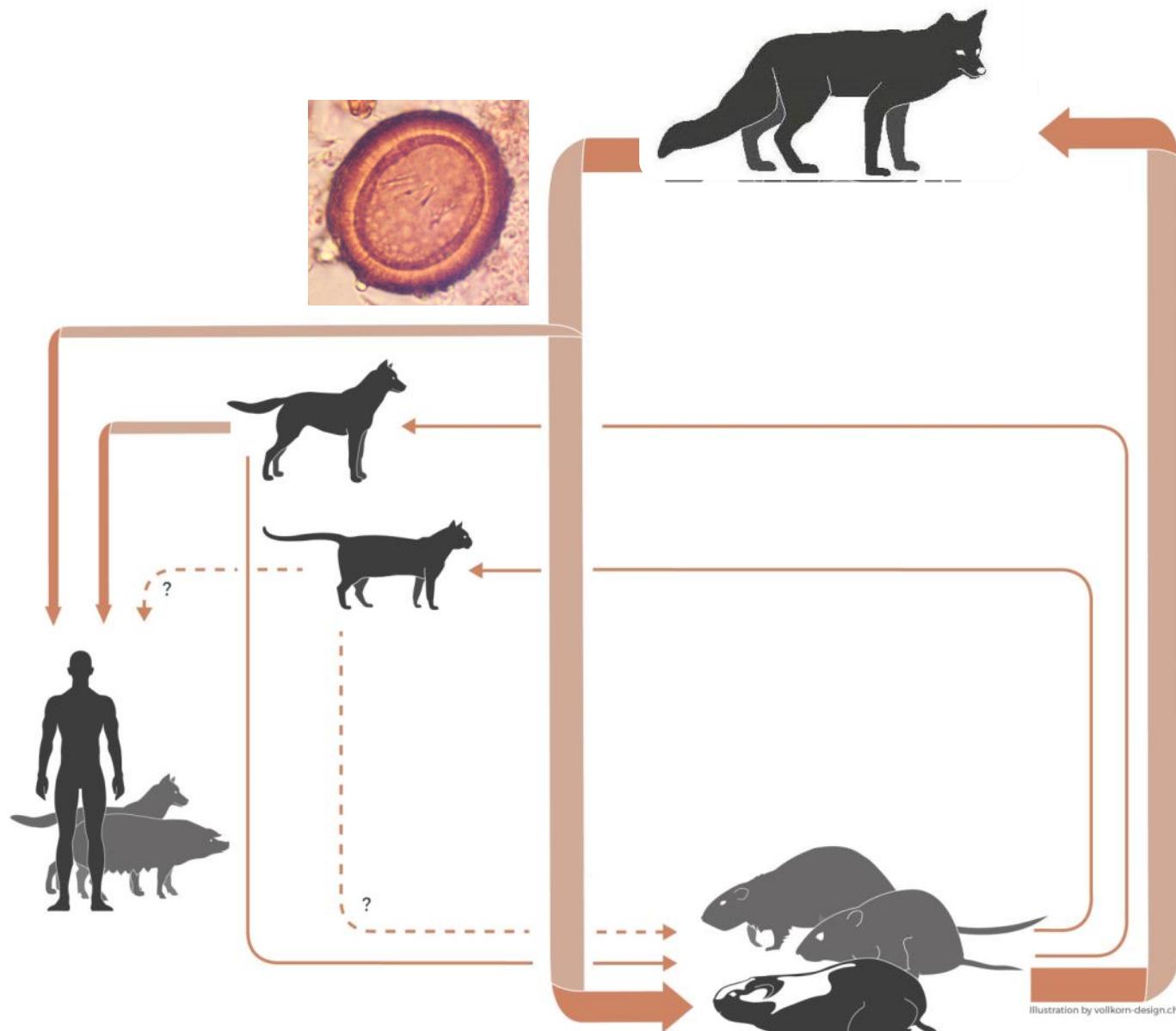
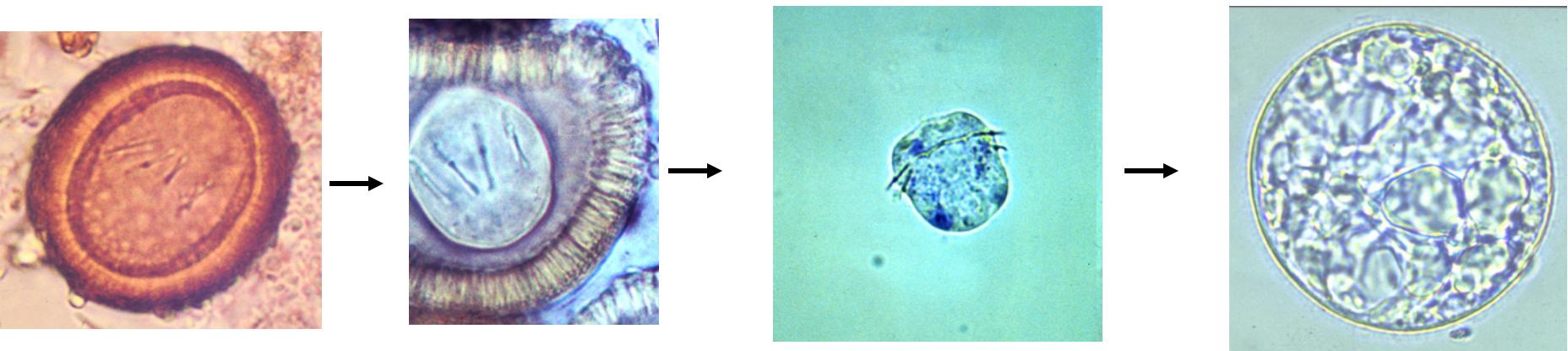
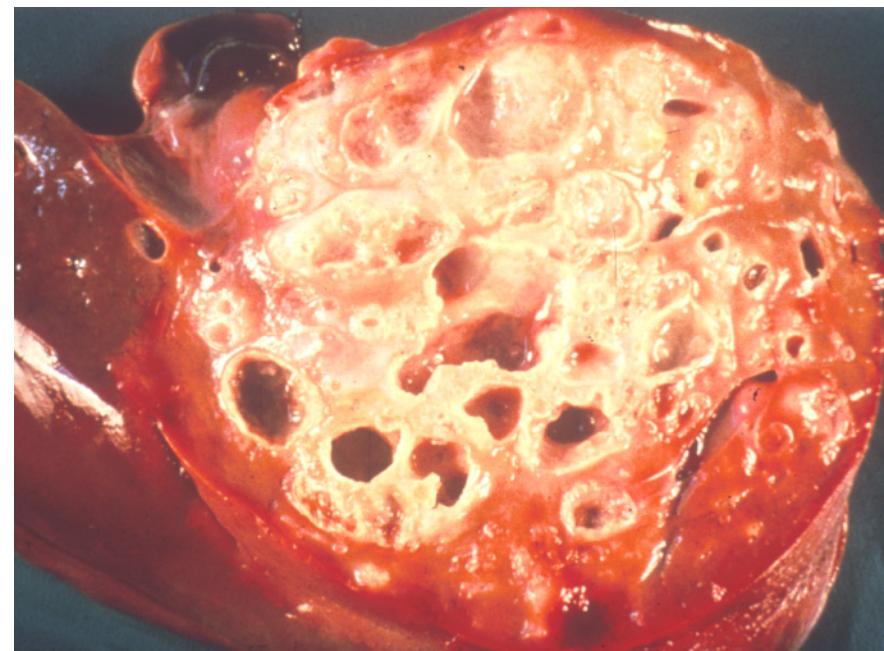
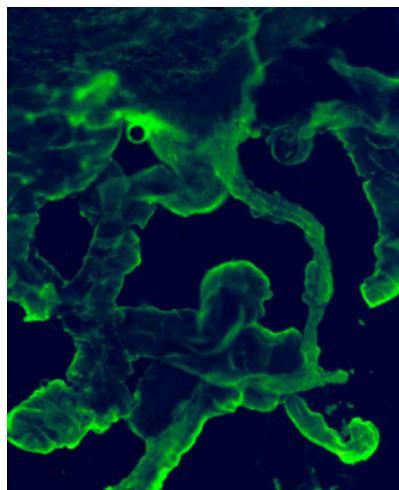
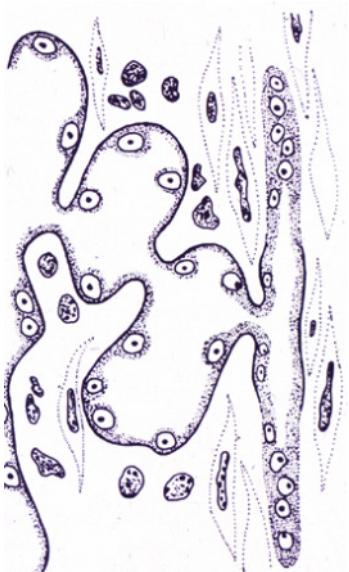


Illustration by vollkorn-design.ch



Echinococcus: early development of the oncosphere

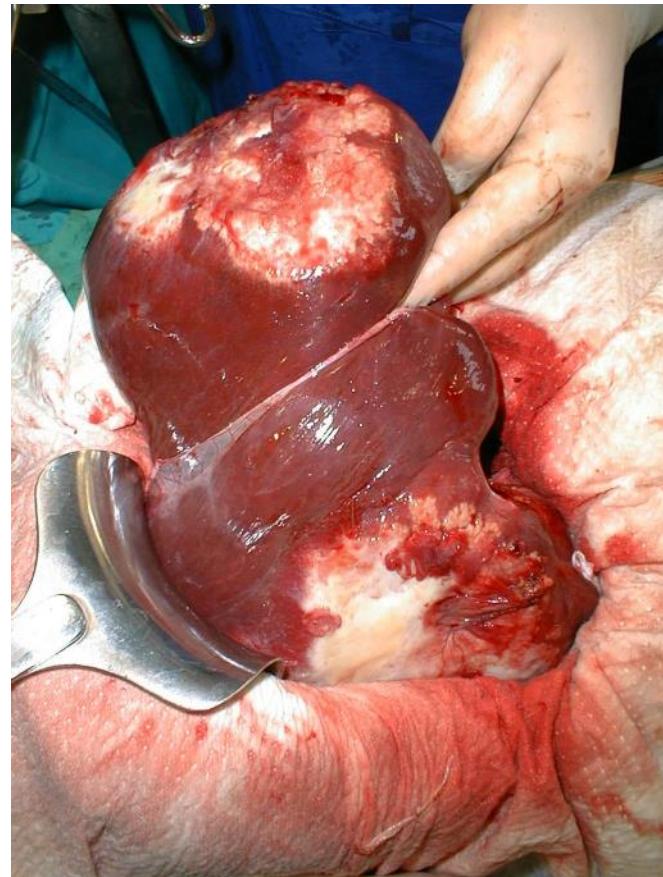


Course of alveolar echinococcosis

- Progressive growth in the liver
- Incubation time 5-15 years,
(asymptomatic cases CH: 26%)
- Treatment:
 - radical resection followed by at least 2 years of Albendazole (Mebendazole), treatment (around 50%)
 - Or life-long treatment with anthelmintics

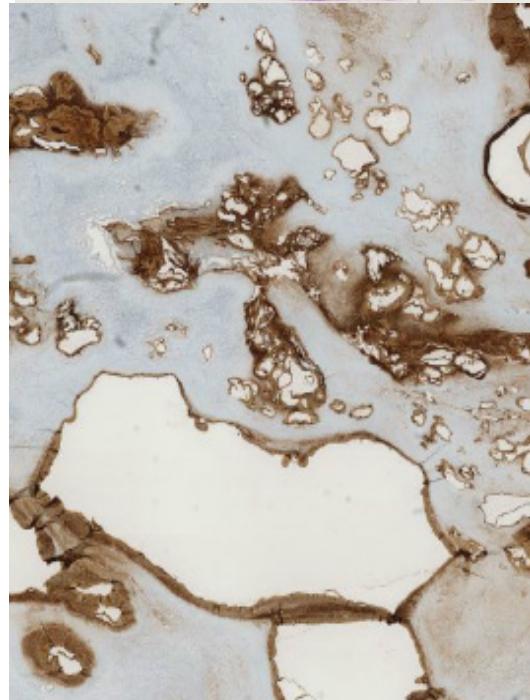
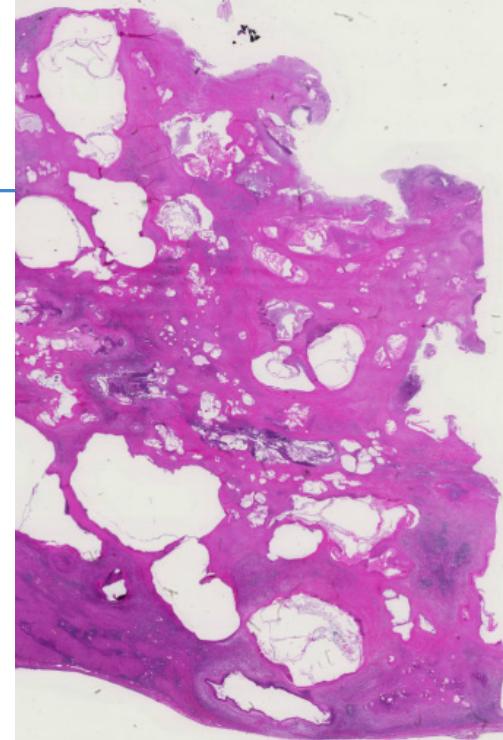
Treatment costs per patient* € 103'000
(CIs 90'000-118'000)

Loss of income per patient* € 78'500
(CIs 45'500-125'500)



Diagnosis of alveolar echinococcosis

- Cardinal Symptoms: Right upper quadrant pain (37%), icterus (12%)
- Diagnostic imaging (US and CT supplemented by MRI, PET and contrast enh. US)
- Serologie (specific IgG)
- Histology
- Immunhistology
- DNA-amplification (PCR)
- (Viability tests after longterm chemotherapy in rodents)



WHO: Diagnostic criteria

Brunetti et al. Acta Tropica, 2010.

At least one:

1. Typical lesions **in imaging**
2. **Serology** (high-sensitivity screening and high specificity confirmation)
3. Histopathology
4. Detection of DNA in clinical specimen



one: possible
both: probable

either one: confirmed

Sensitivity in Swiss patients

Schweiger et al. 2011

Antigen	Alveolar echinococcosis (N=51)	Cystic echinococcosis* (N=32)
EgHF-ELISA	>99.9 %	93.8 % (Lit: 60 - >90 %)
EgP-ELISA	>99.9 %	96.9 % (Lit: 60 - >90 %)
AgB EITB	62.7 %	78.1 % (Lit: 60 – 80%)
Em18	92.2 %	6.3 %
Em2/G11	88.2 %	18.8 %
Em18 & Em2/G11	98 %	18.8 %

*CAVE: Sensitivity can be lower for extrahepatic cyst localisation , in high endemic area, and for inactive cysts

Specificity in Swiss patients

Schweiger et al. 2011

Antigen	Swiss patients with non-parasitic liver lesions (N=38)	Swiss blood donors (N=98)	Parasitic diseases (N=80)
EgHF-ELISA	97.4 %	96.9 %	71.3 %
EgP-ELISA	>99.9 %	99.0 %	73.8 %
AgB EITB	>99.9 %	>99.9 %	98.8 %
Em18	>99.9 %	>99.9 %	98.8%
Em2/G11	>99.9 %	>99.9 %	>99.9 %

Positive predictive values

Schweiger et al. 2011

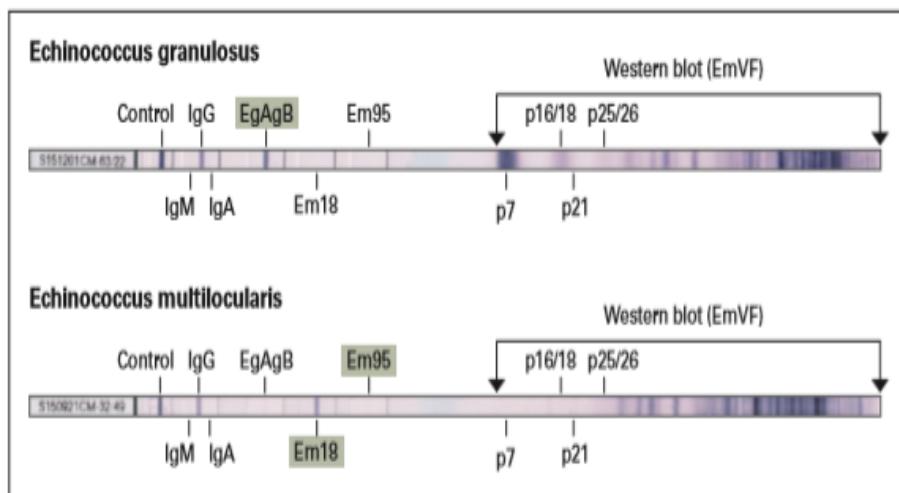
Antigen	Setting A	Setting B
	Differential diagnosis of AE from liver neoplasias (pre-test probability = 1.5%)	Screening for AE in Switzerland (pre-test probability = 0.04%)
EgHF-ELISA	42.9 %	0.1 %
EgP-ELISA	95.2 %	0.2 %
AgB EITB	95.2 %	
Em18	94.8 %	2.0%
Em2/G11	94.6 %	1.9 %

A newly developed membrane-based assay for simultaneous serologic screening and differentiation of echinococcoses

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Examples of Anti-Echinococcus EUROLINE-WB strips incubated with sera from patients infected with *E. granulosus* (top) and *E. multilocularis* (bottom)

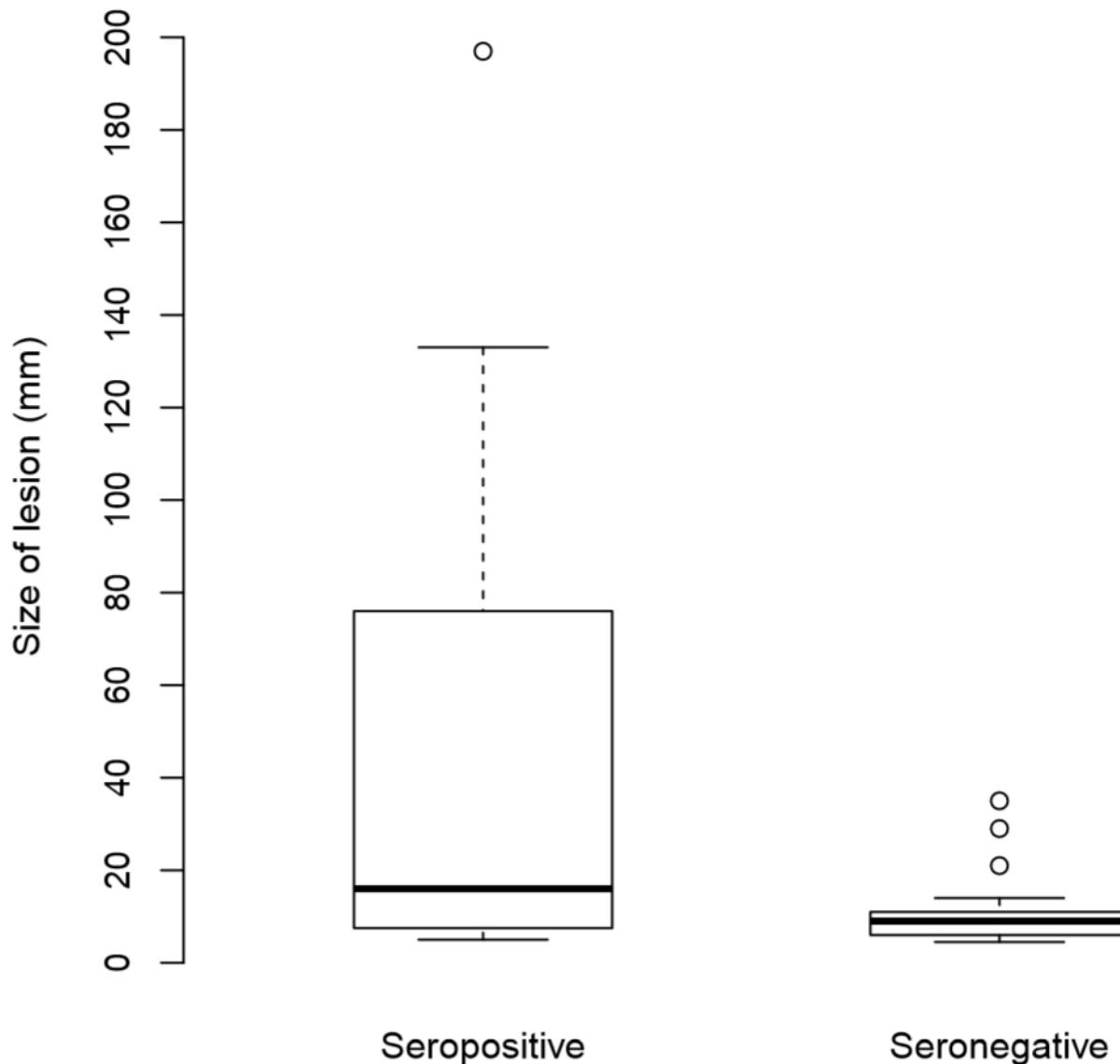
Panel	Positive	Negative
Echinococcus granulosus samples (n=55)	54	1
Echinococcus multilocularis samples (n=52)	45	7
Blood donors (n=50)	0	50
Tumor patients (n=50)	0	50
Sensitivity	93%	
Specificity	100%	
Species differentiation	81%	

Determination of sensitivity and specificity using sera from patients with *Echinococcus* ssp. infections and clinically relevant controls

Sensitivity and specificity of US and serology (ELISA, WB) during a screening program for alveolar echinococcosis (AE) in Kirgizstan, determined with PCR confirmed cases (n=37), (Deplazes, Torgerson, unpublished data)

	Ultrasound (US)		Serology		Prevalence
	Sensitivity	Specificity	predictive value	Sensitivity	
PCR confirmed cases	Set 100%	99.70%	94.80%	51.60%	6.20%

Conclusion for early AE detection: US is the most sensitive method (sensitivity has to be validated), a more sensitive serological test is needed for early detection.

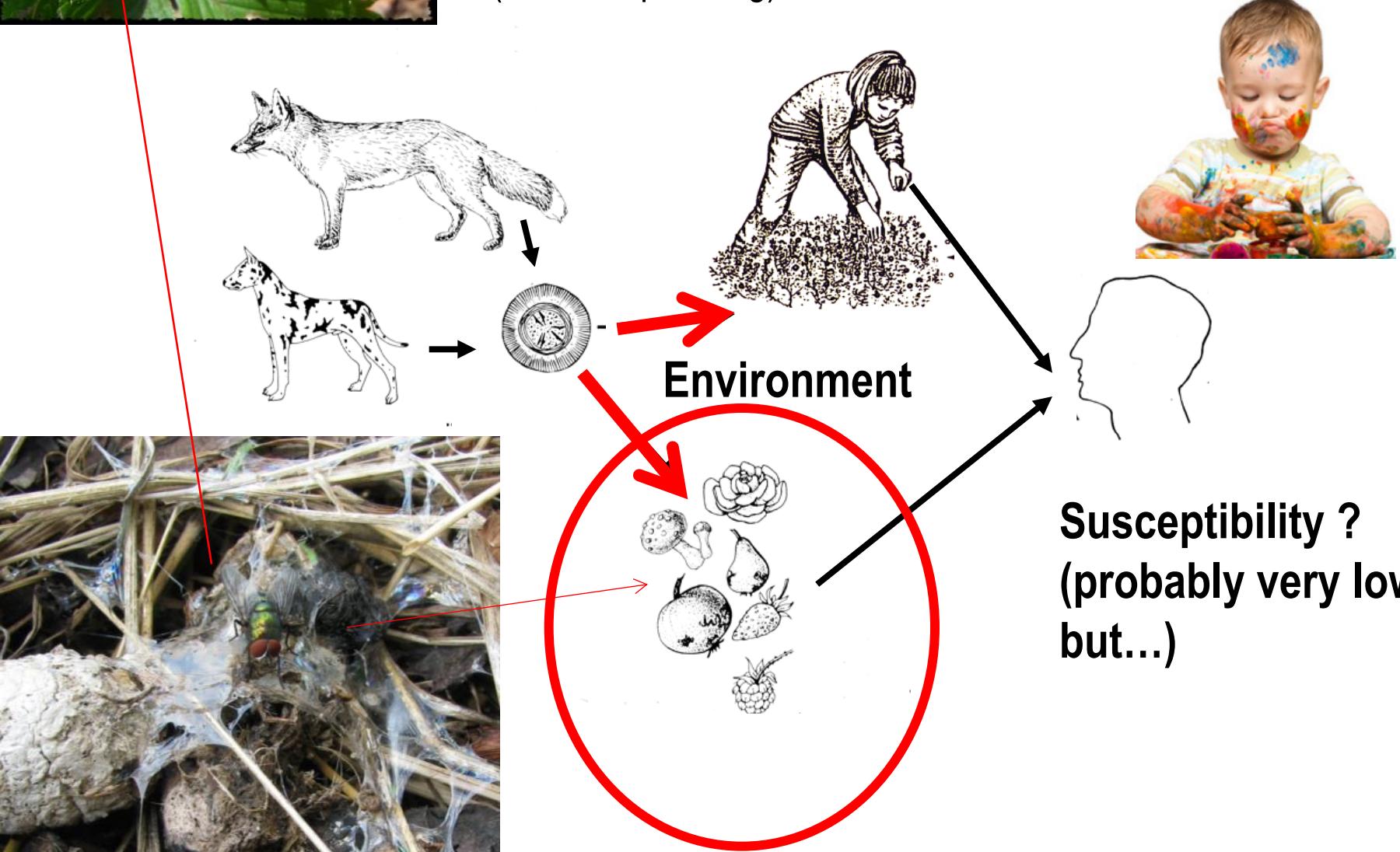


Boxplot illustrating the differences in sizes of lesions (n=49 serum samples available from 57 patients with measured lesions) diagnosed in individuals who were seropositive in either the ELISA and/or western blot (n=27) or seronegative (n=22). (Deplazes, Torgerson, unpublished data)



Confirming exposure with *Echinococcus* eggs:

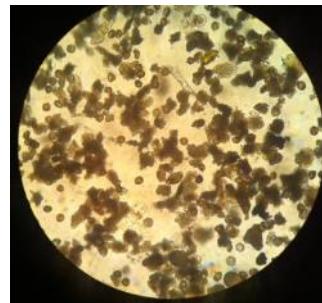
Method: Taeniid egg filtration followed by DNA analysis
(PCR, sequencing)





Zoo investigation

- Collect the rinsing water from the vegetables / fruits for human consumption during 148 days (= 148 samples)
- Around 40 salads and different vegetables (carrots, bell pepper, leek, beetroot, fennel...) were washed per day.



**PCR (Trachsel et al., 2007
and sequencing**

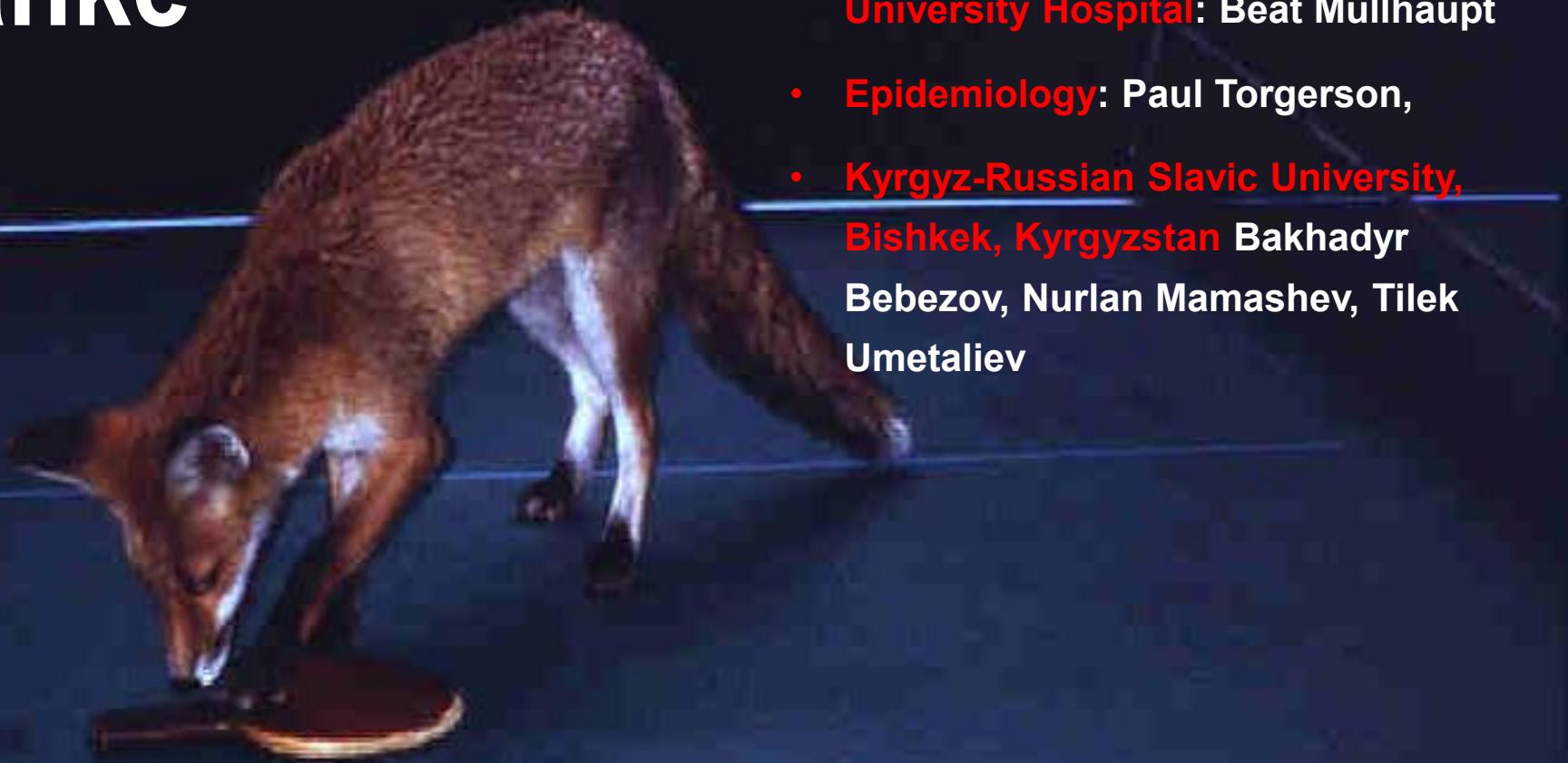
Federer et al., 2016

Detection of parasite DNA amplified from vegetable and fruit provided by local producers or by markets for human consumption in Basel.

Region of collection/season	Taeniid species (major definitive host)	Number of positive samples
Collection from Switzerland (Basel) in autumn (n= 95)	<i>T. hydatigena</i> (dog)	4
	<i>T. polyacantha</i> (fox)	2
	<i>T. ovis</i> (dog)	3
	<i>T. taeniaeformis</i> (cat)	5
Various, unspecified European countries including Switzerland/Spring (n= 46)	<i>T. hydatigena</i> (dog)	2
	<i>T. saginata</i> (human)	1
	<i>T. crassiceps</i> (fox)	1
	<i>T. taeniaeformis</i> (cat)	5**
	<i>T. multiceps/T. serialis</i> (dog)	2
	<i>Echinococcus granulosus</i> (dog)	2**

** two species were detected in two samples (one with *E. granulosus* and *T. taeniaeformis* and one with *E. granulosus* and an unidentified cestode(s)).

Danke



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